UNIVERSITY OF SOUTHAMPTON

FACULTY OF BUSINESS & LAW

School of Management

ASCERTAINING THE VALUE OF A VIRTUAL TEAM STRATEGY IN DEVELOPMENT PROJECTS: A SYNCHRONICITY CONCEPTUALIZATION OF COMMUNICATION PERFORMANCE

By

Kaycee Obanya

Thesis for the degree of Doctor of Philosophy

August 2015

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF BUSINESS & LAW

Knowledge & Information Systems

Thesis for the degree of Doctor of Philosophy

ASCERTAINING THE VALUE OF A VIRTUAL TEAM STRATEGY IN DEVELOPMENT PROJECTS: A SYNCHRONICITY CONCEPTUALIZATION OF COMMUNICATION PERFORMANCE

Kaycee Obanya

This research addresses the question of whether or not the adoption of a virtual team strategy creates value throughout the duration of a development project. It looks at the context in which communication occurs, and then examines the practices that are effective in facilitating communication performance. The thesis also presents discussions on the emerging new perspective of media synchronicity and its applicability to the analysis of the Nigerian operations of a development programme.

Data collection is centred on Enterprise Resource Planning (ERP) activities. With that in consideration, the research adopts a case study design. The technique of template analysis is applied in the analysis of qualitative data. Three work systems involved in the ERP setting (i.e. Applications Development, Business Services and Infrastructure Support) are examined.

Empirical analysis shows that communication media characteristics tend to influence an individual's behaviour. People also behave differently based on the set of tool, policies and practices open to them – and so virtual teams don't all function in the same way. Research outcomes also contribute to managerial practices: it is suggested that enforcing appropriate control mechanisms can be more beneficial in a virtual team than instilling trust. Socio-emotional functions hold important implications for performance within these environments.

Table of Contents

List of Figures

List of Tables

Declaration of Authorship

I, *Kaycee Obanya* declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

Ascertaining the Value of a Virtual Team Strategy in Development Projects: A Synchronicity Conceptualization of Communication Performance

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission.

Signed: ……..

Date: ……

Dedication

This thesis is dedicated to my loving mother Rosemary Obanya. She deserves endless gratitude for her commitments to my education, her constant encouragements, prayers and love. Without you none of this would have been possible.

Acknowledgements

I would like to express my immense gratitude to my supervisor, Dr Jonathan H. Klein for his intellectual enthusiasm and guidance throughout my study. His constant feedback and constructive criticism helped shape the chapters and improve the quality of my thesis.

I would also like to thank Dr Mark Gatenby who exposed me to techniques for mapping out ideas and concepts.

My special thanks go to my beautiful wife Nuria for her patience, love and care. She kept me company all through the process of writing up for the research. I am also extremely thankful to my sisters: first, Noreen for reading my papers despite her busy schedule. Her encouragements kept me going, even when I felt like quitting. I could not have gone through the research period without her support. And to my sister Evalsam; her wisdom was of great value. She spent hours advising me on different aspects of life and my career. I love you all.

To my friends, Nchekuba, Wale, Azira, Thelma, Bernard, Idamina, Iyke you made my student days remarkable.

My gratitude also goes to Liyel Imoke for the approval of financial support. This was crucial to the fulfilment of this research project.

Chapter 1 : Introduction

1.1 Introduction

For a company, which has either successfully managed its operations or failed in it, the importance of fostering effective interactions and connectivity between its people, processes and intellectual assets, is incontestable. In this regard, there is an emergence of software systems, work methods, techniques, and services. The assumption seems to be that they have the ability to deliver effective or innovative connectivity for organizations. There are, of course, a number of practices and concepts at play in all of this; a salient example is a virtual team initiative (Hosseini and Chileshe, 2013; Schweitzer and Duxbury, 2010; Zimmermann, 2011).

A virtual team has, over the last 15 years, become a concept that is core to networking of assets and working together on complex tasks across various locations. More recently, its area of relevance was expanded with gained prominence at governmental levels and amongst information system scholars as a work system that enables teams to function beyond the constraints imposed by co-location. This is as a result of the fact that team members do not share a common workplace all the time. Rather, they interact, using digital communication functionalities such as videoconferencing or more unified communication infrastructures like Groove (Schweitzer & Duxbury 2010). As is perhaps to be expected, to perform effectively, these teams and individuals need to communicate appropriately.

Interestingly, policy makers, industry experts, and academic scholars have all made practical and theoretical considerations on the relevance of virtual working in business and society in general. On the one hand, government representatives have used it to justify the public sectors “dispersed property estate” (See Government ICT strategy, 2011. P. 21). On the other hand, it has been linked with effective utilization of resources. For example, the US President, Barack Obama, signed Executive Order 13589 of November 2011 so that virtual working can be used as a strategy to achieve ‘teaming without travel’ (National Archives & Records Administration, 2011) . From the perspective of technology vendors, the potential value of a virtual team has led to increased investments in communication and knowledge technologies. Jeff Raikes, the onetime Group Vice President of Microsoft suggests that such initiatives would enable and deliver change in organizations whose experts operate from multiple locations. The above discussions neatly summarize some practical considerations made about a virtual team initiative, to both commercial and non-commercial sectors.

In parallel, contemporary research literature provides various instances of virtual team success stories (Kirkman et al., 2002, Lurey and Raisinghani, 2001, Paul and McDaniel, 2004, Reed and Knight, 2010b, Kayworth and Leidner, 2002, Malhotra et al., 2001). But scholars have also shown that organizations pursuing such efforts are confronted by a range of challenges. These include communication breakdown (Daim et al., 2012) and conflict management in the virtual realm (e.g. Kirkman & Mathieu 2005; Hinds & Mortensen 2005), to trust (e.g. Kanawattanachai & Yoo 2002; Sarker et al 2011), knowledge sharing (e.g. Staples & Webster 2008), team members' commitment (Powell et al., 2006), delayed interaction (e.g. O'Leary & Cummings 2007), work time separation (e.g. Sarker & Sahey 2004), cross-cultural and coordination related issues (e.g. Montoya-Weiss, Massey & Song 2001; Shachaf 2008; Zhang & Lowry 2008). Some studies have even sought to understand whether people are actually using the right technologies to work (e.g. Kock & Lynn 2012; Rafaeli and Ravid, 2003). Others (e.g. Deluca & Valacich, 2006) investigated whether people are using appropriate communication channels or adopting suitable techniques (Sarker & Sahay 2002; Olson & Olson 2000; Sarker et al 2012). Indeed, researchers have investigated these issues from different perspectives. For example, Harvey et al. (2004), tried to focus on staffing in a virtual team. Majchrzak (2000) emphasized technology adaptation processes, while Shachaf (2008) adopted a cultural perspective. More recent studies, notably Daim et al (2011) and Barcus & Montibeller (2008) embraced a multi-criteria decision making (MCDM) perspective. Each of these different aspects provides a target to evaluate how well we understand the intricacies of this work system. However, a key unsettled debate concerns whether to consider virtual teams as an analogy to what some authors have called conventional 'team working' – i.e. co-located individuals who interact with one another (Beaubien & Baker 2004; Van der Kleij et al, 2009; Caballer et al, 2005;Edwards and Sridhar, 2005, Bell and Kozlowski, 2002, Alge et al., 2003, Robey et al., 2000, Warkentin et al., 1997).

While the virtual team concept and use of technology in work environments is not new, our understanding of what may constitute as 'real presence' or not, within modern development teams remains unclear. Its relevance has only recently been acknowledged. With the advent of technical innovations and improvements, communication media have generally diversified and become more complicated. More specifically, there are only a handful of empirical studies in the literature where the focus is on team virtuality and the likely difficulties in knowledge communication therein. Like Schweitzer and Duxbury (2010), understanding the consequence of the different dimensions of virtuality on team functioning and not just how ICT systems add value to a team is one of the voids in the current body of knowledge that must be filled in order to continue making advancement in this area. In fact, there is a need to systematically investigate

how work is evolving, including the changes in communication behaviour, the new forms of person-to-person relationships and exchanges. That said, this research commences in chapter 2 with an examination of the theoretical and geographical grounding of the thesis.

1.2 Research Focus and Objectives

This thesis investigates how the adoption of a virtual team strategy creates value throughout the duration of a development project. It looks at the context in which such teams were conceived, and then examines the technical and social systems that are effective in facilitating communication performance. In this study, value is conceptualized as "subjectively perceived desirable outcomes at a personal, collective, corporate or societal level" (Vorakulpipat et al 2009, p.142)

To achieve the above-mentioned goal, the project scope includes (i.e. my four milestones):

- Describing how virtuality in teams is defined and sustained, by identifying its primary components and the relationship amongst them.
- Conceptualizing a holistic approach to virtual work; Creation of a framework that proposes the relationship between team virtuality and outcome values.
- Distilling empirical evidence related to the framework, to aid in a better understanding of aspects of virtuality as well as the impact of communication media factors within the case context.
- Addressing the potential value and cost factors of the virtual interaction. In turn, propose a toolkit for practitioners to promote more effective communication.

The research is structured around two central questions:

(1) Does the adoption of a virtual team strategy create value throughout the duration of a development project?

(2) Are there any risks to such a strategy and what could hamper its realization?

1.3 The Framing of the Thesis

With regards to theory, this research emphasizes the metaphor of systems as well as theories of communication media behaviour. The former posits a comprehensive notion of virtual work that encompasses social and technical influences within a real-world project environment. The latter provides an explanation of how survival in turbulent environments is achieved. It also elucidates on the network of interactions in a project. Of course, this can be a very powerful interpretive tool as it helps give meaning to problematic situations, and in that regard, deepens insights. For example, it can provide an explanation as to why the same communication channel produces

different performance behaviours. The conceiving features of the conceptual framework will be discussed in chapter 2.

Given that a team may be virtual in a variety of situations, the research is case-study based. Furthermore, the research context requires the case-study sites to be knowledge-intensive and a technology driven practice. Thus, participants are not recruited at random. They are purposefully identified to ensure maximum exposure to the dimensions of team virtuality and process interdependence in major aspects of their practice. Data collection is centred on the Nigerian operations of a development programme.

To respond to these central questions (above), the research also poses some intermediate questions: What is the nature of the context in which communication occurs in a virtual team? How can the communication patterns within the Nigerian operations of a development programme be identified, represented and visualized? What key factors are associated with the usefulness of systems of communication applied to their virtual team initiatives?

1.4 Motivation for the line of research

A personal interest in [the broad area of] how team decisions are supported and the limited scope of communication literature was the inspiration for this line of research. This project started with a personal drive, which was to investigate the quality of two tool categories - communication and knowledge technologies - on project teams. The researcher initially wanted to focus on how these technologies fit, or do not fit wholly into the social realities of a real-world project environment. Based on the literature and recommendation from practitioners, the research scope was amended nonetheless.

As discussed earlier, this research motivation was not unfounded. It was however, derived in-part from the researcher's career experience as a systems developer. The nature of that role required the researcher to work and make exchanges with individuals he never met on face-to-face basis. For one thing, his level of socialization changed over time as work reasons allow him to use knowledge technologies to augment relationships. On the other hand, it was not uncommon for final products to fail despite advancement in programming language skills, established common ground, and increased connectivity. Hence, the researcher wanted to move beyond having to just build new things (software systems), but hoped to theorize and explain such human interactions and relationships. As Contractor & Eisenberg (1990, p. 143) put it, "there is no such thing as pure technology. To understand [and build] technology, one must first understand social relationships". The researcher believes that the findings of this project will be of real value to strategists, information system (IS) practitioners and academics alike.

1.5 Contributions & Impact

A detailed discussion of the contributions made by this thesis is presented in Chapter 7. The researcher was able to: (1) Use a range of analytical techniques to empirically verify the theoretical framework and results of previous scholars (2) Provide recommendations for improvements of existing models, such as Media Synchronicity, which support the human elements of virtual teamwork. The findings also contribute to policy and practice in the following ways: Support the refinement of an organization's virtual working practices by reflecting on the experiences of employees; and facilitate IS/IT planning in projects as well as help managers develop their teams to a higher calibre. In addition, casual readers could use the research results to better appreciate and communicate socio-technical complexities, and their role in modern project teams.

1.6 Thesis Outline

The research goes on to demonstrate that deploying virtual teams can be beneficial in projects, but risky and even a collection of experts could fail. Primarily, communication performance is constrained by the nature of control mechanisms, intellectual and physical assets.

Chapter 2 provides a background to the study. It starts with an overview of the theoretical context and some conceptual issues. A framework for addressing the questions raised above is developed. An academic justification for the choice of the research environment (geographic site) is also discussed in this chapter. Chapter 3 presents an elaborate review of the existing literature, highlighting key debates and areas for further development. The review focuses on the nature of virtual interaction, and some of its concomitant dilemmas in a project based work. Chapter 4 discusses the researcher's approach to answering the study questions. Chapter 5 and 6 brings together the findings. Chapter 7 presents an overall conclusion, providing the implications to research, practice, study limitations and areas for future research. Lastly, the final pages will be references and appendices.

Chapter 2 : Conceptual & Theoretical Foundations

2.1 Introduction

This chapter explores some of the theoretical and conceptual issues pertinent to this study. It starts with a background on virtual team initiatives, highlighting where it currently is and where it wishes to be. This gradually progresses to structuring the area of concern for the empirical investigation.

2.2 The Strategic Nature of Work Arrangements

The pioneering work of Henry Mintzberg in the late 70's played a crucial role in understanding how business organizations function at the operating level. He described an *organization* as the collection of skills waiting to be applied to a particular situation. The organizational work structure could depend on the nature of the service to be provided and how they are delivered. Teams however, had not always been part of the typical organizational structure. Until a few decades ago, organizations that created teams among its employees were considered to be innovative (see discussion below). Being innovative means breaking free from conventional patterns as well as circumventing all the paraphernalia of bureaucratic structures such as very formal behaviour and conspicuously distinct chain of command and control (Mintzberg 2003). Historically, the primary responsibility for tasks was assigned to the three levels of the organization: the top management were in charge of a task strategy and stakeholder relations; managers, responsible for everyday supervision and work coordination; and juniors, for technical worries (Maister 1997). But teams can be formed around specific projects or operations, so they break away from conventional specialization and differentiation that are associated with assigning tasks to individual experts in pre-established hierarchy or organizational categories (Mintzberg & Sumantra 2002; Beise et al 2002; Beise 2004; Maister 1997). As such, the team concept quickly became dominant in many organizations, mostly within the manufacturing sector.

Organisational theorists have defined a team as a distinguished set of two or more individuals who perform some work-related task, interact dynamically, and adaptively, have a shared past, and are likely to achieve some shared objectives in the future (Beaubien & Baker 2004, p.51; Steward & Barrick 2000). As at the year 1995, survey results estimate that 68% of Fortune 1000 companies had shifted the management of their operations to a team-based structure (Steward & Barrick 2000). Other surveys indicated that 50% of the employees in 80% of Fortune 500 companies operated as teams. This figure went as high as 88% in public sector organizations (Kersley et al 2005). While the use of teams is growing, Fraser & Mancls (2008) examined the

fundamental question: “Is teamwork and collaboration a silver bullet?” Empirical studies show that a large part of teamwork has been about integrating skills and sharing knowledge to achieve specific performance goals. Additionally, studies give evidence that teams can outdo individuals in carrying out tasks when different skills, opinions and experiences are needed. Robbins (2005) noted that teams can enhance decision making processes within an organization. Likewise, it has been explained in the literature that when people work in a team, complex and tiresome tasks become more enjoyable. In this regard, the assumption seems to be that the informal nature of a team increases people’s sense of participation towards their task. Hence, the benefits of a potentially successful silver bullet would be significant to an organization.

The conventional image of a team is that it consists of co-located specialist with experience in their subject domain. Teams may be characterized as self-managed, cross-functional, and problem-solving. By cross-functional a team may consist of members across different knowledge areas, professions and disciplines. Being self-managed means that teams exhibit a measure of autonomy and self-leadership, where members have a degree of freedom and authority to lead themselves. As a result, leadership is shared and external supervision is minimal (Steward & Barrick 2000). Intuitively, it cannot be assumed that a particular team will always have enough knowledge, skills and expertise to produce reliable outputs (e.g. products) – across multiple projects. The changing roles will require a different set of capabilities with supporting processes, skills and knowledge. To address this dilemma, there are, of course, a number of relevant and effective strategies that organizations frequently adopt; some are depicted below.

First, to complement in-house knowledge and skills, some organizations have opted to rather outsource (Heeks et al 2001; Dunn et al, 2009). Given a global business context such as software development, outsourcing activities to teams in other organizations and countries (e.g. India, China) has accounted for increased innovativeness and responsiveness (Alami et al., 2008; Edwards and Sridhar, 2005; Kripalani and Engardio, 2003). This does not only provide a pool of talents and expertise, but also low-cost advantage to organizations. Nonetheless, adopting this strategy seems paradoxical in the sense that while it complements deficiencies in knowledge and skills within an organization, it also causes knowledge gaps. For example, outsourcing projects to other teams creates knowledge gaps and fragmented skills within an organization. One explanation for this might be the loss of opportunities to develop much needed professional expertise leading to losing key staff or changing roles. Quinn & Hilmer (1994) also elaborate on this concept in their article on *Strategic Outsourcing*. This publication argues that organization should retain in-house, its core activities, and only non-core activities should benefit from outsourcing models. Although some international companies have been able to accommodate the

outsourcing-work model; but as Daim et al. (2012) who cited Fang et al. (2003) noted some have reported new problems such as the inability for in-house project managers to sustain effective continuous communications between teams involved in a project.

Second, a solution for leveraging knowledge and skills, whilst obtaining more control over core activities came with the virtual team practice. The idea is to identify the right individuals, and properly manage them within the same organisation – irrespective of their location (Ortiz de Guinea et al, 2012; Kayworth & Leidner 2000). Together, this creates a demand for teams to operate in virtual environments. Irrespective of the terms used, i.e. either 'virtual', 'dispersed' or 'distributed' teams, the members cease to be 'co-located' specialists (Reed & Knight 2010). Organisations can overcome limitations due to the above mentioned environmental constraints, lack, control or inaccessibility of critical resources. It is worth noting that outsourcing initiatives could involve virtual teams. But as Xue et al. (2005) argues, they are usually part of a different organization. In short, virtuality enable teams to operate beyond the constraints imposed by co-location. These issues are of concern to this research.

2.3 Business Value: Key Parameters for Virtual Team Deployment

A number of business environment characteristics motivate the deployment of virtual teams. Kirkman et al. (2002), Lurey and Raisinghani (2001), and Kayworth & Leidner (2000) all noted that corporate globalization, terrorism scares, corporate layoff, economic and national partnerships, all increase the likelihood of virtual teams being used. In a more detailed consideration of the practical benefits of a virtual team, Carmel and Agarwal (2001) found that organizations such as software companies use virtual team initiatives as a way of reducing cycle time, synchronizing work and achieving a 24-hour work cycle. To achieve this, they adopt a 'follow the sun approach'. Other researchers argued that adopters of virtual teams perceive benefits from its ability to unify different cultures and business ethics (Reed & Knight, 2010).

Favela and Pena-Mora (2001) revealed that virtual teams influence product delivery services. For example, by establishing virtual teams between its 25 development centres around the world, Motorola leveraged global resources, improved product development and customer service. On the one hand, the use of virtual teams in the organization ensures the formalization and extension of operations - homogeneously. The purpose of a virtual team, as pointed out by Markus et al (2000), is to guide an organization's global business process and associated Information System towards a common goal. He also asserts that the strength of a virtual team is its ability to portray organizations as "future" and "networked" (p. 25). Additionally, empirical studies show how

virtual teams constituted ways of cutting bureaucracy (Edward & Sridhar 2003). Time savings due to straight-forward reporting ensure the prompt transmission of project information.

A research underwritten by BlueJeans (2012) on 128 government employees found reduction in business travel to be the highest benefit of virtual interaction. Other benefits attributed to the public sector included: improved engagement, improved collaboration, reduced carbon footprint, and increased personal productivity. As such, organizations could gain in productivity as they save more money through the use of virtual teams (Robert et al 2005). For example, the study by BlueJeans (2012) investigated the impact of video conferencing on distant collaboration. This study revealed that up to 3.5 hours per person [in a week] can be saved by organizations. For a major employer like the US government, this converts into $8 billion in annual productivity savings. Interestingly, the survey findings indicate that such huge savings can be appropriated if just 50% of their workforce adopts video conferencing systems for collaborations. Naik and Kim (2010) cited a study by May and Carter in which the authors observed that teams can save 10 to 23 days per calendar year when they collaborate electronically, using information technology tools, as opposed to engaging in face-to-face interactions. To put it in perspective, this effectively gives an organization more working days. Those organizations able to capitalize on this can expect to reap benefits such as improved financial performance and overall productivity.

Furthermore, the healthcare sector has also been a beneficiary of the virtual team strategy. Paul and McDaniel (2004) studied 3 healthcare virtual teams from different sites in the United States, measuring trust, collaborative working and performance. The results from 74 Healthcare providers (from nurse practitioners, physical assistants and physicians) in 10 projects revealed that virtual team work has an overall impact on health care delivery. Virtual teams, as described here, increases organizational flexibility because medical teams can be created and disbanded quickly, as, and when needed. The measures of effectiveness are reduction in access time, cost, staff agility and economies of scale.

The reasons for using virtual teams are copious and cover different types of organizations and the various stages of a project life-cycle. For instance, virtual teams had been asserted as an auspicious design for building synergies within an organization and are mostly created for delivering sustainable innovation (Malhotra et al 2001). Obviously, innovation is a source of competitive advantage (Kay, 1993) and as much as an organization brings people together from different disciplines and processes, it creates more pioneering products or services. However, this does not imply that all virtual teams will meet the above expectations. In fact, most of them are at risk of failure. In a study of 56 engineering project teams within the aerospace industry, Gibson

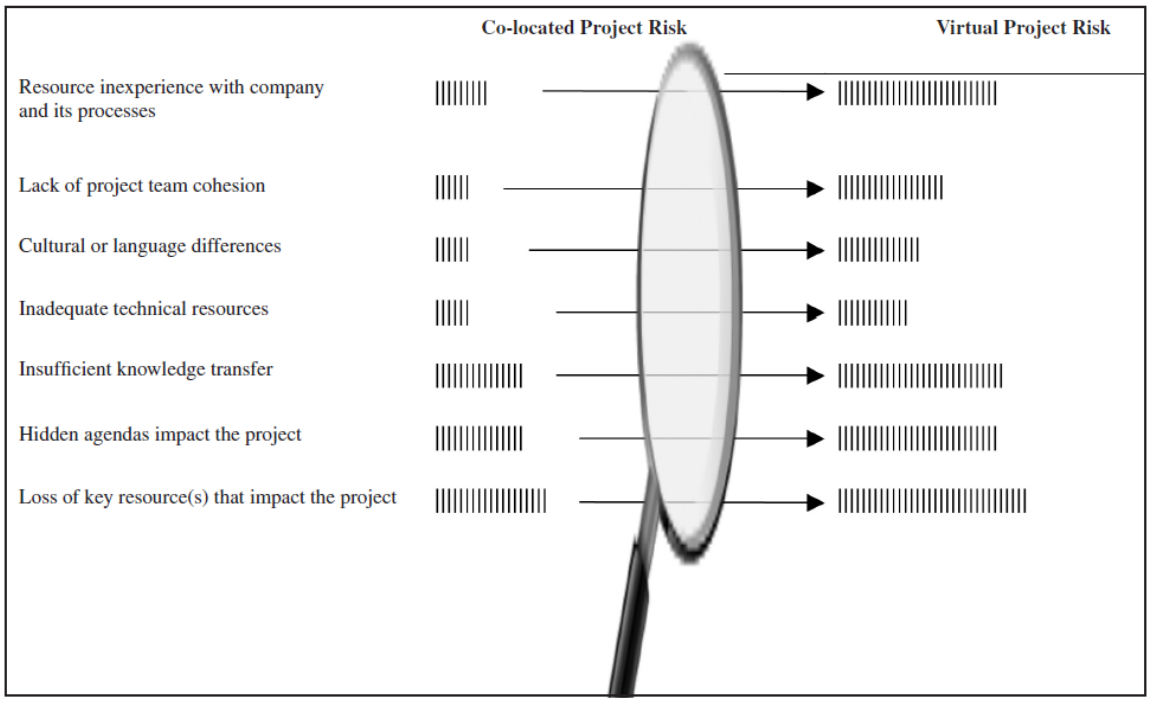
and Gibbs (2006) showed the extent to which virtual teams contribute to the success factors for innovation (discussed further below). The virtual teams studied by Gibson and Gibbs consisted of individuals from various functional areas relevant for the designing and delivering of a state-of-the art next generation military aircraft. Their paper revealed that the adoption of a virtual team can sometimes lead to unintended consequences within a project environment. The authors argued that one of the main benefits of adopting a virtual team, which is to increase organizational flexibility, can actually be detrimental to innovation. This is because flexibility and a dynamic structure may cause weak ties[1]. People need a strong and stable relationship to implement novel ideas (Obstfeld 2005 cited in Gibson & Gibbs 2006)

In an effort to justify the benefits of deploying a virtual team in an organization, beyond mere speculation, researchers have only very recently started examining the economic impact of their use. Unfortunately, many of the current studies on organizational-level outcomes stem from research conducted on small group interactions. A typical example is the research by Barrick et al (2007) who, investigated the impact of team communication and cohesion on an organization's overall performance and found them to positively affect a firm's financial performance and returns. Admittedly, it may be unsuitable to generalize these results to technology-centric work; technology is at the core of virtual team initiatives. See Mathieu et al., 2008 for a review of organizational level outcome in teams.

In view of this, Reed & Knight (2010) identified 55 reasons why virtual teams do not succeed – or do not succeed wholly. From their observation, 7 factors depicted in figure 2.1 below had the most significant impact on a virtual team success. Furthermore, in examining where and why a virtual team is failing to deliver expectations, Espinosa et al (2006) found that *cultural diversity* and *time separation* posed the most substantial barrier to the communicative success of virtual teams. For Lee et al (2006), *task complexity* were the main reason for virtual teams not succeeding. These factors constitute risk to a good effective virtual team (e.g. Horwitz et al 2006; Lee-Kelley & Sankey 2008; Kayworth & Leidner, 2000; Lurey & Raisinghani, 2001; Beise 2004). By risk the researcher means, a "facilitating function" for virtual teamwork activities (Reed & Knight, 2010, p. 19).

[1] Dynamic structure is described as the frequent changing of members, roles and relationships between members. As Virtual teams have a somewhat limited and dynamic lifespan, organisations can allocate roles, responsibilities and resources on an as needed basis.

Figure 2-1: Magnifier Effect of Risk in Virtual and Co-located Project Environments.



(Source: Reed & Knight, 2010)

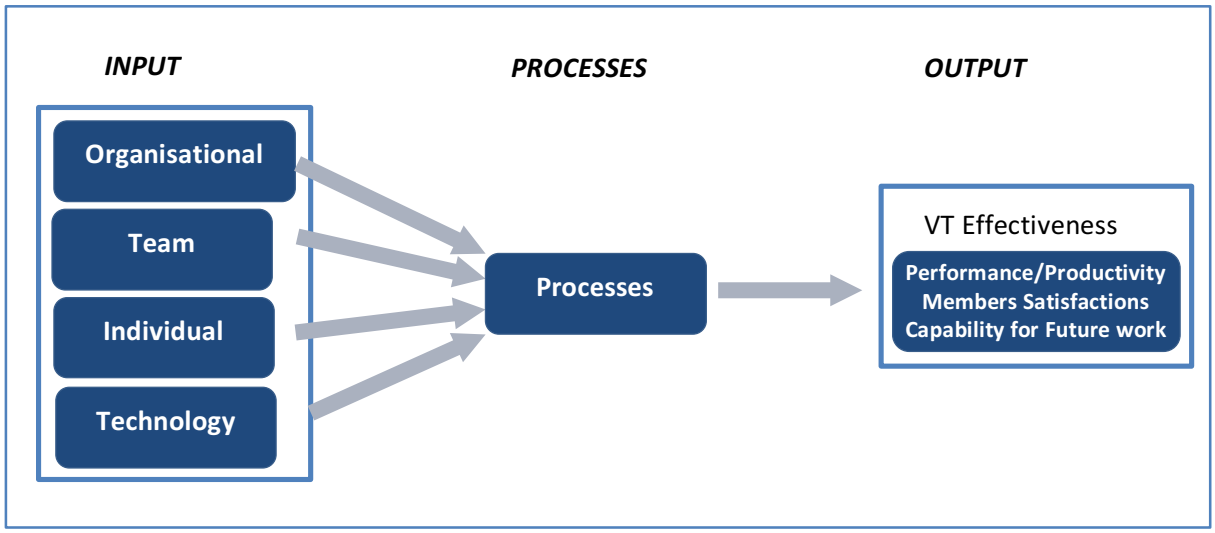
In addition, various studies attribute the risk of virtual teamwork to influences such as lack of trust (Kanawattanachai & Yoo 2002), communication breakdown ((Daim et al., 2012, Reed and Knight, 2010a, Paul et al., 2004), distance (O'Leary & Cummings 2007), electronic dependence effects (Cohen and Gibson, 2003), and coordination issues (Montoya-Weiss et al., 2001). As such, they review prior theoretical models on the same subject and extend the theory for the virtual context. In response, some authors have also proffered strategies that organizations might use to reduce the probability of virtual initiatives failing (e.g. in Dennis et al 2008; Dube & Robey 2008; Sarker & Sahay 2002; Olson & Olson 2000; Kayworth & Leidner, 2001; Lurey & Raisinghani, 2001). These strategies include: technological readiness, adaptive use of technology, stakeholder relations, education systems, training techniques. Other studies emphasize refining member selection processes (D'Souza & Colarelli, 2010) or creating translucence in communication structures (Bjorn & Ngwenyama 2009).

2.4 Achieving Effectiveness - Thinking in terms of "systems"

A number of communication and virtual team researchers have been influenced by systems ideas. But what is not always vivid in the literature is whether or not this is performed knowingly – that is, in consideration of its different aspects (details of system ideas can be found in Peter Checkland's book *Systems Thinking: Systems Practice*). Conversely, those that use the metaphor of a 'system' to think virtual teamwork, require some mechanism for deploying it. The Input-

Process-Output (IPO) model (Hackman 1990; McGrath 1991) has been a useful approach to understanding and analysing the roles of various elements and events of a particular virtual team. The model embodies the systems ideas. It describes how individuals and team behave, the effect of complexity, competing forces, end-to-end set of processes, boundary activities, and how they affect the team structure and its outcomes.

Figure 2-2: Input-Process-Output (IPO) Team Effectiveness Framework



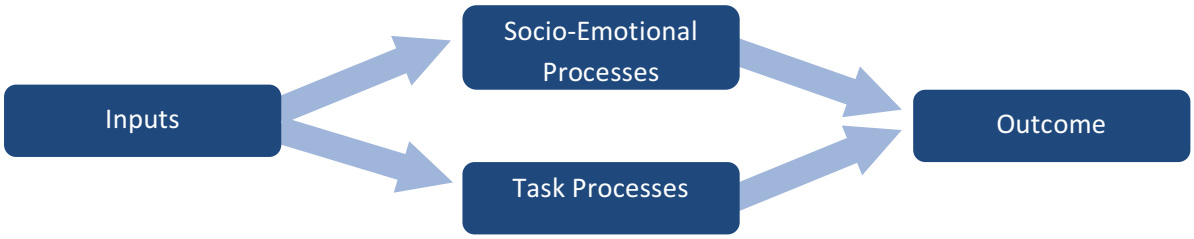
(Source: Adapted from Mathieu et al., 2008)

The IPO model has been widely acclaimed for its ability to assist researchers and even practitioners in identifying, organizing and analysing the intrinsic and extrinsic influences on virtual team initiatives. Espinosa et al. (2006) applied the IPO model to examine the global boundary variables that had the most salient effect of IS project success. Lurey & Raisinghani (2001) used it to determine the practices that led to or inhibited the success of a virtual team. For Beise (2002), the model was used to examine project managers' perceptions and use of virtual teams. Sridhar et al (2009) used the framework to explore the factors, including trust, affecting the performance of distributed virtual teams. Cramton (2001) investigated the impact of team dispersion and digitally mediated contact on mutual knowledge and collaboration. These authors all showed that various levels of interactions exist within the boundary context of virtual team working. They, and other studies, have been discussed at length in chapter 3 (systematic literature review).

The IPO model for work arrangement is constantly being revised by authors (e.g.; Powel et al 2006; Espinosa et al 2006; (Lurey and Raisinghani, 2001, Ilgen et al., 2005, Cohen and Bailey, 1997, McGrath et al., 2001). In Powel et al's (2004) conceptualization of the IPO model, they differentiated processes as either socio-emotional or task-related. In effect, they argued that in a

virtual team, the interaction among members can be influenced by the cognitive abilities of individuals or the mechanical characteristics of their task. Their findings stem from variables such as: communication, coordination, and task-technology-structure fit. These were, of course, micro-level set of activities carried out in order to deliver benefits or value to system owners. Espinosa et al. (2006) provided an IS project-specific conceptualization of Powel and his colleague's framework. They categorized micro-level process activities into process coping mechanisms and task process variables.

Figure 2-3: Powel et al (2006) Conceptualisation



Additionally, other authors adapted IPO models to show virtual teams as having a self-reflexive structure. Ilgen et al. (2005), drawing on the earlier work by Marks et al. (2001) describe virtual teams (their effectiveness) as involving a restructuring of mental models that support worldviews. The authors provided an additional theoretical component to the IPO model. They reconceptualised *processes* as being a *mediator* between inputs and outputs. For Marks et al (2001), 'emerging state' variables, such as trust, shared cognition, and shared understanding are also mediators. They depict the role that time, for example, plays in team functioning. In other words, within a virtual context, emerging states encompass the cognitive, motivational and affective behaviour of team members. They may however change as team inputs, processes or outputs to its environment change. This resulted in the creation of the IMO - Input-Mediator-Output model.

Based on the previous statements, the IPO model is an analytical tool for examining virtual team effectiveness. It embodies the systems ideas. According to the model, virtual team inputs must result in some desirable outcomes. Only then can the virtual team, survive. But survival has been found to be based on a subjective appraisal of effectiveness, such as: quality of a process/system, project success, product/service quality, and delivered benefits (Espinosa et al, 2006; Tidwell & Walther 2002; DeLone & McLean, 2003). Some constructs used in the literature to convey the purpose or justify 'survival' of a virtual team include: communication success, learning, the level of team work, member satisfaction, morale and how well the task process has been conducted (Ocker 2002; Valacich & Sarker 2002; Schweitzer & Duxbury 2010; Wixom & Watson 2001;

DeLone & McLean, 2003; Deluca & Valacich 2006). Member satisfaction refers to the extent to which team members are in agreement with their decisions, outputs and commitment of the team (Lin et al 2008).

2.5 Theoretical concepts pertinent to communication media behaviours.

Different conceptualizations have been adopted in theorizing the complex interaction between information technology, social structure and human interaction. In what follows, the researcher discusses a variety of perspectives within the socio-technical systemic framework. They can be used to further analyse and discuss the relationship between team virtuality and effectiveness.

2.5.1 Structuration-based view

A variety of researchers have adopted a structurationist view (or its extensions – adaptive structuration, alignment model, compensatory theory) to understanding virtual team working (e.g. In Majchrzak et al 2000; Orlikwoski 2002; Deluca et al 2006; Nandhakumar & Baskerville 2006; Xi & Zhenjiao 2010; Kock 2005). Given that technology is at the core of virtual interaction, it proposes that:

> "…the implementation and use of new technology are non-deterministic; technologies are structured by users in their contexts of use" (Majchzak et al 2000, p.570).

In this regard, technological tools provide different physical capabilities, which may guide a virtual team member's interaction with others, their learning and collaboration experiences. It can impact on individuals and teams either through its potential structural 'features' or 'spirits' (Timmerman and Scott, 2006, Desanctis and Poole, 1994). Structural features of technology have to do with the type of rules, capabilities or resources which such tools may offer. For example, a structural feature such as privacy or anonymity has been found to influence social processes when people use certain tools. They affect how or what [information] is shared using communication mediums such as chat rooms. Other researchers, notably Dennis & Garfield (2003) illustrated how virtual teamwork may be influenced through the 'Spirit' of technology. The term 'spirit' has to do with the core purpose of the tool and the expected benefits or value it should deliver to users. It is mostly influenced by either the designer's intentions or the user's perceptions (DeSanctis & Poole, 1994). This includes the interaction design, interfaces, knowledge inference, and training techniques.

Some media theorists argue that only the *spirits* or *structural features* of technological tools may not be sufficient to promote positive virtual interactions (Dennis & Garfield 2003). Rather, it's the

interaction between the structural features, the spirits, as well as how the team uses such technology that may guarantee its effectiveness. Zigurs & Buckland (1998) demonstrated how the potential structural components of a tool can promote a more cooperative interaction. They argue that Parallelism, Interface orientation, Anonymity and Meeting Memory can influence communication-based activities, particularly how information is shared and participative discussions promoted.

Parallelism: This is basically the ability for virtual team members to engage in activities simultaneously. The advantage of this feature is enormous. For example, Dennis & Garfield (2004) cite that it allows system users to make inputs without having to wait for anyone else. They also express that it facilitates equal opportunities for participation from all members. In doing so, parallelism increases each individual's sense of contribution towards the operating decision-making process. In their study on multi-user Group Support Systems (GSS), Denis & Garfield's found that parallelism alleviates obstruction of knowledge creations. This means that all virtual team members can have the same opportunities and the same level of involvement in team activities.

Anonymity: In order to guarantee a seamless integration of contributors in a virtual environment, virtuality sometimes permits anonymity. Anonymity enables virtual team members to make contributions without revealing their identity. However, this structural feature is mostly available in peer-to-peer technologies and it is important for virtual communities. It is not touted in all business environments. Anonymity, however, promotes uniform participation and communication by means of masking identity (e.g. knowledge sources, the source of conflict). Anonymity is most crucial when the effect of social costs associated with the virtuality will be significant (Dennis & Garfield, 2003); most especially in situations of high conflict-resolution and social evaluation.

Meeting Memory: Dennis & Garfield argued that this potential structural feature of technology is associated with storage.

Interface orientation is concerned with display and representations of entities.

The discussions above have shown how the basic 'structures' per se of technology may affect virtual team effectiveness, however, Dennis & Garfield warned that they are "socially dependent on how a team utilizes it" (p.291). This conclusion is in line with the basic premise of structuration, which suggests that a structure informs and constrains human action. Likewise, human action may produce and reproduce structure.

In sum, the theoretical lens of structuration provides insights on certain behaviours and some of its implications in virtual team dynamics and effectiveness. But the academic literature shows that the theory does not accommodate the differences in preferred media throughout the life cycle of a project. Its critical interest is in team development and not team task.

2.5.2 Media-Dependent Perspective

In theorizing the interactive relationship between virtuality and team effectiveness, the media-dependent perspective is another valuable framework. It is to be noted that communication processes are the primary component of media-dependent theories and should be first discussed.

Claude E. Shannon and Warren Weaver's mathematical approach to communication has been the corner-stone of electronic workflow. In their model, a communication process is described as comprising of sending, encoding, transmitting, channelling, receiving and decoding. Messages are represented by 1's and 0's. These signals are transmitted from a source (human or machine) through a channel, to a receiver. On arrival, signals are decoded back to their original form. The transmission rate may be affected by a number of factors including: the channel capacity, symbols, and the amount of frequencies that can be transmitted concurrently (Shannon & Weaver 1949).

Everett M. Rogers' communication process theory focused on the creation, sharing and attainment of mutual understanding amongst the parties (Roger 1986). In order words, creating and withholding information to oneself or even transmitting it to someone who may never understand its content is not communication. Roger (1986) reasoned that recipients of information need to demonstrate that the message has been successfully delivered and appropriately understood. Of course, during the communication process, the role of "sender" and "receiver" of the message is alternated amongst participants. This interchange may continue until communication is complete.

2.5.2.1 Media Choice Theories

With the above information in mind, researchers have theorized that virtual team success could be attributed to the task-media fit practices of the team. A group of researchers suggest that the performance and satisfaction team members get when working virtually is dependent on the type of task they are undertaking, and the mechanical characteristics of the communication media that is used. This determines the team's outcome (Yoo and Alavi, 2001). In effect, the theoretical basis of matching task, with the medium is grounded in two predominant [mid-level] theories. They are the Social presence theory (Short et al 1976) and Media Richness theory (MRT) (Daft & Lengel, 1984).

The Social Presence Theory reflects three key communication themes: co-situation - this explains how people who operate within a particular environment react to other members of the same environment; realism - this constitutes the extent to which the other person(s) appear to be real; and responsiveness - this represents the degree to which people can appropriately react. A number of communication theorists and virtual team researchers argue that peoples' social response to the virtual presence of others is similar to their physical response to (real) people (Swinth & Blascovich 2002; Rettie 2005). Others, however, explained that this may not always be true (Valacich et al 1993). The Social presence theory was proposed by Short et al (1976) as a way of explaining how any communication medium is able to convey cues and salience of others. According to this theory, the extent of social presence of contacts does not depend solely on the words or information exchanged between individuals, but also on the nature of interactions as well as nonverbal and verbal cues.

Theorists have proposed some variations to the social presence theory. Sproull & Kiesler (1986) for example, proposed the social context cues theory to reflect important dissimilarities amongst face-to-face and digitally mediated-communication. With regards to the virtual team setting, it elucidates the degree to which team members are collocated or dispersed. According to this theory, social context cues such as physical appearance, facial expression and various nonverbal and verbal behaviours are lacking in many forms of communication media.

The Media Richness Theory (after Richard L. Daft and Robert H. Lengel) has been the most prominent theory used by researchers to examine the relationship between virtuality domains and team functioning[2]. It has been used to study how technology is selected and used for team activities. Here, virtuality is measured in terms of the informational value of technology (media). MRT's most compelling argument is that team performance improves when a media with the highest richness[3] is used for communication-based activities (see table 2.1 below for illustration). The degree to which virtual team members are uncertain about issues can be reduced when more information is made available to them, whereas having better quality information makes reaching a consensus on issues quicker; this will make it easier for them to take action on an issue. Simply put, team success is based on each member's ability to process information in order to reduce

[2] The ideas behind MRT can be traced back to the literature contributions of Jay. R. Galbraith; Tom.E. Burns; G.M. Stalker; Paul Lawrence & Jay. W.Lorsch - as reported by MRT's original theorists. Galbraith basic proposition was that organisations process information. This information is required if workers want to be more confident in their task. This, in turn, enables them achieve an appropriate level of performance.

[3] Richness is described as the ability of a communication media to transmit salient cues that lack literal meaning; it denotes the bandwidth available to the media that determines its ability to transmit information that contain emotional or affective meaning. Lengel & Daft (1988) explicate further on MRT by suggesting that richness may differ based on four situations: (1) non-verbal cues (2) variety in language (3) immediacy of feedback (4) an individual focusing on a particular receiver.

uncertainty and *equivocality*[4]. In keeping with the media richness theory, technological tools that have lower media richness (e.g. Email systems) are better used for information gathering activities while moderately rich media such as video-audio technologies are suitable for problems-solving. Face-to-face contacts are best for idea generation and comprehensive team discussions (Maznevski and Chudoba, 2000).

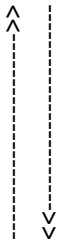
Media	Interaction	Continuum
Face-to-Face	Human-human Contacts	Richer
Video conference	(Machine) Digitally-Mediated Contacts	
Telephone Conference		
Synchronous Instant Messaging		
Synchronous electronic conferencing		
Asynchronous bulletin board		
Asynchronous email		
Written mail	Numerical documents	Leaner

Table 2-1: Communication Media (Adapted from Daft & Lengel 1986)

More recently, John R. Carlson and Robert W. Zmud contributed to the literature with their Channel Expansion Theory. Their theory was based on the individual as opposed to the media (Carlson & Zmud 1999). The authors argued that communication revolves around experiences. They involve experiences with communication partners, the organization's outlook and people's work context (e.g. culture, jargon, and organisation-specific language), as well as the subject of conversation, and the nature of the medium currently being used. Thus, a medium's richness is not static (as portrayed by MRT), but evolves based on people's level of familiarity.

Despite the theoretical sophistication of these theories in shedding light on the interactive relationship between people, the use of technology and performance, it has drawn some criticism.

Arguably, the premise of social presence or media richness is unreasonable in a holistic approach to virtual team working in the sense that it may fail to reflect the way different professionals – across disciplines - use various media (see below).

Firstly, media richness theory, for example, has been accused of inclining mainly towards the philosophical doctrine of positivism (Dennis & Valacich 1999). It focuses on task dimensional factors, and largely ignores the social factors such as team development, policies and relationship building, which are responsible for making sense of a complex task. This may suggest that human

[4] Further, the notion of Uncertainty dates back to the Shannon-Weaver model. In the 1949 book titled "The Mathematical Theory of Communication", uncertainty was described as the lack of information.

and organizational values are not [considered] characteristics of the empirical world that the theory tries to explain. Likewise, 'Richness' is arbitrary because it may be an expression of a person's preference. It could also be a way of communicating their feelings towards an object, event or situation (Ibid). In short, the terms Daft & Lengel used can be quite controversial as they do not provide a standard per se. Its meaning may depend on the individual (Markus 1994). Thus, validation is still within the intellectual domain.

Secondly, most of the proponents of Media Richness and Social Presence theories use it to test the 'perception' of media-fit and not the actual effect of media usage. Studies that use objective [or say quantifiable] measures rather than 'perceptions' for evaluating technology and its influence on team effectiveness can perhaps challenge the claims made by the theory (e.g. Dennis & Kinney 1998). Contrary to its central tenets as discussed in the subsections above, the objective performance of face-to-face interaction can be considerably lower than electronic media. For example, it may not be uncommon for practitioners to use technological tools to gather information rather than incurring a *cost* to achieve face-to-face interaction. In this situation, a virtual team's performance does not necessarily improve when a media with the highest richness (F-2-F) is used for communication-based activities. The summary here is that, media richness theory, does not allow a practitioner to calculate the consequence of every potential media available to them and evaluate each, in terms of their goals. In the context of this research, it may not allow a practitioner to evaluate the different dimension of virtuality applicable to them vis-a-vis their task/communication objectives.

The media richness theory proposes that the capability of an electronic media restricts people's intuitive modes of communication (Carte & Chidambaram 2004). Technology may also govern conversational topics in terms of preventing people from properly expressing themselves when conversing with others. For much of literature, there are hardly any empirical evidences to validate these claims made by the theory. It's worth noting that MRT has been validated in empirical studies that focused on more conventional communication media such as face-to-face and telephony. But inconsistency tend to arise in studies where research participants use mediums such as e-mails (Carlson and Zmud, 1999).

The most obvious criticism is that these models present a very simplistic view of organizational life. Deluca & Valacich (2006, p. 325) argues that neither the social presence or media richness theory is able to explain empirical results where users of communication and collaboration tools (e.g. Email-based systems) modify their behaviour in ways that seemed to be independent of the extent to which social presence or media richness are conveyed. The literature offers an even

more interesting explanation of such results, arguing that the theory appears preoccupied with uncertainty and equivocality (Damian et al 2000). It assumes that learning within an organization context is negative or non-existent, when in fact, the discussions above shows that learning is one of the key characteristics of most complex open systems.

Theoretically, the above issues raise the dilemma of rigour and relevance to this study, mainly because the theories may not account for the subjective, as well as the relatively objective nature of a virtual team's experience in a real-world project environment. Table 2.2 below further illustrates the weaknesses of MRT in explaining media choice in the work environment.

Author	Agents, Task	Method	Findings not explained by Media Choice theories
Markus (1994)	US risk management corporation 375 – managers	Quantitative - Survey	Email supports rich communication for managers. This suggests its richness over other medias. Its major beneficiaries were executives and senior managers.
Dennis & Kinney (1998)	132 university students – Experimental participation	Quantitative study – Laboratory setup	The basic proposition of MRT wasn't supported by the findings. The use of a richer media didn't result in better performance when people are engaged in higher equivocal tasks. However, the authors noted that failure of MRT may be attributed to a number of factors. This include: research design, nature of task, subjectivity of richness.
Burke & Chidambaram (1999)	33 groups of management students. 127 Participants	Quantitative Study – Task-based laboratory Setup	Findings provided mixed support for media use and choice theories. For example, results show that dispersed project team members could be better managed with synchronous media as opposed to face-to-face. Recall, on MRT's scale of richness, face-to-face media ranks higher than synchronous (e.g. video) for equivocal task. Various reasons were given for reduced group performance, including – F2F media characteristics facilitating a sense of kinship and closeness amongst group members which can be a source of distraction from task. Leaner media, on the other hand gives primacy to the message, thereby improving group performance.
El-Shinnawy (1997)	US-based Aerospace Corp.		The findings show that a richer media (voice mail) is less favoured to a leaner media (email) in situations of uncertainty and equivocality. Storability and traceability associated with emails made it the media of choice for the practitioners.
Deluca & Valacich (2006)	8 team, process improvement; 2 sites	Field-based	A media that lacks in its ability to support social cue doesn't rob it of its richness for the task. Likewise, some people have the ability to perform as effective as others, when using lean media. Written documents can be very formal and focused. In this regard, it can capture intended cues and meanings.
Lee (1994) & Ngwenyama & Lee (1997)	US Practitioners Managers Secondary data from Markus (1991) and Markus (1994) respectively.	Qualitative Interpretivist – Hermeneutics	Richness emerges through the interaction between receiving messages and actively interpreting meaning. For some users in their work context, emails may support richer communication. Available resources and users skills all contribute to richness.

Joinson (2002)	The authors observed changes in behaviour in terms of 'criticism' whenever people work virtually. That is, managers tend to send more positive messages as well as provide unparalleled level of support to their subordinates whenever collaboration tools are in used. This finding is somewhat consistent with the observations of Kock (2005). Ned Kock formulated the Compensation Adaptation Theory (CAT) to explain how team members adjust their communication behaviours to accommodate the shortcomings of their communication channel.

Table 2-2: Exemplar studies pointing out some conceptual weaknesses of MRT

Furthermore, the empirical weakness of MRT can be demonstrated from the knowledge management perspective. Whilst conducting an Interpretivist inquiry on knowledge transfer mechanisms, Jasimuddin et al (2014) discussed various factors influencing media choice. For example, time sensitivity (conceptualized under corporate urgency) was a driver for email usage. This may suggest that richness - or appropriateness – of a media varies with the organisational situation (Jasimuddin et al 2014). In their earlier paper, Jasimuddin and his colleagues argued that knowledge influences how people communicate, with whom they communicate and the things they can communicate.

Indeed, several alternative views about media choice and various aspects of communication exist in the literature. For Kock (2001, 2004), communication behaviour within an organisational setting is psychobiologically driven. He argues that some media such as face-to-face come more naturally to humans. Others, such as asynchronous communication are cognitively demanding, and therefore some people are more hesitant to use them.

Some IS researchers have developed and embraced social-dependent theories. These theories help elucidate on the situational factors that influence team design and informational behaviour. Specifically, they expound aspects that have to do with information delivery, learning processes, and technological artefacts.

2.5.2.2 Media Synchronicity Perspective

In 1999, Alan R. Dennis and Joseph S. Valacich put forward the theory of Media Synchronicity, as an alternative to the theory of media richness (Dennis & Valacich 1999). It seems possible to adopt the theory to derive predictions about the impact virtuality including the use of multiple technologies, may have on individuals and teams engaged in communication-based activities. This is because it does not define a media as rich or not; rather media are based on a number of material properties that may have considerable effect on an individual and team's interaction, collaboration and learning (Kock 2005). The theory also accommodates socio-economic factors.

It may be worth noting that in 2008, the original theory proposed in Dennis & Valacich (1999) was refined and further explicated by Dennis, Fuller & Valacich (2008). Theoretical foundations were clarified.

The Media Synchronicity Theory (MST) has three dimensions: capabilities of media, communication process and team functioning. It builds on the basic propositions of Shannon & Weaver (1949) and others, notably McGrath (1991), Rogers (1986).

(1) Characteristics/Capabilities of media: Media may possess any of the following capabilities (Dennis, Fuller & Valacich, 2008):

- Transmission velocity – The extent to which team members may receive rapid feedback. This physical characteristic of a media was labelled as 'immediacy of feedback' in Dennis & Valacich (1999). It was however revised to 'transmission velocity' by Dennis et al (2008). The authors reasoned that 'transmission velocity' depict how fast a message can reach its recipient. Immediacy of feedback tended to portray the outcome of an interaction.
- Parallelism – The extent to which simultaneous conversations may be supported effectively; it represents the number of simultaneous transmissions. It is to be noted that whilst reviewing how MST has evolved through the years, it was noticed that Dennis & Valacich (1999) ranked parallelism as being 'low' in face-to-face media. Dennis et al (2008), on the other hand, ranked face-to-face as supporting a 'medium' level of parallelism. The reason for the change is unclear but it may very much be based on the fact that in face-to-face communication people don't always talk one at a time.
- Rehearsability – The extent to which users may alter, develop, build customized content and fine tune a message before it is sent; it represents the ability to fine tune a message before it is sent.
- Re-processability – The extent to which users may be able to re-address a message in light of the context in with the communication occurs; it represents the ability to process a message after it has been received to give better understanding.
- Symbol variety – The degree to which a message can be represented; it represents the different ways a message can be encoded.
- Reciprocity – the length of time between the sending of a message and the receiving of a response. This sixth capability was not explicit in Dennis & Valacich's (1999) original framework, but was conceptualized in Glancy and Isenberg (2011) to represent a time interval.

(2) Communication Process: This is the second dimension of the media synchronicity theory. It stresses that whenever different media are available, the most effective media selected considers two fundamental communication processes: information processing (convergence of shared meaning) and information transmission (conveying information). According to this theory, the different communication media as shown in Table 2.1 do not exhibit the same level of support for conveyance and convergence process. Convergence has to do with the extent to which shared meaning can be developed while conveyance represents the exchange of information following the pondering on its meaning (Dennis & Valacich 1999, p. 5). This

determines the connection between communicators in virtual projects or geographically dispersed task. This becomes even more significant when virtual teams are culturally diverse and geographically dispersed.

(3) **Team function:** This third dimension represents the role of social and organizational systems. It is concerned with how a team is designed, including the relationship between members, their experience working on particular tasks and work histories. In analysing these complex interactions, the Time Interaction Performance (TIP) theory formulated by McGrath (1991), provides a useful framework. The theory identifies three concurrent functions in which teams are capable of performing while they execute their work. The first is termed the *production function*, which explains how virtual teams contribute to their embedded organization as their members perform assigned task. The second function deals with the *well-being* of the team. This highlights the supportive ethos and behaviours that are relevant for an effective virtual team. The third simultaneous function is a member-support (i.e. Relationship with others).

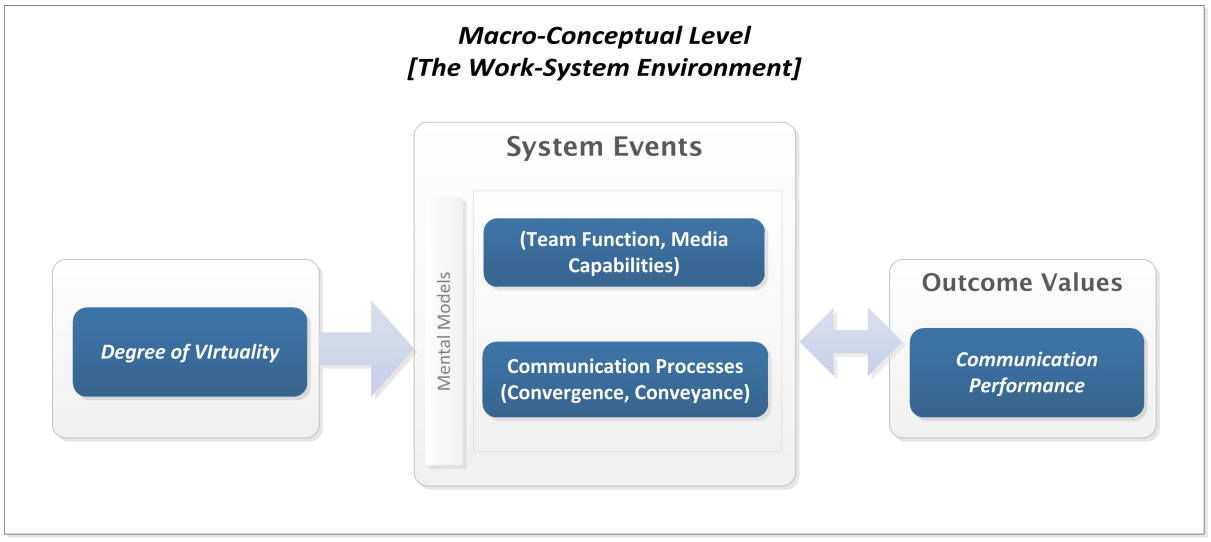
Based on the discussions above, section 2.6 builds the conceptual framing for this study.

2.6 Building the Conceptual Framework Diagram

Discussed in the section above, this study examines how team virtuality interactively impacts on team processes and influences the outcomes. Drawing from the IS literature, the conceptual framing comprises of three main components: aspects of virtuality, knowledge communication mechanisms, and effectiveness components. The conceptual framing is based on two guiding principles: that is, it elucidates the assumptions made by open system thinkers with those of communication media, to understand different levels of abstraction – in a purposeful manner. The tool provides insight on how a complex open system – such as a virtual team can survive in a turbulent environment.

The proposed framework is shown in Figure 2.4 below.

Figure 2-4: Conceptual Framework Diagram



(Researcher: Initial context diagram showing the relationship between virtuality and performance assessment)

It is important to re-emphasize how the components are related in light of this study (textual descriptions). Recall, the statements above indicate that virtual team initiatives are composed of complex and ill-specifiable human behaviour as well as programmed behaviours (which may be behaviours of designed part of the technical system, or man-made artefacts).

From the left hand side, team virtuality is the input variable or team design factor that will be considered in this study. Schweitzer and Duxbury (2010) outlined three interrelated dimensions of virtuality: Member virtuality, Distance virtuality, and Team Time worked virtually. In their model, team virtuality was conceptualized beyond a single interpretation. This, as well as other author's perspective on virtuality has been discussed extensively in chapter 3 – systematic literature review.

The second aspect of the framework is based on the process of conducting virtual work[5]. It focuses on a team's ability to interact and learn. Unlike the input conditions that focus on the current state of the team and individual; the process criteria emphasizes the future state of the team and its members in relations to different project requirements. This facet draws on media synchronicity theory in explaining how teams function, the structural characteristics of media as well as how individuals transmit, process, and respond to information. The reason for adopting MST relates to analysing the recursive linkages between the micro events and the macro-conceptual context. In the section above, MST was described as a mid-level theory.

[5] A 'process' view of events, mediators, and emergent states are not antithetical.

The third facet of the conceptual framework is the actual *outcome values* component. The literature review shows that the effectiveness of teams can be assessed based on the successes of individual/team task and processes (See section 2.4 above). It includes measures of satisfaction and performance, wherein performance is seen as the degree to which an individual or team's output is consistent with objective measurements such as a required standard. The assumption seems to be that a good effective virtual team should be capable of optimal performance. It should also provide satisfaction for stakeholders (Lin et al 2008; Bal & Teo 2001; Malhotra & Majchrzak 2004; Hackman, 1990). The following definition has been used in this study:

> Outcome values are the extent to which the team can meet its own expectations (i.e. sustenance of virtual interaction, creation of knowledge value - professional development & learning) and those of its composite members (i.e. communication media viability & usefulness).

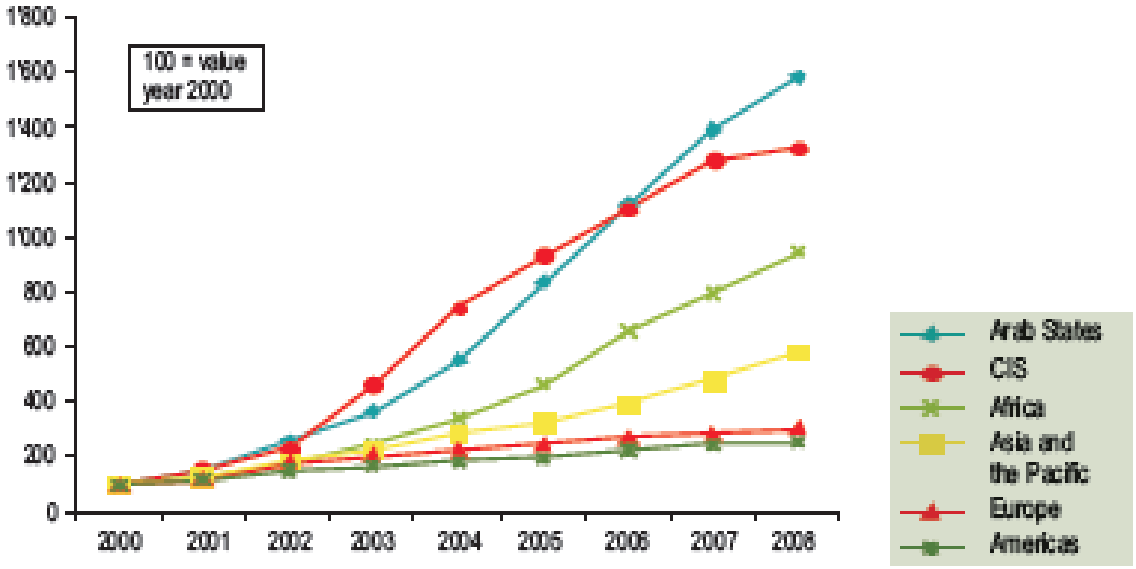
Lastly, the framework advocates understanding the environment (climate) in which virtual initiatives occur.

2.7 Virtuality and the Society

This sub-section provides an academic justification for the geographic context of the research.

One useful inference from the International Telecommunications Union (ITU) report is how widely African private and public-sector organizations are adopting the virtual working environment. The ITU report shows an unprecedented rise in the penetration of ICT & telecommunication infrastructure in developing countries, suggesting an increase in virtual interactivity (ITU 2012). With a falling cost in IT infrastructure, organizational uptake of virtual working arrangements has seen strong growth, and by 2013 the number of new users to an internet connected environment surpassed those of developed countries. Putting this in perspective, by the end of 2012, approximately 168 million individuals [in Africa] embraced some form of distributed communication service. This is a huge leap from the dwarfish 4.5 million in 2000. It corresponds to a 15% penetration rate of the continent's 1.1 billion people (Internet world stat 2013). Virtual interactivity and connectivity, through the internet, has become a part of every society, globally.

Figure 2-5: Internet User growth trend by World Regions



(Source: The World Telecommunication Report (ITU))

With such rapid societal, organizational, and technological change, serious opportunities and challenges can arise. How people are working may be changing. Thus, a look at developments in productivity (team performance) in sectors such as industry and services is worthwhile. Note that the World Employment Report (WER) also highlights the urgent need for strategies, managerial policies, and innovations, targeted at sub-Saharan countries. Its primary aim should be to raise levels of labour productivity - by whatever order of magnitude.

As organizations seek to leverage on the potential benefits of new forms of working, researchers look at ways of managing the inherent risk; formulating and extending theory. Research has focused on different conditions, industries, sectors, task and projects. Nonetheless, from the extensive literature review of about 270 virtual team research articles in chapter 3, less than 7% were based on actual African project experiences, although a few researchers considered an African geographical context – South Africa – in their analysis (Horwitz et al 2006). What must be expressed is that Africa should not be seen as a singular homogeneous cultural unit for the following reasons: it has a long history of disparities that arise from varied colonial influences, its ethnic cognitive difference, as well as the economic imbalance of states, which play a role in the income of individuals or exposure of organisations/persons to information sources/resources.

2.8 Geographical Background

Taking into account the discussions above, the geographical focus of this study is in Nigeria. Nigeria makes an appropriate geographical context for a number of reasons. First, it is a country that is split across ethnic lines with 374 pure ethnicities. However, ten ethnic linguistic groups

constitute up to 90% of the population. On this note, this geographical context offers a fertile ground to understand social systems, including cultural forces that might shape a virtual team strategy and outcome. This research also takes advantage of the geographical dispersion of citizenry to examine what insights into the virtual experience can be revealed from studying an ethnic heterogeneous context. The focus and analysis, however, is not on the ethnicity-nationality debates, but on communication behaviour and its role in virtual team dynamics and effectiveness. Nigeria has one official language – English.

Second, virtual interactivity has become prevalent among industries in the Nigerian context. The country is Africa's biggest economy, with the highest number of digital network connections – (by working population 48.4 Million). Internet penetration also increased by 34% in a 12 years period. The number of PC built also rose by about 0.5 million per year. Thus, the researcher expected aspects of virtuality and process interdependence to feature, as it remains prevalent in a well-connected society. Furthermore, Nigeria has an established track record of foreign partnerships - as evidenced in its espoused internet traffic and in ILO data. This leads to the third reason, which is the largest market in, and probably most informed workforce from sub-Saharan Africa (ILO 2012).

Nigeria has a population of over 170 million people, with about 50% being of working age. In fact, the quality of the Nigerian workforce has drastically improved in the last decade. In the last 15 years, an increasing amount of students are getting their education in Europe and America. About 2500 of them return home every year to join the existing workforce. Others are absorbed into the international labour market.

Finally, current industrial policies in Nigeria and other parts of the world have been aimed at creating a wider geographical dispersal of industries – particularly manufacturing (Global Employment Trend 2013). Economic factors are setting the stage for an era of digitization of rural areas. By implication, a greater number of underserved regions are gaining access to not only internet facilities and economic activities, but also to a variety of communication and information resources. The major concern for managers now is how to effectively support communication and decision-making across the enterprise; provide a good working climate and raise productivity (team effectiveness).

2.9 Framing the Research Question in relation to Research Needs & Core Concepts.

This research illuminates some of the challenges and opportunities associated with information system domains. Reviewed in section 2.3 & 2.4, a virtual team, for example, could assume a long-term strategic role in an organization besides its core operational function. This proposition was conveyed within the literature as its development (virtual teams) from being an innovative work arrangement responsible for overcoming constraints due to location, lack and control of critical resources, to becoming a strategic work system responsible for delivering responsiveness, innovativeness in complex tasks and related issues. This implies that the degree of virtuality is very vital to a team process (macro-level), but also to the individuals who work together (micro-level). On the one hand, in organizations, a virtual team is peddled as providing a series of benefits which cannot be appropriated from traditional co-located teams. Individuals, on the other hand, are interested in (amongst other things) how these factors shape their working environment, including their ability to create shared understanding. They play a key role in determining the effectiveness and efficacy in which complex tasks are executed, and the extent to which diversity has an effect on how it functions.

From a sociological perspective, it has been important to establish whether the increase in virtual interaction – facilitated by media devices - is supporting new kinds of human relationships or whether it's a mere replication of existing human behaviour (Gilson et al 2015). A group of critics argue that virtual teamwork, in a way, isolates people and reduces *real* social bonding or connections because it causes lesser physical person-to-person exchanges. This line of argument may invariably suggest that the strength of relationships as well as the quality of information exchanged within a team has decreased as virtual forms of interaction increases. On the other hand, the advent of technology and innovation in organizations may suggest that virtual team initiatives have actually enhanced communication to unparalleled heights in history. It is creating channels for more interaction, information transmissions and learning. However, as Xue et al (2005) came to understand these problems, they discovered that sources of trouble lay in the very nature of virtual teamwork. This led them to conclude that "the factors that make virtual teams work together are not well understood". Clearly, neither are the factors associated with the quality and usefulness of systems of communication applied to virtual team initiatives.

Despite having a significant number of publications, the virtual team research area is typically referred to as "maturing" (Saunders & Ahuja 2006, p. 663) and still "struggling" empirically (Schweitzer & Duxbury 2010, p. 269) and theoretically (Watson-Manheim et al 2012). Gilson et al

(2015) contended that the domain of virtual teamwork still offers "promising opportunities" for research and practice. For Verburg et al. (2013) who agrees with Raghuram et al (2010), the area of virtual work is still theoretically and empirically robust and dynamic, and providing an answer to even the fundamental question of "what is virtual?" will continue for a long time.

Excitingly, some scholars suggest an agenda for future studies. One of the items on their agenda is a call for research that focuses on team virtuality. This research call is centred on the observation that very few studies offer meaningful definitions and measures of a team's degree of virtuality (Dube & Robey 2008; Schweitzer & Duxbury 2010). Further, the extensive literature review in Chapter 3 shows that little is known about how conventional teams actually differ from virtual teams when it comes to media decisions. There is a huge gap in our understanding of the different aspects of virtuality (Schweitzer & Duxbury 2010) and communication processes (Dennis et al 2008) and not just how technology functionalities add value to an organization.

To summarize, there are empirical and theoretical gaps in the literature. On the empirical side, it is desirable to provide better documentation and explain virtual teamwork and communication media behaviour as this has implication on organisations. On the theoretical side, most of the existing theories are somewhat limiting – to our context. For example, arguments in structuration are designed to explain certain behaviours but not the differences in preferred media throughout the life cycle of a project. Likewise, existing literature on media dependence has focused on task dimensional factors. It does not extend to social functions such as policies, knowledge and relationship building that are responsible for understanding a complex task. Social influence theories focus on media choice, normative or emotional meaning and not communication performance. Although the literature review shows that nothing answers the question of what drives communication behaviours in virtual team better that the theory of media synchronicity, recent stream of studies indicate that there is still a need for empirical investigation.

The media synchronicity perspective (after Dennis & Valacich 1999) was unable to concretely answer some questions on virtual team work and communication media such as those put forward by Deluca & Valacich (2006) and Kock (2006). This resulted in the two authors producing new propositions and a new theory, respectively. Hence, it is unlikely that virtual team effectiveness is simply a matter of *media synchronicity* alone.

It is worth re-emphasizing that MST has been revised and explicated by Dennis et al (2008). This, in principle, addresses some of the shortcomings of previous empirical findings. More explication of this theory would add to the existing body of knowledge, notably to communication performance outcomes in development projects.

In this regard, this research intends to explore how a virtual team adds value through the duration of a development project and what motivates this process. It asks the following questions to clarify the issue of why the design, behavioural and communication performance issues associated with a virtual team arise:

1 Does the adoption of a virtual team strategy create value throughout the duration of a development project?

2 Are there any risks to such a strategy and what could hamper its realization?

The intermediate questions asked are: (a) what is the nature of the context in which communication occurs in a virtual team? (b) How can the communication patterns within the Nigerian operations of a development programme be identified, represented and visualized? (c) What key factors are associated with the usefulness of systems of communication applied to their virtual team initiatives?

2.10 Conclusion

This chapter provided a theoretical and geographical background of this study. The chapter began with a discussion on the limitations of traditional work arrangements. It then detailed some situational factors a development project team has to deal with. The review also uncovered that no virtual team theory exists *per se*, rather theories and models from other intellectual domains have been adopted for a virtual context. The limitations of these theories have been demonstrated.

A conceptual framework which serves as a reference point for the research proposition was developed and critically examined. It was generalized through the metaphor of systems and communication processes. The researcher uncovered that, communication media theories (as a mid-level theory) can provide some behavioural insights on the capabilities and assets that may be available to practitioners. Even so, it offers explanation for those factors that are relevant to the continued survival of a virtual team.

Research questions were formulated to reflect the research needs and the conceptual framework. They will aid in meeting the four research objectives as outlined in Chapter 1.

In addition, the geographical context was discussed. Nigeria was believed to present a fascinating geographical context for studying how work systems are evolving, including the context in which communication occurs within an ethnic heterogeneous environment. Indeed, the study will go a long way to engender the success of organisations such as international joint ventures.

In what follows, the concept of team virtuality, communication media and effectiveness is examined in detail. The extensive review of literature in Chapter 3 below would shed light on whether a virtual work should be considered a silver bullet or more of a white elephant.

Chapter 3 : Literature Review

3.1 Introduction

The advent of increased research in the area of virtual teams as a result of organizations' reliance on communication technology has necessitated a comprehensive examination of prior work, so as to provide deeper insight into the subject domain. This ensures that previous studies are not duplicated. For that reason, this chapter examines key debates before proffering areas for further development. The effects of a number of situational factors, as found in the extensive research literature are explored.

The chapter is divided into two main sections. Section one highlights the guidelines for the type of studies to be synthesized, analysed and the search strategy. Subsequently, there are critical discussions on virtual teams with the succeeding sections providing empirical findings and theoretical models.

SECTION ONE: The Review Process

3.2 Reviewing the existing literature

The virtual team literature is diverse, ranging from general explorations to detailed case studies and practical experimentation. It covers different types of products, tasks, tools, individuals, team types, industries and countries. In order to gain a good understanding on what is happening within the literature, the researcher performed a systematic search of online databases. The electronic libraries included: Jstor.org, Ebsco, Web of Science, InterScience, and Google Scholar. Keywords such as "virtual teams", "virtuality" "remote teams", "dispersed teams", "global teams" and "distributed interaction" were used as search criteria. Other key sources included relevant books, proceedings of conferences dedicated to the IS research area and non-academic industry publications.

The next stage involved examining the articles within the leading journals. Their titles, abstracts, keywords and full text were reviewed in-order to determine how each study contributed to our knowledge of virtual teams, particularly its design parameters, deployment, use and how stakeholders cope with task complexity with respect to communication. Almost 270 articles were found that might be included in the literature review[6].

[6] not all were selected for the final narrative review

The growing number of articles being published shows that it is interesting and currently relevant to the academic and practice community. For this review, however, greater emphasis was laid on studies published from 2000 till present. So as not to miss important articles, the review also adopted a 'snowball' approach. As more articles were sourced, preliminary reviews were carried out and further references were pursued. This was necessary as it helped sharpen the focus of the review exercise and triangulated on key insights.

After reading and recording the findings of the [text in the] journals, a final analysis and narrative summary was performed. A special database software tool was developed by the researcher to warehouse notes and artefacts for the entire project - as the literature review was part of a wider research exercise. It also allows a defensible and backward traceability.

It may be worth noting that the Web of Science database has a citation mapping functionality, which facilitates snowballing. It also aids in tracking high impact studies. The figure below (3.1) illustrates how Jeremy Lurey & Mahesh Raisinghani's article on the "best practices in virtual teams" (Lurey & Raisinghani 2001) is used to identify 98 other articles including Schweitzer & Duxbury (2010).

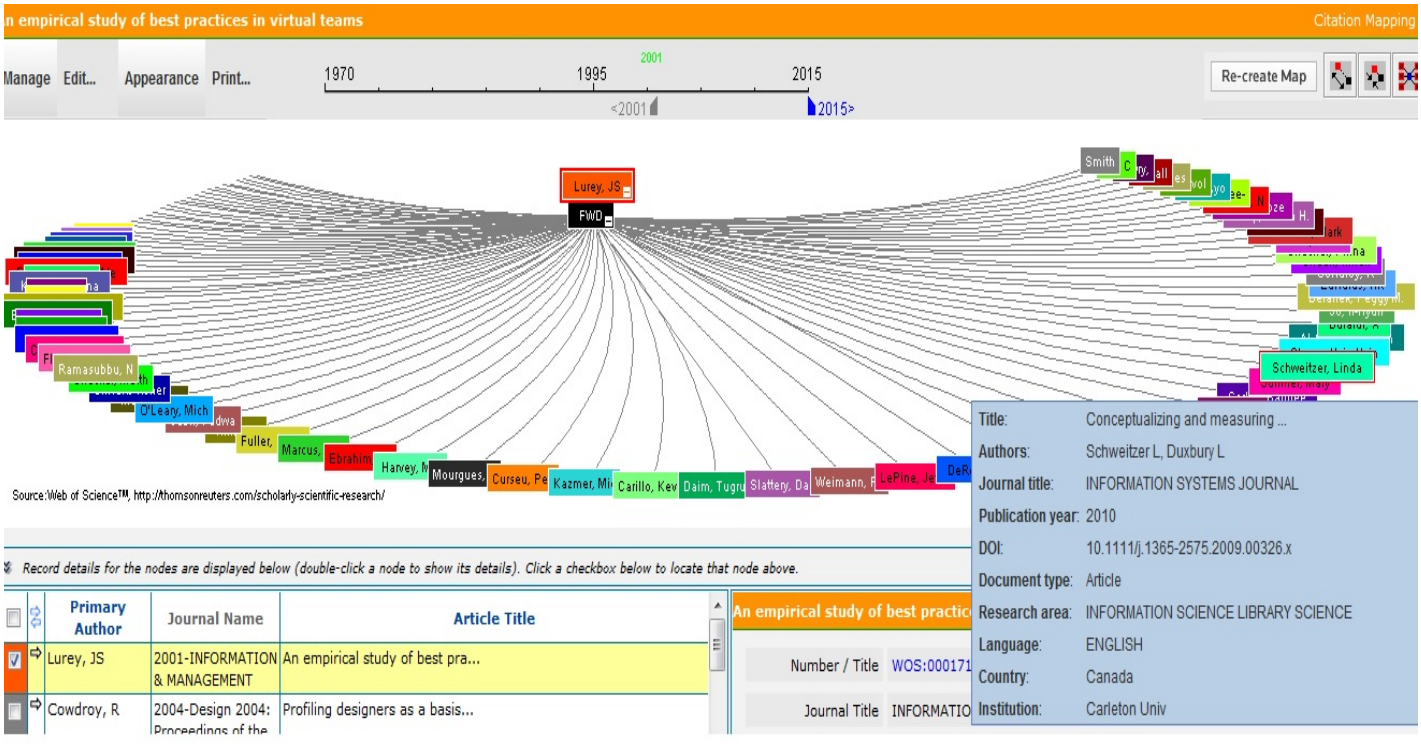


Figure 3-1: An example of Snowballing

3.3 Study Selection

The bases of inclusion of articles were as follows. The selected author(s) must have participated in a virtual team activity /project or be reporting on an empirical study; that is, the publication must contain data, results or analysis. It should have both IT and virtual interaction as key themes in the manuscripts. Nonetheless, to broaden understanding of the literature, some key conceptual and theoretical papers were reviewed. Such papers were not affected by the cut-off date.

To eliminate selection bias, the articles were not explicitly screened on the basis of whether it mentioned any particular contingency factor (e.g. Leadership, knowledge transfer) or technological tool. However, success antecedent, project activities, team outcomes or performance measurements needed to be discussed or measured. The empirical study should not just address psychological motivations. Specifically, investigation of the factors should be done within the context of a task(s) or project(s). Relevant computer-mediated-communication studies were included.

Journals
Information System
Small Group Research
Organisational behaviour
System Science
IEEE Transactions on Professional Communication
Computing and E-collaboration
Information & Knowledge Management
Decision Science
Project Management

Table 3-1: Most Common Journal/ Research Discipline

In conclusion, this section shows how the entire review process contributes towards the final development and direction of this thesis. This next section plots the landscape of current reported knowledge in terms of the attributes of virtual teams and elements of communication.

SECTION TWO: The Review

To begin, some key terms must be understood. They will be discussed from different standpoints: firstly, presenting virtual team working from a technological view and secondly, from an organisational outlook. Certainly, some key thoughts, in view of the general practice, will be discussed.

3.4 Communication in Context Revisited: A Review of Interactions over Time & Space

The overall concept and principles of virtual team might seem clear and understandable in the sense that team members are recognized as performing the majority of their work from different locations. However, in describing the virtual team concept, it is important to first explain what is meant by a team (this was discussed in the previous chapter), and then determine what actually makes it virtual. This approach is consistent with the views of Schweitzer & Duxbury (2010), who, among others, argued that a virtual team is actually a subset of a team. This means that all teams (including virtual teams) possess similar characteristics (see table 3.2 below). Critical to this argument, when does a team become virtual? How can it be differentiated from others? The assumption in the literature seems to be that if a virtual team is not a unique type of team, then there is nothing new or interesting about it.

CHARACTERISTICS	ALL TEAMS		
	Statues	***Co-located Teams***	***Virtual Teams***
GOAL	Collective Performance & Outcomes	Yes	Yes
SYNERGY	Positive	Yes	Yes
ACCOUNTABILITY	Individual & Shared Leadership	Yes	Yes
WORK	Modular/ Independent	Yes	Yes
Knowledge & skills	Complementary	Yes	Yes
CULTURE	Complementary & Varied	Yes	Yes
COMMUNICATION METHODS (e.g. use technology	Institutionally Determined	Yes	Yes
BOUNDARY SPANNING	Organisational/O.U Originating	Yes	Yes

Table 3-2: Commonalities between team

[Source: Adapted from Robbins (2005); Schweitzer & Duxbury (2010)]

3.4.1 Exploring the Virtual Working Environment

For decades, the notion of virtual has confounded the imagination of thinkers, writers, scholars, designers, entrepreneurs, and visionaries (Bailey et al 2012). Researchers have been exploring

methods needed to create a new form of reality of what may constitute 'typical' within contemporary society; that is, the evidence of human presence appearing real. The application of these ideas has been located within three management science domains: (1) coding and simulations (2) virtual communities (3) the creation of virtual teams. With respect to the first, one of the frequently cited applications is in the creation of representations of the real world. These are mostly game-like worlds (virtual worlds) that pivot on the idea that remote entities, and those physically present can be co-situated in the same environment. It ranges from architectural sketch pads to enhanced user interfaces, multimedia simulated environments, simple spatial representations, and customized 3D avatar experiences. They are mostly used for experimentations. For example, studies show that graphical virtual worlds and computer-based simulated environments are being used to measure customer satisfaction, and in education using the second-life concept[7] (Longridge et al 2001; Kincaid et al 2003; Bailenson et al 2008; Minocha & Morse, 2010). As such, simulations could be described as the closest technique by which contemporary society can be recreated (Bailey et al., 2012).

It may be worth noting that much of the research into virtual worlds has been guided by social presence theories (see its description in section 2.5.2 above). Actually, the notion of social presence has been likened to Erving Goffman's conceptualization of 'self' (Rettie 2005). Goffman discusses 'cues' as projections in the presentation of self (Goffman 1990). In the virtual world, this may reflect in customizable features such as avatars, configurations, text background and colour schemes. According to Goffman, human behaviours are like masks. That is, the projected self is usually based on a desirable/deliberate image.

Empirical research into the virtual world of second life has benefited from these lines of reasoning. For example, Bullingham & Vasconcelos (2013) studied the presentation of different identities within a virtual environment. Applying Goffman's theories, the authors found that human participants of a virtual world were recreating their offline selves, online. A number of artefacts were involved in the recreation process, and these include: voice, avatar design, and personal detail. Although Bullingham & Vasconcelos (2013) observed that people actively recreated themselves online, the authors also discussed the possibility that an online self may not be a true representation of offline identity in that the virtual environment allows 'editing' of behaviours. This means that some traits can be suppressed. The truth of the matter is that any identity can be projected in the virtual realm. Bullingham & Vasconcelos reasoned that fear, for instance, can even result in the construction of a particular identity.

[7] Second-life is conceived as a 3D virtual world. One illustration of the concept was presented by Linden Labs in 2003; it allows people recreate daily activities. It supports synchronous interactions.

Another common application of virtuality is the creation of *communities*. Before telecommunication technology became accessible to so many users, the word community typically represented a collection of closely-knitted people who mainly resided in the same vicinity. With the advent of online platforms, which allow people to exchange ideas in a virtual environment, this concept of proximate community interaction has been further augmented by virtual interactions. Virtual communities may involve individuals from the same geographical location who know each other on a personal basis, but may be interacting on an international or professional level, with anonymous participants. As shown by Brosnan & Burgess (2003), 76% of the professionals surveyed engaged in virtual interaction - such as internet-enabled activities - for their professional learning. To this end, virtual communities are now the buzzword of how individuals generally interact with each other over the internet; bringing different people (most times unknown to each other/ anonymously) with common interest or objectives together with only one goal – to share. To stay true to this goal over a prolonged period, they need to have a continuing interest in what they share (Klein et al 2005). This concept has been applied with reasonable levels of success in social networking platforms such as Facebook, LinkedIn, Tumblr, where people *like*, *follow* and exchange news (referred to as updates, feeds, blogs), events and even personal photos. The concept has also been applied in an organizational context as evident in Fahey et al's (2007) case-study of SAP online communities. In virtual communities, the net-worth, and network-of-people may grow exponentially as new interests are added and shared. There is, of course, some network effect here, where, the more people nurture a particular interest, the more people it attracts - which ultimately facilitates community lock-in (i.e. loyalty). This is either lock-in to the subject, or particular virtual platform. Indeed, several lines of academic research has emerged from virtual communities; they have been described notably by Wasko & Faraj (2005), Hibbert (2008), Brown & Duguid (2001), Fahey et al., (2007).

After discussing how virtuality has been applied in simulations and communities, it may be unclear as to what actually constitutes virtuality in teams. Table 3.3 (below) shows some key similarities and distinction between the various types of virtual work. For instance, virtual communities, as with a virtual team, consists of 'people' who may be from similar backgrounds (e.g. cultural, functional disciplines), and who may interact without the need to ever meet in person. They may both be influenced by similar contingency or situational factors. But a virtual team, unlike virtual communities, has well-specified targets and goal. They are directed by ends, rather than being means-directed. As such, it is not an overstatement to suggest that the difference between the types of virtual work has more to do with the *set of activities* undertaken by the physical *entities* made virtual.

	Type of Virtual Work		
	Virtual Teams	**Simulation**	**Virtual Communities**
Key Determination of Virtuality	Distant collaboration	Study & Experimentation	Distant-Learning
Physical Entity that is made Virtual	People	Object or People	People
Activities	Synergy: Positive	Synergy: Cause-Effect	Synergy: More Neutral
	Accountability: Mutual	Mutual Dependence	Individual
	Well-specified targets, goals and ends		Means directed based on continuous interest
Interaction Amongst the Physical and Virtual	People interact with one another via indexical representation that stand for the team members	People work with primarily iconic representation that substitute for physical entities and their associated processes	
Determinant of Digitization	Mediated communication	Emulated operation	Sometimes Anonymity
Technology	Digital-Communication Systems	Computational and modelling software	Online Platforms
Spatial Separation	Between Team members	Between People & Objects of other people	
Skills	Complimentary		Random & Varied
Representation (input & Output)	Emphasis on digital representation	Emphasis on the visualized representation	
Workers Relationship with representation	Operating with or on	Operating within	
Common Types of Representation	Voices on telephone, text in e-mail, CAD, drawing, arguments	Models, animation	Text, feeds, post, blogs
Examples	Virtual team of real estate agents, software developer, process improvement members, or IT service managers.	Building design - architectural, Education – Second life	Virtual communities of gamers, Open source communities.

Table 3-3: Summary of Virtuality including aspects of digital representations

(Source: Adapted and extended from Bailey et al 2012).

As the illustration above suggests, there is no one-size-fit-all approach to illustrate what *working virtually* entails. For Bailey et al (2012), virtuality perhaps implies "working with a representation of the physical rather than with the physical itself". They continue by saying that:

> "Virtuality occurs when digital representations stand for and in some cases completely substitutes for, the physical objects, process or people they represent" and "Digitization involves the creation of computer-based representation of physical phenomena. Because the representations can traverse long distances via computer and telecommunications links, digitization facilitates separation between people and the represented phenomena (physical objects, physical process, or other people." (P.1485)

The two key functions of technology in a virtual context are access and communication. By implication, there are strong dependencies between time, place and communication process (Powel et al 2004). One comes across four possible communication scenarios in the literature: Same-time, same-place; Same-time, different-place (synchronous); Different-time, same-place (asynchronous); Different-time, different-place.

	Same Place	Different Place
Same Time	Face-to-Face Meetings	Remote Conversations E.g., Conferencing Systems
Different Time	Local Message E.g. Shared Workspace, Co-authoring, Shared Database	Asynchronous/Remote Message E.g. Message Based Collaborative Systems

Table 3-4: Communication Scenarios

(Source: DeSanctis & Gallupe's (1987) Time-place matrix)

The reason for different communication scenarios lies in the fact that people interact for different reasons and to achieve different goals (Hertel et al, 2008; Curseu et al, 2008).

3.4.2 Media Capabilities for Communication Processes

The next section discusses how communication and collaboration technology is paving the way for teams to become more or less virtual.

Until the late 1990's, technological tools used by business and academic teams were designed around traditional message systems such as bulletin boards, newsgroups and electronic mail. As shown in Table 3.4 above, these tools fall under the 'different-time' and 'different place' communication scenario; they are one of the forerunners of digital communication systems. With asynchronous communication technologies, messages can be transmitted intermittently rather than as a continuous stream. In a team context, electronic mail for example, is mostly used to deal with partially disconnected time frames, so as to gather information, decrease group interaction and setting up meetings. However, as traditional message systems were being used for different stages of complex tasks, several problems were identified, including the need to store information into categories (Majchrzak et al., 2000) and reduce information overload (Kock 2001; Alavi et al 2001; Kock 2004). For these reasons, newer systems were needed, based on the principles of electronic mail. As Hazemi et al (1998) points out, a new category of communication and collaborative application emerged to facilitate better message handling, message structuring,

work team organization and workflow support. It also allows rapid and interactive user experience.

van Fenema and Quresh (2004) carried out a field study on virtual teams, investigating how team members in India and Canada were using asynchronous communication systems for information sharing. The authors report substantive benefits in using email systems such as the ability of an individual in a different location to leave a digital representation of 'required action' for retrieval at the receiver's convenience[8]. The idea is that email systems allow delayed interaction and people can work from different places and at different times. They further noted that asynchronous systems reduces information dependence as it increases the importance of crafting comprehensive messages (van Fenema and Quresh, 2004). The literature also indicates that participants in an asynchronous environment were not confined to a specific time and place, neither are teams who use email systems constrained by temporal or geographical boundaries (Benbunan-Fich et al, 2001). As a consequence, virtual team members can contribute to conversations whenever they possess useful inputs. Team members also have an opportunity to reflect more on their contributions and have more articulated discussions. However, in email-based systems, as more mails are received on the same discussion thread, it becomes more difficult for virtual team members to track the conversations, and therefore the subjects in their discussions will change very rapidly (Arvapally & Liu, 2011).

Caballer et al (2004) observed that an asynchronous functionality delays the resolution of project issues that require urgent attention. This is because project members do not have to be *Active* to receive messages. Being *Inactive* means that virtual team members are not on the system simultaneously with either receivers or senders. They work at different times and usually from different places. Caballer et al's (2004) research data further showed that email systems provide less satisfaction to users due to the fact that the communication media is poor in transmitting all the information required to complete a complex task. Moreover, a survey of 214 managers communicating across sites indicated that 61% of them end up misinterpreting their colleague's via email (TandBerg, 2007). The ability of email systems to enable uploading and downloading from computing devices and to search through or query work objects at a somewhat fast speed ensures a greater flow of communication between virtual team members (Benbunan-Fich et al 2001). Nevertheless, in the real world, the amount of information that can transmit via email is

[8] According to Dennis et al (2008), communication systems can digitally represent a variety of symbol sets ranging from visuals, to verbal, text, tables, videos, and mathematical models

not a lot; large files cannot be sent through email. There are limits to send within an organization, and a smaller limit to send outside the organization.

As workers speed increasingly becomes a crucial aspect of work to manage, particularly for teams working under time pressure (Caballer et al 2004), another research direction that emerged was based on the *Active Message* concept. In regards to the communication framework detailed above (Table 3.4), Active messaging entities support same time – different place project activities. By this, virtual teams can establish point-to-point connections between its members, usually via synchronous protocols. Active messaging entities comprise of communication ports and their key purpose is to permit uninterrupted communication between the sender and the recipient of a team message. Within a project environment, the sender can simultaneously act as a receiver, and a receiver can also operate as a sender; concurrent interactions are permitted. For example, instant messaging functionalities (typically referred to as instant chat messaging) allow virtual project teams to have real-time conversation - initiating a virtual meeting discussion. Thompson & Coovert (2006) found that instant messaging can be a feasible alternative for teams that don't have the means to have face-to-face meetings. Nardi & Whittaker (2002) also noted that active messages could help in developing an impression of social connection and consciousness within a team. It encourages unplanned exchanges that foster understanding and trust (Olson & Olson, 2002; Zheng, Bos, Olson & Olson, 2001).

Conferencing systems in general, integrate synchronous and asynchronous communication functionalities. So they support real-time interactions in a virtual team. These systems typically possess audio-video (multimedia) capabilities. Thus, virtual team members may operate in different places and in different time zones. Cummings et al (2002) observed individuals to be manipulating the use of communication modes to achieve different objectives. Virtual conferencing is a good functionality that leads to creating confidence and trust between team members (Aldea et al., 2012). In a model developed by Brown & Miller (2000), video-conference was shown to be the best fitted media and it produces the highest attitudinal outcome of team members. However, Baltes et al (2002) noted that the somewhat absence of social context cues in video-conferencing setups may lead to frustration and dissatisfaction of teams using conferencing systems. Likewise, 43% of the 217 managers studied by TandBerg (2007) reported that people misunderstood communications over conferencing systems (specifying telephoning systems).

Recognizing the substantial influence of organizational elements, the literature highlights the importance of proper training of users. Cascio (2000) argued that individuals should be taught to

operate in video conferencing environments, most especially if the technology is sufficiently different from those previously used. Conversely, Van der Kleij et al's (2009) downplayed the importance of providing costly training sessions to people that have regular tasks, and who expect to have future interactions working together from different sites or at different times. They showed that conferencing systems, for example, have a learning curve and virtual teams can merely be allowed to learn and adapt to them while executing their complex task. Van der Kleij et al's (2009) results from their experiment of 66 members of 20 virtual teams suggested that emphasis on training could be counterproductive to an organization; that is when effort, time and financial resources are devoted to the development of solutions to *non-problems.* Instead, virtual teams should be allowed to adapt their existing technological frames in response to any new technology. In theorizing these complex interactions, Leonard-Barton's (1998) model of the successful adaptation process provides a useful framework.

In addition to the communication systems that are based on messaging and conferencing, another research direction has been on systems that enable *argumentation*. A typical argumentation system provides collaborative functionalities that assist teams in making decisions. The tool is based on the concept that people undertake intense conversations and analyze task by exchanging *arguments*. The earlier models of these systems were designed to support 'different time' and 'same place' activities as they represented ways of emulating a continuous brainstorming session in a group decision room. However, as distributed technologies become more mature and are increasingly applied to more complex working environments and scenarios, argumentation systems tend to fall into the 'different time' and 'different place' groupings. As discussed in earlier sections, virtual teams enable teams to function beyond the constraints imposed by co-location. Therefore, argumentation systems are digital communication tools that allow stakeholders who work at different times to post arguments, supporting evidence and present alternative solutions to issues notwithstanding the proximity of their collaborators. It employs a client - server architecture where the central server processes the digital representations (arguments). A representative tool of this category includes: *Collaboratorium* (Klein, 2007; Gurkan et al, 2010) and *HERMES* (Karacapilidis & Papadias 2001).

Klein (2007) investigated how 220 people within the University of Naples were using an argumentation system (Collaboratorium) to work at different times. The author showed considerable benefits of augmentation-systems in different areas of collaboration. Klein found that such communication-systems are not only relevant for organizing conversations that were made at different times or helping team members better understand problems, but also to support multi-criteria decision making. In another empirical study, Liu, Wanchoo & Arvapally

(2011) evaluated the performance of argumentation systems for collaboration and learning. From their experimental research involving 25 software development students working from different sites, they found that these communication systems help individuals' exchange knowledge better.

In a later study of 21 students, Arvapally & Lui (2011) developed a metric that can help researchers compare email systems and argumentation systems for knowledge exchange, namely: quality of collaboration and average number of posts per member of the team. As such, the authors empirically evaluated the effectiveness of email-based and argumentation systems for collaborative decision-making. Their results confirmed that the *learning* and *collective intelligence* of a team can be achieved when members use either email systems or argumentation systems. However, their results indicated that knowledge amassed via argumentation systems is more effective for problems solving because it is captured through arguments. In addition, Arvapally & Lui found that email systems are poorer in supporting collaborative decision-making because it takes longer for people to achieve a consensus when emails are used. Argumentation tools can be used to facilitate negotiations (Hazemi et al (1998).

With the advent of increased bandwidth and broadband connectivity (ITU 2009), web-based support for asynchronous communication has gained increasing acceptance within the business and academic community. Web-based tools such as Weblogs and Mozilla Bugzilla are typically used to enhance or enable communication and collaboration over the World Wide Web (WWW). Of course they improve information sharing as it facilitates the rapid distribution or publication of project information resources. They also enable video streaming functionalities in which recorded images, discussions or virtual meetings can be re-visualized. Visualization, using web-based tools can help team members understand their task after a virtual session (meeting) (Aldea et al 2012).

A more recent trend is the use of social media for virtual teaming. Facebook has been one of the tools most frequently used to support communication and collaboration. Etim & Huynh (2015) examined the use of social media for virtual teaming. The study was based in a large Vietnamese Bank. Data collection was from seven virtual team members using social networking tools such as NetMeeting, Twitter & Yammer. Based on the results, Etim & Huynh (2015) find social media platforms to be useful for virtual teaming, mostly in enhancing communication between existing and newly formed teams. The content of their task included holding meetings and socializing.

It is worth differentiating between Web-based communication systems (some authors used the term Web 2.0 (Murugesan, 2007) or Enterprise 2.0(McAfee, 2006)) and other commercial groupware products such as *Lotus Notes* and *Lotus Sametime*. Lotus Notes, for example, facilitates digital communication based on shared file functionality, and digital representations can be

recreated, indexed, searched, updated and routed as required. Here, computers are the integration platforms for digital communication as opposed to the Web in web-based tools.

Nonetheless, discussions in the literature show that the direction of causality between technology and a virtual team is still debatable. An important question that has been raised is: Does the use of technology make a team virtual? (Lurey & Raisignhani 2001; Fiol & O'Connor, 2005 ; Cohen & Gibson, 2003). Schweitzer & Duxbury (2010) expressed doubts about the possibility of technology making a team virtual. According to their conceptual framework, technology does not appear to be a sufficient condition to characterize a virtual team. They argued that the dependence on technology is a likely consequence of being virtual – and not necessarily a reason to be called a virtual team. After all, many modern teams are already using tools such as smartphones to increase mobility, VoIP, Web-conferencing solutions, as well as visual collaboration solutions to enhance work environments and keep teams closer together.

Consequently, for a team to be 100% virtual, organizations need to equip their teams with the most appropriate communication tools. To this end, vendors such as Microsoft, Cisco, Lotus, Oracle and IBM have integrated some of the key features of digital communication (as discussed above) into their developed software. Commercial collaborative products provide email-based features, document management, argumentation functions, meeting scheduler and group conferencing. The resulting tools can be a Group Support System (GSS), Group decision support system (GDSS) or Collaborative information portals. They are developed on the *open client-server architecture*. On the one hand being *open* means that the tools are a dynamic collection of rules and resources (Orlikowski 1995; Hartel et al 1998). Orikowski (1995) further explains that open ended application usually:

> "… offers benefits of flexibility, but also creates the possibility that – without adaptation of the technology to the context and vice versa – the technology will not reflect local conditions or communication norms and hence be underutilized or inappropriately utilized" (Orikowski 1995, p.424).

Table 3.5 below provides a survey of some commercial products and shows a summary of their key capabilities. Although increasing evidence suggests these technologies already work together in very powerful ways (Kock and Lynn, 2012; Watson-Manheim and Belanger, 2007). They also have a wide range of features by themselves. It is worth reiterating that this understanding is at the centre of the Media Synchronicity Theory. MST has been discussed in Chapter 2. Recall, MST does not focus on the communication features of a media device because they can be designed or integrated in different way. Rather, its focus is on the various capabilities that influence communication processes (convergence and conveyance). These are not necessarily the same.

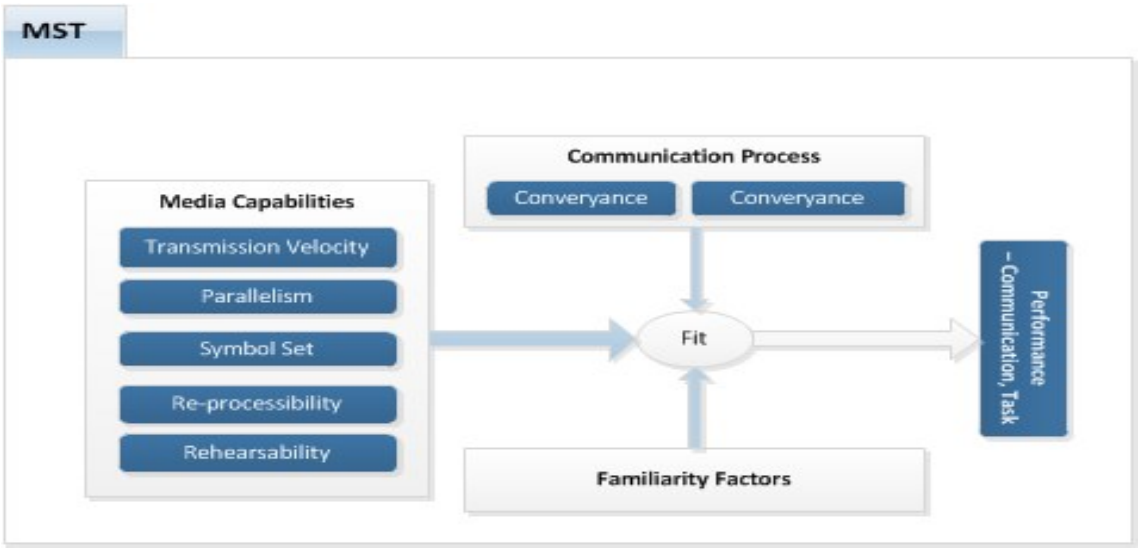


Figure 3-2: Media Capabilities in a Communication Context (from Dennis et al 2008)

Furthermore, it is not unreasonable to state that modern communication and collaboration tools can evolve into any media device. For instance, most smartphones can be used to make video or telephone calls. They also have email capabilities and can be transformed from a handheld phone to a super computer, which supports complex augmentation. It can also employ web-based integration where a cloud server processes files or stream videos. The fact of the matter is that all these capabilities can be used simultaneously or separately.

Vendor/ Product	Primary Functionalities	Other key capabilities	Some team Coordination features
Microsoft Exchange	Email functionality	Conversation treading, document sharing, information sharing; Text, images	Intelligent meeting scheduler, calendar, contacts diary - for new employees
Lotus Notes	Shared database functionality	Document Warehousing & document sharing; Multiple formats (text, images Voice, video capabilities)	Work assets catalogues, Project histories
Novell GroupWise	Active messaging, Email functionalities	Information sharing, discussions threading; Notes (text)	scheduler/calendar synchronicity, task management
Novel Soft Solution	Shared database functionalities	Document sharing; Searching and retrieval or documents	
Cisco WebEx Social	Display/ white board, Active messaging, Conferencing((IM/Tele-Presence, audio) functionalities, Email systems	Speed request-for-proposal (RFP) by crowd sourcing answers, tagging interest, discussion treading, information sharing	Standardized naming conversions, knowledge transfer, work assets & project histories
Go-to-Meeting	Audio and HDface functionality with either Toll-based phone conferencing or iVoIP	Social video visualizer, Presentation & follow-up	Support mobility and Recurrent meeting scheduler; Support Up to 25 member conferencing
Share Point	Content Management systems and Whiteboard	Enterprise Content Management	work assets & project histories

Table 3-5: Summary of Architecture of Some Popular Products
(Source: Gathered from multiple industry and practitioner documentation)

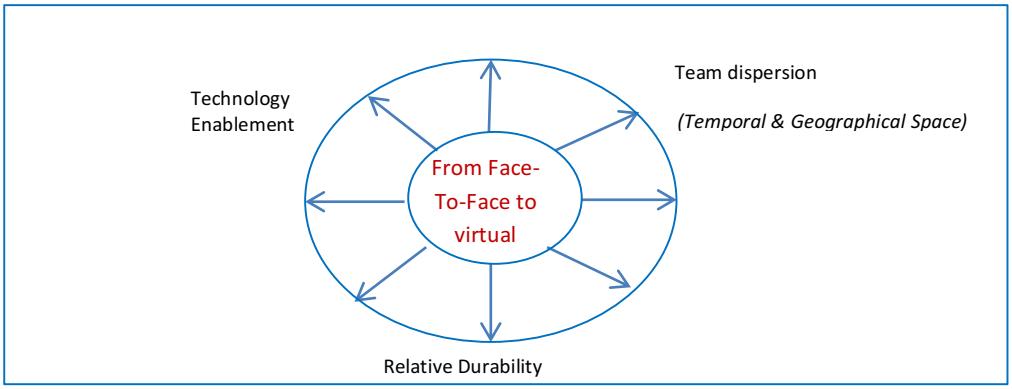
3.4.3 Survey of Dimensions of Virtuality in teams

The majority of the studies on virtual teams have perpetuated a dichotomized view of human behaviours as seen in the works of Alge et al, 2003; Kratzer et al 2006; Robey et al, 2000; Van der Kleij et al, 2009; Edwards & Sridhar, 2005; Caballer et al, 2005. The underlying assumption is that there are distinct differences between computer-mediated and face-to-face interaction, digital communications versus human-human communication, virtual versus real, proximate as opposed to dispersed, online versus offline, off-screen interaction versus onscreen. However, studying virtual teams in natural or business environments (as opposed to laboratory environments) led to new observations. For example, Lurey & Raisinghani (2001, p.3) noted that a single team member deciding to perform part of their work from a remote location does not create a virtual team arrangement.

Other authors [e.g. (Gibson and Gibbs, 2006, Kirkman et al., 2004)] observed that real world teams were neither purely proximate nor 100% virtual. Like many white-collar jobs, workers may sometimes engage in same-site collaboration and other times distant collaboration. Therefore, capturing virtuality of teams as a dichotomous measure was one-dimensional, particularly for field studies. For Zigurs (2003 p.340), the often-assumed dichotomized view is actually a continuum, as teams may vary from being fully proximate (i.e. having zero degree virtuality or 100% face-to-face interaction) to being more virtual. Even the most proximate team can be influenced by technology components and processes such as the use of email, video conferencing. Therefore, identifying a clear or single cut-off point by which a team becomes a virtual team can be difficult. For this reason, virtuality has been seen as a variable state and not a fixed condition.

A number of theories have attempted to define virtuality at the team level. To illustrate, Figure 3.3 below conceptualizes virtuality as a composite of three distinctive dimensions: team dispersion, technological enablement and relative durability of the team. As shown by the evenly distributed arrows, all aspects of virtuality may be equally important (Zigurs, 2003).

Figure 3-3: Some measures of virtuality in Teams



(Source: Adapted from Zigurs, 2003)

Schweitzer & Duxbury (2010) undertook an in-depth exploration of virtual teams and differentiated the criteria for developing and maintaining a virtual team from measures of its virtuality. Using a quantitative study of 30 virtual teams from a Canadian-based company, the authors identified and analysed four (4) aspects of virtuality: extent of not working face-to-face, collocation patterns, distance between collaborating members, and the extent of undertaking asynchronous work. Due to the similarities between the former two aspects, they aggregated the dimensions of virtuality into three: team time worked virtually, member virtuality and distance virtuality. According to Schweitzer & Duxbury (2010), member virtuality embodies the extent to which the members of virtual teams may be co-located or dispersed. It was operationalized as the proportion of individuals that worked in different locations. Distance virtuality represented a geographical separation of members and it was measured based on the amount of effort or 'travel time' needed for team meetings. The last aspect of virtuality discussed by Schweitzer & Duxbury (i.e. Team work time) represented the proportion of team task that can be performed virtually. It elucidates issues such as work shifts and flex hours. From Schweitzer & Duxbury's (2010) standpoint, any given virtual team will have all three aspects of virtuality, each with varying levels of degree. Schwietzer & Duzbury's (2010) virtuality dimensions were developed as a result of an in-depth theoretical analysis of the likely factors that differentiates a virtual team from proximate teams.

Additionally, the findings of Chudoba et al. (2005) showed three overarching aspects by which virtuality in a team is established: team distribution, variety of work practice and work mobility. Team distribution referred to the degree to which a virtual team may contain members that are dispersed across various geographical locations and time zones. It also includes language difference. Although Chudoba et al. (2005) conceptualized geographical distance and time

separation as a single dimension of virtuality (i.e. team distribution), other scholars such as Staples and Webster (2008) separate them into two dimensions: time zone virtualness and structural forms. In Chudoba et al's (2005) study, the *work process variety* was used to represent the extent to which a team-based organization brings people together to achieve collective goals. In determining virtuality of teams, it expounds the differing expectations and views virtual team members may have regarding issues (e.g. culture, trust).

From their empirical study on team empowerment, Kirkman and his colleagues (Kirkman et al., 2004) equally captured virtuality as a 'sliding scale', and discussed three aspects: (1) The proportion of time members spend working face-to-face compared with working virtually (2) The number of team members at a particular location (3) The proportion of time team members spend doing virtual work vis-a-vis other duties. With the exception of the third dimension, Kirkman et al's measures of virtuality seem consistent with Schweitzer & Duxbury's findings. Part of the appeal of Schwietzer & Duxbury's (2010) dimensions, in comparison with others, such as (Kirtkman & Mathieu 2005; Martins et al 2004; Bailey et al 2012; Gibson & Gibbs, 2006; Chudoba et al., 2005) is that it is highly intuitive. Team members can readily identify with the depiction of the three over-arching dimensions of virtuality. But for Riopelle et al. (2003), it is all about the context of work and may not by limited to just physical location, team size, cultural and language variations, and time-zone. Aspects of virtuality may be set by business conditions.

Besides the common aspects of virtuality already discussed, Bailey et al (2012) introduces an additional aspect of virtuality: 'indexical representation'. They established that people (virtual or collocated) operate within the bounds of representation; that is, people operate *with* representations of each other (e.g. text of an email; voice on telephone) or *on* digital representations from others. Arguably, this may be an added predictor variable that renders a team, virtual. In brief, Zigurs (2003) view is that the more aspects of virtuality a team exhibits, the more virtual it may be.

The development of continuum measures of virtuality enabled a programmatic research on virtual teams. By this, it allowed researchers to use common sets of definitions and measurements (e.g. In Gibson & Gibbs 2006; and Robey et al, 2003). For these reasons, researchers have shown that aspects of virtuality such as technological enablement, distance and the extent of face-to-face interaction have separate, yet meaningful patterns of correlations with other variables (e.g. team outcome variables). For example, Schweitzer & Duxbury's index of virtuality (that is; member virtuality, team time worked virtually and distance virtualness) was used to examine the connection between virtuality and attitudinal outcomes such as performance,

satisfaction, capacity for future virtual collaboration and professional development. They observed that the physical distance amongst team members was highly correlated with their perceived level of effectiveness (i.e. two measures - satisfaction & performance). They also observed that team member's virtuality was considerably linked with member views of a virtual team's performance. Their results cast some light on what makes for a more or less "effective" virtual team.

Kirkman et al. (2004) examined the moderating effect face-to-face interaction has on team empowerment, process improvement and customer satisfaction. They measured virtuality by counting the amount of face-to-face interactions. Empirical analysis from 35 teams showed a positive relationship between virtuality, team empowerment and their performance.

Chudoba et al (2005) found that measures of virtuality (that is, workplace mobility, the team distribution and variety of work practice) had a negative implication on team outcomes. Conversely, the data collected from their Intel case showed that no particular relationship exists between team distribution (one aspect of virtuality) and its performance. Of course, such findings contradicted some similar studies which identify distance itself to have a major influence on team effectiveness. Different possible explanations have been attributed to Chudoba et al's (Chudoba et al 2005) contradictory finding on virtuality in teams. First, the corporation explored in this case study, Intel, had over the years developed in-house mechanisms which helped its employees adapt to any issue caused by distance (e.g. organizational, or cultural differences). Second, the benefits of the team distribution outweighed the limitations of virtual working – (as consistent in the discussion in chapter 2 above).

Overall, the mixed nature of these findings might be further evidence that the multiple components often associated with a virtual team are not as significantly interrelated as previously presumed. For instance, teams that are geographically dispersed don't necessarily have to be more electronically dependent (e.g. Cohen & Gibbs 2003). Teams that are geographically separated don't have to be structurally dynamic. Gibson and Gibbs (2006) find that a team can be geographically dispersed and still maintain a stable structure. This result re-emphasizes the independent and non-interrelated effect that the different virtual team factors or design conditions might have on team functioning. It also goes to say that the presence of one feature doesn't necessarily compensate for the other. This reinforces the need for rigorous research that examines any virtual team factor and context - in its own right. It is worth noting that research in this area covers a varied range of subject domains, including software engineering, enterprise modelling, development projects, engineering projects, routine processes.

Issues/ Variables	Selected Studies
Distance	Gibson and Gibbs (2006); Sarker & Sahey (2002) Sarker and Sahay (2004); Chudoba et al (2005);Schweitzer & Duxbury (2010);O'Leary and Cummings (2007); Cohen & Gibson (2003); van Fenema & Quresh (2004); Griffith et al. (2003)
Time Separation	(Griffith et al., 2003); Espinosa and Carmel (2004);Sarker & Sahey (2002); Espinosa & Pickering (2006); van Fenema & Quresh (2004); Espinosa et al. (2003);
Electronic Dependence	Chudoba et al (2005); Cohen & Gibson (2003); Schweitzer & Duxbury (2010); Gibson & Gibbs (2006);Griffith et al. (2003)
Extent of Face-to-face	Bryant et al (2009) ;Kirkman et al. (2002); Bryant et al (2009) ; Leenders et al (2003)

Table 3-6: Literature addressing aspects of virtuality

3.4.4 Summary

The scope of virtuality as well as the role of technology in virtual team initiatives has been discussed. The subsection began with a discussion on virtuality, digital representations and the variety of technologies and tools used by teams, exemplifying communication media characteristics. It progressed to reviewing measures of virtuality in a work environment and highlighting its different dimensions.

3.5 Characteristics of the Communication Environments

Indeed the amount of factors that might influence a virtual team can be so great that most researchers tend not to examine the possible independent distinctions, and even inadvertent effects of each variable (Gibson & Gibbs 2006). The discussion in the subsections above indicates that there remains a need for a broad understanding of a typical virtual team environment, and not just the dimensions of virtuality.

3.5.1 Setup of Development Projects for Virtual Team Operations

Espinosa et al. (2006) studied a variety of industries and roles, from IT executives to the project managers of 7 organizations in 6 countries, and suggested that functional, organizational, cultural, geographical separation and time separation are the key features that might characterize a virtual team environment. In the same vein, Gibson & Gibbs (2006) add the criteria of being 'nationally diverse' and 'structurally dynamic', to the mix. Other researchers have identified contextual variables such as 'restricted lifespan', 'dependent on transient organizational needs', as crucial features of virtual teams (Majchrzak et al 2000; Kossler & Prestrige, 1996; Townsend et al., 1998; Jarvenpaa et al., 1998). Although Powel et al (2004) clearly argued that these are not a defining characteristic of a virtual team, but more of a consequence of the specialized role they (virtual teams) often serve in organizations.

Some of these researchers used the *concept of boundaries* to highlight the possible attributes of a virtual team because as Watson-Manheim et al (2012) asserts, boundaries help distinguish or clarify one environment, domain or situation from another. In Espinosa et al's (2006) study, boundaries differentiated the various virtual team components. It also provided ways of recognizing the distinction between project teams that are-virtual from those that are not.

Although co-located and virtual teams have been discussed extensively in the sections above, hybrid structures sometimes exist, and therefore needs clarification. Studies on hybrid project environments have been characterized in different ways. For example, Staples & Webster (2008) discussed a hybrid structure as having part of the team local to a collection of team members, and another part being remote. Also, a hybrid team structure has been described based on the ratio of electronic and face-to-face interaction (Cousins et al., 2007; Watson-Manheim et al 2012). For instance, how often workers operate on or with digital representation as compared with engaging in face-to-face conversations. DeLuca & Valacich's (2006) empirical observations, largely supported by the media synchronicity theory seem to explore this particular hybrid definition. Third, hybrid situations have been characterized in terms of how virtual-time fits with or complements other aspects of everyday work activities (Kirkman et al., 2002).

Therefore, to accommodate hybrid environments, Watson-Manheim et al (2002) introduced and discussed the attributes of a virtual team, according to the *concept of discontinuities* (as the alternative to the fixed boundary model). Discontinuities set focus on the underlying process issues and the potential challenges arising from unknown boundaries or invisible/difficult to identify boundaries. Discontinuities can identify team factors that may manifest due to "a lack of coherence in aspects of work" (Verburg et al 2012 p.69). Chudoba et al (2005) found six possible sources of discontinuities in a virtual team: time zone, geography, culture, work practice, technology and organization. These findings were in keeping in line with earlier empirical studies. For example, Watson-Manheim et al. (2002) who identified similar discontinuities: spatial, temporal, organizational, relationship, work group, and cultural. Majchrzak et al (2001) used the term "*misalignments*" to refer to elements of an organisational environment that causes changes in a work context.

Conditions	Definition
Discrepancy	*Individual perceives situation as significant difference between expectations & reality*
Novelty	*Situation is perceived as being unfamiliar or previously unknown*
Deliberate initiative	*Person responds to external stimulus to actively evaluate situation and adjust behaviours where suitable*

Table 3-7: Conditions leading to the recognition of discontinuities
(Source: Watson-Manheim et al 2012, p. 39)

Just as the *concept of boundaries* and *discontinuities* can be used to describe a virtual team environment, some authors discussed virtual teams in terms of '*fault-lines*'. The notion of fault-line was proffered by Lau & Murnighan (1998) as a way or representing the ever increasing boundaries caused by virtuality. Simply put, various 'fault-lines' are tantamount to the basis for self-categorization as a virtual team. To this end, Polzer et al (2006) emphasized one factor associated with a virtual project environment: geographical diversity. They noted that once such a fault-line is triggered, observable relations between members of virtual teams should differ from relations among other teams. Unfortunately, the literature on fault-line is rather limited when compared to boundaries and discontinuities. Some other empirical studies include, Rico et al (2007);Thatcher et al. (2003); Lau and Murnighan (1998) and Li & Hambrick (2005).

Notwithstanding the discussions above, a comparison between the concept of discontinuities and misalignments suggests commonalities in their underling ideas: (1) they both depend on an individual's perception of problematic situations at boundaries (2) they are all outcomes of activities/events occurring within a particular boundary. Likewise, boundaries and fault-lines may be antithetical in that they both define a particular system and differentiate it from its environment.

Using a composite of the taxonomies already discussed, Table 3.7 below shows the boundaries, fault-lines and discontinuities as they have been applied in describing a virtual team. However, a synthesis and critical analysis of the literature identifies four recurrent features or sources of diversity consistent with most virtual teams: IT/ICT, cultural/national diversity, time/asynchronicity, geographic distance, Organisational work structure/ boundary-less.

Study (s)	Descriptions of Virtual team Environment
Nemiro(2002)	Geographically dispersed, with a high reliance on technology to successfully perform work
Majchrzak et al (2000)	geographically distributed with a very malleable structure, and rely on information technology more so frequent than conventional teams
Pauleen and Yoong (2001)	Members of different countries use communication technology to execute work, they are culturally and functionally diverse
Baba et al (2004)	Possess physical and temporal distance, encompassing at least two nations. They are culturally diverse and interdependence with a dependence on technology.
Shin (2004)	The extent of temporal, spatial, organisational and cultural dispersion within a group that must use electronic means to communicate.
Paul et al (2005)	a team connected via telecommunication and information technology that also cut across, boundaries that are national, organisational and functional.
Harvey, Novicevic and Garrison (2005)	Geographically & organisationally dispersed, and consist of individuals who perform their work in various time zones, and have members in different nations all over the world where their membership is usually temporal and their structure is transitory and hence communicate mainly using technology
Deluca & Valacich (2006)	Allows organizing work team by electronic workflow, not physical location
Schweitzer & Duxbury	Members do not share a common work space always collaborate using tools;

(2010)	Geographical dispersion, Asynchronicity or both - determine their virtuality.
Espinosa et al (2006)	Global working divided in to various boundaries which could be time zone, cultural difference, and geographical distance
Chudoba et al(2005)	Depending on discontinuities in geography, time zone, organisation, national culture, work practice and technology
Edwards & Sridhar (2005)	Dispersed across organisational, space and time boundaries and are often cross-functional in nature
Gibson & Gibbs (2006)	Multi-faceted higher order construct comprising: nationally diverse, electronically dependence, geographically dispersed and with a dynamic structural arrangement
Maznevski and Chudoba (2000)	Internationally distributed groups, which substantially use technology-supported communication, Possess Location diversity, Multi-National, Global in their task.
Zigurs(2003)	Geographical and organizationally dispersed, Collaborative via IT &ICT, goal oriented
D'Souza & Colarelli (2010)	Spatial Distance, lack of visibility and proximity, and dependence on communication media.
Polzer et al (2006)	Configurationally dispersion
Lurey and Raisinghani (2001)	Electronically accessed World Class Competence
Massey et al (2003)	Groups that are restricted by time-restricted, non-repetitive, which generate one-time outputs (Specifying global Virtual Project teams).
(2006)	Evolutionary form of networked organisation that utilizes IT and Communication Technology to interact.
Gallivan (2001)	Considered a subset of a virtual organisation, consisting of dispersed group of individual's collaboration towards a certain objective for a specific period of time.
Sarker & Sahay (2004)	Interactions take place not in a physical place, but in an electronic space, where information and communication technology enable "access to information flows, and convey a sense of 'abstraction', 'openness', 'infinitude' and 'freedom'".(p.5)
Daim et al (2011)	Technology is at the heart of a virtual team's existence with their task involving people from different countries who may have different religions and culture

Table 3-8: Some descriptions of Virtual teams, highlighting different possible configuration

It is however important to note that virtual team, as a phenomenon seems to be in line with the theoretical borders of 'virtuality'. So as not to confuse virtual teams with virtuality, some authors (e.g. Balthazard et al 2004) argued that a virtual team constitute factors associated with team building and is characterized by "competing requirements and criteria's for members" (p.60). Each of the virtual team factors can be appraised based on the frequency a team member experienced them when working virtually (see research by Chudoba et al., 2005, Kirkman et al 2004).

The next section sheds light on a number of situational factors that influence performance.

3.5.2 The Effect of Distance

As described in table 3.7, geographic separation has been the main determinant of virtual teamwork. For this reason, virtual teams are often associated with communication challenges such as spontaneous communication, communication differences and delays (Daim et al 2012; Sarker et al 2011). Some researchers focused on communication effectiveness in virtual teams

(Caballer et al 2005; Thatcher & Delucour 2003; Olson & Olson 2003; Van de Kliej et al 2009). These studies show that because of the distributed nature of work, virtual teams have to rely more heavily on information and communication technologies. Herbsleb et al. (2000) examines the subtleties of distance on team work and contrasted it with the rich interaction of same-site work. They found that employees who work in different locations appear to have significantly fewer communication and contact in resolving problems. Furthermore, reports indicated that there were delays in the resolution of work-related problems when more than one site was involved. Issues that would have been resolved within seconds or minutes (as in the case of single-site collaborative work) could easily be stretched out. Armstrong and Cole (2002) noted that teams that are separated by distance had experienced more difficulty in reconciling issues. Geographic separation increases the effort required to find people, establish contact and have the required collaborative sessions with the right people. Some studies also find that they are communication-related difference in how virtual and face-to-face teams manage conflict situations (Damian et al 2000; Espinosa et al 2006).

In contrast to earlier empirical studies on the relationship between distance and team task, Nguyen et al. (2008)'s findings suggest that distance does not always introduce delay in communication. Neither does it have a practical effect on performance (measured as task completion time). Based on the study setup, their test also showed that variation in communication or response time does not necessarily mean variation in geographical distance. They, however, acknowledged that their contradictory discoveries (with respect to the previous studies) could be a function of their quantitative methodological stance. Quantitative studies that used self-reported interviews or survey data may not provide objective measures of communication delay. A possible explanation can be that the participant may recollect and report only high delayed communication incidences, overlooking the less significant, but regularly occurring incidences - which provide a larger sample to generalize from. Knowledge Management (KM) initiatives based on a collection of best practices, knowledge sharing and the support of KM tools can lead to a reduction in communication delay at certain sites. This in turn may contribute positively to reducing cross-sites communication delays.

But distance is not the only causes of communication difficulties in virtual teams. Dube & Robey (2008) studied the enablers and dis-enablers of work within a virtual environment. They empirically analysed tensions and contradictions experienced by 46 members of 26 organizations and identified some organizational paradox. A paradox is a contradiction in terms that can be used to explain how the co-existing of opposing concepts can occur. For example, 'trust' was found to be important to virtual teams but a person's trustworthiness can only be determined in

the absence of trust. Simply put, mistrust is crucial to establishment and sustenance of trust. In fact, this paradox acknowledges that virtual team members device strategies to survive the paradoxical situations that arise such as geographic dispersions. Dube & Robey's exploratory study was consistent with Lewis (2000) and Earley and Mosakowski (2000) descriptions of paradox as well as Pearlson and Saunders (2001) research on work arrangements.

3.5.3 Consequence of Time Separation

While the results from the studies above indicated that 'distance' matter in collaboration, other studies focused on 'time difference'. As Espinosa and Carmel (2004) puts it, time difference tends to increase coordination costs on teams. Time separation makes communication and coordination a lot more difficult (Griffith et al 2003); it causes teams to be more 'virtual'. Other studies have shown that time difference intensify the effects of distance, most especially when multiple time zones are represented (Espinosa and Carmel, 2004). The direct linkage between distance and time has been measured by the amount of non-overlapping work schedules. In their study of virtual teams implementing ERP solutions, van Fenema and Qurashi (2004) found that time difference partially disconnects people pursuing a collective effort from multiple-sites. The author collected data, from teams that operated in Singapore, Malaysia, Japan, China and the US (although some working hours overlapped). Further, using a phenomelogical approach, they observed different strategies that virtual teams use to reduce the influence of time difference, namely: anticipation of reciprocal behaviour, awareness of each other's activities and environment, collaborative dependence on other's actions & expertise (p.12). Each represented a mechanism for coordinating work as well as an attempt to minimize requirements for cross-site communication.

In an ethnographic study of ISD virtual teams in the US and Norway, Sarker & Sahey (2002) identified some of the challenges virtual teams face when they have to work across different time zones. Below, elaborates on these challenges and its manifestations: processing work in parallel with others across time zones, the existence of different schedules, delayed response. These challenges cause complexity in virtual teamwork and need to be managed for a virtual team to be effective.

3.5.4 Coordination and its role in Virtual Team Functioning

The literature review so far has established that in a virtual team, 'shared place' and 'shared time' matter in the successful execution of communication-based activities. But due to the lack of physical contact, there is a feeling of isolation amongst members of a virtual team. Some individuals also have a tendency of being socially unconnected to other team members. In fact, studies have found that such isolation can result in a lack of cohesion and an inefficient team

process (Bryant et al 2009; Benbunan-Fish et al 2001). Coordination represents the unity of efforts, sharing of goals and the work activities. A well-coordinated team can produce more and better results (Massey et al 2003; Maznevski & Chudoba 2001; Lin, Standing & Lui, 2008; Kayworth & Leidner 2000; Colazo 2008).

A subset of empirical studies has examined the strategies and interventions aimed at improving virtual team coordination. They have been considered because, as Aldea et al (2012) noted, the lack of coordination among team members can pose numerous issues for the team. When work is performed across time zones and physical location, there is an extent to which teams can be effective.

Given the significant challenges to effective coordination within a virtual work environment, Maznevski and Chudoba (2000) focused on the central question of how temporal coordination is achieved. The authors found that virtual teams can use 'interim face-to-face meetings' as a mechanism to coordinate work activities, and improve social ties. By applying the adaptive structuration theory to guide their investigation, the authors were able to provide insights into global virtual team dynamics and highlight pattern that exists when 'time matters' in collaborative activities. They also confirmed that virtual team effectiveness is a function of appropriate interaction incidences. This means that periodic face-to-face meetings play a crucial part in structuring the overall virtual team process, and affecting the member's interactions and team performance. According to Watson-Manheim et al (2002), interim team meetings provide 'continuities' that bridge those temporal gaps (i.e. A gap of time, space and even culture). In brief, these social engagements enhanced team performance, leading to a more effective virtual team.

Whenever face-to-face meetings were not achievable, the implementation of certain coordination protocols was found to improve team performance. As a consequence, Massey et al (2003) examined temporal coordination mechanisms. These are "interaction process structure[s] that may intervene to direct the pattern, timing and content of interaction incidents in a team" (p.2). The authors showed that mechanisms, such as scheduling deadlines, regulating interactions, and work pace specification can be used to coordinate cross-site work. Continuous monitoring and analysing project strategies and task interdependence (i.e. how changes in one area of work affect others) enhances efficiency, in that it mostly pre-empts the need for amends. These mechanisms also increased clarity of roles and accountability. Each mechanism, however, was susceptible to unexpected events, which demanded virtual team members engage in substantial communication. For Kirkman et al (2004) such challenges can be overcome through team member empowerment.

Other researchers, for example Arnold et al (2001) have argued in favour of better 'leadership' at both the team and organizational level.

3.5.5 Socialization, Team Development & Cohesion

The prominent argument in the literature on virtual team is that team members need to meet social and relational concerns. As per the Time, Interaction and Performance (TIP) theory, teams are entrenched into the surrounding social and organizational systems (McGrath 1991; Deluca & Valacich 1999). The findings from several studies show the importance of these social factors in facilitating team performance (e.g. Chang & Bordia 2001; Oshri et al's 2007; Potter & Balthazard, 2002) . Socialization in virtual teams is largely regarded as a process for relationship building and team development. Ahuja & Galivin (2003) described socialization as a process in which people develop the behaviours, workplace attitudes and knowledge needed for effective functioning in an organization. In terms of team development, Kock (2001) shows that virtuality seems to reduce the level of team interaction as well as team duration. But socialization fosters cohesion and creates a sense of belonging to teams. Through informal interactions, members are able to gain knowledge and develop the desired skills of a particular role. Mentoring program also enables socialization of virtual team member (Suchan & Hayzak 2001).

The literature on socialization and interaction in virtual teams is extensive. Crowston et al's (2005) study on face-to-face meetings suggests that even virtual teams use them (socialization) as a strategy to enhance interpersonal relationships. Underpinning techniques include, celebrating team success, making relationship building an item on the meeting agenda and encouraging cross-site mentoring. Its direct linkage with performance was also confirmed by Ocker (2002) in their research on high/low performing virtual teams. Amongst other benefits such as enabling strategic effectiveness and ensuring team member retention, research also indicates that socialization at a group level is positively related to inter-functional coordination capabilities. For this reason, collaboration and team performance has been shown to be dependent on how the virtual team members socialize. Not all researchers agree, for example, Kiesler & Cummings (2002) found that fewer informal communication opportunities might have a positive impact on team functioning. One possible explanation is that it reduces the possibility of conflict arising as well as ensure that more time is spent on actual team task.

Oshri et al's (2007) suggests that the use of technology and face-to-face interaction are two mechanisms which facilitate team development – most especially during the early stages of team formation, project initiation, or when a member has recently joined the team. In most cases, relationship building would continue all through the team tenure.

Several studies have found that interpersonal relationships developed from initial socialization (through any mechanism) may eventually erode over time. Therefore, researchers have attempted to formulate strategies that virtual teams might use to re-socialize over time. A multiple case study in LeCroy & SAP provides supporting evidence. From interviews and documentations of about 51 members of a virtual team, it was however, discovered that virtual teams find it difficult to sustain the same degree of interpersonal relationships from the start-to-end of a project or throughout the team lifespan. Over time, the steady degradation of interpersonal ties within a distributed team (global teams) will be sustained if there is a lack of process or organizational mechanism that can support the re - acquisition of norms or attitudes (Oshri et al's 2007). In this regard, the adoption of new technology may sometimes create an opportunity for relationship building. As such, teams may need to re-new or re-acquire norms and work attitudes associated with the new technology or work procedures (Oshri et al's 2007; Mark 2001).

3.5.6 Trust & Control

Trust is the binding force that holds virtual teams together. The functioning of teams is central to it. In virtual team studies, trust was found to be rooted in the perception in which team members assess each other's competence, ability and benevolence. It is built when a virtual entity delivers on its commitment. Merely having good intentions does not build trust only a trustee's integrity (Albert & Kelsey 2003). The virtual team literature has identified five types of trust: (1) calculative trust, which conceptualizes trust from a resource-based view; it is a kind of market-oriented and economic exchange; (2) competence trust, which is associate with knowledge, skills, expertise and abilities of the trusting parties; (3)relational trust, which is modelled as social artifact based on individual bonding or goodwill (4) swift trust, which is the trust that is built when people meet for the first time, and (5) Integrated trust is a combination of the different types of trust (Sarker et al., 2011; Piccoli & Ives 2003; Kanawattanachai & Yoo 2002; Henttonen & Blomqvist 2005; Paul & McDaniel, 2004; Zolin et al 2004).

Paul & McDaniel (2004) developed a trust model to investigate the interrelationship that different types of trust may have on distributed team members. They found a strong positive relationship between trust and the performance of parties engaged in a virtual work process. Their results as well as those from Zolin et al (2004) showed that developing trust across distance is challenging, particularly when members have no prior working relationship. In addition, empirical studies show that during the early stages of a project, members of a potentially future high performing virtual team exhibit a higher level of trust (this is actually swift trust). Virtual teams might be capable of establishing a relatively high level of trust - at the start of projects, but retaining that

level throughout the project life cycle can be a daunting task. Trust may decline even further when project deadlines are approaching or during the climax of a project. But high levels of trust exist in virtual teams who partake in frequent interactions.

Trust is frequently acknowledged as a crucial facilitator of virtual teamwork due to the fact that it helps bridge gaps or discontinuities caused by virtuality (Piccoli & Ives 2003; Kirkman et al., 2006; Dube & Robey 2008).

Particularly, because digital communication has a depersonalization effect that may hamper or slow the development of social relationships. In fact, technology may alter how and what cues might be observed or ignored. However, this may be beneficial in some instances as was observed by Damian et al. (2000). Their study showed that virtual team members tend to find it easier to resolve differences whenever verbal cues are absent.

Gallivan (2001) provides an alternative view of trust in distant collaborations (although not virtual team working specifically). He circumvents the conventional wisdom that virtual work requires a significant level of trust to properly function. The author explored scenarios in which trust is not a necessary component of effective performance. Based on a variety of nine case-study projects he showed that other mechanism like control, for instance, and the absence of trust as such, had been central to high-quality and reliable performance. It is worth noting that some virtual teams such as those used in open source software (OSS) projects do not rely on trust to ensure effective collaboration (Gallivan 2001). Rather, such virtual teams utilize control mechanisms to shape an individual's behavioural and attitudinal outcomes. As a result, virtual teams experience better communication and coordination activities.

Markus et al (2000) identified four kinds of control mechanisms used by virtual teams (in OSS project): (1) sanctions, (2) rules & institution, (3) membership management, and (4) individual reputation. Behavioural control mechanisms increase vigilance, most especially when people perceive that specific obligations have not been met. Behaviour control may sometimes affect trust in a virtual team, negatively. According to Piccoli & Ives (2003), it tends to make some individual more vigilant by increasing the "salience of incidents caused by incongruence and reneging". Other studies suggest that trust and control are synergies that are mutually interdependent in virtual teamwork (O'lary et al 2001). In other cases control mechanisms are even viewed as an alternative to trust. In summary, control, also helps in shaping and enforcing certain collaborative habits. Nonetheless, some un-collaborative behaviour such as deception (Fuller et al., 2012) and defection (Rockmann and Northcraft, 2008) have only recently been found to influence trust in a virtual team.

Together, the above discussion has shown that virtual working is still under-explored and that key emerging state factors such as trust and control may still be subject to debate.

3.5.7 Shared Cognition & Shared Understanding

Studies like that carried out by Watson-Manheim & Belanger (2002) suggest that virtual teams are constituted by five key communication-based activities: knowledge sharing or transfer, information gathering, coordination, relationship building and conflict resolution. For Cramton (2001) these activities present five types of challenges to a virtual team: "(1) failure to communicate and retain contextual information (2) unevenly distributed information (3) difference in the salience of information to individuals (4) relative differences in speed of access to information (5) interpretation of the meaning of silence" (Cramton 2001, p. 355).

Consistent with these challenges, researchers have acknowledged how different domains (e.g. working with different mental models in practice) typically produce interpretive differences. Teams require a shared mental representation[9] of knowledge to interpret events, collaborate or execute tasks/projects. The impact of shared mental models on team performance, for example, can be seen in Bjorn & Ngwenyama (2009) and Mathieu et al (2005). They found that when knowledge becomes more highly specialized, novices or laypersons[10] are restricted in their access to this knowledge because it develops its own terminology and sense-making schemas, which typically resides with the specialist; virtual teams are susceptible to communication breakdown. In such situations, a shared language will be required before a virtual team can complete a task (Majchzak et al 2000; Dennis et al 2008).

The whole point of creating shared understanding is to facilitate better communication. Continual questioning, learning, and reflection in the work environment have been the basis of shared understanding (mental models). In fact, virtual team members constantly strive to create a 'shared understanding'. For example, teams can develop shared meaning or shared understanding when, and-if they are involved in similar activities/task. Rooij, Verburg, Andriessen & Hortog (2007) observed that establishing a shared understanding is difficult in virtual teams that use technological tools which lack visual cues. Visual cues facilitate nonverbal communication. Team colleagues can assess if a message has been understood and if it's been agreed with or not.

[9] It is worth noting that various conceptualizations exist in the team literature. As an example, Mathieu et al's (2008) article made reference to 'collective cognition', 'organised understanding', 'shared mental model', 'shared mental representation of knowledge'.

[10] Novice, as described in the-free-dictionary (online) is "a person new to a field or activity" in order words; a beginner

Building shared understanding is hard work in any virtual team. It takes weeks, months, and even years – undeniably, it is a continuous journey. It is fraught with risk (Reed & Knight 2008), either a lacking of learning-oriented culture in the organization, teams, or failing to realize the cognitive distance of team members (Robey et al., 2000, Majchrzak et al., 2000a). The premise is that people's experiences and mental categories differ, but are developed as people interact and share experiences. Of course, cognitive distance presents both problems and opportunities in virtual teams. On the one hand, it provides an opportunity where people who interact can learn from each other. Team interaction leads to learning when things are known differently. On the downside, team collaboration becomes conditional (mostly when a virtual team is working on a new or novelty project/task). As such, until cognitive similarity is achieved virtual team activities will be filled with communication and coordination problems; learning orientations positively influence a team's ability to communicate. In this regard, virtual team initiatives can provide valuable learning experience not just to the members themselves but also for the entire organization. This was evident in the study by Gatlin-Watts et al (2007) on how student and faculty in universities both learn during virtual team projects and the virtual team provided valuable training opportunities.

Newell & Edelman (2008) focused on learning in the context of distributed team projects. The authors developed the concept of dynamic project learning capabilities, as involvement in projects is a common place within most virtual teams. As project learning is neither perfect nor static, learning serves to refine and improve communication. In addition, Kirkman et al. (2004) points out that team empowerment experience might be central to learning in teams. They argued that being allowed to reflect on actions and experiment are crucial characteristics that potentially make teams learn, but they duly noted that this mostly occurs during face-to-face meetings.

From a sociological perspective, it is not unreasonable to state that virtual teamwork is more than collaborations and task cooperation. Individuals and teams tend to engage in complex social exchanges. Using a virtual project team as an example, Bosch-Sijtsema et al (2011) and Bjorn & Ngwenyama (2009) discussed how individuals transfer knowledge and abilities simply by their interactions in a shared space, and over time their 'thought worlds' are in sync. They start enjoying enormous opportunities, which go beyond information gathering, conflict resolution, knowledge transfer or performance. Likewise, Swigger et al (2012) observed that 'social communication' behaviour is a good way of knowing the level of shared understanding of a team. One study however focused on specific work practices that enable teams meet the demands of the virtual realm. In this regard, Robey et al. (2000) conceptualized virtual teams as a community

of practice, showing how learning occurs in the context of particular work practices. The community of practice perspective of virtual teams is not often studied.

3.5.8 Culture and its impact on Communication

Exploratory studies on the effect of different factors in virtual software development projects have shown that distance, time and socio-cognitive factors might not be the only sources of diversity and challenges, but social factors such as culture can also have an impact on team functioning. This manifests when work is done across global boundaries, functional areas or organizational boundaries. For example, the diversity literature suggests that shared values, beliefs and norms that emerged from educational and life experiences determine behaviours. As such, the issue of culture is therefore very important because cultural background alone can be used to determine team membership and well-being (Sarker & Sahay 2004; Edwards & Sridhar 2005; Olson & Olson 2000; Schien 2000; Anderson & Hiltz 2001; Favela & Pena-mora 2001; Gatlin-Watts et al 2007; Gibson & Gibbs 2006; Maznevski & Chudoba 2000).

From his seminal work on cultural dimensions, Hofstede (2001) describes culture as "…the collective programming of the mind that distinguishes the members of one group or category of people from another". Professor Emeritus Geert Hofstede identified national culture along five dimensions: (1) Individualism vs collectivism. America for instance, is believed to be individualistic. People tend to put personal goals ahead of the interest of the wider group. On the other hand, collective cultures (e.g. Brazil, Russia & China) give primacy to the interest of the group (Ardichvili et al 2006). (2) Large versus small power distance, which suggest how well less powerful team members expect/accept the unequal dispersion of power. (3) Masculinity versus femininity; this portrays the allocation of roles amongst gender. (4) Long versus short term orientation. (5) Uncertainty avoidance.

These differences can have an impact on the ways people communicate (Anderson & Hiltz 2001; Earley & Gibson 2002; Zhang & Lowry 2008). For example, some cultures have been observed to take a longer time to reply emails than other. For instance, Krishna et al (2004) discusses how Indian engineers take less time to reply emails than Japanese professionals. The authors however attributed the delayed response of the Japanese to a work-related communication culture that lays emphasis on wholeness and accuracy in their mode of replying; that is, their cultural values emphasize formality of communication. In contrast, Indian engineers seemed to be walking the part of their North American colleagues who are less concerned with content, but proactivity.

Delayed response or silence may also be attributed to language barriers such as limited English language competence. This variable disrupts communication process and affects virtual team

outcomes because it might result in less frequent communication, misunderstanding, limited task participation and longer time for communication (Sarker & Sahay 2004; Espinosa et al, 2006). Kayworth & Leidner (2000) observed from virtual teams located in Mexico, Europe and the United States that linguistic difference accounted for a significant level of information loss and distortion, particularly when individual members decrypt communication through their own cultural perspective. As such, communication quality may also lead to higher performance in virtual teams.

Past studies also explained how cognitive differences - as a result of cultural gaps - affect team behaviour, project outcomes and members' ability to communicate ideas. It influences the different perspectives team members have on issues, and their preferred way of communicating and resolving them. The cognitive difference that stern from national culture also contributes to the complexity of managing cultural differences in a virtual team context. For example, Espinosa et al (2006; p.356) found that Asian team members hesitate to either proffer objections or to bring possible problems to general attentions. However, the negative effect of cultural difference on project performance can be managed through early awareness of cultural gaps. Nevertheless, sometimes, the difference in cultural orientation has no direct linkage with how virtual teams execute projects or how efficient their processes may be (Anderson & Hiltz 2001).

Although most studies found positive relations between culture, communication and virtual team performance, a few demonstrated a more neutral relationship (Edwards & Sirhdar 2005; Luo Y, 2000). Here, it was found that cultural values can be used to determine the social needs of individuals, but had no significant influence on team outcome. However, Edwards & Sirhdar's (2005) exploratory study was limited to software 'requirement gathering' - indicating a need for additional research. Fevela & Pena-mora's study on the student virtual team projects in the US and Mexico provides directional similarities.

Closely linked to cultural difference is national diversity. Some studies acknowledge that national diversity is a country specific boundary that coincides with virtuality. It is also a basis for self-categorizations and team identity (Gibson & Gibbs 2006, p.460;Espinosa et al., 2003) . It is probably more noticeable than particular organizational or functional diversity. National diversity affects internal communication in the sense that it leads to weaker social ties and cohesion. Gibson & Gibbs (2006) found that it also influences the team member's ability to leverage information from others.

Virtual teamwork enables organizations to strategically place specialists from various functional areas on a particular team, thereby optimizing the team performance which might affect the organization's performance (Hinds & Keisler 2002). Inevitably, functional diversity can lead to

cultural clashes. This basically means that when multiple areas of expertise are represented in a team, cultural differences are manifested. Moreover, it is worth noting that the literature presents conflicting findings. For example, Lurey and Raisinghani (2001) surveyed 67 individuals from different professional settings, including sales, marketing, legal support, research and management consultancy, and did not detect significant relations between functional diversity (education system) and team effectiveness measures such as performance and product satisfaction. However, its been observed that differences in educational background amongst peer teams (e.g. all computer science members) can have a negative influence on project experience and performance of the team members (Edwards & Sirhdar 2003). Kayworth & Leidner, (2000) conducted a study that explored for critical success factor for global virtual teams. They found team members' educational orientation (technical expertise) in the use of particular technologies to be positively related to a team's success.

When people work in a single location, or within a single discipline, one culture and language can be promoted and easily shared among all team members, resulting in ease of interaction and communication. However, when work is dispersed (geographically or functionally), diversity associated with language and culture can easily lead to misunderstanding. Central business policies and national cultures may clash and may result in unyielding interaction among virtual teams (Horwitz, Bravington & Silvis, 2006). It is to be noted that numerous conceptualizations have been proposed to describe cultural implications on an organisation. Waring & Skoumpopoulou (2012), for example utilized Meyerson & Martin's (1987) perspective approach to indicate that culture is a complex phenomenon and one way of observing it is through the kaleidoscope metaphor. The authors illustrated this approach with a study of cultural change within an integrated information systems work environment.

In summary, this subsection has suggested that communication challenges are amplified by cultural differences. They may be reflected in nationality, language, functionality, ethnicity or organisational diversity. In addition, the discussions showed that when trust is absent, people are less likely to share information and thus cultural difference is manifested.

3.5.9 Summary

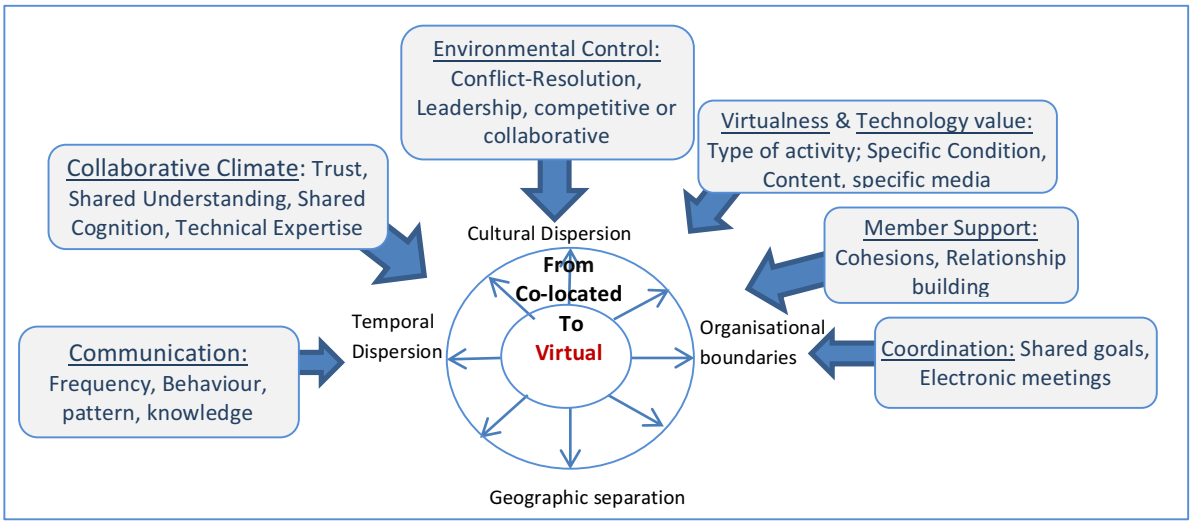
So far, the previous sections examined how virtuality in team is defined and sustained, by identifying its primary components and the relationship amongst them. With regards to team effectiveness, results show that diversity[11], task and technology attributes are some contextual factors that provide opportunities, challenges, but sometimes have no effect on team processes or outcomes.

[11] Chen et al (2004) noted that diversity is the heterogeneity of team member characteristics.

3.6 Synthesizing Empirical Studies

As per research trends, the critical and rigorous literature review indicated that the literature tend to lend itself to six key areas. See below.

Figure 3-4: Key Areas, showing alignment of themes and components



The table below (3.8) shows a varied selection of cases from the literature review. The key insights from the articles were transferred to a gap analysis table and used as the starting point for identifying trends, key messages, gaps and some areas that future research should explore.

Table 3-9: Sample Selection: Exemplar, Contextual, Task, Team and Technology Level influence Studies

Study	Agents, Task	Conceptual Framework, Perspectives	Method, Sample	Issues, main variables	Valued arguments, Results & Measures
Contextual Explanation (including Function-performed, Market-served, Country-context, Technology-context)					
Anderson & Hiltz (2001)	Undergraduate students(Negotiation task) (Cultural Context)		Experimental; 175 (United States + 38 other countries); 46 groups	Consensus Change, Post meeting Consensus, Influence Inequality, Decision satisfaction, Quality of discussion, Process Gains/Losses	A mixed cultural team may successfully use a distributed, asynchronous communication tool to execute a value-based cognitive conflict task (negotiation). The richness of face-to-face setting promotes easier discussions and decision-making on the task. 'Over-richness' (a surplus of social context cues, or excessive communication) is also critical to the functioning teams.
Alhawary (2012)	Jordanian medical services – Country Context	Virtual team collaboration	Quantitative Case study Regression analysis		Cultural difference, spoken language and variation in time has an impact on collaboration in a virtual working environment. More specifically to the jodanian medical context
Vorakulpipat et al. (2010)	Construction- Industry context	Knowledge value	24 senior staff; 4 organisations; Case-study adopting principles of Action Research	Knowledge management, value creation	Factors that affect knowledge value creation include production factors, process factors, technology factors and human resource factors
Monalisa et al (2008)	High-tech – Industry Context				
Espinosa et al (2006)	Field Study, with IS managers (Task-context: IS project)	IPO Model	22 interviews; 7 organizations in 7 countries; Australia, Ireland, India, UK, USA,	Global boundaries, coordination, team coordination, IS project	

			South Africa & Mexico	success	
Powel et al (2006)	Graduate Students	Task-based antecedent & Affect-based processes	3 countries: USA, Australia & Ireland; 159 participants; Quantitative Method, Cross-sectional study	Team commitment, member effort, trust, teamwork process	Factors contributing to the level of commitment depend on the role of technology & type of communication used for the task. Establishing work processes ensures that some project uncertainties are eliminated. A perceived member effort does not affect the development of trust.
Staples and Webster (2008)	Field Study (Job roles varied from nurses, sales, administrative, teachers & analyst); knowledge transfer tasks	Social Exchange Theory; Knowledge Sharing in Virtual Teams	1 organisation; 985 individuals; Quantitative	Trust in Teams, knowledge sharing, Team Effectiveness (measured as both perceived team performance & intention to remain on team)	When task interdependence is low in teams, it's crucial that trust be developed for knowledge to be effectively shared. Knowledge sharing is an important component of a team's performance, irrespective of whether team members depend on each other for completion of their tasks.
Swigger et al (2012)	Global Software Student team (instant messaging, bulletin board, shared server space)		Experimental; 111 participants (21 teams ;2 projects); Turkey, US, Panama	Temporal coordination mechanism, Performance, Process coping, trust, team communication	Social and planning behaviours tend to emerge in team as members get more used to themselves. The formation of trust is a prerequisite for high performing teams focusing on communication behaviours. Such behaviours (e.g. seeking inputs from members) result in successful completion of task and less on social interactions.
Benbunan-Fich et al (2001)	(Idea generation task); (Email, message board and conferencing)		Quasi-Experimental Case study; 1 organisation (technological University) 50 participants (10 teams)	Coordination, use of technology, performance(quality, length & perceptions)	Virtual teams adopt a more loosely coupled interaction approach, in that, team member's work concurrently on different aspects of the same task.
Kanawattanachai & Yoo (2002)	MBA Students, Decision-Making Game, Web-based interface, email	Trust by Perceptual Measures	10 nationalities, Quantitative Research, 140 Participants;	Trust, Virtual Team Performance Optimization	Communication media influences the formation of trust in a virtual setup – an effect which may hamper or slow the development of social relationships relevant for tasks.

			Confirmatory factor analysis but qualitative Analysis used to support findings. Team-level analysis		Physical distances separating trusting members of high performing teams play little role in their performance.
Blomquist et al (2005)	Student Project Teams; Web-based Interface	Learning Communities	Quantitative Study; 155 participant; Sweden (1 university	Group duration, distance and coordination	The development of team community is related to how the team collaborates and communicates during tasks. Hence, the more they coordinate their task the more their performance improves.
Caballer et al. (2005)	Student Teams (intellectual task)		Laboratory Study; 124 Participants	Time Pressure, Team Satisfaction	When working without time constraints, face-to-face teams are more satisfied with their work outcomes than their computer-mediated counterparts. Under time pressure conditions, virtual teams are more satisfied with the final quality of their work because typing text or drawing images as opposed to saying them forced member's to focus their efforts strictly on task-relevant information. Time constraint stresses time pressure and urgency on task completion. Face-to-face teams also become more committed to a group decision than virtual teams.
Kock & Lynn (2012)	Field-Based; NPD teams; Multiple media from Attached audio to E-list		Quantitative Study; 290 participants; 66 organisations; United States	Media variety; Task complexity; team effectiveness; team efficiency	Having a variety of (up to seven) media provides better performance for complex task when teams execute communication-activities. This would occur if their spirits (elements) are complimentary. Differences in technological tool may encourage different social interactions. Coordination activities for example are facilitated by a high degree of electronic communication media.

Individual Analysis - Individual-Level Determinant					
Balthazard, Potter & Warren (2004)	Executive MBA professionals; Intellectual decision making task; web-based conferencing tool	Five Factor Model of Personality (aka Big Five)	248 participants; 63 virtual teams	Personality traits, Expertise, Interaction style, Team performance	Group interaction style affects performance and this is determined by the communication trait which is manifested by individual members and rooted in individual personalities. It can be observed via some technological tool. Cognitive indicators (e.g. expertise of an individual) and personality related factors (e.g. extraversion) contribute to interaction styles. Virtual team interaction styles could be predicted if individual personalities are assessed
Townsend et al. (2001)	Undergraduate (Problem-solving); Desktop video conferencing	Technology Acceptance Model	64 participants; Quantitative – lab setting; Exploratory in nature	Task success, Project success, System utility	Positive relationships exist between System Utility and a team's performance. A negative relationship was found between system satisfaction and the performance of the virtual team. Anticipatory attitude of the workings (or functionalities) of a system has a significant effect upon an individual's perception of the System Utility. Enthusiastic users may spend significant time exploring and manipulating technology.
Group Analysis - Team Impact					
Horwitz et al. (2006)	From Sales agents to Developers (Field-Based) (TNS)	Human Resource Development	69 companies,16 countries (one from Africa: South Africa); 115 responses from individuals; Descriptive Quantitative Research	Cross- Cultural issues, Prior work experience, Employee Development, Leadership	Differentiating between cross-cultural and virtuality factors can be difficult. Managers of virtual teams can directly supervise goals and policies, but have a partial picture of the work process

D'Souza & Colarelli (2010)	Undergraduate students; laboratory controlled task		Quantitative Research;100 participant's (not categorised as team, participants testimonies)	Personal Characteristics, task skills, boundary spanning, selection decision	Virtual teams open up more diversity at the work place when boundaries are spanned, such as cultural and geographical boundaries. Gender plays a significant role in team member selection for both proximate & virtual. Downplaying individual personal characteristics reduces demographic biases when team members are being selected. Unlike in face-to-face situations, Task skills were found to crucial in decision-making process associated with the selection of individuals who work in a virtual team.
Schweitzer & Duxbury (2010)	Field-Based Study (on-going virtual teams)		1 Canadian company, 107 respondent, 30 virtual teams; Quantitative Research	Dimensions of virtuality, Effectiveness (Performance, members satisfaction, professional development, capacity for future VT work	
Bryant et al (2009)	MBA Students, Project teams; Experimental design	Media Richness Theory	United States (1 university); 89 participants (20 teams)	Demographics, Use of technology, Reward Structure, Social loafing	Gender impacts on the extent to which social loafing occurs (informal leadership) within the team. There are differencing between male and females in regards to how social loafing is perceived. However, when mixed-incentive schemes do not exist, the perception of social loafing believed to exist is higher with females. With richer technology, incentives lead to increase in members' satisfaction, in that it causes a decrease in social loafing.
Leenders et al (2003)	Product Engineers	Social Networks	11 countries; 243 individuals, 44 teams;	Team Creativity, Frequency of Communication, team	Managing creativity of team members implies managing the creativity of the entire team. Creativity of an NPD team decreases based on the team tenure/ longevity. The

			Quantitative Study	tenure/age, team size	main product of NPD is knowledge. Creating knowledge is dependent on the situation, such as knowledge sharing and innovation. Creativity requires ad-hoc communication.
Muethel et al. (2012)	Field-Based; Software Development Projects	Shared Leadership	Quantitative Study; 96 teams; 36 Companies; 433 respondents	Socio-demographic factors, Shared Leadership behaviours, team performance, National diversity.	Shared leadership is a very important team process and is central to team performance. National diversity as well as a higher level of female-to-male ratio, positively affects shared leadership behaviour. In addition, there is a relationship between High mean age and shared-leadership. But this is a negative relationship
DeLuca et al. (2006)	Field-based; Student teams	Compensatory Adaptation Theory	Qualitative study; 4 virtual teams; An educational service organisation		
Dube & Robey (2008)	Field-Based (TNS)	Concept of Paradox	26 Organisations; Canada; Exploratory approach using Qualitative techniques, 42 people	Geographical Distance	The paradox existing within virtual teams can be hardly 'resolved' by members, but rather coped with. The five paradoxes identified include: (1) VT require physical presence (2)Structure aids Flexibility (3) Independent contributions lead to interdependent work in VT (4) Mistrust is instrumental to establishing trust (5) Social interaction makes task-oriented teams successful.
Deluca & Valacich (2006)	Field Based; Process improvement teams; Asynchronous electronic communication media	Media Synchronicity Theory	Canonical Action Research (qualitative - Quantitative triangulation;8 teams, 2organisations (35+41=76 team members)	Team performance, task analysis, information exchange	Using Media with lower synchronicity can result in better virtual team performance. As teams develop a history while working together, performance can be achieved even if they use only asynchronous media.

Maznevski & Chudoba (2000)	Field-based, Global Operations (Manufacturing Tech. Inc, Varied Member Roles); video conferencing & emails	Adaptive Structuration Theory	1 organization(United States); Multiple Method-longitudinal study; Qualitative research guided by Grounded Theory	Processes, performance, communication, cohesion, culture and commitment, technology used.	A richer media can be recognised based on its ability to provide multiple communications along various channel. Structural characteristics can proffer explanations to the inconsistent matches amongst message and medium.
Majchrzak et al (2000)	Field Study, NPD teams (engineers to develop a complex engineering concept); (email, shared server space, video)	Structuration Theory;	Mainly Qualitative (Case-Study), triangulated with Quantitative Analysis; 8 participants, 1 team, 1000+ work items; 3 organisations	Use of Technology, Adaptation process, technology change,	Over time, if a virtual team must achieve its performance targets, changes have to be made to the technology spirit itself.
Van der Kleij et al (2009)	Student Team; Video conferencing		Longitudinal Experiment; 66 participants	Communication Patterns, Task Performance	Teams using video conferencing technologies experienced more difficulties in regulating conversations than their face-to-face counterparts. Virtual teams are able to maintain comparable high and stable performance in spite of differences in communication patterns by adapting their communication patterns to their working environment. Virtual teams create a more formal communication environment when interactions are characterised by good mannerism and politeness.
Alge et al (2003)	Undergraduate Students (decision making task)		Laboratory Study Quantitative analysis; 198 participants; United States; 66 teams	Communication Media, Team temporal scope, Openness, Information Exchange, & Decision Making effectiveness	Media differences can be found among people who have no past working relationship (work histories). People who communicate through synchronous computer mediums share less unique information than face-to-face teams with no prior history shared.
Nandhakumar and	Field Based -Mainly Construction project	Structuration Theory	Qualitative Research - Interpretive Case-Study;	Trust forms,	Organizations develop work practices that are successful only because of a particular technology in use. Some

Baskerville (2006)	members (Off-shore working -Designers, fabricators, construction workers, and operation people); web-based tool		40 participants over 2years; 1 organization(petro-chemical), up to 10 teams	collaboration	technologies impose restrictions.
Individual & Group-Level Analysis					
Oshri et al (2007)	Field-based (Globally distributed Software development) using groupware products		3 organisations (US, Geneva, India, Netherlands); Multiple Case-Study: total about 140 people; Qualitative, Interpretive Approach	Team Communication, interpersonal relationship, Technology Usage; Socialization in teams	Interpersonal relationships developed from initial socialization (through any mechanism) may eventually erode over time. Prior to a F-2-F meeting, virtual teams tend to use asynchronous media (e.g. emails) as the primary mode of communication. After a kick-off meeting, misunderstandings are resolved using mainly synchronous media (e.g. instant messages, video conferencing, phones).

Overall the key debates and messages from the literature include:

- Communication is a tool that has a direct effect on the social dimensions of teams.
- Changes in the communication environment mean that individuals have an opportunity to develop new behaviours, and relationships. Project team members can also acquire or sustain new capability and assets (Schweitzer & Duxbury 2010; Daim et al 2012; Watson-Manheim & Belanger 2002; Mark et al 2001; Dennis et al 2008).
- Knowledge has the potential to influence people's communicative action (e.g. Staple & Webser 2008).
- The use and implementation of communication technology are determined by both the organization and its users (e.g. Majchrzak et al 2000; Espinosa et al 2015).
- Some studies tend to suggest that controls can be applied to communication channels. Access to relevant information is often limited or controlled by either external support mechanisms or internal group dynamics (Kock & Lynn 2012; Lurey& Raisinghani 2001; Joshi, Sarker & Sarker, 2006; Duan et al, 2009).
- The scope and principles of a virtual team pose vital questions for understanding the interplay between the degree of virtuality and team effectiveness.
- 'Technological paradoxes' and 'team paradoxes' may be present. The existence of an attribute sometimes lessens the efficacy of another (e.g. Dube & Robey 2008).
- For a team to be regarded as virtual, it must have members who do not always work together at the same place or at the same time. Temporal coordination plays an indirect role in interaction behaviours. Also, ICT is the key enabler of virtuality (e.g. Gibson & Gibbs 2006; Bailey et al 2012).
- Perhaps, the deployment and use of digital communication systems by a virtual team is typically dependent on knowledge which can be codified (Dennis & Garfield 2004; Ananth et al 2011).
- A virtual team is not more concerned with mediated contacts as it is with organisational learning, sharing knowledge and experiences.
- Virtual teams contain agents whose interaction produce shared behaviours, unique capabilities (e.g. particular technical skills) and a unified cognition. They are culture-centric in that they function like autonomous mini societies.
- Team members have to overcome the differences caused by time separation in order to successfully collaborate as a virtual team (e.g. Espinosa et al 2006; Espinosa et al 2015).
- A technology designed to support virtual teams may not be different from other forms of information systems – used by teams that are not 100% virtual.
- Physical (real) communication declines as teams move higher on the virtuality continuum.

- Situational factors add significant predictive powers to virtual team effectiveness.

Activities/ Determinants of virtuality: About 15 distinct activities/ context of virtuality were identified in the literature review. Although in some instances, a particular activity was categorized by several labels. Table 3.10 below shows the 7 main tasks examined in the literature.

Team Objective / Content of Task	Selected Studies
Production and Development (e.g. electronic product, bikes)	Leenders et al (2008); Bailey et al (2012) ;Kratzer et al. (2006); Kock & Lynn (2012); Gibson & Gibbs (2006); Espinosa et al (2006); Majchrzak et al (2003); van Fenema & Qurash (2004); Muethel et al (2012); Hauptman & Hirji (1999); Brunelli, (1999); Malhotra et al (2001); Monalisa et al (2008)
Problem-solving & Decision-Making (e.g. financial decisions)	Townsend et al (2001); Martins & Christina (2011); Kanawattanachia & Yoo (2002); Bryant et al (2012); Kakola & Salo 1999; Caballer et al (2005) ; Aubert and Kelsey (2003) ;Rautiaine, Nissinen & Lassenius (2000) ; Tuikka (2001); Alge et al (2003)
Software development	Bjorn and Ngwenyama (2009); Giuri et al. (2008) Jonsson, Novosel, Lillieskold & Eriksson (2001); Marttin, Lehto & Nyaman (2002); Ocker (2001); Ocker & Fjermestad (2000); Sarker & Sahay (2002);Sarker et al. (2001); Bjorn & Ngwenyama (2009); Lowry et al(2010); Herbsleb et al (2000); Gavin (2001) ;Muethel, Gehrlein & Hoegl (2012) ; Lee, Delone & Espinosa et al (2006); Reed & Knight (2010); Evaristo & Scudder (2000); Wiredu (2011)
Project Management	Daim et al (2012); Verburg et al (2012); Majchrzak et al (2000) Rautiainen, Nissinen & Lassenius (2000); McDonough et al. (2001)
Knowledge Management	Robertson, Sorensen & Swan (2000); Staples & Webster (2008); Gupta et al. (2009)
Strategy Development	Maznevski & Chudoba (2000); Polzer et al (2006); Piccoli & Ives (2003); Powel et al (2006);; Kirkman et al (2004)
Process Improvement	Deluca & Valaciah (2006)
Other task, including Negotiations, Idea generation	Damian et al. (2000); Anderson & Hiltz (2001)

Table 3-10: Example of Virtual Teams Types, organized by Tasks

Tasks such as software development, product development and knowledge management were mostly found in studies that emphasized on global/*virtual project teams*. In most of these studies, the teams under investigation mostly had fixed tenure (i.e. there were short term teams).

Team Type: Most of the activities/tasks listed in table 3.10 (above) were synonymous with the type of teams studied. For example, software design teams performed software development task. Other types of virtual teams discussed in the literature include: service teams, pharmaceutical teams, nursing teams, management teams, technology teams and student teams.

Student teams, irrespective of their task, were the most common. In some other studies, such as Daim et al (2012) the virtual teams were matrix organization.

Team Types	Selected Studies
Medical Teams (e.g. Nursing Teams)	Dennis & Garfield (2003); Ireson & McGillis (1998); Paul & McDaniel (2004); Gibson (2003); Alhawary (2012)
Management Teams	Bunderson & Sutcliffe (2002); Kilduff, Angelmar & Mehra (2000); Lubatkin, Simsek, Ling & Veiga (2006); Srivasta, Bartol & Locke (2006)
Technology teams (e.g. technicians)	Monalisa et al (2008) ; Bosch-Sijtsema et al (2011); Mathieu, Gibson & Ruddy (2006)
Student teams	About 76% of total literature review
Consulting Teams	Carson, Tesluk & Marrone (2007)
Manufacturing Teams	Langfred (2005); Bailey et al (2012)
Supermarket Teams	Schneider et al (2005)
24hr Knowledge Factory Teams (e.g. call centre)	Gupta, Mattarelli, Seshasai & Broschak (2009)
Government Teams	Jarman (2005)

Table 3-11: Team Type

Below provides further information on the major country context and industries focused on in the literature.

Major Country Context	Major Industries/ Sector
United States, Korea, Indonesia, China, Canada, India, The Netherlands, Geneva, Taiwan, Brazil, New Zealand, United Kingdom, Ireland, Australia, Germany, Denmark, Thailand, Malaysia, Finland, South Africa, Turkey, Panama, Singapore, Japan, Sweden, Portugal, Mexico, Switzerland, Jordan, Norway	Retail, Manufacturing, Aerospace, Consultancy, IT Services / Software Organization, Healthcare, Academic, Medical services, Household Goods, Pharmaceutical, Construction, travel industry, petrochemical

Table 3-12: Major Country and Industry Context

Communication Media: Much of the studies explicitly referred to a particular communication scenario (for instance, Face-to-face, video conferencing), or collaborative technology (such as, Lotus notes) as either guiding the data collection or within the analysis section.

Situational Factors: Empirical studies showed that people's experiences with a communication environment may be moderated by a number of variables (contingency or situational factors). Below provides a list of papers.

Table 3-13: List of some papers on aspects of virtuality in teams

Contextual Issues / factors	Selected Studies
Literature discussing aspects of Virtuality & team diversity	
Geographic Diversity	Cohen and Gibson (2003); Sarker & Sahey (2002); Chudoba et al (2005); Schweitzer & Duxbury (2010); O'Leary & Cummings (2007); Gibson & Gibbs (2006); Hinds and Bailey (2003)
Time Separation	Espinosa et al. (2003); Swigger et al. (2012);; Griffith et al (2003); Espinosa & Carmel 2004;;Sarker & Sahey (2002); Espinosa & Pickering (2006); Swigger et al (2012)
Culture difference	Dekker et al. (2008)Dekker et al (2008); Kayworth & Leidner (2000); Sarker & Sahey (2002);Van Ryssen and Godar (2000); Shachaf (2008); McDonough et al (2001); Robey et al (2000);Vogel et al. (2001)
Nationality	Martins & Shalley (2011); Daim et al (2012);Gibson and Gibbs (2006);
Educational System/Functional Diversity	Van Rysson & Godar (2000); Sarker & Sahay (2002); Bunderson & Sutcliffe (2002); Kirkman (2002); Olson and Olson (2000)
Structure	Montoya-Weiss et al (2001) ; Maznevski & Chudoba (2001); Majchzak et al (2000);Malhotra et al (2001); Ramesh & Dennis (2002) ; Kayworth & Leidner (2000);Burke & Aytes (2001); Robey et al (2000); Galvin & Ajuja (2001);(Timmerman and Scott, 2006)
Informational Value of Tools	
Media Variety	Kock & Lynn (2012)
Task-Technology Fit	Powel et al (2006);Kirkman et al. (2004); Maznevski & Chudoba (2001); Ramesh & Dennis (2002);Robey et al (2000);Lurey and Raisinghani (2001); Majchrzak et al. (2000b)
Electronic dependence	Gibson and Gibbs (2006)
Technology	Van Rysson & Godar (2000); Kayworth & Leidner (2000);Mark (2001); Maznevski & Chudoba (2001);Suchan & Hayzak (2001); Sarker et al (2001)
Literature addressing Team Well-being & Member Support	
Learning	Robey et al. (2000) ; Srihdar et al (2008)
Social Norm	Sarker et al (2001)
Leadership	Malhotra et al. (2007); Horwitz, Bravington & Silvis (2006); Purvanova & Bono (2009)Giuri et al. (2008);Kayworth and Leidner (2002);Lurey & Raisinghani (2001);Wakefield et al. (2008); Hambley, O'Neil & Kline (2007); Huang et al. (2010);Balthazard et al. (2009)
Trust	Pinjani and Palvia (2013); Kanawattanachai & Yoo (2002); Henttonen & Blomqvist 2005; Greenberg et al. (2007); Sarker et al (2001); Sridhar et al (2008); Jarvenpaa & Leidner (2004) ; Harell & Daim (2009); Rockmann and Northcraft (2008);Fuller et al. (2012); Sarker et al (2011)
Shared Knowledge/Shared Meaning	Cramton (2001); Sarker & Sahey (2002); Malhotra et al (2000); Majchzak et al (2000) ;Bjorn and Ngwenyama (2009);Rooij, Verburg, Andriessen & Hortog (2007)
Team development	Sarker et al (2001) ; Horwitz, Bravington & Silvis (2006)

Team formation	Munkvold and Zigurs (2007); Zimmermann (2011);Baruch and Lin (2012)
Team Identity	O'Leary & Mortensen (2011); Shapiro et al (2002)
Mentoring	(Suchan & Hayzak 2001)
Emotions	Ayoke, Konard & Boyle (2012)
Shared Language	Majchzak et al (2000)
Interaction style	Potter and Balthazard (2002);González-Navarro et al. (2010)
Media Richness	Klitmøller and Lauring (2013), Rockmann and Northcraft (2008)
Knowledge production/creation	Krumpel 2000; Algem Wiethoff & Klein (2003)
Member Status	Galvin & Ahuja (2001)
Creativity	Martins & Shalley (2011);Chang (2011); Kratzer et al. (2006);Leenders et al. (2003)
Selection	D'Souza & Colarelli, (2010); Lurey & Raisinghani (2001)
Reward	Bryant et al. (2009); Lurey & Raisinghani (2001)
Conflict Management	Paul et al. (2004)
Decision quality	
Staffing Challenge	Harvey et al (2004) Harvey et al. (2004)
Literature addressing communication-based activities	
Tasks coordination through Communication	Sarker et al. (2011); Anderson et al. (2007); Diam et al (2012); Massey, Montoya-Weiss, Hung (2003); Sarker & Sahey (2002); Horwitz, Bravington & Silvis (2006) Dain et al (2012); Cramton (2001); Suchan & Hayzak (2001) Cramton (2001); Daim et al (2012); Horwitz, Bravington & Silvis (2006); Maznevski & Chudoba (2001) Galvin & Ahuja (2001); Van Rysson & Godar (2000);Kayworth and Leidner (2000); Srihdar et al 2008;
Knowledge Transfer	Staples & Webster (2008); Malhotra et al (2000); Majchizak et al (2000) ; (Xi and Zhenjiao, 2010) ; Klitmøller and Lauring (2013)
Information Exchange/content	Bunderson & Sutcliffe (2002); Galvin & Ahuja (2001); Krumpel (2000); Rafaeli and Ravid (2003)

Table 3-14: Literature Support for Team Relationships and Virtual Team Outcomes

Issues/Contextual Variables	Selected studies
Coordination – Performance	Balthazzard et al (2004); Yoo & Alavi (2001) ; Paul et al 2004; Arnold et l (2007);Benbunan-fich et al (2001);Blomquist et al (2005) ; Carless and De Paola (2000); Chang & Bordia (2001); Hooff & Riddler (2004); Kirkman et al (2004]; Massey et al (2002]
Coordination – Satisfaction	Caballer, Gracia & Peiro (2005); Lurey & Raisinghani (2001) ; Ocker (2002); Paul, Seetharaman, Samarah & Mykytyn (2004); Purdy & Nye (2000) [Article93][Article119][Article103][Article 98][95][81][24][25]
Communication – Performance	Timmerman and Scott (2006);Lu et al. (2006); Hooff & Ridder (2004); Piccoli et al. (2004)
Conflict-Performance	Motoya-Weiss et al (2001)
Cohesion – Performance	Potter and Balthazard (2002); Sargent & Sue-Chang (2001); Gil, Rico & Alcover (2005)
Cohesion – Satisfaction	Ocker (2002); Ba;tjazard, Potter, & Warren (2004); Carless & Poala (2000); Javenpaa & Ives (2004)
Trust – Performance	Sarker et al (2011); Kirkman et al. (2006), Sarker et al. (2011);Yoo (2002); Arnold, Barling & Kelloway (2001);Aubert & Kelsey (2003); Edwards & Sidhar (2005)
Relationship Building – Satisfaction	Hang & Lai (2001); Lurey & Raisinghani (2001)
Conflict-Satisfaction	Lee-Kelley (2006)
Communication – Satisfaction	[Article119][Article98] Lurey & Raisinghani (2001); Maznevski & Chudoba (2001)
Education System – Performance	Rosen et al. (2006); Sarker & Sahey (2002)Lurey & Raisinghani (2001)
Coordination – Trust	Kanawattanachai & Yoo (2007); Arnold, Barling & Kelloway (2001)
Leadership – team cohesion	Huang et al. (2010)
Relationship Building – Trust	Aubert & Kelsey (2003); Beranek (2000)
Education System – Satisfaction	
Culture – Trust	Zolin et al. (2004)
Cohesion – Relationship Building	Yoo & Alavi (2001); Yuo Y (2002)
Demographics – Performance	Martins and Shalley (2011)
Demographics – Satisfaction	Balthazard & Potter (2000); Bryant, Albring & Murthy (2009)
Culture – Coordination	Kayworth & Leidner (2000); Van Rysson & Godar (2000); Maznevski & Chudoba (2001)
Culture – Communication	Kayworth & Leidner (2000); Van Rysson & Godar (2000); Robey et al (2000)
Roles/Structure/Design – Performance	Gil, Rico, Alcover & Barrasa (2005); Motoya-Weiss et al (2001); Kaiser et al (2000);Lurey & Raisignhani (2001)
Roles/Structure/Design – Relationship Building	
Roles/Structure/Design – Satisfaction	Lurey & Raisignhani (2001); Swan (2001)
Roles/Structure/Design – Education System	Morris, Marshall & KellyRainer (2002)
Roles/Structure/Design – communication	Piccoli, Powell & Ives (2004); Ramesh & Dennis (2002); Galvin & Ahuja (2001)
Relationship Building – Performance	Yoo & Alavi (2001); Yoo & Kanawattanchai (2001); Massey, Montoya-Weiss, & Hung (2002); Lurey & Raisignhani (2001);Jiang, Chen & Klein (2002); Mark

	(2001);
Cohesion-Coordination	Yoo & Alavi (2001); Balthazard, Potter & Warren (2004)
Coordination - Relationship Building	Kirkman et al. (2004); Sarker et al (2001)
Performance – Satisfaction	Gil, Rico & Alcover (2005); Lurey & Raisignhani (2001)
Communication – coordination	Carless & Paola (2000); Robey et al (2000)-VTD
Communication – cohesion	Sarker et al (2001)-team development; Carless & Paola (2000); Horwitz, Bravington & Silvis (2006)
Trust – Satisfaction	[Article-25]
Culture – performance	Edward & Sridhar (2005); Luo Y (2002); Anderson & Hiltz (2001); McDonough et al (2001); Horwitz, Bravington & Silvis (2006)
Culture – Educational systems	Sarker (2005); Van Rysson & Godar (2000)
Culture – technology use	Van Rysson & Godar (2000)
Culture – performance	Van Rysson & Godar (2000); Mark (2001)
Technology use – performance	Mark (2001); Majchzak et al (2000)
Knowledge work – Performance	Bosch-Sijtsema et al (2011)
Structure – Coordination	Ramesh & Dennis (2002)
Project Success	DeLone & McLean (2003); Sridhar et al (2008); Kayworth & Liedner (2000);Espinosa et al. (2003); Espinosa et al (2006);Wixom and Watson (2001); Majchzak et al (2000)

Of course, the above categories are quite subjective due to the sheer diversity of methodological approaches and contextual idiosyncrasies that surround this body of research literature.

3.7 Areas for Further Research and Development

Based on the articles reviewed, the following observations were made:

- Most studies focused on either North American or EU-based teams or industries. Few studies were found from teams in developing countries and even fewer from Africa (one clearly identified as involving South Africa).
- Of all the variables in the literature, trust received the most attention. Other variables such as shared understanding and shared cognition received lesser attention.
- For one thing, VT studies are still yet to appreciate the role knowledge structure plays in completing communication. Although knowledge management research (e.g. Jasimuddin et al 2014) has indicated that knowledge influence communication, and even media decisions such as face-to-face or email interactions; the two groups of researchers don't really relate their findings with each other.
- Some studies, notably Staples & Webster (2008) have looked at the effect of virtualness on knowledge sharing teams. Others (e.g. Gupta, Mattarelli, Seshasai & Broschak 2009; Pinjani et al 2013; Klitmoller & Lauring 2013) have looked at knowledge sharing in virtual teams. There is a need to review both domains and highlight their connection. Subsequently, empirical investigations may be needed.
- On a methodological front, the body of research literature was dominated by student teams operating in experimental laboratory conditions as opposed to real world stakeholders. The methodological implication is that there is need to explore how the expectations of the aspects of virtuality and knowledge communication vary across different complex real-world task and amongst practitioners. This warrants more organisational case study research.
- With regards to theoretical development, an overarching theory of virtual team working has not yet emerged. Probably due to the inconsistent description of virtuality in team or because there is a gap between theory and practical considerations. It may well be because the practice itself is grounded in different domains: information system, project management, knowledge management, strategic management.
- A significant number of studies used the term, virtuality and virtual teamwork synonymous without drawing distinctions. As such, it was difficult to successfully distinguish proximate team members from those that are more or less virtual. Only a few studies however, used meaningful definitions and measure of team virtuality (e.g. Schweitzer & Duxbury 2010). Likewise, the discussion in the previous chapter clearly shows that the dimensions of virtuality have been developed from practical and

theoretical considerations, necessitating empirical validation. The implication is a need to investigate what may constitute as 'real presence' or not in a team.

- Two points come to mind with respect to communication media: (1) From the literature review, most studies focused on the impact of specific/certain media on individual or teams, rather than emphasizing the impact multiple media may have when people combine them for increasingly complex tasks (Kock & Lynn 2012). The former had drawn some criticism from the practical and academic world because organizations of today don't function that way; a variety of technologies are available for individuals and teams (Aiken, Wang & Paolilo 2011). (2) From the research call of Deluca & Valacich (2006) and Kock & Lynn (2012) - very few scholars examined the relationship between multiple media attributes and communication performance. Perhaps it may be because of the continued over reliance on the media richness theory as opposed to newer theoretical lens such as the media synchronicity theory. Yes, MST is a new and interesting concept. It has the potential of expanding our knowledge of communication in virtual team initiatives. So much more work is needed on this concept.
- A lack of empirical work was found mostly in the context of strategic-level determinants and the role of organizations. More work is needed in this regard to enhance understanding, most especially from a resource-based view. This would provide opportunities for understanding if there is a relationship between the effectiveness of virtual teams with respect to key operational factors in an organization such as availability of funds, reputation, human resource and knowledge management practices. In fact, the literature review showed that many of the studies do not provide organizational performance data to support the cost and proposed benefits of a virtual team.
- Furthermore, there was a lack of country-level analysis. The result is a gap of understanding concerning country-level factors that may impact on a virtual working initiative.
- As was observed, a large amount of studies focused on knowledge-intensive work (e.g. problem-solving, product development related tasks). Conversely, it may be interesting to know if all technology-proficient teams, for example, possess the same characteristics and communication behaviours. Likewise, can virtual team initiatives help us understand the needs of a very functionally diverse team.
- With the exception of Reed & Knight (2010), who explored differences in risks between traditional and virtual project environments, a survey of prior research literature revealed no other studies into the differences between failure in traditional and virtual project environments. This may further suggest a disconnection between organizational-level

outcomes (e.g. Return on investments) and the motivation for which virtual teams are used.

- More clarity is required to draw a distinction between individual-specific risk, team-specific risk and organization-specific risk. A likely research focus might be a comparable study amongst international organisation, focusing on how different virtual teams implement decisions.

3.8 Conclusion

In this chapter, the researcher presented a discussion on virtual teamwork, processes, virtuality, and digital communication-systems. The narrative was based on a review, interpretation and synthesis of a large range of relevant literature. The objective was to provide a good theoretical and empirical understanding of the key parameters for developing a successful virtual team strategy.

As highlighted in chapter one and the critical analysis in chapter two and three, this research is justified mainly because of the following needs:

- The need for more field-based studies, as opposed to laboratory studies currently dominating the literature on this topic.
- The need to address the lack of meaningful definitions and measures of virtuality; facilitating a clearer distinction between co-located and virtual teamwork. In that light, research is needed to empirically validate the dimensions of virtuality and examine the extent to which they overlap.
- The need to bring the environmental factors within a virtual team process to the forefront; to create a more holistic framework. Some factors influence media decisions, a better understanding of these factors would improve communication performance.
- The need to explore the commonalities among various teams within a particular project, including distinctive or uncommon behaviours required to facilitate the variety of activities. Likewise, the need to relate the process of virtual team working using theories of communication media behaviour.
- The need to expand our knowledge on team virtuality and effectiveness to other settings. For example, there is a dearth of research from the African perspective. Likewise opportunities also exist to study how virtual teams function within a programme.

In the next chapter, the research philosophy, research strategy and data sources will be examined.

Chapter 4 : Methodology & Design

4.1 Introduction

This chapter presents the methodology that facilitates answering of the research questions. It sheds light on possible research approaches as well as provides an insight into the role of the researcher in this study. Subsections highlight the research philosophy, strategy and different methods for data collection.

4.2 Philosophical Basis & Meta-theoretical Commitments

Having defined the research needs and objectives, this section considers an appropriate research paradigm whilst giving justification of its suitability. However, a good question to ask initially is 'what philosophical doctrine is best'? There is probably no supreme answer to this question, but it would depend on what is being looked for, from the perspective of the researcher. Specifically, the researcher must come to terms with what he takes *reality* to be, and how *knowledge* can be achieved. According to Collis & Hussey (2003), a researcher's belief system plays a role in how the world is perceived, as well as how knowledge should be sought and evaluated. It serves as a guide, and suggests meta-theories, methods and techniques for describing data (Creswell 2007, Saunders et al 2009).

To a great extent, the interest in and allure of how reality should be perceived, and knowledge created, has been subjected to a long history of debates. They have typically been two competing philosophy camps. On one side, a group of researchers are allured by observable facts and figures. These scholars have argued that *situations* and *events* adhere to rationalism and empiricism, which might lead to law-like generations. The opposing philosophy camp base occurrences on relativism and idealism. They argue that *events* are socially constructed and open to multiple subjective interpretations. The two philosophical camps are characterized broadly as Positivist and Interpretivist.

The positivist philosophy came into prominence in the nineteenth century during the rapid advancement of natural science and technology. Here, researchers believed that there can be a single objective reality (ontology). According to the positivist, science alone is considered ultimate and vigorous. So, organisational, technological or societal challenges can be understood and resolved by applying appropriate scientific models. In fact, the proponents of the positivists'

philosophy assert that explicit knowledge has tangible meaning by itself. It should be obtained via empirical observations (Creswell 2007; Collin & Hussey 2003; Saunders et al 2009).

Epistemologically, positivists are of the opinion that information systems research, for example, should seek after measurable phenomena. Unobservable concepts should be avoided as much as possible because it limits the researchers' ability to be unbiased (Axiology); reality should remain external to the researcher. In most cases, a research process should start with formulating hypothesis (deduction or reduction of variables from conjectures). This can be tested, producing repeatable results and conclusions. A study should be robust enough to generalize to a larger population.

In consideration of the different techniques available to a researcher, positivists do not have to pay as much attention to the very essence of their subjects (e.g. human beings and their thought process) as they do with the data (e.g. its volume, representation and frequency of occurrence).

Despite the overwhelming usefulness of this philosophical approach to research, outside the confinement of a controlled environment, its ability has limits. For instance, the ensuing use of quantitative methods of data collection and analysis is more concerned with the extent to which certain variables affect, or are affected by other variables – not accounting for the human activities that connect both variables[12]. For Easterby-smith et al (2004), a positivist position can provide breath on a phenomenon, but it may lack the ability to provide depth – particularly from the social perspective in which ends and expected views are inconsistent and sometimes, perplexing.

The Interpretivist position on the other hand, considers reality to be ingrained in the subjective perceptions and actions of individuals (ontology). According to this ontological position, the belief systems of people in society allow them to construct and have multiple interpretations of reality (Collis & Hussey 2003; Hughes and Sharrock, 1990). Since the social world may consist of subjective realities formed by names, concepts and labels (Burrell and Morgan, 2005), Interpretivists believe that both the observed and observers are open to various interpretations of the social world. Attention should also be given to the subjective nature of human thoughts and action (Duberley, Johnson & Cassell 2012, p.20). In short, to successfully investigate a phenomenon, there should be a substantial level of interaction between the researcher and the

[12] It is worth emphasising that some authors draw distinction between qualitative and quantitative studies based on the type of evidence collected and not their underlying philosophy belief. This has undoubtedly been a source of further debate by academic institutions today (Yin 2003).

entity being studied (Creswell, 2003). For those who hold this view, a suitable way to undertake research is by utilizing qualitative techniques for understanding historical and literary text.

Interpretivist, like positivist also faces some criticism. For example, Interpretivist research tends to ignore the objectivity in the real world necessary for establishing facts. Rather, it accepts the notion of relativism, implying that they are contending claims to the truth across various situations, communication sequence and contexts. Taking into account the research technique available to a researcher, qualitative methods of data collection (e.g. interviews) are more dominant in Interpretivist research (Creswell 2007; Mile & Hubberman, 1994). Proponents of this philosophy argue that its logic is characterized as inductive, and thereby its procedures may evolve over the course of the study. Particularly, as the researcher collects and analyse data from the field (i.e. the external world that is being observed by the researcher) (Yin 2003).

The discussions above demonstrate that positivism and Interpretivism are two intellectual doctrines - a way of viewing the world and gathering facts about it (Work 2007). However, some scholars propose the need for reconciling the two dominant schools of thoughts. In that regard, they have argued that the mainstream positivism and Interpretivism positions are actually extremes of a paradigm continuum (Connell & Nord 1996; Collis & Hussey 2003; Miles & Huberman 1994; Saunders et al 2009). In response, authors like Patton (2002) discussed the need for establishing middle grounds or variations to the extreme beliefs. Here, researchers can retain commitments to some key aspects of either positivist or interpretive inquiry. It is worth noting that it is difficult and complicated to identify a unified body of literature.

A range of methodological perspectives has drawn on the idea of having variations to the two major philosophical traditions (e.g., either wholly or partially positivist ontology with a subjective epistemology). These groups of scholars hold the view that degrees of objectivity exist, or are worth striving for. They sometimes claim that our senses can determine what reality is (Saunders et al 2006). Qualitative neo-positivism, post positivism, and critical realism are examples of some research paradigms that take influence from ontological realism per se. The application of some of these paradigms can be challenging and subject to lengthy debates because there is no unified definition of what realism is. Different authors, for example, Saunders et al (2009), Hunt (1991) have applied the term to describe their own variant of a set of philosophical doctrines. Likewise, in their book on *Research Methods,* Gill & Johnson (2010) attempted to provide a generalizable definition of realism. They go on to say:

> "Ontological/metaphysical realism considers that reality exists independently of the cognitive structures of observers, while epistemological realism considers that reality to be cognitively accessible to observers"(p. 242).

Furthermore, some scholars have approached the philosophical dispute through the "suspension of judgements on ontological and epistemological concerns" (Holden & Lynch 2004, p. 405). To this end, pragmatism is another research paradigm that is a go-between the two mainstream paradigms discussed above. For Holden & Lynch (2004), pragmatics have a 'just get it on with it' attitude to research. An important feature of the pragmatist paradigm concern the use of theories, which should be tested first, through neutral observation of the external world. This determines whether it does suffice in that regard. Interestingly, this idea of theory testing emulates some characteristics of positivist epistemology as highlighted in the paradigm review by Duberley, Johnson & Cassell (2012). Nonetheless, subtle differences exist. Whilst positivist do not take scientific models to be a definite explanation of how the world work, but a way of generalizing experiences and certain patterns. Pragmatists on the other hand, are generally not interested in how true or untrue a theory is, but in its usefulness and practicality in the current situation.

Given the discussions above, the subsequent sections re-emphasize the rationale for the chosen paradigm. These are the researcher's basic philosophical belief regarding ontology, epistemology and the methodological approach for this study. They determine the data collection methods.

4.3 The Adopted Paradigm & Key Research Implications of the Philosophical Stance

It may sometimes be difficult to concretely fit a research idea to the extreme subjectivist and objectivist paradigms. So before going any further, it is important to address any potential misconceptions about the current study by acknowledging assumptions and biases (Miles and Huberman, 1994).

First, this study does not embark on a hypothetico-deductive strategy such as those in mainstream positivism[13]. Here, team members and their champions are crucial subjects of the empirical investigation. They introduce a measure of subjectivity to the research process. As discussed in the sections above, human beings stern from dissimilar backgrounds and they possess differing belief systems. This may manifest in their interpretations of team dynamics,

[13] Hypothetico-deduction has to do with the reducing a problem to the smallest possible elements. Concepts are quantitatively operationalized.

aspects of virtuality, perceptions of their success and opinion regarding the nature of internal tasks and technology. These are all sources of understanding (meaning) and the exclusion of the 'subjective' will be futile to the success of the study. Conversely, the way the relevant stakeholders perceive and make sense of their work environment cannot be ignored. Therefore, to understand the phenomenon, the researcher must draw from the narratives told by social actors.

Second, though understanding the meanings and the interpretations that social actors subjectively attribute to the phenomenon is important in explaining and describing it; still, the inquiry is built on certain objective realities. In practice, teams that are virtual tend to have structural/mechanical properties. Although these structures are malleable (Majchrzak et al 2000), they still consist of real actions (e.g. rules, life-cycle processes, resources, unified communication infrastructures; see chapter 2 above). From a sociological perspective, these individuals and teams use certain communication media, which have attributes, and so, the characteristics of the real world objects have to be acknowledged and accounted for.

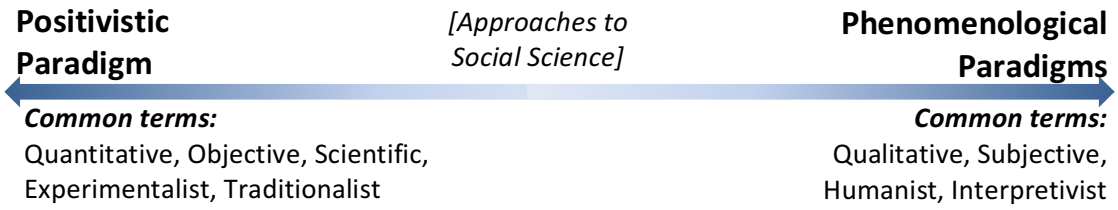
Third, the empirical investigation is conducted within a proposed conceptual framing that was derived from literature and practice. The theoretical framework and research questions tend to pre-empt the relationship between some factors. Hence, the researcher assumes a priori to the case – slightly leaning towards a deductive positivist approach. However, there is an extent to which the predetermined conceptual framework/priori is capable of explaining the issues surrounding virtual teamwork. The interest thereof is to revisit and modify the conceptual framing as determined by the empirical analysis. Thereby, inductively producing alternative constructs for explaining the phenomenon. Indeed, with the interpretive tradition, new and unpredicted findings can emerge.

Fourth, the researcher's own interpretation of organizational realities as well as his interest in generating knowledge that contributes to effective virtual communication also plays a role in data collection and analysis. In addition, there are, of course, possibilities that the researchers' understanding of the various conceptual components (either from the extensive literature review or as an experienced member of a virtual project team) might influence how the results are interpreted. Neutrality during interpretation cannot be guaranteed because of the researcher's position as being both a social actor and an interactive observer. Thus, researcher bias may exist; the axiology of this research is value-laden.

Following the above discussions, this study depends on Interpretivist traditions in eliciting respondent insights/values in specific virtual project situations as well as analysing and presenting

results. Nonetheless, the study starts with a deductive strategy due to the reliance on an explicit conceptual framing in determining elements of the research environment - prior to data collection. The conceptual framing pre-empts theoretical relationships and propositions. However, they are not imposed by the researcher. More importantly, the researcher is striving to explain them [as viewed by the social actors]. This means that the research approach is very much on understanding the phenomenon through the meaning individual research actors ascribe to situations (Eisenhardt & Graebner 2007).

Figure 4-1: Classification of paradigms

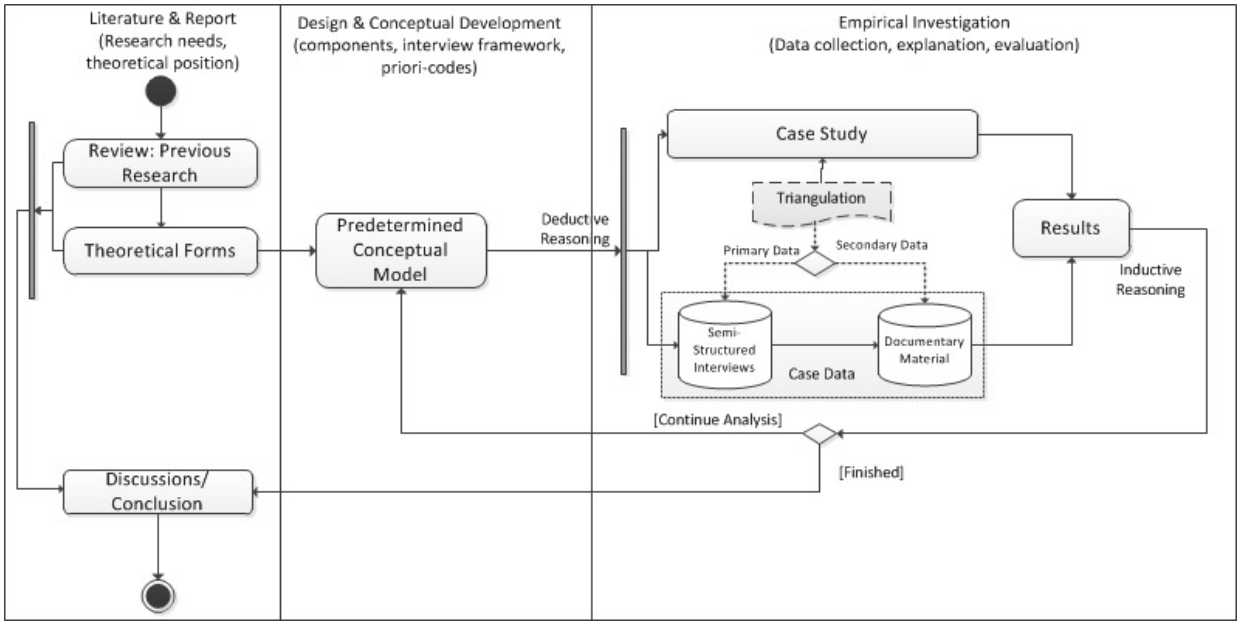


(Source: Adapted from Hussey and Hussey (1997))

From the figure above (4.1), the phenomenological stance acknowledges that there are multiple limitations to what people may know about the reality that underscores a domain of discourse. On the one hand, conceptualizations (including the researcher's intuition & framework) can provide us with a view of things, but this would only be a partial view. The conceptual framework, in this perspective, is just a tool or lens for debating reality. Reality varies from person to person. Thus, the researcher's goal is to infer what things are really like through human understanding and experience of the phenomenon.

For all these reasons, the application of interpretive traditions – can provide an understanding of the paradigmatic influence of this study. It also has strong resonance with those comments on socio-technical systemic orientations discussed in chapter two.

Figure 4-2: Activity Diagram Showing Conceiving features of the approach to the Qualitative Research Process



4.4 The Research Strategy: The Case for a Case Study

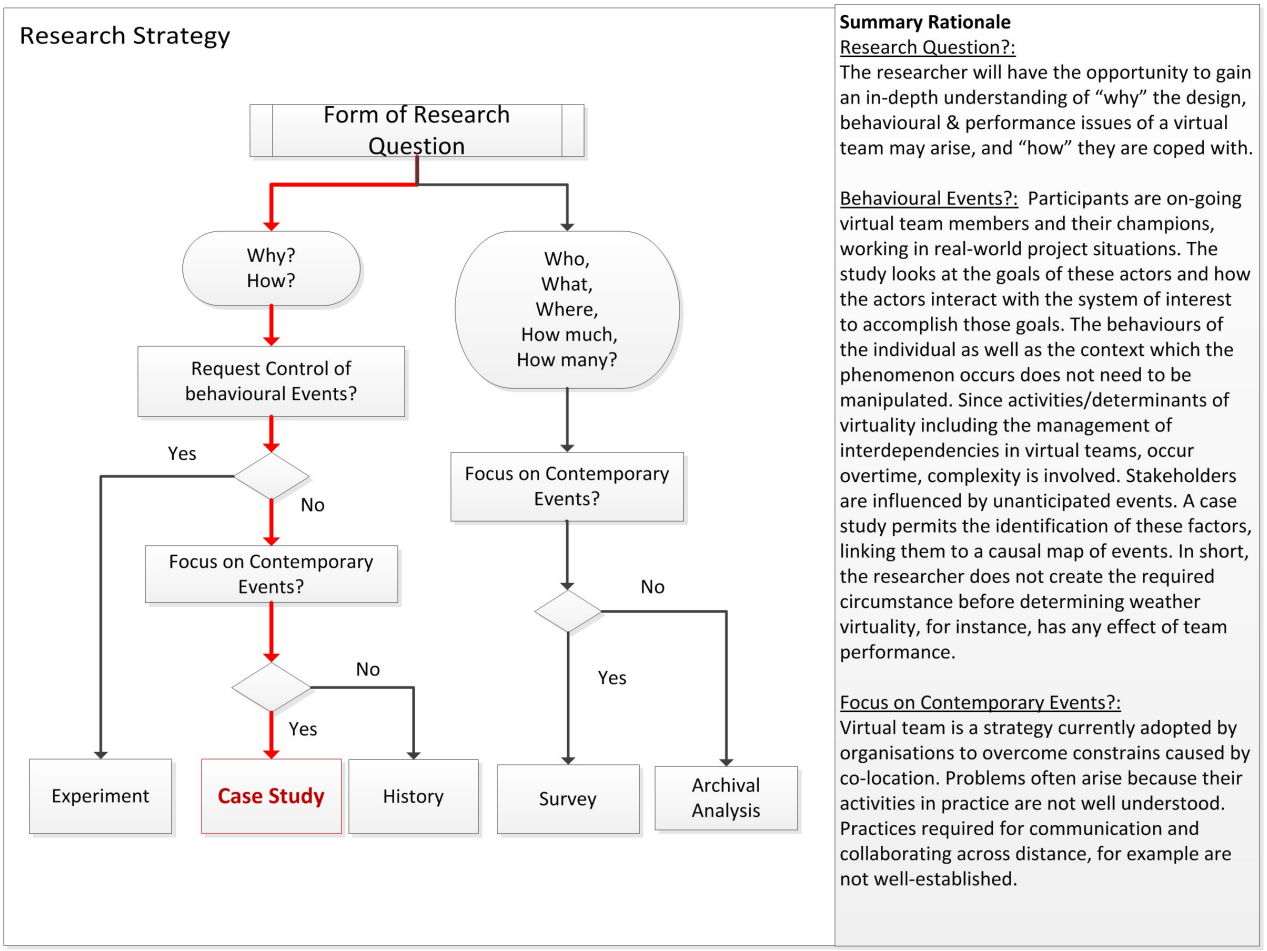
There is considerable diversity in the different ways authors approach case-study research. For example, Yin (2003) takes a more reality-oriented approach to case study design, whereby he advocates the use of conceptual tools – theories, intuition, frameworks, principles. In contrast, authors such as Stake (2006) tend to frame case-study research from a more constructionist orientation. There is little or no emphasis on initial predictions or theoretical/practical commitments. Emphasis is made on how the stakeholders themselves interpret their actions within their social interaction. As a result of these differing views on case-study research, there was a need to carefully and critically select references that underpin the research paradigm.

Based on the views of reality and knowledge as discussed above, Yin's approach to case-study provides a good scope for this study. According to Yin (2003), a case study is a suitable strategy for empirically investigating a 'phenomenon of interests' as it exists within its natural environment. It is mostly used when the boundary context and the main phenomenon cannot be easily differentiated. Case-studies have been used by many information systems researchers, as observed in both Benbasat, et al (1987) and Palvia et al's (2003) review of IS journals. Of course, a case research strategy can be used for different purposes, including examining, exploring, describing, and evaluating the complex interactions that occur in real-life situations (Yin 2003).

Due to the intertwined relationship between a phenomenon and its context, case study research frequently depends on various sources of evidence that need to converge to give the case meaning. They may be either qualitative or quantitative evidence or even both.

The graphical representation and description below (figure 4.3) provides a further justification for case-study in this thesis. Yin describes three conditions that influence when and why a case study should be used. They depend on: (1) how the research question is crafted (2) the amount of control the researcher has over the behavioural events, and (3) whether or not the focus is on contemporary events (Yin 2003).

Figure 4-3: Why Case Study? Researcher's flowchart of Choice & Rational for Case-study Adoption (An adaptation from Yin (2003) discussed at a workshop, Cardiff)



In additions to the rationalization summarized in figure 4.3 above, a case study is particularly appropriate for studying variables and less understood situations, such as the influence of intrinsic and extrinsic factors on team success. A case study will show, how and why (or why not) virtual teams are effective when their activities, takes into cognizance the material properties of their chosen media, the communication process and team functions. The case study will also show how

simply making changes to extrinsic influences (e.g. technological) is, or is not sufficient to define/guarantee an effective virtual team[14].

It is worth mentioning that some case study research in the IS field has also followed an explanatory strategy through a-priori reasoning. One of the earliest and perhaps most prominent is the single-case study undertaken by Markus (1983) where she developed a conceptual model, evaluating three theories: people-determined, system-determined and interaction-determined theories of resistance. Her study focused on the implementation issues of a management information system. With her adoption of a case research strategy, she demonstrates that even a failure of predictions, revealed from a predetermined conceptual framing could actually produce new and important findings. It could contribute to our knowledge of the confounding factors. It could also elucidate on unanticipated events, minor interactions and other complex or dynamic issues that may have caused the prediction to fail (Bitektine 2007). Markus (1983) inevitably, silenced criticism in terms of research design and methodological rigour.

4.5 Perspective on Case

Miles and Huberman (1994) describe a case as a phenomenon of interest that occurs within a particular boundary context. They are embedded in a natural setting. A case is sometimes regarded as the main unit to be analysed. They may take several forms from a simple process to programs, organizational change, implementations, projects, roles, individuals and cultures. However, the key to defining a case is to understand that it is determined by the research objective and question (Yin 2003). The above arguments share resonance with Gerring (2007, p.19) who writes "a case may be created out on any phenomenon so long as it has identifiable boundaries and comprises of the primary object of an inference"

From the research objective, understanding team virtuality is part of the boundary context, and the case study also contains embedded units – communication activities and the mechanisms for managing of interdependences in projects. In this study, the unit of observation is the individual (team member, work stream lead, programme leaders, virtual team managers, key users, partners and consultants).

[14] The case study approach also allows the researcher to ascertain if the team design issues and practitioners' experiences were similar within the same industry.

4.6 Sample Strategy

To structure the empirical investigation towards achieving its goal, some questions deserved attention, such as 'what number of people is required in order to draw meaningful conclusions?' 'What sample should be interviewed and for what purpose?' The former leads to the researcher deciding a 'saturation point' after which no more data would be collected for analysis. This prevents the research from going-on ad infinitum. The attainment of saturation is checked as the researcher analyses the data. The latter is important because a research phenomenon should be properly 'scoped'. See section 5.3 for further details of the cases selected to be included in this study.

In choosing the research environment and subjects, the researcher adopted a purposive sampling technique (Patton, 2002). The inclusion criterion for participants was as follows:

(1) Be a practitioner: a current member of a virtual team, have recently worked as one on a project (so retrospection bias will be minimized). Or

(2) Be a stakeholder in a development project: Team task, project activities need to be dispersed in at least two places to maximize location diversity, virtual interaction and exposure to unified communication infrastructures.

(3) Have a well-defined identity (e.g. team name) or function.

For ethical reasons, the following considerations were also made.

(1) Selected practitioners had to be competent adults, and of working age.

(2) Participants were volunteers and they had to use their personal time for interviews. In doing so, there were no disruptions to their organisational work.

(3) As participants were being asked to draw on real life experiences, conversations that could have negative implications on their employment were avoided. Likewise, cross-reference codes are not being used whenever the researcher is unclear about the implications of a participant's viewpoint.

In the context of the research objectives, the sampling decisions are appropriate because it not only allows the investigation of factors associated with aspects of virtuality and communication performance, but enables the researcher look particularly, at variations of the project work system spectrum. These sampling criteria will be discussed again in the next chapter.

4.7 Data Collection & Analysis

4.7.1 Data Collection Method

After presenting the research strategy, this section gives details of data collection techniques. One of the strengths of the case study strategy is that it allows the researcher to collect data from several sources. However, this also depended on the size of the organization, the number of team members that can be consulted, and their location (discussed further in the next chapter). In case study research, interviews are the most commonly used data collection technique. They show the richness in narrative, stories, and notes as opposed to numbers (Yin 2003). Interviews take the form of question and answer sessions, but unlike other techniques such as workshops and questionnaires they are conducted on a one-on-one basis. In designing questions for an interview, Who?, Why?, What?, When?, Whom?, and Where?, provide an appropriate framework for identifying areas of concerns (Duberley et al 2012). They take several forms, from closed-ended questions to open-ended questions and probes. Closed questions compel the interviewee to provide specific answers. A researcher (interviewer) seeks to tease out some specific information. Open-ended questions on the other hand, do not constrain the interviewee; it enables them to take control of the interview and elaboration on issues as they see fit. Probing questions allow the researcher to follow-up observations or non-verbal signals with further questions in order to gather richer information.

Because of the dispersed nature of the informants involved in this study, semi-structured interview yields more return for the investment in personal resources, including time and effort. It also ensures consistency in analysis, and thereby increasing the reliability of the study. The participant profiles are provided in Chapter 5.

Documentary material was organized as follows: (a) Documents relevant to the organization and its projects: existing data flow maps, team profile, product information, reports, some project training resources, project governance framework (b) Documents written by team members – to further reflect a particular stakeholder's position on an issue (c) External publications, including archival data from industry reports such as Technology Evaluation Center, Nigerian Communication Commission (NCC), Info & Tech, and confidential private consultancies. The collection and use of these documentary materials facilitated understanding the interview data in their appropriate context. Documentary evidence was also intended to confirm impressions obtained during interviews. For instance, extracts from a project status report, and project charter, was used to confirm member's distance and team time worked virtuality. This contributes to the validity of the findings.

4.7.2 The Instrument

This research draws on existing conceptualizations from the virtual team and communication literature, thus, the interview question covers specific themes/topics. Prior studies, such as Dennis & Valacich (1999) provide valuable insights to the kind of interview questions that participants may be asked (see discussion in Chapter 2).

With the aim of answering the research questions, it was useful to consider the inquiry process in two parts. Part one, collection of some background data on individuals, team identity, characteristics of the project environment and so on. This set of questions captured the different locations of members, how the teams/business work, as well as project-level data. This led to the second part where the discussions focused on perceptions of team virtuality and the expectations in their everyday practice. In the final stage of inquiry, the content was based on other components of the conceptual framework that informed the research design.

In fact, semi-structured interviews can be more productive because more relevant information can be gathered from just one interview session (Gerring 2007). They provide the best opportunities were the researcher could appreciate what a virtual team actually does, their concerns and their expectations from any process or system.

A few points are worth mentioning: (1) Some initial study questions were converted to interview questions as suggested by Creswell (2007). (2) Some interview questions were broadened, while others were omitted or modified as the researcher actively engaged with participants. (3) Sometimes, the researcher had to put the respondent in scenarios, to help them properly understand some questions or discuss their experience further. The use of scenarios helped in the identification of virtual communication in an appropriate context.

Research Concern	*Research Questions*		Concepts/ Themes	Research Method/Comments
Building knowledge of meaningful definitions and measures of team virtuality. Existing phenomenon of virtual team in an Africa-based project context. Focus on understanding virtual teams in terms of media capabilities and individual's communication behaviours. Building a holistic framework and bring environmental factors & communication process to the forefront. Expand knowledge on virtuality and its role in outcome values.	What is the nature of the context in which communication occurs in a virtual team? How can the Nigerian operations of a development programme be identified, represented & visualized? What key factors are associated with the usefulness of systems of communication applied to their virtual team initiatives? Are there risks to a virtual team strategy and what could hamper the realization?		Aspects of Virtuality; Team Functions; Communication Process; Media Capabilities; Outcome Values	Semi-structured interviews, with a mixture of open-ended and closed format questions is used to draw the characteristics of virtual team and the properties of their communication networks. Data echoed how practitioners perceived and respond to the different aspects of virtuality and process interdependence. From interviews, some participants told stories which reflected team design issues. Some questions were: What does it means to be working in a virtual setting as opposed to non-virtual? Participants were encouraged to speak freely about their project experiences and perception. Interview questions included: the kind of problems that merits a group effort, some of the problems faced on a daily basis, the strategies/techniques for sharing information in a virtual setting, when/why synchronous and asynchronous features of communication media is used. Questions also targeted cognitive and affective elements of their virtual experience. Interview questions allow participants reflect on the systems and processes put in place to facilitate their activities. That is, the technological means and social influences driving their behaviour within a project environment. Explanations were sought regarding the collaborative atmosphere the stakeholders currently face and expected to face in the future. Participants were also asked to provide insights of successes from their project activities.

Table 4-1: Research Question leading to Interview Questions

4.7.3 Justification of Data Analysis & Coding Procedure

To answer the research questions, the data analysis process was divided into two key steps: identifying and mapping out ideas/concepts; and narrative explanations. Using template analysis technique (Crabtree & Miller 1999 ; Waring & Wainwright 2008; King 2012), transcripts and other texts are coded (see further description below). Template Analysis (TA) is a style of thematic analysis that provides both structure and flexibility in the coding and description of complex textural data. A key feature of this technique is the creation of a coding template, which is systematic, well-structured and can be revised. According to King (2012) TA can be applied to a broad range of epistemological positions. It has been employed in studies that incline towards constructivist commitments, phenomenological approaches and even realist-orientations (Ibid).

It is important to briefly discuss why a researcher might use template analysis over other closely related thematic techniques such as Interpretivist Phenomenological Analysis (IPA)(Smith et al 1999) and grounded-theory analysis (Corbin & Strauss 2008). First, TA is neither prescriptive nor bounded to a given philosophical or theoretical assumption. Unlike grounded theory that has specific procedures for data gathering, analysis and meta-theoretical values, TA allows researchers to tailor their analysis to their own requirements and philosophical commitments . Second, it offers a pleasingly simple method that is both potent, yet less-time consuming. It can also comfortably handle a relatively large volume of text. This is in contrast to IPA that usually involve coding a sample of 10-15 participants (King 2012, p. 428).

The above discussion leads to the third advantage of employing TA. Nigel King goes on to say that template analysis "… does not insist on a fixed number of levels of coding hierarchy", rather "it encourages the analyst to develop themes more extensively where the richest data are found (in relation to the research question)"[15] (2012; p. 429). Thus, it can be analyst-driven. Intensive coding of data can be avoided in this study. A coding template can be easily re-applied as more data comes in.

Template analysis can be a go-between the 'top-down' and 'bottom–up' approaches. Researchers can use pre-existing categories/a-priori codes that have been developed prior to data collection (e.g. from a conceptual framing, literature). Researchers can also accept the new codes/themes that emerge from the field. Working through the transcripts, some prior themes can be merged, new once can be inserted while less appropriate codes can be either modified or deleted. Hence, initial categories are not imposed by the researcher. Causal links are inductively developed - by immersion from data items.

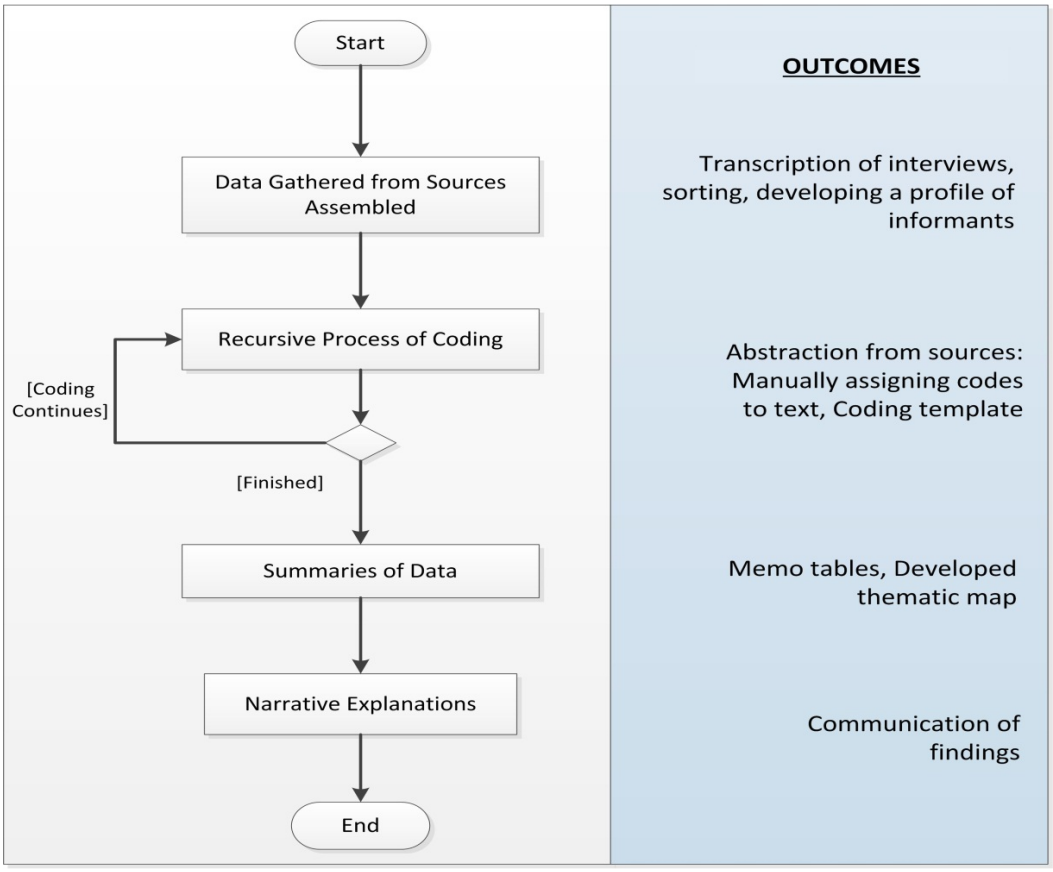
[15] Grounded theory analysis usually has three iterations of analysis

Another advantage of this approach (TA) is the incremental nature of data mapping. This means that there can be early feedback on the usefulness of the data gathered, with themes and findings arising early on in the analysis process.

There continues to be much support for template analysis, most especially from scholars who opt not to use computing features such as NVivo keyword search functionality to extract findings in their qualitative study. While articulating their position on the matter, Waring & Wainwright (2008, p. 92) noted that "… immersion in the data is an essential part of the interpretive process and use of technology [for detailed analysis] can often act as a substantial barrier" to interpretation. In this study, viewpoints were organised and manipulated with the Visual Understanding Environment (VUE). This immediately provided benefits through increased clarity and reduced risk of data loss or oversight.

VUE is a data visualization and management software tool initially developed in Tufts University. Information on its features and capabilities can be found on: (https://wikis.uit.tufts.edu/confluence/display/VUEUserGuide/ENGLISH+USER+GUIDE).

Figure 4-4: Overview of Data Analysis Procedure



4.7.4 Preparing for Data Collection

As previously discussed, this study employed a purposive sampling technique. The research questions were formed around a particular phenomenon in its context – virtual team working. Therefore, the first hurdle was to determine relevant case-study organizations to approach. Introductory letters were sent to eight potential research organisations – stating the nature of the study, the researcher's role and the extent of their involvement in the study. The geographical context has been justified in Chapter 2. Preliminary conversations with IT divisions and programme leaders about their projects, virtual interaction emphasis, process technologies and unit-grouping were crucial when considering research participants[16].

It is worth mentioning that gaining an audience with legitimate representatives of the approached organizations was a daunting task. Due to a low response rate from conventional introductory method, the researcher embraced more indirect strategies, such as utilizing social media to seek employees - friends-of-friends/family - on LinkedIn and Facebook. The aim was to identify and connect with anyone who may be affiliated with these organizations; to act as a broker. Another challenge encountered - prior to data collection - was promoting the value of the research to the approached organizations, whilst convincing participants that the study was 'non-threatening'. Some of these organizations used bespoke software systems and proprietary methodologies. This, amongst other things, was a source of either refusals or reluctance to participate. Research participants were, however, assured that reasonable discretion will be provided.

Confidentiality was promised and respected in this study. To promote openness, anonymity was also promised. Real names were not to be used when making reference to people in real situations. In addition, nothing that was said in the interviews (or in other text) would be directly attributed to their organization.

As alluded to earlier in this report, before conducting the main data collection exercise, several conversations were held with stakeholders (Programme leaders, IT practitioners, site heads). These meetings provided some insights into the shortcomings of the interview guide. On the one hand, the researcher realized that certain words used in the interview instrument were confusing (see illustration below). In addition to being ambiguous, the interview instrument did not seem to cover all aspects of the theoretical concept developed in this project. Hence, reviewing and modifying the interview instrument was necessary before proceeding further with data collection. This idea of revising the research instruments accords well with Flick (2009) who advised that

[16] The researcher acknowledges the contributions made by the participants of the Ecole de Management de Normandie doctorial colloquial who helped in fine-tuning criteria's for shortlisting informants and searching out organisations.

interview questions should be understandable and critically thought through. Only then, would the desired insight be obtained.

An example of revision to the in-depth semi-structured instrument can be found in the box below:

An Initial Question: *How does your virtual team contribute to the main business objectives?* *First, a problem with this question was that it caused the initial interviewees to produce a finite list of their job functions. This did not really account for a range of behaviours and experiences. Second, a stakeholder – who was theoretically a member of a virtual team – raised concerns on the essence of referring to his team as a virtual team, probably as opposed to an Application Development Team.* *Later, when the contentious participant was asked 'what are the means required to successfully implement a project and what are the means available to the team,' his reply was"… members are based in different testing locations." The finding from this series of conversations was that, the researcher might need to pursue and clarify meanings. Hence, the question about a virtual team's 'contributions to the business' contained greater complexity. This ranges from context to process and practices in their project.* *Inspired by these initial conversations, the researcher had to re-evaluate the interview instrument to clarifying ambiguity - allowing respondents explain the phenomenon under study from their own perspective – in keeping with an Interpretivist epistemology.* ***A Modified Question Design:*** *Would you elaborate on what it means to be working in a virtual setting as opposed to non-virtual? "Virtual teams", what does the term mean to you? This flowed naturally into - What is your opinion about the potential of a virtual team for an organization?*

Table 4-2: Initial Data Collection & Analysis Experience

Furthermore, the modified question above was able to engender detailed responses from participants. The question format also made sense to all interviewees. As a consequence, it was possible to empirically see the existence of virtual team initiatives in organizations and in what sense they may exist.

4.7.5 Data Analysis: Developing the Template

4.7.5.1 Familiarizing with data

Subsequently to the data collection exercise, transcribing of interviews and familiarizing with documentary data items were the starting point for the analysis. During the transcription of verbal data, profiles for the different informants were created. Notes were also taken. The notes were basically casually connected sequence of events and situations associated with the study context. Some notes can be seen in Appendix A. Ideas for lower order codes were also jotted down – but not applied to the data - at this stage.

4.7.5.2 A priori- themes & preliminary coding

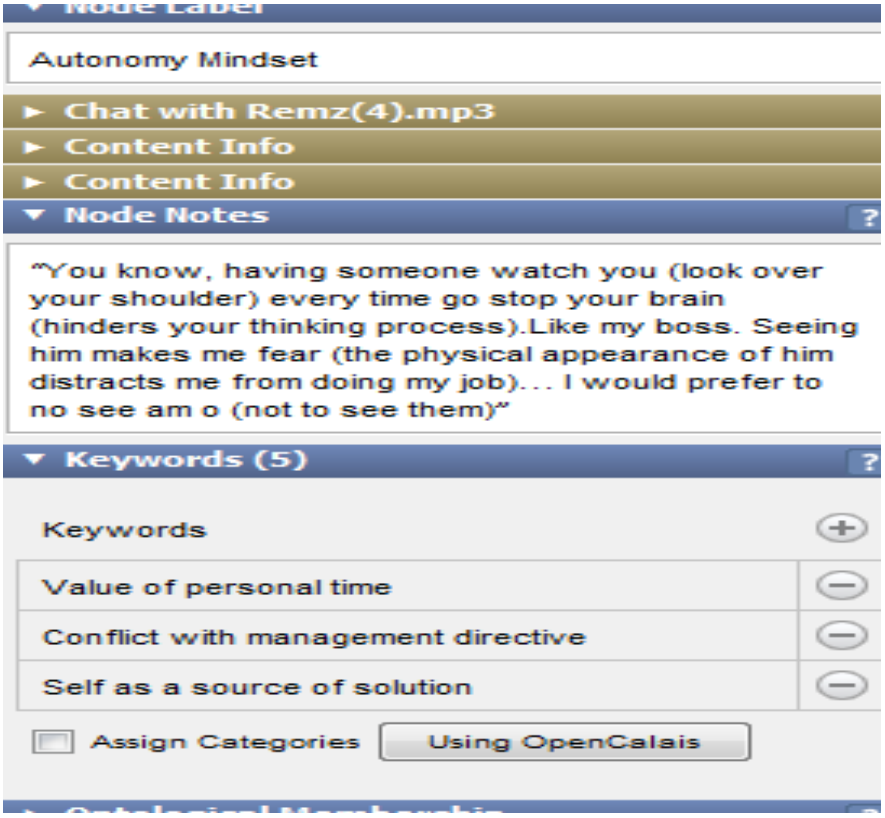
During the earlier part of this research project, a conceptual framework was developed (see chapter 2). The initial coding template consisted of 5 themes that were based on the theoretical position of the research. Table 4.3 below describes these themes. Hence, predetermined themes and topics formed the basis of the template analysis.

A priori theme	Description/Subcategories
Aspects of Virtuality in Teams	This is about the inputs and team design elements. From literature, some subcategories include: member virtuality, distance virtuality, team time work
Team functions	This depicts who they are as a team and includes: personal values, group norms, and evidence of discontinuities.
Media Capabilities	Transmission capabilities, Processing capabilities
Outcome, impact	Include: individual expectation, team expectation, organisational/project goal.
Communication process	This refers to information-sharing behaviours, which according to Dennis et al (2008) can be either convergence on meaning or information transmission. Two initial codes were convergence on meaning, information transmission. These two codes were extended to include conveyance acknowledgement, expertise etc.

Table 4-3: Main categories of a-priori themes & preliminary coding (Based on the media synchronicity theory and literature)

Through a recursive process, codes were assigned to the text. The codes represent some of the areas of concern put forward in interviews (or other data sources). The data was decomposed into about one hundred and fifty-two (152) codes. Of course, the same data extracts were sometimes coded for more than one theme. As noted in King (2012), there is no fixed rule on the levels of coding a researcher may have in their analysis. Lower order codes are developed from a more iterative process. This involves going through the data, and identifying themes. It is worth noting that only themes relevant to the research objectives were eventually used in the narrative.

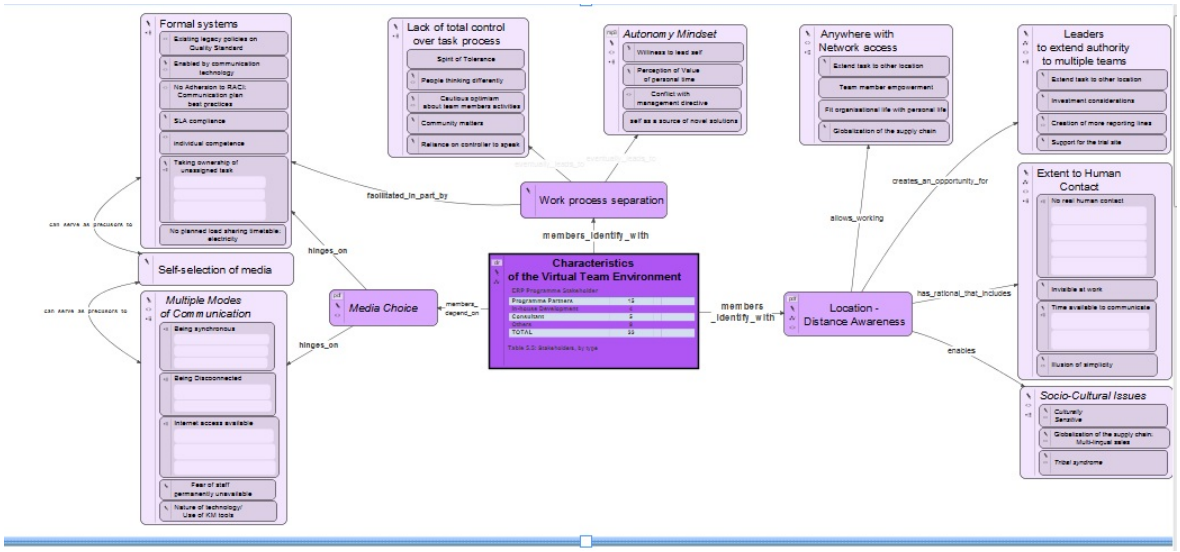
Figure 4-5: Illustration of tagging of text



(N/B: alternative codes/other codes under consideration were saved as keywords)

The initial template evolved in support of new and interesting aspects of the data set. The figure below illustrates one of the early refinements of the template. A map of key concepts (ideas expressed in data) was developed to help the researcher visualize and make sense of the interview data output. This also helped the researcher detect patterns related to a virtual team adding value. Multiple versions of the template analysis were produced over the research period.

Figure 4-6: Developed thematic map showing hierarchically-organised codes based on theme.



VUE was used to visualize and integrate the codes, allowing pathways and coding hierarchy to be easily modified. Another advantage of using VUE was that it allowed the researcher attach comments directly the codes. Some codes were also linked to resources like text or documentary materials.

By applying techniques of template analysis and mapping out the ideas, the researcher was able to get a complete picture of the socio-technical structure of the case being studied.

4.7.5.3 Defining & Refining Themes

In the course of analysing the data, some codes were merged or re-captured under a new theme. For example: 'formation' 'team architecture' and 'virtual as a strategy' were merged to form a new higher order theme called 'relational links'. This was later revised to 'project organisation situation'[17]. This reflected all the intended consequences of team virtuality to the product design effort, and organisation in general.

At the same time, the lower level codes: 'corporate rationale', 'looking forward', and 'positive' were all re-organised. After a number of iteration, and a systematic review of the text, these codes were revised and merged to a theme. The theme 'virtual team areas & perspective' (previously called aspects of virtuality) captured the practices, perspectives on virtuality and team design elements such as a flexible work pattern.

[17] The category name had been refined multiple times over the course of the project.

Another template change was in generalizing the comments associated with 'connection', 'hardware' and 'legacy policies in communication' to produce a category 'Infrastructure'. Because the initial conceptual framework did not explicitly portray the role quasi-external agent's played in communication performance outcomes, there was a need to create a new main theme.

The insertion or merging of themes was necessary because, as the coding template was further developed, it became increasingly obvious that some earlier themes were either too broad or did not capture all aspects of the data that could have been relevant to answering the research questions.

4.8 Conclusion

The chapter sets the scene for the empirical investigation and presented the researchers underlying philosophical beliefs, research strategies, data collection techniques and analysis procedures. In what follows, the case-study setting is described. This leads to communication of findings

Chapter 5 : Analysis & Presentation of Findings

5.1 Introduction

In Chapter 4, the researcher examined various aspects of the research design, highlighting the philosophical doctrine, sample characteristics and the technique used for distilling the evidence. This chapter aims to build on those discussions, focusing on the analysis process and present the research findings.

5.2 Organisational Setting

5.2.1 Case Study Characterisation

This study investigates how the adoption of a virtual team strategy creates value throughout the duration of a development project. It looks at the context in which such teams are conceived, and then examines the technical and social systems that are effective in facilitating communication performance. The process took guidance from the conceptual framework discussed in chapter two, with communication media behaviour being identified as a key subject of investigation in this thesis. The research domain is the Nigerian operations of a development programme. Data collection is centred on ERP activities.

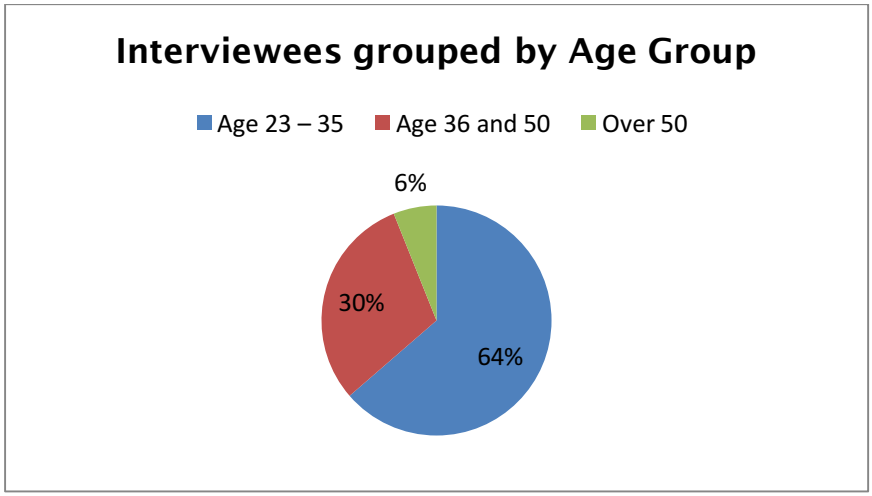
The research data was collected primarily from an Enterprise Resource Planning (ERP) Programme within a large West-African manufacturing corporation. The ERP Programme portfolio was diverse in organisational terms. That is, teams and individuals were from various functional areas. Together, these professionals were responsible for the development, successful implementation and post-live maintenance of ERP system components. The researcher also included external views from consultants, strategic partners, vendors, key system users and others with a virtual team experience. The opinion of different type of respondents was important for the study; to triangulate data. From these participants, the researcher could look back at development project activities and forward to the possible effect of the latest virtual team working practices of an organisation.

In total 33 semi-structured interviews were collected. Most interviews were audio recorded, but whenever participants were not comfortable being recorded, hand notes were taken. Interviewing sessions took between 45miniutes - 1.5 hours. The audios were processed using Audacity.

In this study, interviews were focused at the middle-operating echelons of an organisation structure. The interest, to the research, was to learn and share the insights from those whose roles were entrusted with translating project inputs into outcomes as well as converting work

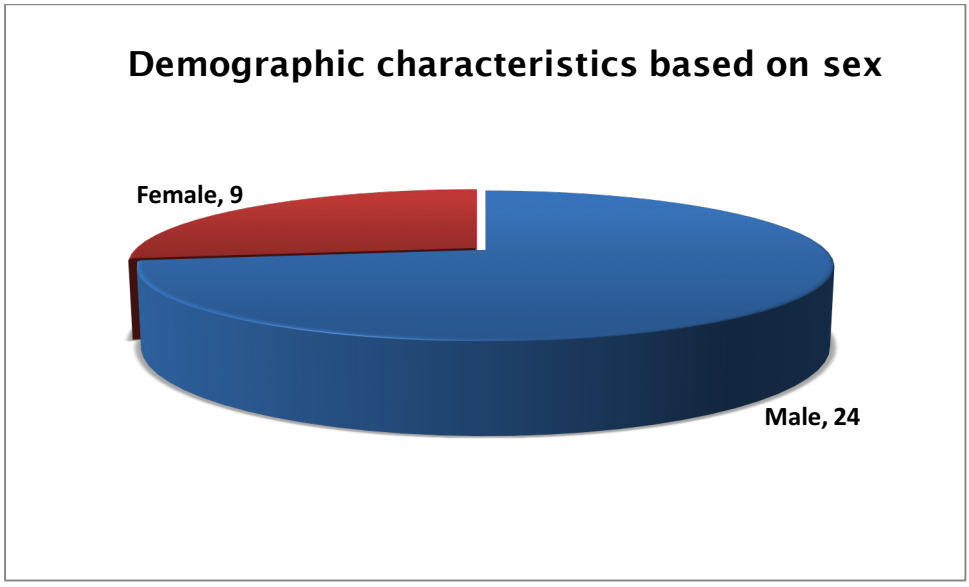
strategy into action. In addition, the respondents were trusted with achieving the difficult balance between promoting 'team virtuality', and managing their performance. Knowledge communication is also a crucial component of this process.

Figure 5-1: Stakeholders, grouped by age



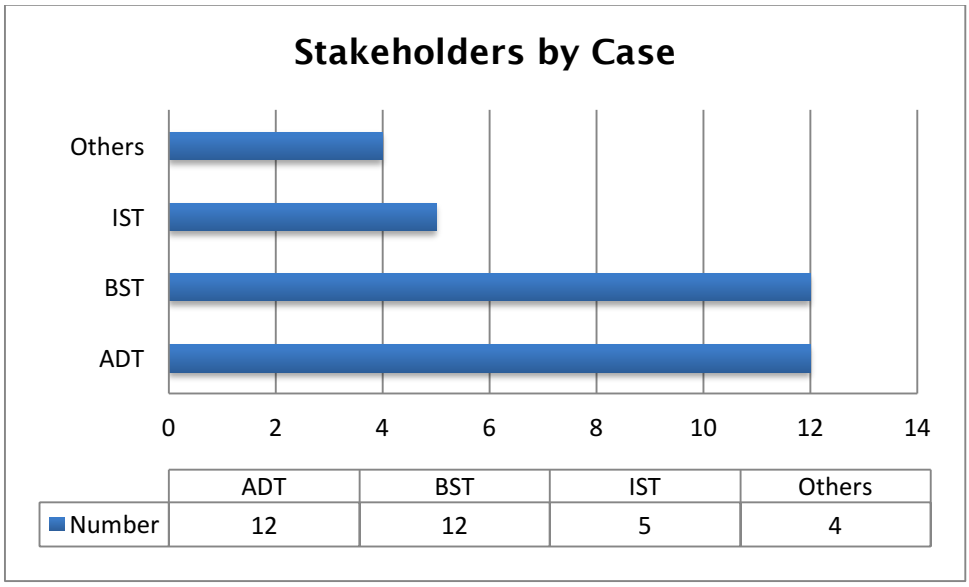
Further details of the study are given in figures and tables below:

Figure 5-2: Stakeholders, grouped by sex



It is to be noted that covering all the projects within the ERP programme was deemed to be practically unattainable. The work systems that play a dominant role in developing and supporting the technology system include: Application Development (ADT), Business Services (BST) and Infrastructure operations (IST). They elucidate aspects of virtuality and process interdependencies as part of an espoused work arrangement. Each work system is treated as an individual case study in keeping with the multiple case study strategy (Yin 2003).

Figure 5-3: Overview of case selection and empirical data.



Although system deployment is in Nigeria, some managed services are hosted in Johannesburg – South Africa. Information transmission occurs across places but Service Level Agreements (SLA) from the centres ensures that the ERP system is available whenever required.

	Time Zone	
NIGERIA	UTC+1 (the same time all year round, no daylight saving time); WET	Nigerian operations, deployment location, business partners, consultants
SWITZERLAND, FRANCE	UTC+2h (CEST); UTC+1h (CET)	Semi affiliate companies. Participation based on availability and secondment of resources.
SOUTH AFRICA	UTC+2h (maintain the same time all year round, no daylight saving time SAST)	Connectivity data centres, server, managed-services partners
UTC – Difference from London time (GMT); CEST – Central European Summer Time *SAST – South Africa Standard Time; WET – West African Time*		

Table 5-1: Work-time difference across three time-zones

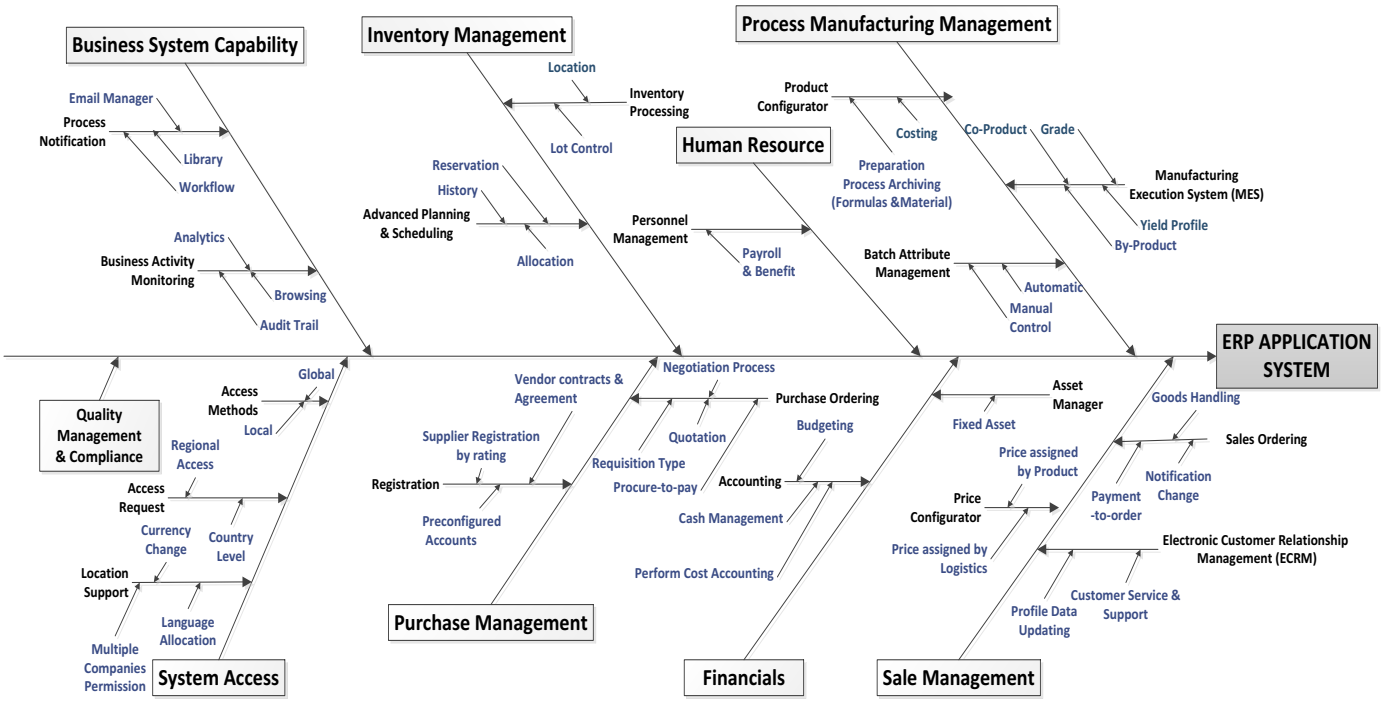
The table shows that work-time can vary slightly by geographical area and time of the year. Due to daylight savings time during the summer months in Europe, Nigeria has a one-hour time difference with Switzerland and France. There is a one hour time difference with South Africa, however, Nigeria maintains the same time all year round.

5.2.2 Conception about Manufacturing ERP

Although not central to the analysis, the researcher would be providing a brief overview of ERP and why an organisation may implement them. Just as the name implies, Enterprise Resource Planning (ERP) is an organisation-oriented infrastructure, which coordinates data flowing through multiple business processes. It is crucial in the optimization of existing processes by bringing together a number of business functions in real-time. The ERP product in itself, encapsulates business best practices with regard to Financials, Operations, Process manufacturing, Logistics, Sales, and Human capital management. Organisational data can be exchanged as a standardized and normalized format, which eliminates unnecessary redundancy (Hossain et al, 2002). This, in principle, ensures a more effective coordination across functional boundaries of the organisation. The system also automates core business activities (O'leary, 2000).

According to the literature, Enterprise systems provide various levels of control to an organisation. It also supports processes and services by providing multiple functionalities on a single platform. This platform typically consists of different modules. The chart below illustrates some key functionalities & standard modules.

Figure 5-4: ERP Application Components



(*Source: This diagram was produced after reviewing both project documentation and TECs standards for ERP systems. These documents outlined guidelines and requirement listing for ERP applications).*

Documentary analysis also suggests that organisations gain the following:

- Enhancement of corporate performance management by providing data mining capabilities. This, in turn, allows users to transform complex business data into actionable insight.
- Providing greater insights into the workforce by facilitating tracking and tracing of processes and work objects.
- A user-friendly interface that provides easy identification of supplier/distributor connection issues, inventory/order control & management.

5.3 The Cases

The analysis and discussion below are as a result of the different phases/methods of data collection. As deliberated above, the data analysis procedure was informed by the qualitative coding techniques of template analysis (King 2012; Waring & Wainwright 2008). In this research, templates encouraged consistency across the data set. It was also useful in determining the relationship between ideas within the data.

The researcher distils the characteristics of a virtual team from the point of view of practitioners. Three work systems involved in the ERP development setting (i.e. Applications Development, Business Services and Infrastructure Support) are examined. The segregation is informed by the research objectives (below). Hence, contextual insights from the different participants and practice domain, was crucial. In other words, the three cases selected provide useful exhibition of the phenomenon of interest.

The analyses the themes inform would provide answers to the research project's central questions, which are:

- Does a virtual team strategy add value throughout the duration of a development project?
- Are there any risks to such a strategy and what could hamper its realization?

Subsequently, the researcher shed light on what drives communication behaviours, and why a set of events occur in some situations and not others.

ADT, BST and IST consist of various levels of stakeholders ranging from core members to peripheral members. Although the sampling approach was purposeful, the research also benefited from snowballing techniques. This resulted in the recruitment of participants described in sections 5.4.1, 5.5.1 and 5.6.1. Due to the nature of an ERP programme respondents referred the researcher to people outside their organisations. This was helpful in gaining access to a larger number of participants, and a mixture of team member experience.

The first project identified that emphasised the dispersed nature of the network of practitioners was the 'ERP Selection Project'. This was completed before the start of this study. It involved examining the current state of the organisation's information systems, feasibility on licensing, maintainability, recurrent consultancy fees, and then choosing ERP partners for the implementation phases.

Note: case characteristics and participant's communication processes are sometimes established by commenting on the project related tasks (e.g. applications testing, training scenario).

In addition to earlier discussions on case design (in chapter 4 and above), the use of three cases in this research is also influenced by practical conditions. An ERP programme is characterised by three work systems. ADT has a presence in both the 'selection' and 'implementation projects'. IST on the other hand plays a stronger role in 'post-live & support projects'. Although before BST can signoff a system design document, it is typically reviewed by support. It may be worth noting that ADT and IST are similar in terms of their knowledge-base and technologies. In sum, the use of more than two cases increases the robustness of the study.

5.4 Case One: The Application Development Work System (ADT)

5.4.1 Case Description

This case account pertains to the Application Development work system (ADT) whose ERP activities cross organisational boundaries, for instance, in partnering. A breakdown of respondent is listed below. These respondents were entrusted with translating their project inputs into outcomes as well as promoting team virtuality.

ID Number	Job Type/Position	Profile
ADT_ID1	Development	Makes big contributions to software projects, and has experience in a major delivery. Has worked with people dispersed in 3 locations.
ADT_ID2	Development	Has 3-4 years work experience and uses collaboration and communication technology every day to talk with colleagues. Engages in frequent communication with solution delivery teams.
ADT_ID3	Software QA	Committed to quality control and promotes compliance to the software delivery life-cycle. Project activity warrants frequent communication and traveling across locations.
ADT_ID4	Integration	A practitioner with experience in multiple project roles having worked both in Africa and Europe. Has used different technology solutions and claims to have a lot of exposure to project wherein unified communication technologies such as WebEx for presentation, Skype, Polycom have been used.
ADT_ID5	Testing	Works as a member of a virtual team and actively uses communication systems to maintain contact with project members in a distant location, mostly during user acceptance testing (UAT).
ADT_ID6	Business Partner	Has less than two years' experience delivering and configuring applications for multiple client team. ICT use is up to 70%
ADT_ID7	Implementation Partner	Works concurrently on multiple projects and is very enthusiastic about technology. Wishes to see changes in communication systems that support virtual work. Some innovations desired include, having "an interpreter built into the communication system". This desire is driven by exposure to multiple projects as well as regular communication with international practitioners. Some do not speak the same language.

ADT_ID8	Solutions Architect	Has worked as part of a project team for 3 years and has been using virtual communication.
ADT_ID9	Practice Administrator	Helps setup VC environments. Day-to-day role also involve raising request for resources and maintaining virtual interactions with project managers and PMO analyst.
ADT_ID10	Business Architect	Has a good understanding of virtual teamwork and spends approximately 80% of work time communication with people that are not part of the immediate team.
ADT_ID11	Consultant	Recalls starting work as a developer, 15 years ago. Works from home, engages in various walkthrough via conferencing technologies. Also provides technical oversight to development project activities.
ADT_ID12	Contingency Worker	Has been a technical resource hired from outside the deploying organisation and has been involved in corporate consultancy.
OTHER		
OTH_03	Trainer	No ERP knowledge or experience but trains principal users and end users on how to manage both new processes and systems. The mechanisms adopted include Webinars, group sessions, one-to-one and face-to-face.

Table 5-2: Participant profiles

5.4.2 Case Findings

For ADT, the real value proposition of the virtual practice lies in work separation effects and the ability of team members to shift between communication media. With regards to the latter, it was found that no interviewee engaged with communication technology (e.g. video conference) purely out of interest or to satisfy an abstract thirst for interaction (i.e. friendship) with distant colleagues. Most were motivated by the desire to enhance their personal work output. As a result of this, ADT employed a number of communication mechanisms that make their work visible to others. However, the choice of which media to use – at any point in time – was not always in the hands of the team members. All these are discussed below.

5.4.2.1 Project Organisation

The case organisation does not design and implement its own ERP product per se. Despite the fact that in-house specialists were fully capable of writing enterprise software, they adopted several clusters of functionality already developed by one of the world's leading ERP vendors – working with J.D Edward partners and Oracle DBA. Some industry observers, from the Technology Evaluation Center, believe that the manufacturing sector (for ERP solutions) is mature. On this note, there is probably no justification for re-inventing the wheel. Strategic partnerships provide an opportunity for a rapid implementation. In-house proprietary technologies are integrated as add-on sub-interfaces. Wherever possible, they need to automatically transfer data to or from the main enterprise system (Technology Evaluation Center Advisor).

Some projects within ADT's portfolio were software integration and extension of business applications: the integration of Plant Maintenance Systems, the payroll system interface, weight bridge truck scale and manufacturing execution.

Furthermore, the manufacturing sector in Nigeria is constantly emerging so the ERP system needs to be flexible to accommodate uncertainty. Web service standards such as WSDL, SOAP protocol and XML facilitate coupling of solutions that exist independently of each other.

In this ERP programme context, a steering committee exists. It is more or less an executive body that regulates all project activities. They are also responsible for disbursing budgeted funds in line with the board's mandate. The success of the programme would be reflected by the extent to which the investment in ERP systems and process improvement activities can knit different parts of the organisation into a more coherent whole.

Furthermore, the ERP implementation methodology is based on the system development life cycle (SDLC).

5.4.2.2 Virtual Team Areas and Perceptions

The first general observation was that the communication process of a virtual team is not easily described, most especially from the *actor's* point of view. Respondents illustrated the scope of focus by saying:

> *"You're [virtual if you are] speaking to someone in a city in any other part of the country,[you're] providing them an access to information about your project, over a browser." (ADT_ID1)*

Within the same realm, another respondent deliberated on how the environment can shape communication needs and practices (of course, technology also allows the environment to evolve. This is one of the precepts of adaptation theories). Emphasising their business context, an ERP channel partner noted:

> *"We are a large group of businesses so there is a lot of an opportunity to work with people [in various locations]. My first project was on auditing. In my current project, [I'm] involved in redesigns. I work with 2 [people] in the same building; 1 at opposite ends. Besides that, I have had the opportunity to give virtual presentations to client project teams (miles away)" (ADT_ID10).*

One could observe from interview data that the most obvious perspective of virtual teamwork was based on the number of sites involved in communication and the completion of their projects. For example, in explaining the means required to successfully deliver a finished ERP solution, some answers included features of geography. This emerged through a statement like "*…members are based (onsite) in different testing locations".* Here, the virtual task situation (underpinning communication) was that quality assurance test scripts for an ERP application are executed in two manufacturing facilities, head office and technical centres. During the technical development phase of the ERP programme, there were dedicated testing staffs at these locations. The ERP application had to be tested first, and then presented to users (client project team members) for trial. Owing to the fact that response [feedback] plays a role in the testing process, it was important for the practitioners to collaborate on this task using digital communication systems. It was perhaps pertinent that they familiarized themselves with the medium specified in the project plan.

Furthermore, another ERP stakeholder typified communication needs and the virtual team concept as he describes how colleagues from other regions help to ensure a successful product launch:

> *"[Because] the IT people in Nigeria are very competent, they have their own project, which they would [sic] look after. So within my own product line they might be certain requirements that are only based in our location. So when issues relating to this region come up, we can look after them and resolve them promptly. Then there are also times when there is a product we are trying to launch and it's going to be launched globally. We could also have developers and engineering teams from across the globe, helping to get this done."*

The second part of this viewpoint (see below) emphasized the break-down of complex tasks into smaller components that can be executed at various points in time (and in different places).

> *[So a particular site] is working off certain things. We only need to have periodic meetings. If it takes us being on the phone call at whatever time of the night, just so that everybody is on [sic] the meeting, we would do that. We reach decisions. We would share responsibilities – 'you get that done, you get that done' – and all of that. Everything is all fed back into the system so that everybody can access it and then we move forward from there." (ADT_ID1).*

As expected, it was impractical to have the customized ERP system designed, documented, implemented or extended by a single entity. So virtual teamwork, as described by research respondent was about individuals and sub-groups expanding their scope of collaboration as well as splitting complex activities, to other locations.

To scrutinise the level of connection amongst project team members, questions were asked on where "individual authority to decide and act begins and ends". Participants emphasised that because of the distributed nature of ERP projects, most members do not interact extensively with other members. This point was coded in the template as *'autonomy'* and *'coordinate ERP development activities'.*

Also, the rapid temporal nature of ERP projects meant that participants learn to communicate efficiently, not bothering with redundant or surplus information. A respondent explains:

> *"You never get to give every detail because at this level everyone would probably have an idea of what the meeting is all about (from reports - maybe). So it's just a case of you confirming that – yes - you know what you need to do and can get it done within*

a particular period of time. If there are any technical challenges you envisage, you need to raise it - this might be your only opportunity because most-times you have to work in isolation. So what you'll need to find out [at the point of the meeting] who your contacts would be. Like you know, get email details so you can basically communicate with each other to keep them informed of your progress outside the conference call. But what you typically confirm [during meetings] is that - yes you can get this done, the problems and who you may need to work with. This is really useful or else things can quickly go out of control…the time allocated for the meeting can be so short".

Thus, the set of comments making reference to actors being able to 'lead themselves, and still solve group problems' conveyed the interviewees' assertion that virtual teamwork creates value by reducing the burden of frequent interactions. This allows operational-level actors to concentrate on their core task. Autonomy was advantageous in ADT, most especially to specialists in its integration project. It gave them the confidence that there could meet project deadlines.

A number of studies point to the importance of autonomy and fragmenting design responsibilities. Daim et al (2011) citing Zhang et al (2008) identify delegation of responsibilities as a vital management approach for teams as it ensures ownership of tasks at all level, which can lead to increased performance. The author, however, highlighted some effects of improper delegation in distributed projects: increased communication overheads and risk of misinterpreting signals and cues arising from cultural and language differences. ADT provides similar observation:

"There are obviously challenges by the virtue of not being based in the same place. By the way everyone speaks English on the telephone conversation, but there is still some level of language barriers, by that I mean very accented voices.

from a cultural perspective, sometimes the way [some people] deal for example. You need to push them a little further to give you a yes or no answer. Cos they might most times be more ambiguous. Maybe not deliberately, but sometimes it feels like the response you get is quite ambiguous and may kind-of have to keep pushing and pushing and pushing; which can be a one-way cue."

An implementation specialist reflects the same point as he complains about the limitations of communication systems in general:

"it would be nice to have a translator that could interpret our communication across borders. This would be helpful when you want to have a discussion with people who

don't speak your language at all. I have experience when we had to get an interpreter across the two sides. I wish they could be technology that can do the interpretation for us without having to hire an interpreter" ADT_ID7.

Converging with the literature on software teams with respect to communication, empirical research provides insights to the effect of distribution on collaboration. See for example, Herbsleb et al (2005) who found that the distance between team members has a negative impact on project communication and timeline (task completion time). This is because of the lengthened response time associated with inquiries. Nonetheless, the idea that spatial distance has no tangible effect on communication and task completion time has also received some support in case studies(Herbsleb et al 2005; Herbsleb & Mockus 2003). Wolf et al (2008) undertook a quantitative study of software development projects involving North American and European sites - observing that distance does not always have a significant effect on project communication processes. In their study, both collocated and multiple-site communication sometimes resulted in similar development pace. Due to the mixed positions on distance, Bjarnason et al (2014) interviewed 15 people from 5 companies with the hope of identifying the factors influencing coordination in software development projects. Their resultant theory suggested that more effort is required to communicate effectively when software entities are not situated together.

5.4.2.3 Boundary-Spanning Communication

The boundaries of a virtual team strategy can be difficult to capture and describe. Maznevski & Chudoba (2000) defined a virtual team as: "internationally distributed groups, which substantially use technology-supported communication, possess location diversity, multi-national, and global in their task". ADT satisfies Maznevski & Chudoba's definition in that it comprised of sub-groups, with globally coordinated tasks. However, a statement from Hightower & Sayeed (1996) (as cited by Warkentin et al 1997) best illustrates how they function. ADT is characterized by stakeholders who have been given "the opportunity and motivation to contribute [relevant] information" (Warkentin et al 1997, p. 980).

- *Expertise:* The most vivid manifestation of communication patterns in ADT are the three groups in the area of *Network & infrastructure*, *JDE business partner team and CNC & Oracle DBA.* Each group constitutes a number of specialized stakeholders, headed by an industry certified expert. The aspiration of each group is to *"partake in the various phases and tasks as specified in the project plan and according to their own skills and competencies"* (Document: Charter). Each specialist brings knowledge to the group. For example, role differentiation between analyst and

quality assurance was reported for the system integration projects. A range of comments had been provided that illuminates their characteristics:

> *"[work is structured such that] you have dedicated teams for specific roles. So you've got the software engineers and within these people you have the analysts, designers, the testers and coders. You've also got the field guys who go to run and install tools. For every function you've got dedicated people. That's what they do day-in day-out[…] so it's almost going to be impossible to change roles (functions), - it's not impossible because by the time you go into managerial positions and all these things, you are covering different product lines, you are also looking at finances and what's coming in and what's going out – and all of that.(ADT_ID6)"*

The specialists were providing and maintaining a system whose very essence was evolving through the life of the programme; therefore, they were dedicated to learning.

In fact, the ERP system changed as user requirements changed.

> *"So from my perspective, the way our roles tend to work is by dedicating key members of a work stream to a project. But then you can easily float around because at the end of the day, it's just a case of requirements. What you'll find is 'how you solve a problem somewhere can easily be adapted to how you solve a problem in another area'. The only difference is just the requirements."*

> *"Our projects are open for extension but close to modification. So when you write something you write it with the mind-set that if requirements should grow and we need to extend it, it's easy to extend it without actually regressing the code too much. Without making changes that would affect what is already in production*".

The structure of ADT also encouraged information exchanges between its sub-groups.

From documentary analysis, it was apparent that most software related projects (e.g. building of manufacturing extension) were a product of partnership agreements, involving in-house specialist, and external experts such as ERP partners. Some members were responsible for validating change request, overseeing implementation methodology, defining/ executing requirements, in-house project management, and providing on-site support during switchover. The ERP channel partners were seen as integration experts, trained by Oracle specialists, with the goal of ensuring that the ERP system goes live without any major incident. Just to re-emphasize, project team members and other stakeholders were exchanging information regardless of their functional groupings.

And dissemination of knowledge and skills is the primary reason for which ADT members communicate. Weick & Meader (1993) suggests that this decreases individual and team ignorance.

Interviewees also recognised that in the various ERP project contexts, the creation of shared understanding was a swift process as they were able to utilize knowledge and skills associated with their professional domain.

- *Shared Methods, Mental Models & Understanding:* Most participants reported that they have better levels of interactions with people who share their professional language. This represents a form of shared mental models.

> *"when we are executing large projects my key allegiance is to my functional area because the way developers' reason is different from business development. The way the QA guys reason is different from how we reason as well. Overall, we are all walking to the same goal (ADT_ID2)."*

For some media theorist (e.g. Carlson & Zmud 1999; Dennis et al 2008; Kock 2004), shared patterns of coordinated behaviours enable team members predict and explain messages such as system data and development information. It also allows people to generate expectations on what is to happen next within their project environment. Perhaps, this is possible because as the interview data suggest: "*experiences are the same".* This comment also reveals shared mental models. Other remarks linked to this point: *"We all go to the same schools, take the same certifications…"* It is also not unreasonable to suggest that people learn and develop from others' experience, extracting meaning from the information conveyed within the team.

Several researchers (Klimoski & Mohammed 1994) argue that multiple mental models could exist within a team. Some examples within this study context are mental models associated with the software task, conceptions about ERP (e.g. system rules, enterprise architecture), information about services rendered, project management and SDLC methodology. Together, these organised knowledge structures; they facilitate interaction, communication and consequently varying levels of synchronicity (Dennis et al 2008).

There are, however, a few more things to know about the communication and collaboration patterns within ADT. Practitioners from different groupings have diverging world views. Whereas Oracle DBA were interested in the performance of machines/ software stack - providing technical knowledge on JDE architecture, query optimizing, setup and development, JDE business partners (the analysts) emphasised the business elements and believed in documentation, training and system compliance with business rules. By bringing these world views together – technology

savvy and business acumen, ADT is able to design or extend ERP components. In addition, practitioners communicated and shared holistic and functionally autonomous analysis (of data and information) throughout the duration of every project. Apparently, the senders and recipients of messages had a shared objective.

Some comments in the data reflected professional differences between these groups. *The comment below portrays the difference in world view between the technology savvy and business people.*

> *"When it comes to our itinerary; the business [guys], bless them, and technical guys are like different. The business guys or should I say not technical people come up with [the] plan in their head, while the technical guys are more realistic. They come up with the requirements in their head as if it's done already so they don't integrate well with the developers. So it's very useful to have someone who is technically inclined [to be] resourcing as opposed to someone who isn't.*

Furthermore, ADT's operation is not an end to itself. To the extent that user requirements change, the programme evolves; information relevant to the ERP system flows between different professionals. So, ADT members maintain strong links with other work systems. The role of other virtual groups is discussed in a later section.

Especially noteworthy, most respondents commented that on a daily basis, they are overloaded by information from team members, strategic partners and support teams. Responding to every single message was nearly impossible and therefore they choose what to respond to. The implication of this, particularly in the ADT context of performance is that the information individuals select - define the work environment. Weick & Meader (1993) articulated that this process involves individuals making observations about their work and gathering information that would be acted upon.

- *Community:* Most interviewees elaborated on the importance of the wider development community in ensuring completion of projects. Specifically, communication with individuals - who use complementary technologies – enables them to enjoy access to innovations and frameworks.

As discussed in section 5.4.2.1 above, ADT were implementing and extending a system that was based on web technology, under conditions of constant change. New standards, security requirements and protocols were released regularly, requiring members to share ideas, experiences and stay creative. It was also vital that they (e.g. in-house specialist, business partners) were aware of what was in the Oracle product pipeline. Web-based changes sometimes

created technical issues (for business applications already in production). In response to these opportunities and challenges - team members tended to keep a close eye on techniques and codes written by others as well as new open frameworks supported by Oracle. Just to reiterate, the system development culture fundamentally upholds the importance of community – through online forums. Their task requires information transmission and information processing and thus, synchronicity.

For a consultant interviewee, he believes that a lot has changed in IT and how you succeed in rapidly changing environments is totally up to the close working relationship between stakeholders internal to an organisation and those of the larger community. Recanting a matching order, the respondent states:

> *"you have the freedom to exploit your contacts in other organisation [and] see the best approach to a problem…*" (ADT_ID12)

Others described:

> *"… coding is no longer a solo matter." (ADT_ID2)*

> *"Because I can work in different teams, at the end of the day, you go off to look at other frameworks to get an architecture. Some sort of design to start with. Then you just think 'how do we go about and develop it? (ADT_ID8)*

Apparently, ADT's work practice involved continually reusing and reviewing intellectual assets of others and assembling them into forms useful to their own customized ERP solution.

Within the same realm, an interviewee gave a statement summarizing the broader usefulness of a community:

> *"The key things that you need to know are, you need to have a knowledge of [the shared] technologies to be able to – because we use a lot of frameworks –, which means we can obviously embed [other individual and teams written codes] in our systems and expand on them. So we use a lot of open source frameworks. So obviously if you're using java for development; you need to store your data somewhere in a database. Alright, you can go over and write a really good database from scratch, but there are a lot of open frameworks which[…] can do the job for you... Organisations see that - ahhhh – 'this is a useful technology'… to provide community support. The reason I mentioned it is, for example, with databases, they all correlate – basically a layer between our Java and the database, how the application communicates with the database, a framework has already done it. So*

you just need to understand how the framework (including codes) works. And that way, focus on the real job as opposed to the nuts and bolts. Of course, you still need to know how data would be persistent in the database but then because you've got this framework from the community – like a layer in-between – it just makes your job a lot easier. You can then focus on the logic as opposed to try to re-invent the wheel…From the point of view of your role as a member of a virtual team anyway…the community helps a great deal."

Another trend permeating to boundary-spanning communication was to shorten the development cycle for the add-on modules. There is a continuous flow of innovative ideas, which help people tackle their project challenges or improve their output. Other related comments were:

"The good thing about IT, especially the kind of developments I do is 'there are loads of resources out there' ... All problems have been encountered by at least one person. So they are different solutions and different ways [of solving a problem] and all the answers are graded. People come and are like 'tick tick tick tick'"

And more to the point, Keith et al (2010) noted that the understanding of "advice networks" is a useful approach in recognizing the characteristics of the group structure.

Taken together, the ERP programme context, and practices, required ADT members to seek and assemble information from multiple sources. This behaviour can however be explained in part by the media richness theory (Daft & Lengel 1986). The theory posits that organisational units have informational requirements and for these requirements to be met, people strive to reduce uncertainty and equivocality in its task. The result is often cross boundary communication with people who are vested in their practice, for example. The theory of media synchronicity takes this argument a step forward by stating – explicitly - that communication would be based on two processes: transmitting information and building shared understanding. See chapter 2 for a background of the theories.

5.4.2.4 Media Capabilities & Communication Systems

Communication within ADT was not only determined by informational requirements, but also media conditions. On the one hand, stakeholders accessed and assembled information from multiple sources (see above). ADT members, on the other hand, made their work visible, using different diagrams and technologies as tools to capture and demonstrate requirements.

For starters, it was not uncommon for ADT members to execute their task in parallel, necessitating them to make others aware of what was being done:

> *"When, more than one person is working on a particular requirement, a team member has to take ownership of a part of that requirement. At the design phase, if two people are working on a requirement, they define a line where one person stops and another person starts. Nonetheless, some requirements can be in parallel, but some are in sequence which means a particular person cannot start until another person finishes because of the level of dependence. When working in parallel, one person may have to wait for the other party to catch-up whenever they reach a point when they cannot proceed alone."*

Moreover, multiple platforms were used to manage task interdependence and concurrent contributions in projects. These platforms allowed team members to visualize process information, product backlogs and end products. For example, due to the synchronous character of VoIP, participants used it to keep others informed on work progress. Below is an illustration describing a professional's experience demonstrating features of an ERP sub-interface (i.e. functionality of a product):

> *"I connect to whoever I am demonstrating the product to, and establish communication. But when it comes to demonstrating the product – there are different ways you can demonstrate a product – there are virtual [and visual] as well,... all you're really doing is providing them with a secured remote access to your virtual system so they can actually see what you're seeing. So you project (display) your version of the exact same object on a screen. So they are seeing the exact same thing you're seeing, but over a browser and a secure system. You are communicating, usually over the VoIP system, while at the same time demonstrating your product over a browser window. Now every click you make on the browser is seen by others [...] (Interviewee giving some description about a particular product interface and functional requirements) [...] and you basically just drive the demonstration (ADT_ID11)."*

VoIP allows voice and data to be transported over digital channels such as the internet; therefore, it was very useful in making work progress visible. Seemingly, the creation of shared understanding progressed more efficiently due to the use of a VOIP virtual system (that supported visuals and writing). These capabilities enhance the demonstration of project components.

Furthermore, designers, analysts and tech support were all able to post incidences and technical requirements to a common repository for easy retrieval. Due to the cloud-based storage nature of content management platforms, teams could not only trace their processes and progress, but they could navigate through entries, eliminating the need for some face-to-face meetings:

> *"JIRA is more effective [tool used for technical requirement] than regular email systems because it makes it very easy for people to retrieve historical information. You don't have to know the incidence [number] to go look for [people or] information shared about it. With it you can see updates, notifications, and keep track of what is going-on on a particular product item [or subject]…If they have been issues where we've got discrepancies, you want to be able to trace these discrepancies to the very sources, you go out of your way to solve the problem even"*

Unsurprisingly, participants had an obvious preference for sharing information through content management platforms as opposed to emailing for instance. One reason was the ability to leverage on its tracking and storage capability. Of course, they could also seamlessly take ownership of unassigned task.

Another interviewee opined further:

> "*So what we have is a system in place, which is like a content management system that maintains our requirements and notes, where different parts of the development team have access to the information. We tend to work with numbers, like a reference number for each individual request. That is something like a change request number. What that means is, it's easy for you to then track request. What you'll find is, we send emails, [but] 'imagine they are two guys on a project, one is in Lagos, one is in Abuja, they start communicating, and all of the sudden the project [phase] gets completed, two months down the line a new person is assigned to a project because there are new requirements and they need to obviously know what's been going on before. It may be very difficult to sieve through the emails or find those that worked before to give you documentation.*[18]"

The figures in Appendix B are examples of work items that were uploaded to a common repository; for retrieval by others. Different versions of the work item were added/pooled together throughout the life cycle of the project. No wonder participants emphasised that uploading

[18] This particular characteristic of their communication media can be viewed in the light which Dennis & Garfield, (2003) categorized as meeting memory.

information or data is not an end in its self, but is followed by several discussions and comments by team members.

> *"You see, if someone sends out a document, everyone tries to put a comment in the document – sometimes it's relevant – sometimes it's not. But everybody tries to put a comment in the document and nobody's comment is thrown away. You send contributions as bullet points like - so you said this!, why do you think we should add this! or we don't think we should add this! or we feel this should be better!…." [ADT_ID8]*

The comment above echoes the fact that the structural capabilities of the media affect the way ADT functions. For media theorists (Dennis & Valacich, 1999; Dennis & Garfield, 2003; DeLuca & Valacich, 2006; Dennis et al 2008) some tools facilitate reprocessability and rehearsability (see discussions in chapter 2); they reduce the need for team members to discuss and clarify issues, in-person. Herein, they are more virtual.

In fact, our findings confirm the value of Media synchronicity theory in explaining communication and collaboration in a distributed work environment. The evidence from ADT is consistent with the findings of some authors investigating software related projects that cross organisational boundaries of space (Ramesh & Dennis 2002; Niinimaki et al 2012).

As the statements above illustrates, the ERP design process often required some tasks to be executed under a set of constrains that stipulate that particular tasks cannot commence pending the conclusion of others (i.e. sequential). It is perhaps plausible to state that there had to be back-and-forth communication between team members until certain tasks were completed. Clear communication rules help to control how individual contributions are assembled. One example of communication rules relates to how team members interacted during group meetings:

> *"…it's a case of 'you log into a telephone conversation, when it's your turn [to sspeak], you just make your presence known like 'Hi, java developer'… there's a need to be a controller who would drive the agenda. For me this is very important and the main difference between virtual and face-to-face because you rely so much on a controller to know when it's your turn to present your requirements." (ADT_ID1)*

Communication also revolves around formal frameworks. Indeed, formal frameworks were part of ADT's strategy to structure communication, divide work, and extend tasks to other locations. Formal systems guided how the teams functioned. These include how the pace of most projects was managed and documented.

The comment below elaborates on a situation that necessitates a face-to-face interaction. He commented:

> *"If we had a meeting and we agreed on a certain part, and one of us figures out [later] that there is an issue with that part that we had earlier decided upon, and we all didn't see it initially, we get to meet and reconsider it. Then again, it depends on the requirements because work has been allocated and everyone understands what their responsibilities are and what supposed to be doing."* "*We can communicate by email, don't get me wrong, but in order for us to track changes, or issues, emails are not good enough. We need to cover our tracks from a contractual point of view – just to make sure you've fulfilled your own part of the requirements. (SCOFFs) Someone would have the responsibility of that monitoring" (ADT_ID10)*

Notwithstanding the comments above, respondents' accounts reveal a range of reasons why team members usually shift between various communications media. For instance, individual and team competence increased the importance of certain media over others (such as emails). A respondent remarked.

> *"If you're working with a group of people, fantastic team members, everyone competent in their own right, what needs to be discussed would just be discussed via email and everyone goes their way understanding what has to be done. If there is a requirement to meet, we'll definitely meet because the job has to be done carefully, properly and accurately. There is a rule [that if you observe] something isn't being done properly, stop what you're doing, take 5 minutes to re-assess the situation before carrying on. [And] if [you are] still unsure – you stop it all together (and maybe seek help and meetings)."*

A very surprising finding was that, shifting from one communication media, to another, seemed to be driven by not only individual and team competence, but also quality management standards. This is non-prominent in the literature. Apparently, the requirement for quality in the development and implementation of the ERP system is rooted in the communication process. As with the product development philosophy, it is much better to build the ERP system in 'quality', as opposed to enforcing quality measures at a later stage of the programme. Hence, by stopping work and holding discussions, project team members evaluate the suitability of their activities (e.g. scripts, file administration, classification) in relation to the agreed goals and objectives. Obviously, team members also learn from their mistakes, in the process.

Further evidence supporting MST was highlighted in a study by Ninimaki et al (2012). The authors applied the theory of media synchronicity to their study of 12 projects in 3 organisations. Their results indicated that communication tools high in transmission velocity (e.g. face-conversations) is very useful in building shared understanding and focus. Deluca & Valacich (2006) reasoned along the same line. In their study on the performance of eight virtual teams engaged in a complex problem solving exercise, the authors observed that teams that used high-synchronicity media (e.g. face-to-face meetings) for convergence communication, were more effective than those that used low synchronicity media (e.g. asynchronous media).

An important point to note is that, the selection of a communication system may not always be guided or influenced by its structural capabilities, but its convenience per time. A respondent makes the following conclusions about when and how media is used, *"… it boils down to the structure and infrastructures that have been put in place. If I wasn't in an organisation that makes emphasis on planning, I would probably just be using phones."*

Video has been relied on for some remote meetings. It has been an indispensable tool for team discussions. Interviewees explain that video conferencing provide an opportunity to review other people work in real time. In other words, conferencing provides users with capabilities for giving immediate feedback. It supports live conversations as well as enables the transmission of rich information.

> *[With Video] "Let say for example - in the course of development, there is an error. They would contact you the designer and say we have so-so-and-so discrepancies, is it still ok to go ahead and use this (component) for this purpose. So you look at what they are talking about and you run your own calculations and analysis and all those things, and then you can tell them yes or no. The truth is it could be anything. But you're providing [real time] support to coding guys and they understand what you are talking about."*

Likewise, participants feel a sense of mutual contribution in a video conferencing environment.

> *"[Video conference] can be quite useful to give everyone the option to obviously contribute, and you can then tell them 'this is what I would be doing', this is 'how long I expect it to take'. There would be mutual consent as well."*

Interviewees also explained that the feedback experience in VoIP enables them contribute better as a team.

Some respondents advocated a mandatory email communication after ad hoc video conferencing. One respondent explains that at the end of a meeting, emails were necessary to document team decisions. Asynchronous electronic mail provides low level of synchronicity so team members can re-examine messages as they convert decision into text format. Of course, the benefits are enormous including giving the team a sense of accountability.

In fact, emails and phone calls sometimes precede face-style interactions:

> *At least if they read your email and invite you for a conference call then you know that there is a possibility someone has found a solution. Or it's already been escalated. You can then take that risk [with a conferencing system]."*

> *"I [for one like to make] only calls after reading event reports anyone then books an appointment for a meeting with everyone – 'no one wants excuses'. If anyone can't understand what they are saying [about the issue raised in the report] they can make a request for a site visit in a day or two*

Video conferencing provides support from a sales perspective.

> *"Two ways I use conferencing calls, I use it from the point of view of collaborating with other teams members and use it from a sales perspective as well. Selling my abilities, my accomplishment on a task or as a first point of call (ADT_ID5).*

Making regular trips to a site has monetary implications. Thus, one communication tactics employed by an ERP consultant was to use plain telephones whenever a deploying organisation had not yet made financial commitment towards the ERP project.

> *"Most of our business is done across West Africa, so it's more cost effective [interacting virtually], than catching a flight to go to a place where they'll tell you they don't need that system or your product. So it's once you've kinda established communications on a particular project we are hoping to break grounds with, really, the first viable option would be to have a telephone call. So from that perspective, it's useful to initiate a conversation and talk about your abilities… at some point you still need to meet in-person. You'll still need to make a trip. But to start a process with – it is useful." (ADT_ID11)*

This consultant *(ADT_ID11),* nonetheless described some challenges of using of traditional telephone and VoIP.

> *"They are different ways of looking at it. I don't really think you can seal a deal based on having a telephone conference and call [from sales perspective, and not*

from collaborating]. Simply because you know [sic], there is so much you get from the facial expression. So if I'm physically in the same room [pause]… first of all, you don't know if the person you are having a conversation with is actually listening. You know, they may not be concentrating on what you are doing [sic]. They could be doing something else and just saying 'yes, yes, yes, yes'. Because you can't physically see them in-person, you're not sure if they are really concentrating or actively taking part in that conversation." (ADT_ID11)

Other tasks requiring telephone was identified. A software tester suggested that telephone conversations were necessary to get clarification on tasks:

"I make phone calls when I just want to get clarification from somebody"

Another respondent noted that the media was perfect for monitoring progress.

"…Essentially, we need to be able to know what other people are doing"

The respondent further links the media decision to the culture of team members.

"Am not very good at back and forth emails especially in this diverse culture where the Igbo guy (a local tribe) is making a statement and you say 'OK' but he is asking you a question. (ADT_ID7)"

With regards to instant messaging (IM), a key characteristic was that it provides a seamless and informal experience for reading and writing of messages. Within ADT, Instant messaging and VOIP were viewed as one-to-one media. It inculcates some of the characteristics of synchronous communication, meaning that there is a general expectation that the response to a message would be immediate. The researcher heard during interview sessions that IM communication does not conform to formal protocols. The implication was that messages were casually phrased and grammatical errors were overlooked. What is apparent from previous empirical studies is that communication media provide varying level of synchronicity. A commonly held view is that IM is used in question and answer type of interaction, making it suitable for information conveyance (Niinimaki et al 2012; Dennis et al 2008).

Furthermore, Face-to-face interactions were used to review end-of-year achievements, technical challenges and to provide feedback on individual performance.

"If I need to do my PDR (personal development review) I have to do face-to-face with my manager "

In these situations, team members were given the opportunity to discuss challenges and future aspirations. This further demonstrates a link between future performance and face-based interaction.

The comments above show aspects of the practitioner's communication behaviour. These are situations that influenced their use of asynchronous or synchronous communication systems. The findings also demonstrate the value of MST (Media Synchronicity Theory). It is articulated that communication system users can make individualized decisions regarding when and how to use a particular media, however, the capabilities offered by the chosen media can shape their communication behaviour.

5.4.2.5 Infrastructure

Beyond the issues of task and media capabilities, the other things affecting communication practices in ADT's context are accessibility and connecting/disconnecting due to network disruption. The most mentioned source of disruption was the lack of stable electric power supply. Blackouts are a common occurrence in Nigeria. A number of factors such as the redistribution of electricity make blackouts last from a few seconds to days. There are no tangible load sharing timetables in place. In these situations, performance is often affected:

> *"Because electricity in Nigeria is a major issue, people [that work from home] are unable to come for meetings. When you really dig into it you will find that this can set a project back days. Trust me it's a pain"*

Publicly available data on Nigeria's power generation and consumption indicates that less than 4200 megawatts of electricity is generated for over 177 million people. This translates to less than 12% of the country's daily electricity needs[19].

That being said, because of the high cost of running generators, ADT stakeholders working from home were sometimes unable to join group meetings. Accounts from interviewees shed more light on this:

> *"The energy situation has gone from bad to worse. I spend about N30,000 every month just to use the generator. If you take this month alone, I have had no electricity at night. 'What are the options?' Well, I have a lot of work… so what do you do now."*

[19] Although there are different estimates of national power generation (from government, non-government sources).

Communication behaviour became evident as he explained:

> *…when you can't connect [to a video conference call, for instance] you have no choice but to [phone] call, right.*

The impact of these issues on ADT's effectiveness was amplified by the lack of mutual support between individuals in the scheduling of meetings*:* some people insist on certain times, but others were more flexible *"team members are antagonistic on the idea of delaying their work because of others."*

In sum, electricity supply issues changed how members interacted with others, as well as when they could use certain media. Based on their location and how much personal resources they were willing to contribute to the projects (e.g. running generators at home), some people were less likely to participate in detailed group discussions.

5.5.2.5 Team Functions

Having considered communication behaviours, the next question is on the creation of value. Outcome value refers to the extent to which a virtual team can meet its own expectations, the expectations of its members as well as the expectations of the organisational context of their work.

- *Values & Norms:* ADT's approach to an effective virtual team strategy manifested itself through collaboration patterns and committed relationships. More specifically, attributions were based on a variety of *relational links* such as those associated with solving problems and fulfilling requirements. Comments from various stakeholders' support this finding. This is what they are saying about their relationships:

> *"We maintain a very close working relationship with our ERP provider up to the point that we adopted their frameworks. We have made little customization to components"*.

From a collaboration perspective, this suggests that top management encouraged working across the organisation's boundaries. Internal team members, in effect, benefit from the deep experience their ERP partners acquired whilst working in different industries and with various types of manufacturing processes.

> *"JDE consultants provide the know-how and experience on how to reorganize discrepancies between cost centres, manufacturing and distribution site."*

The focal argument here is that the virtual team strategy was about securing partners that would not only play a prominent role in the ERP implementation phase, but were interested in facilitating the required 'process improvements' in the organisation – post Go-live. One informant describes how they chose channel partners who fit their business environment: *"[suitable candidates] must share our values, [and] look glad to stay [with the organisation for the long haul]"*.

This view is expressed more vividly by another comment:

> *"You don't just cater for today's needs. You anticipate growth in the future. 'What is the most elegant way we can provide a solution?' The more you can demonstrate that in your delivery, the more pluses you have" […] "the more you can remain useful to us as a team player, the better as well".*

Additionally, the use pattern (of a virtual team) revolved around investment-based interactions, such as the relationship between shareholding companies. It seems reasonable to suppose that there is an advantage if an organisation wants to fully utilize its available/spare resources, and improve efficiencies. For example, an integration project was initiated in 2011, where a temporary project team was seconded from other cooperative partners to support project activities. Indeed, this flexibility in staffing contributes to national diversity & competitiveness, which naturally, a virtual team leverages on.

To conclude, we have seen that a virtual team strategy acts as an integrator (of experts), and at the very least, it creates value at initial phases of projects.

- *Authority, seniority & hierarchy:* Respondents also reported on some specific tactics geared towards the sustenance of value. A critical part of maintaining a successful virtual team involved familiarity with each other, as emphasised by the coded extracts below. Skill level and area of expertise were different, so performance was somewhat socially informed. For example, interview data indicated that members engaged in both 'mentoring' and 'shepherding' activities:

> *"Mentoring is important. I see a mentor's role as a passive role, given that he's not a manager and doesn't go nagging people on what they are up to. It is passive from the point of view of, if a colleague has needs, if he's got a requirement and he needs something done and he needs some sort of guidance, then I'll be able to help out. Also, if he has any questions – technical preferably, but he may have administrative questions as well, but any technical question.*
>
> *Technology is not one shoe fit all, so there are different times where you need to do things differently. So my role as a mentor can be to show him all the options out*

there… But my role from a mentoring perspective is if there are to be any questions, a need for guidance, then they can basically contact me to talk and if I can't help with it, then I can refer them to someone else."

An external industry analyst, agreed. He believes in the strategic value of mentorship: *"[Mentors] nurture the frontlines… [and] pay close attention to their [technical training and retraining] needs" (ADT_ID12).* The role of mentorship is expressed more richly with these comments below.

"[A mentor] encourages creativity, he doesn't say 'oh no you must work like this' – No. So he encourages creativity, you go out and do it, [then] report to me and then let's see how we can work together. He doesn't micro manage"

Another aspect of socially informed behaviours was identified as *shepherding*. An interviewee describes the process of *shepherding* people who are not equally skilled - to success. This also involves activities relating to transmission of information and good leadership:

"A boss leading a team needs to be able to communicate, to pass on information directly to them, to act as a Shepard, to act as a motivational centre. He's got so many responsibilities that are all tied to communication. Is he such a person that is easily accessible? Is he someone that comes across as low-judgemental?' Easy-going type of person. Is he someone that you need to watch yourself around with what you say, how you say it and stuff like that? There are instances where they would drop you in the ocean, but not deep enough for you to sink. And what you need is a little bit of challenge [sic]. You know it would be difficult but eventually you can overcome it. That is the whole idea of giving you this project to start with. Now the more you deliver, the more responsibilities you get. There are instances where you have peer-reviewing, when someone looks at your work to make sure it is fit for purpose, that's before it goes to QA cos the whole idea is if anything breaks, it comes back to you. Of course it's not good for your appraisals. Yes, mistakes would be made but the last thing we would want is for your code to be consistently rejected because of errors you've made."

"My boss likes to see himself as coming off the bench. At the point when you are extremely stuck, they come to deliver. They see themselves as a reserve. 'They come in there, if there is a problem, they get it done. They don't just get it done, they carry people along. Just make them know, well, this is how you do it"

This process is not passive in our case context. Interviewees recognised that an ERP programme thrives on the contributions from more experienced individuals.

However, mentorship [and member development] was not one-directional. Seniors were also mentored by their subordinates. These situations were coded as *'inversing mentorship'* in the data analysis template (illustrative quote below). This is also reinforced by Klein et al (2005), who argues that some classes of practitioners, such as scientists, exhibit a rather Egalitarian structure where information and knowledge[20] moves freely and change frequently. The master-apprentice framework is virtually inexistent. If mapped onto Klein et al's categorisation of practitioners, ADT may be typified by an Egalitarian structure. Of course, at opposing ends of the spectrum is the stratified structure. It is very dominant in business processes like finance, which some other ERP stakeholders identify with (see BST case account in section 5.5).

> *"Before the end of every project you would know who to trust, trust me!. From the technical perspective, who you trust is based on the experience they have had. Technical wise, I can learn from anyone, so I can learn from someone junior to me as long as you can defend the reason why I should take your options. I am quite open-minded from that perspective. The problem is that, there is a danger where because he is junior [to me] he can't know more than me. But this is wrong because as long as the person is quite open to technology and learning, there are chances that there are things they know that you don't know."*

The comment also suggests that at the closing phase of a project, the person you eventually trust is based on the informational experience they have had and knowledge demonstrated.

Further, participants were questioned on what they thought was a significant issue affecting the cohesiveness of their teams, to date; most of them responded that it's not having someone available to elicit information during working hours:

> *if I've got another engineer who is nearby, I can always bounce off him. Because there is no way in the course of anyone's one day are you able to remember everything that you've ever learnt in your whole life. There could be a phenomenon that's at play in the issue that just because it didn't really occur to me right there and then, so I [need to] bounce it off someone else.*

[20] I use the term information and knowledge crudely, suggesting that there are synonymous with each other.

"Now, because I'm involved with this project, naturally I need to know more about the issue from a design criteria perspective. So I dig back into whatever information I can gather. If I look at it, and I realize I'm not able to make the decision [] – if it's something I'm going to call the guys – then fine. If it's something my boss, maybe the project manager should probably know; I can always call the person-up and we just talk it through. "

In short, placing a high value on working relationships was considered a factor for performance (McGrath 1991).

The media synchronicity theory suggests that as time goes by, the level of media synchronicity is adjusted in accordance with the level of familiarity. This includes team members: familiarity with their task, with a media and with each other.

5.4.3 Summary

This section unveiled various conceptions and understanding relating to virtuality in teams and the drivers of communication in general. Key findings are summarized below:

- Informational requirements and media conditions drive interactions in the virtual setting. In situations where accuracy is important, participants emphasised that systems oriented towards face-based communication should be used in preference to any other mode of communication. In fact, quality appeared to be an organisational goal that engendered high levels of face-to-face interaction.
- What's more, communication behaviours in the case context is not just underpinned by temporal gaps (i.e. a gap of time, space, media), but also infrastructure.
- ADT members were vested in their practice.
- Lastly, mentoring lent itself to the survival of the virtual team.

5.5 Case Two: The Business Service (BST) case for Virtual Teamwork

5.5.1 Case Description

This second case will look at the virtual team strategy of the Business Service work system (BST), focusing on communication behaviours and performance issues.

The respondents are not ERP application developers, but have been stakeholders in its delivery. Their project activities typically span at least two places, giving them exposure to location diversity and unified communication infrastructures. BST stakeholders were mostly involved in the implementation phase of an ERP programme.

ID Number	Job Type	Profiles
BST_ID1	Project Manager - Functional	Facilitates knowledge transfer to business application architects and has been involved in negotiating requirements. With the exception of Emails, respondent has found virtual work challenging because of the diversity of technology solutions.
BST_ID2	Corporate Communication	Has 7 years' virtual project experience, including taking on the role of corporate communication lead. Past duties have been to create a communication plan to align and support a change management strategy.
BST_ID3	Business process owner	Has worked as a business process owner for a procurement business chain for 10 years. Level of communication and virtual work has been dependent on involvement in project, including its size, location and complexity of system change. ICT usage can be up to 50% of work time.
BST_ID4	Business process	Provides legal support. A practitioner with 6 years' experience controlling deliverables produced by multiple teams. Dedication to project and usage of ICT to accomplish work varies.
BST_ID5	Internal Audit	Has been involved in coordinating and monitoring resources among various technical, functional, and third parties. Validates implementations of business services on system.
BST_ID6	Key User	In last project, dedicated 25% of time to data uploads, and communicating results both in-person and with the aid of communication

		system.
BST_ID7	HR Specialist	Has 6-7 years experience providing local support to projects, including communication, recruitment and resolving change management issues.
BST_ID8	Business Partner	Has worked as part of a business partnering team, providing onsite and remote support to project teams. Role includes defining business documentations as well as critical and non-critical request.
BST_ID9	Business Process local	Experiences an absence of proximity with other units, such as sales agencies. This necessitates the use of communication technology.
BST_ID10	Key User	Has worked as part of a community of end-users, helping in system design, testing as well as recording observed gaps in processes. Activities provide an opportunity to learn from stakeholders, use unified communication systems and experience location diversity.
BST_ID11	Site Resources	Had no prior project experience but has actively been involved in generating business requirement and communicating them face-to-face or using communication systems. Has also led product sales and managed issues affecting a business area that spans multiple agencies.
BST_ID12	Consultant	Communication Strategy was the subject of respondent's masters' degree project. Has since developed and reviewed project documentation in collaboration with colleagues.
OTHERS		
OTH_01	Strategic Partner	An industry related value chain stakeholder.
OTH_02	Account Executive -	Provides ERP support and coordinates assistance from multiple locations.

Table 5-3: Participant profiles

5.5.2 Case Findings

The data collected suggest that virtual working evolves naturally. BST members were involved in routine manufacturing operations, besides those designated to them in the implementation of the ERP system. The case result also suggests that group cohesiveness tends to decrease whenever functional project managers engage in informal face-to-face communication. All these are discussed below.

5.5.2.1 Project Organisation

This theme is based on the relational and collaboration contracts between BST and its team, and among project team members.

BST is conceived as a natural arrangement of business functions wherein virtual working evolved as a way of executing routine tasks and process. In project situations, the work structure is akin to Henry Mintzberg's Shifting Matrix Organisation (Mintzberg & Sumantra 2002). Here, project team members report to a leader, who signs off on key project deliverables – but they are still part of a particular functional area. The method of taking decision is semi-autonomous as observed from the following comments:

> *"I don't make all the decisions because I don't own any resource. The directors decide what they want me to do with their assets. Then I figure out if things are too good to be true or absolutely wrong (BST_ID3)*:"
>
> *"As a company we have laid down the processes but the way people govern their people is up to them. At the end of the day we are all interested in maximising shareholders' profit (BST_ID2)"*
>
> *"Different managers have different styles and what shape them are their experiences & personalities (BST_ID11)"*

This rather semi-autonomous approach is typical of how the various sub-groups essentially manage themselves.

BST plays a key role in the delivery of an Enterprise System. Documentation describes the programme as not only consisting of system development activities but also change management. The ERP system is aimed at improving all aspects of the organisations supply chain management process, starting from the point of sale (POS) up to materials management.

Projects within the ERP programme do not maintain full freestanding operations in functions such as finance and procurement. In addition, legal requirements and policy documentation necessitate the participation of a range of expertise (e.g. HR, audit, finance). According to one informant, business process owners that normally handle administrative services can be transferred to ERP delivery on a secondment basis – to work with an application specialist.

To BST, the success of the ERP programme includes:

- Knowledge documentation.
- Ensuring the design, maintenance of existing functions and enhancement of new business process.
- Facilitating educational programmes and processes. Process improvement efforts are considered a separate and on-going project. It leads to new processes, roles and modification of job descriptions.

Because information is shared across boundaries of space and function (i.e., between application specialists, support staff and business process owners among others, the decisions regarding work methodology is key. To coordinate and manage workflow, a hybrid project management framework is used. It combines PRINCE 2 with waterfall or other methodologies at the implementation stage. PRINCE 2 is used to manage and control the overall programme, including the various sub-projects. It is also used to monitor budget, timelines, resources, risks, assumptions and dependencies. In this regard, challenges associated with operations cross boundaries are reduced.

5.5.2.2 Virtual Team Areas and Perceptions

There is no single interpretation to what working virtuality entails. Whereas another work system within the ERP programme - Business Services (BST) - operates from different locations and uses technology to support communication-based activities, the stakeholders are not distributed across time zones. Hours of work are the standard minimum working week of 37 hours.

Respondents illustrated the scope of virtual work by saying:

> *"The spread of employees in different business offices is promoting a virtual structure." (BST_ID3).*

The next comment, further illustrates the concept:

"My boss does (spends) half day in our office and the other half at the factory"

Another business service respondent believes that technology can be used to provide a more global reach.

> *"If you take it back a couple of years ago, right before the emailing service and all of that. It was a lot crazy to really communicate. It was difficult to relate on the global playing field because you have to send across information by letters. It could take some time to go through the post and all that. There was a risk that whatever you sent could get damaged or get lost in the process, in transit. So emails and the new IT technologies of today have made a lot of things easier (working together). We could pass across information electronically, which arrives in the next second. Like you said, [referring to the interviewer], to relate with people not just on email, but through video which allows you to be almost in the same room with the person. Although it's not exactly the same, but it's better than just relying on email from somebody you've never seen before." (BST_ID9)*

As with the literature (e.g. Schweitzer & Duxbury 2010; Dube & Robey 2008; Bailey et al 2011; Chudoba et al 2005) and the respondent's conceptualization, the ability to create an awareness of distance was a key feature of the virtual context.

Other factors such as project governance mechanism were thought to influence communication within a virtual team setting. The data analysis method and the research findings show that many of the respondents believed that a project's director's ability to extend their authority to multiple teams had an impact on communication structure and how people interact.

By asking questions on where "authority, decisions and action begins and ends", participants indicated that responsibilities and communication in the various ERP projects cut laterally through the vertical silos of multiple locations, function, and partnership arrangements. In terms of roles, functional project managers were responsible for creating plans for the various functions from the broader project plan. They also took up the responsibility of being leaders of project task for their business areas. Operation-wise, these stakeholders coordinate support of the regions with respect to the business processes they are responsible for.

In discussing an ERP programme, a functional manager was quick to note that 'change request' and 'new functionalities' highlight the interdependence between work in various geographical locations as well as the relationship between different ERP stakeholders.

A recent graduate employee provided a more specific example of elements of virtual teamwork. Referring to the training arrangement, she noted that it is more difficult for people to learn about aspects of a job:

> *"[If you are Virtual] you can't even do some certain things."* (Probe: like what?) *There are situations where you need to shadow somebody, look at how he does things and it cannot be the same as being in the same room with them." (BST_ID10)*

Against this backdrop, it seems to be that the actual distance between team members is not as crucial as the impact spatial separation has on how work is conducted (Bell & Kozlowzski 2002).

5.5.2.3 Boundary-Spanning Communication

Before examining how BST adds value throughout the duration of a development project, it is vital to consider who appropriates that value. This requires understanding the communication environment where the value is created. Gibson & Gibbs (2006) show that a good way to start the analysis is to understand the structure of the virtual group. The characteristics of the group also predict its communication structure (Hinds & McGrath 2006)

- *Expertise:* Unlike ADT, where there is a high level of interdependence between various sub-groups -across functional boundaries, BST is, in contrast, a rather natural arrangement of business functions. Further analysing the internal processes of this work system, it is found that member tasks are typically broken down into distinct value adding activities that may each benefit from a degree of virtuality. They include: procurement, sales, distribution.

With a closer look at the physical location of programme stakeholders, the data reveals that they operate from various sites: manufacturing sites, sales agency, head office, and distribution sites. Individuals are involved in routine manufacturing operations besides those designated to them in the implementation of the ERP system. Furthermore, they were support staff members involved in the provision of ERP solutions. There was a need for a governance service for finance and resource management in project activities.

Dedication to non-routine tasks varies from 25% - 100%:

> *"it's more or less resourcing on the point of view of the HR managers and technical director because they look at what the overall project is, and figure out where do we really need more bodies in. So it's the case of prioritizing. If*

we've got this key project, sometimes they need to pull you out to do other things. Funny enough at present you work on multiple projects simultaneously, but then you allocate different priorities to those projects. But the priorities of the projects don't need to be done consecutively; you're just to ensure that you get your task done and manage the time effectively because they would be a deadline. (BST_ID11)"

"When things are quiet, everyone more or less retires to their key duties. They would always be things to do, anyway. At the end of the day, regardless of what you're doing, it determines how you develop, and it's at the advantage of the company. If you are on a fixed project, you may know the in-and-out of a particular job."

"Many of the time, I don't get to choose my task. It's as they come…as long as there's work going in the company, there is always going to be a need for improvement upon what we have. There is always going to be a problem to solve, you know, they just always come. No delays. If you have a dry spell period, there is always a list of things you didn't finish off, you know, because of time; or you check-out some task from a colleague (OTH_02)."

BST members provide personal knowledge for the ERP system components, from common language information structure, to master file, chart of accounts, data types etc. Also, team members were disseminating knowledge and skills in legal requirements and company policy. These people don't just know how things are currently done within their work environment; they also know what needs to be done for the ERP technical development phase to be a success.

Additionally, BST has a dynamic lifespan with roles and task requirements changing at various phases of Implementation. Some ERP project phases place a significant value on subject matter expertise. For example, the responsibilities of the functional managers and other business process owners were more visible in the conception and switchover phase of new modules. Their sub-task included: documentation (e.g. change control request, high-level design review), data uploading to the new system, system testing for back-office functions.

As the collaboration pattern above illustrates, a virtual team strategy allows BST to become more flexible, responsive and adaptive by enabling them cross organisational boundaries of

location and function. In this study context, project teams comprised of the most suitable people for a particular project phase. People were selected from procurement, sales, distribution, and support functions such as finance and legal. In order words, team members provided process and product know-how at their respective location owing to the fact that the ERP projects are functionally diverse.

In a nutshell, the line activities of BST mirror a typical functional organization. Information relevant to the ERP system is exchanged amongst the different professionals and value chain partners.

- *Shared Methods, Mental Models & Understanding:* It is however unclear whether BST can be considered a collection of experts at project inception phases (see discussion in section 5.6.2.4 below). As has been demonstrated by the analysis in that section, BST comprised of direct hire of natives. Within the same realm, a few respondents were quick to state that until their selection for the phase one project, they had no prior technical understanding, project management or ERP experience. Respondents reported that they undertook intensive short training in project management and enterprise applications. Conversely, conveyance of knowledge from one person or location to another was commonplace in BST. Of course, even people widely recognised as experts do not know everything that needs to be done for the ERP technical development phase to be a success.

Among the terms frequently used to highlight the conveyance of knowledge from one location or person to another, was 'induction'. The word was used to describe the formal processes of conveyance. Conveyance refers to the transmission of information or knowledge.

> *"We introduced an induction. This is beside the general HR induction. We show them were information is. But in addition to that we give them one-on-one awareness session (BST_ID2) "*

> *"We have induction within the team itself. Each process lead does some kind of training, even if the new team member already has that experience from their previous role. We want them to understand how we do it here because if we just leave them to read about past work from the knowledge portal, it would be very scary. It can be very discouraging if they get into the pool of the work and see the huge amount of information, which they need to consume within a short period of time. It can be very discouraging (BST_ID9)."*

It is worth noting the conveyance process benefited from the use of information portals.

- *Shared Methods/Models:* Within BST mental models such as Chart of Accounts, Accounting Principles, and Management Allocation Guide, were used to discuss and learn about aspects of work.

A training material that reveals the existence of shared mental models supports interviewees' comments:

> *"The [manufacturing process's] Common Language is sponsored and developed by the [Division] to help to operate efficiently and achieve synergy in a multi-local organization…Being built on a vision for [the business's] operations management; it encapsulates rules & practices, integrating them into daily management…It standardizes the structure of information … enabling sharing information easily…It is the basis to measure performance and benchmark"*

For some theorists (e.g. Dennis et al 2008; Kock, 2004), shared mental models enable team members to quickly encode and decode familiar information. Hence, convergence happens quickly. As discussed in chapter 2, 'convergence' comes from the extraction of meaning from information that is conveyed from one place or person to another.

5.5.2.4 Team Functions

The Media Synchronicity Theory (after Dennis & Valacich 1999) identifies some functions that virtual teams are capable of performing. A virtual team is involved in *production function*, meaning that they contribute to their embedded organization as their members perform assigned task. The theory describes another category of functions that deals with the *well-being* of the team. These are things like supportive ethos and behaviours (McGrath 1991). Also, MST includes a third simultaneous function referred to as member support. It represents relationships with others.

To examine how cohesive the virtual group was, questions were asked about the kind of problems that merits a group effort and some of the problems faced on a daily basis - with particular reference to communication. The overall perspective was that of reduced cohesion stimulated by the need to satisfy certain individuals rather than a group.

- *Values and Norms:* Most respondents were fundamentally aware of *cultural differences* in the dispersed work environment.

"In today's age and time you have to be aware of people's background - cultures and all that. You don't go to discuss with somebody from say, for example, the other person is a Muslim; you don't go religious on each other. You wouldn't just say the first thing in your head. You think, keeping everything professional and at the business."

The excerpt shows that people tend to pay attention to cultural orientations and avoid them.

Moreover, Nigeria is divided along ethnic lines, with 374 pure ethnicities covering an area of 923,768 km^2. It is therefore not surprising that as communication in BST crosses boundaries of space, they also cross cultural boundaries as well.

It is to be noted that most interviewees perceived tribal rivalry and strong personalities to be a key factor in the accomplishment of a task.

"Like I said, we all have the same work plan. We are working towards a common goal. But we are working in different locations across Nigeria. And you know how Nigeria is, one state is like a country… conflict sometimes may come up when someone thinks [that] something can be done in a particular way and another person says 'it just doesn't work that way in my State', 'is this something very difficult for you to understand?',… People just try to prove a point to another person. They like to express their frustration with loud voices".

Another statement of text that reflected strong personalities and conflict was:

"Conflicts arise, but they are not heated arguments. Maybe there is a bias here because I really love my team. If I didn't enjoy my team I'll be complaining about it. I'll compare it with other teams I've seen. You hear them shouting during their meetings, you hear them come-out, you hear them exchange words when they are angry. I think it's because each person on their own are wholesome people, they respect only their own opinion."

From this statement, it could be deduced that during meetings, people were competing to be heard. These activities do not strengthen relationships or contribute favourably to the organisational context of work.

A virtual team strategy portrays how BST should create value for its members, itself and the context of their work. As mentioned earlier in this report, business process owners, functional team leaders and members were questioned about the potential value of a virtual

team for an organization. Most of the interviewees noted that an effective virtual team strategy must somewhat be aligned with the organisations' overall strategic plan. It contributes to the achievement of the following strategic aims:

- Provide an opportunity for integrating multinationals partners.
- Contribute to the overall business strategy, particularly, to achieve better communication plus quality service.
- Working to ensure compliance with local regulations and policies.

For BST, a virtual team strategy presumes a proactive role. It provides opportunities for integrating stakeholders associated with the manufacturing business. For instance, the French shareholding partners frequently provide technical leadership in the development of high-quality products and in-house solutions. They also provide support to various technical centres. In addition, virtual teams connect specialists who are geographically dispersed across its businesses.

Another of BST's strengths is the co-operative relationship that exists between value chain partners - who are geographically dispersed in various states within the Nigerian federation. An ERP programme does not operate in isolation, but in the wider context of the organisation. As a result, a supplier's involvement is a crucial component.

More so, technology is radically changing the manufacturing process in Nigeria, which is now driven by the need to interact with strategic partners (contractors and suppliers) in more than the traditional method of face-to-face, compelling organisations to develop *multiple communication channels*, just to survive. In fact, one of the organisation's goals is to achieve faster communication with suppliers, so they can respond promptly to the needs (i.e. sale orders) of their external customers. The truth of the matter is that, using a virtual team to connect suppliers was not the organisation's original goal; it is just the by-product of their pursuit of 'faster communication plus quality service'.

One more of BST's strength is the tacit knowledge possessed by indigenous employees relating to the local manufacturing environment. For example, natives who work as procurement process owners possess a detailed knowledge of supplier's reputation and procurement practice, which provide excellent business intelligence when designing and executing a 'tender process'. Thus, the virtual team strategy ensures that local knowledge is harnessed.

BST draws existing knowledge from people who would typically have been the wrong fit for projects. Although this might not have been deliberate; compliance to local agreements and policies resulted in this characterization. One participant makes reference to the intertwined link between the Nigerian rural community development initiatives and an organisation's hiring process. He notes that, by building manufacturing factories in certain locations and extracting raw material from the land belonging to village communities, the organisation is constrained by the number of non-indigenous people it can recruit. Local managers recommend project members. But these people may go on to work with global partners or projects. *Local content* is the terms often used when people of a particular community are recruited in order for an organisation to comply with its *build-employ-extract* contract.

Team selection, underpinned by local content policies has on the one hand helped people reap the bulk of development project rewards, such as job creation, direct project hire of natives. But on the other hand, it has constrained locally-sited projects and offices from having people with exceptional abilities. The fact of the matter is certain intellectual talent is not always found in some geographical areas in Nigeria. This plays a role in the amount of conveyance and convergence processes that occurs during a project life cycle. Recall, convergence and conveyance are the two key communication processes associated with all task.

Whilst this was one of the main fault lines during project inception and initiation phase, there was a clear appetite for knowledge amongst stakeholders. Most respondents raised the idea of "seeking knowledge" even before the researcher reached interview questions about their knowledge transfer processes.

Analysing the cost and benefits of adhering to 'local content' - in business terms - is beyond the scope of this study. Nonetheless, if BST was to progress and perform well, without having exceptional talents (at project initiation and team inception phase), then they needed to have certain processes rightly assembled during the execution phases.

When asked to sum up the supportive ethos and behaviours that are relevant for an effective virtual team, some participants discussed activities relating to "transparency". Projects should be approached with an openness attitude:

> *"The main thing I like about when we gather is that information is shared. Sometimes when you're called to a meeting it can just be like 'oh gosh, meeting again'. But at the end you [still] go for the meeting and you just share, just talk. My boss is good. You just know that if there is a pending topic we did*

not hash-out in this meeting, in the next meeting she has feedback. I told her that I admire that skill."

Interviewees also acknowledged the role of relationships and familiarity with others as a component (and a conduit) of group development. With regards to MST, one factor that affects performance is the extent to which people have work together on past projects: BST provides similar observations:

"The desire to work with the same virtual team member on a future project] depends on how there got along of the previous one; If the frequency of communication agreed had been followed through and if the first project has recorded success. "(BST_ID6)

- *Authority, seniority & hierarchy:* Documentary analysis revealed that a formal communication strategy was specified during the inception and planning phase of the ERP projects. However, it seems to be that information transmission was done with little reference to the pre-determined plan. Project managers defined what channels should be used for communication but were either unable or unwilling to enforce how or when it's used. This was a great surprise given the amount of effort and time committed to the development of project control documents. These include: information needs plan, project governance framework and delivery gates. Conversely, it is not unreasonable to suggest that the organisation vis-a-vis its managers, instils a high level of trust on its members, through the predominantly unenforced and unsupervised implementation of its communication plans. Sadly, this trust was sometimes abused. An example of such is the functional project manager's informal use of face-to-face communication channel to discuss changes to requirements.

Bearing the above point in mind, non-compliance to communication plans led to a project casualty as detailed in the narrative shared by an interviewee. Here, the interviewee tells a story about a friend who lost her job because of some team norms and negative behaviours:

"She is a planner and she works with this primavera-like software; to put all the plans together. Whenever they went out for a project meeting and assigned different resources, different roles, different things people should do, after the meeting, the [functional] project manager would come up to her, 'change this, change this' - twitching and twitching and twitching. Other

people on the team are not really aware of the changes (because unlike the manager, other stakeholders' cross boundaries of space)".

Additionally:

> *"And apart from people not being aware of it, when some challenges came up, people denied ever instructing those changes because there was no communication strategy [or collective consent] to it. I remember just before she got fired, I randomly told her [to] just get them to be sending you an email, copying everyone-in since you guys don't have a platform (method) where you can be doing stuff like this. If they don't send you an email, then you, send the person an email copying everyone in and tell the person to confirm the change…it is good for you to have a specific type of strategy. There would always be changes, so you have to balance.*

This statement might however be interpreted as a virtual team's effectiveness being negatively influenced by the functional project manager's use of face-to-face media. According to the story, the junior team member was afraid to speak up – or rather – afraid to challenge how the changes in requirement were communicated. The implication with respect to MST is that even though face-to-face communication could provide high synchronicity, it seems that it does not always.

Revisiting earlier discussions on the analytic method (in Chapter 5), a key feature of template analysis is 'parallel coding'. This means that the same data extract can be tagged with more than one code. This is especially useful if the researcher wants to show many aspects from different angles. Thus, the above statement was simultaneously coded as *competing lines of authority.* Such pattern of behaviour towards authority might be an artefact of national culture.

It was observed that the Nigerian culture strongly advocates the importance of hierarchy and 'respect to elders'. What's more, most people tend to avoid challenging their bosses (or much older colleagues) even when they break the rule, like instructing project changes without enough mutual consent of other stakeholders. No wonder the trend of informal face-to-face communication created an opportunity for poor documentation, i.e., they created bad record keeping practices that inhibits virtual team

cohesion. Intuitive logic says that partially conveyed information negatively affects group performance.

- *Trust in Virtual Interactions:* Apparently, the non-compliance to a communication plan reflects the lack of adequate controls within this work system. So how was effectiveness in projects ensured? In this regard, the notion of trust resonated with few interviewees.

Some references to trust in the data are shown below:

> *[trust] "I think there is a very good level of trust, as I said, that's what really helps us… It looks like we are all working towards a common goal. Well it is obvious that we all work hard (BST_ID3)."*

> *"Because some directors are technically equipped, which means that most [of the] time the [inputs] they give are more or less accurate. So everyone more or less trusts each other. Because he's from a technical background, it's absolutely helpful (BST_ID9) "*

Recall that a distinction between trust and control was discussed in the literature review (Chapter 3). Gallivan (2001) argued that trust comes from firm belief whereas control is about a set of principles and practices intended to eliminate "opportunistic behaviours".

5.5.2.5 Familiarity with media

Familiarity with media: Familiarity with communication media supports group development and helps a virtual team perform even better.

> *"What encourages people to want to work together again depends on how effective the virtual arrangement has worked for them. If for example, there were able to use the technology that supports the virtual team very well." (OTH_01)*

> *"Training is key and if people are not well trained on how to use the communication system very well; this can be a very huge factor in virtual team effectiveness. If people don't have the right skill to set up the technology, it can be a big hindrance." (BST_ID8)*

Other communication media incidences related to what the researcher coded as *Technology illiteracy.* The point here is that BST members have access to information shared in platforms used by other collaborative partners. Not all of them know how the resources work or what to do with the distributed information. It may be worth

reiterating that information is shared across boundaries of space and function (between application specialists, support staff and business process owners among others). There is a requirement to communicate and share information unique to each ERP-system component.

5.5.2.6 Media Capabilities & Communication System

As highlighted earlier, information exchange and decision-making was across manufacturing sites, sales agency, head office, and distribution sites. In fact, in the absence of proximity, stakeholders use different media for communication. This suggests different communication needs and practices (Niinimaki et al 2012).

Like ADT, the work conditions of BST required team members to regularly access information from various sources as well as notify others about what is being done. On the one hand, to facilitate the exchange of rich and detailed information, team members utilized common languages, with a variety of symbols. These include: analytical breakdown (i.e. cost centres, responsibility centres, and product descriptor) and Management Allocation Guide. On the other hand, BST members valued forms of communication like email. It enabled individuals to communicate and share information, irrespective of location and work hours.

On the one hand, face-style meetings allowed individuals to make project inputs as well as obtain commitments from other.

> *"when the people have question, what you find is – by explaining it to them in person, you can immediately tell whether they get your answer or not. So it's usually a case of 'ahh, how does that work' and you can say 'it works like this or that'.*

> *"…And if the person is like, making facial expressions where you believe that oh I need to give this guy more information – then you can. But over the telephone you're not quite sure because you can't physically see the expression. You can't tell for certain if they get what you're driving at."*

MST describes face-to-face media as one that is high in information convergence capabilities. It facilitates decision-making because of supports facial expressions and non-verbal cues.

BST members tended to accept emails as a suitable communication channel. Emails support a lower level of media synchronicity.

> *"emails [are] coming-in from here and there, it is very difficult to have a systematic plan of your day". (BST_ID10)*

By using email, virtual team members can transfer information amongst themselves.

> *"In an email it's not that hard to probably articulate problems and share them. [But] often when conferencing you'll find people trying to put holes in your challenge, trying exactly to show it's your problem. Just to make sure it's not their responsibility to fix. And often you need a manager to actually seat back, read it and tell you how we'll proceed." (BST_ID6)*

- *Processing Capabilities:* The Media Synchronicity Theory suggests that emails are appropriate for conveyance, but are not very suitable for converging on shared meaning because it offers limited emotional, attitudinal and normative cues such as gestures, body language.

Also, messages from multiple senders are not transmitted simultaneously, making it unfitting for group discussion.

> *"Had an important message I was to get (expecting). I didn't receive it. 24hours later I logged onto my mail from the web… (it was there) (OTH_02).*

Derived from Dennis et al (2008), when a task requires detail discussion or group decision-making, having a channel that supports immediacy of information feedback and restricted number of concurrent transmission of information between the team members is considered to be more appropriate.

Especially noteworthy, some respondents discussed the importance of traditional telephones.

> *"Just like I received an email one day from this guy who said he is coming to see me. I had already sent what he asked for and he said everything was ok but he said he wanted to come and see me. I really needed to know why because there are certain questions that don't fall in my hands. So I picked up the phone and said 'Hi as regards what?' because seeing me is of no use. He now asked – what questions can he come to see me for, then? I told him if it involved something in the email. But if it involved a decision you are not happy with – it was not my call because I am just administering the information that was cascaded down to me. So basically, I get in touch with people when I think its not necessary to keep sending emails. I pick the phone and call" (BST_ID7)*

Although some of the drawback of telephone communication were also identified and articulated by respondents. These include its lack of support for rehearsability. Rehearsability deals with the ability of a media to allow team members rehearse and fine-

tune a message before it is sent. Rehearsability is a time consuming process. It is challenging when ERP stakeholders have to use telephones to communicate with a large number of people every day.

> *"So imagine having to communicate with over 50 people in each day you need to be careful to ensure that the right information gets to the right person. The right people get the right information and the wrong people are not given access, deliberately or not. It is not just 'get the phone' or anything like that'. Currently I engage with over 100 people always, just to give you a perspective. So you have to provide the right information to the right person." (OTH_02)*

The analysis above has shown that communication systems are sociotechnical systems that enable and enhance boundary-spanning communication activities. In this regard, two media capabilities have been discussed: transmission capabilities & processing capabilities (Dennis et al 2008).

5.5.2.7 Infrastructure

Respondents were questioned on what they thought was the most significant communication incidence to date. The analysis of data gathered from this questioning revealed inconclusive result. However, a key aspect of the practitioner's communication behaviour was influenced by connectivity.

First, some participants emphasized that people who work away from office sites were reluctant to use certain forms of communication such as conferencing. This is owing to the fact that broadband in Nigeria is sold in capacity limited bundles. Conversely, it promotes the use of traditional telephones[21] and short-term connections for emails. The use of voice communication over transmission lines is considerably more expensive than data.

> *"VOIP eats a lot of data when you want to have more than just a chat. Not very convenient if you don't have [wifi] [unlimited data on your plan supposedly, when not working from office sites - you check your data usage])."*

Second, the mode of communication in projects was also influenced by bandwidth capabilities:

[21] In this context, traditional telephone differs from Voice telephony over the Internet

"I like the fact that everyone can call. The frustrating thing with calling with video conferencing is the network we have. I'll just use Nigeria's problem (BST_ID2).

The following was also recorded during a session:

"Bear with me a second; I think there is an issue with communication, can you hear me, confirm you can hear me please. Gosh, I think for some reason I may have lost connection. Please wait for one second while my system connects back. (After 10 seconds the interviewee responds) ...I think I should be back and you should be able to hear me. Sorry - for some reason I lost connection here. I actually decided to stay in the office to have this session rather than do it from home where I tend to have bad internet connection."

The second part of the above participant's comment (below) suggests disconnecting due to external influence.

"Sometimes we call in, we dial in and then someone is talking and then we lose someone, and then another person is like 'I didn't hear anything you said'(BST_ID3).

In fact, data analyses reveal a number of 'Nigerian problems' that could cause disconnection during a videoconference. These include network failure and electric power supply disruption. With regards to the latter, secondary data indicate that public supply of electricity is in short. Individuals and organisations are not isolated from its effect.

5.5.3 Summary

Some of the key findings are summarized below:

- Some context specific communication behaviours were identified, like team members being afraid to challenge to their senior. The result is explained by the perceived cultural impact. This play a role in whether or not a virtual team strategy – as adopted by BST – adds value throughout the duration of a development project.
- The findings also indicate that face-to-face communication media were not always used to share information in projects efficiently and effectively as it was sometimes abused.
- Lastly, the preferred mode of communication sometimes boils down to retail access of broadband bandwidth.

5.6 Case Three: Infrastructure Support (IST) Account

5.6.1 Case Description

This third case study report is intended to complement the ADT case account. With the aim of representing the various points of view of relevance to the research objective, a third key perspective was identified. This chapter discusses the design issues of the Infrastructure Support work system (IST).

It is worth noting that due to limited resources and feasibility, it was not possible to have one-on-one interviews with all members of a particular support team. This was as a result of inaccessibility of certain locations or unwillingness of some members to participate in the study.

ID Number	Job Type/Position	Profile
IST_ID1	IT consultant	Has been working within a virtual environment for over 10 years and has been using various technologies. Frequently engages in IT related audit.
IST_ID2	Service Management	IT service lead, responsible for managing service delivery to support teams - including the service management for data centre services. Promotes an incremental approach to system projects that should span several weeks.
IST_ID3	Operations Infrastructure	System Manager. Been responsible for IS infrastructure and has worked on numerous small to large projects. Role involves maintaining relationships with managed-service providers and vendors.
IST_ID4	Local IT	Junior Technical Analyst. Does development work and uses collaboration and communication solutions. Supports and handles ERP related requests and changes. Maintains constant communication with system users and providers.
IST_ID5	Local IT	A junior support analyst, who is involved in configurations, environments, and servers. Other tasks include helping to setup communication and collaboration tools.
Others		
OTH_4	Supplier	Involved in installation of hardware, telecommunication and software. Also facilitates knowledge transfer to various organisations' IT resources.

Table 5-4: Participant profiles

In this study, IST was given a mini-case statue because of the specificity of its operations. It was possible to place a boundary around their function. The respondents utilized ICT for most of their work.

5.6.2 Case Findings

IST uses the virtual team strategy to connect local IT teams with outside partners (such as applications service providers). Unlike ADT where dispersion of work was determined by the complexity of their task (e.g., quality assurance testing), IST's dispersion has more to do with the workflow design. Stakeholders are tasked with supporting *services* on certain sites, including after-hours IT support. Based on these structural characteristics, Schweitzer & Duxbury (2010) could argue that it qualifies them as working virtually.

5.6.2.1 Project organisation

IST is generally considered a head office unit, with the primary role of being operators and managers of Information Systems. A team of IT staff has to work together with applications service providers to deliver some of its services. Consequently, projects and post-live operations cross boundaries of space. Respondents explained that the nature of their work often required groups of collaborating teams within the enterprise. People with a range of skills frequently work together, bringing their domain knowledge to the group.

There were a number of instances in which individuals on the staff of a local IT team would collaborate with external stakeholders. For example, by bringing managed-service providers into the ERP support structure, the deploying organisation is able to proactively support and evolve their system. This contract between local IT and their partners is illustrative of member virtuality (Schweitzer & Duxbury 2010). Application service providers and local IT perform most of their shared task without meeting face-to-face. Role differentiation also makes this possible.

External consultants are sometimes embedded with in-house teams to assess the overall IS systems. Auditors also visit periodically.

Figure 5-5: Illustrations of Product Development Workflow & Road Map

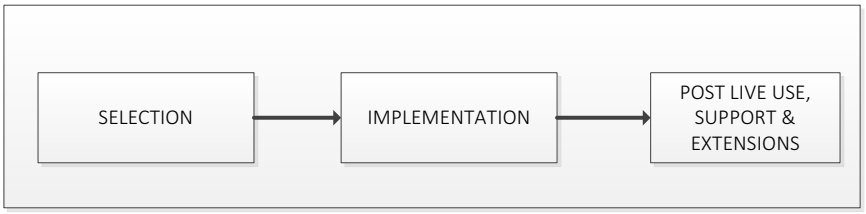


Figure 5.6 (above) illustrates that an ERP programme typically goes through three phases. Each phase contains a series of sub-tasks which can be communicated and appraised independently. In this respect, a robust communication infrastructure is of paramount importance to the programme. Information portals are also central to ERP delivery and support. These portals are "shared information repositories" where ERP stakeholders can review projects and system changes. On the one hand, it ensures that everyone not only has information on live/active projects, but they also know what people are changing.

In speaking of information portals, an IST interviewee explained that:

> *"We have a portal and we have SKMS (skill knowledge management systems). This is where we have all our tasks, policies and guidelines. So it is like a knowledge resource portal (IST_ID4)"*

Creating a shared information repository allows gaps in current operations to be identified and addressed.

A respondent emphasised the importance of system projects following an incremental work methodology (IST_ID2). Large changes and succeeding application integrations should span several weeks. The success of ERP projects would be reflected by the extent to which the group of collaborating teams/individuals properly integration and support various systems. Further, the function of service management is loosely guided by frameworks such as ITIL. These frameworks were used to organise and visualize work across the project organisation.

5.6.2.2 Virtual Team Areas and Perceptions

This section begins with discussions on the participant's fundamental understanding and experience of a virtual working environment.

A virtual team was perceived and described in different ways. Some views were based on system managers not being able to correctly account for or guide their subordinate's daily activities. An interesting low level-code that emerged to offer a richer interpretation of this issue was the ability for team members to be *'invisible at work'*. In other words, participants believed that it is difficult for a team that is virtual, to visualize how and when their members (peers or leaders) are undertaking task - even if they are aware of the processes they are supporting. As one respondent reflects *"…you get detached… [It's almost like] you're in a world of your own*".

A junior technical analyst explained that the virtual working environment provided some level of autonomy and freedom:

> *"As a virtual team I think I have some level of autonomy. I am not being micromanaged. I am allowed to make decisions on my own – as long as it is within the remit of my work. I am allowed to take any corrective action to resolve any situation I am in (IST_ID4)."*

In this sense, working virtually is indeed 'independence' to the analyst. This is owing to the fact that ERP-related tasks can be clearly specified. However, this freedom brings added responsibilities to team members in terms of self-management and performance assessment.

From a collaboration perspective, virtual team members are not only independent, but are encouraged to take initiatives.

> *"If no one is around I have to do what I need to do. I make decisions by myself and report it back to my manager to let them know how I have gone about it (IST_ID5)."*

There are advantages to autonomy. The benefits for a project organisation include ensuring that team members maintain ownership of tasks at all levels (Zhang et al 2008). This can translate to increased performance (Daim et al 2011; Zhang et al 2008).

Nonetheless, autonomy can result in increased communication overheads. It can also lead to misinterpreting signals and cues arising from cultural and language differences.

"[…] We have got different accents. The way I speak is different from the way [another person] would speak. Culture plays a very huge role because we come from different backgrounds (IST_ID5)."

Other respondents tried to contextualize their experience with statements such as:

"I think we work (aim) to encourage shorter face-to-face activities and more use of methods like [phone] calling. The annoying thing is [that] in this diverse workforce you just see people talking funny'" (IST_ID4)

These requirements provide a frame of reference for the communication behaviours of a virtual group.

Schweitzer & Duxbury (2010) noted that speaking different languages is common-place in virtual teams. It is also a major challenge to communication. For Bell & Kozlowski (2002), effective communication becomes more problematic when teams span different boundaries, such as cultural and language boundaries.

Distance is central in the practice and understanding of team virtuality to the extent that any discussion of virtuality begins with the notion of distance. In describing what it means to be working in a virtual setting as opposed to non-virtual, all respondents portrayed a work arrangement in which people are spatially separated. An outcome of spatial separation is that individuals do not have to work face-to-face most of the time. Likewise, members' independent contribution is valued from the distant location, meaning that IST stakeholders from various site help to ensure project success.

Respondents argued that the distributed nature of an ERP environment meant that most members do not interact extensively with other members:

"[For virtual teams] I'll put face-to-face interaction at 30%" (IST_ID3)

Another vivid manifestation of the lack of face-to-face interaction was in an IT consultant's use of "virtual communication", which he attributes to "70%" of project time. He also stated: *"I don't do more than 30% face-to-face. The remaining is over the telephone, and video conferencing".* As discussed in Chapter 3, several researchers argue that virtual work can be characterized by the lack of face-to-face interaction (Kirkman et al 2004; Schweitzer & Duxbury 2010).

Notwithstanding the argument above, the IT consultant (quoted earlier) was keen to present a virtual setup as one where members were not only separated by distance, but also relied heavily on communication technology:

"When you say virtual you mean that people that are in different locations and using technology to communicate. It can be via VC or Skype or Via messaging or using Basecamp, especially for developers.

Expanding on why communication technology is vital, he further noted:

"[The analyst developers] have got a platform where they can share work. I think this is what it means to be virtual (IST_ID1)."

Of course, the heavy reliance on technology for sharing work is a consequence of not being in the same place. This view has consensus in the literature (Dube & Robey 2008; Bjorn & Ngwenyama 2008; Schweitzer & Duxbury 2010). Themes relating to communication practices and media choice would be discussed in a later section.

A service management specialist also tried to contextualize his virtual working experience with discussions on" shared reporting dashboards". These are technology components that simplify work coordination and standardize reports. It also gives stakeholders information on the status of IT incidences. The spatial distance between team members complicated the coordination of work during a service crisis. It causes delays. This may be why Dube & Robey (2008) argue that effective and standardized communication is required to manage a dispersed work arrangement.

Among the words used by respondents to discuss their experience within a virtual work arrangement was 'hot desk'. This practice meant that people on the staff of a site and those who visited from other sites could work - on a temporary basis.

"[Working] in client sites or in various offices you hot desk (IST_ID1)"

"There are no assigned desks for IT support. Support staff should be moving around supporting and not seating (IST_ID4)"

Due to the subjective nature of virtual work, it was not surprising that the perceived scope of focus given by respondents was sometimes very broad. One respondent found difficulties identifying the boundaries of a virtual team:

"A virtual setting can be to any scale. It can be within your team; it can be within your organization. It can be inter-organization. It can be inter-country. It can be inter-continent" (IST_ID2)

Even though this participant's perception of a virtual team encompasses many concepts, when the above comment is analysed together with other comments (see below), a key theme can be identified. It is possible to observe features of geography in the participant's understanding of

working virtually. Likewise, the value placed on a virtual team strategy includes boundary-spanning communication. These are illustrated in the extract:

> *"It also helps with outsourcing. If for example your company is in the UK[22] and you have some other skills that is available abroad – the people don't have to go out of the UK to work so that means that you can source skills outside of your domain without having to employ people or relocate them to where you are."*

Relating to the IST context, a virtual work environment provides the deploying organisation an opportunity to outsource local IT services as well as source skills from other domains.

Taken together, the various aspects of virtuality could have both positive and negative influence, depending on the context. One positive characteristic is work responsibilities can be fragmented and shared across locations; with team members taking ownership of tasks. The negative side is that separations (distance & work process) increase the overheads and risk in communications across virtual team boundaries.

5.6.2.3 Boundary-Spanning Communication & Task completion

Although IST does not have an explicitly stated virtual working strategy, it was possible to identify phenomena associated with communication practices. One support specialist, for example describes the need to adjust his natural ways of talking.

> *"We manage operational services, sometimes via video conferencing, so yeah it is just about human contact. People can't talk properly. [But] when we are sitting in the same room the effect of having to talk one-on-one is there." (IST_ID3)*

An effect of video conferencing was that team members don't always converse properly. Similar points appeared in multiple comments; it is suggested that some people are constrained by the communication media. While video conferencing is valued, it affects how the communicating parties interact when managing operational services.

In describing when video conferencing should be used, a service manager suggested that it is suitable for *"meeting (s) with the entire team".* Another comment is presented below to reflect the same point.

[22] The respondent used a UK – Outsourcing relationship as an example - just to demonstrate and better illustrate the point that was being made.

"If I were doing one-on-one I would not go to the VC because it is like a big room and it is not that effective when you have to do one-on-one video conferencing. But if you have to communicate among a large number of people, say up to 10 people or more- video conferencing is ok. If you have to do one-on-one, I think I'll rather use IM as opposed to VC."

One thing that stands out from the respondent's comments is that VC facilitates communication among a large number of people.

Remote connection has been very useful as it enables the virtual team members to still function in the case of adverse weather conditions. Stakeholders spoke of clocking in hours from home.

"From emails, to telephone, to messenger to VC – I think technology has played a huge role. It even allows working from home. This is another advantage that technology has enabled (IST_ID2)"

Participants attached varying levels of importance to working remotely. On the one hand, an IT consultant emphasised that it was essential to meeting "billable hours" target. For a service manager the value appropriated from clocking hours from home via remote connection was equivalent to the value placed on "service delivery". Working remotely allows service managers support "second-line support teams" anytime, and from anywhere.

In fact, remote connection has transformed how project artefacts are developed and supported. It promotes real-time visualization of work items. The consequence is reduction in virtual collaboration difficulties. A consultant opined:

"You can share your desktop [screen], but again, virtual collaboration or communication is more than that. It is an important way of how we now work (mostly in the case of [adverse weather conditions.])".

The second part of this viewpoint (see below) suggests a preference in working from home or ad-hoc locations as opposed to traveling to a particular site. In this sense, the respondent thought it more effective to do actual work than waste valuable time commuting. It is not unreasonable to suggest that the pressures associated with meeting 'billable' hour targets make time a very valuable commodity for the IT consultant.

"I don't want to spend the whole time traveling when I can be working"

However, local IT team members reported that they rarely worked from home and their managers seemed less tolerant of people working from their houses. They prefer the traditional work system where people go to a fixed place of work every morning.

For one thing, the virtual setting, - enabled by communication technology - creates value for the virtual team as it makes work items available 24/7, from any *place of communication* - with a network access point. This allowed employees to fit their organisational work into their personal circumstances. Even more important than that, it empowered virtual team members to work freely, as they so choose.

> *"I [feel trusted to] take control of where [and how] I would like to work, but that doesn't mean I can (act carelessly)",* he continued.

It is tempting to classify IST as hybrid because it is similar to those described by Cousin et al (2007) and Staples & Webster (2008). These authors argue that a team has a hybrid structure if part of the team is local to a collection of team members, and another part is remote.

5.6.2.4 Media Capabilities

So far, it has been discussed that most virtual team activities involve the use of communication systems. Technologies such as video conferencing, messaging systems, traditional telephones and information portals are used to communicate, collaborate and learn about others' work, challenges and skills. As discussed in chapter 3, most communication systems have a wide range of functionalities ranging from stand-alone chat messaging to voice, team awareness and content management.

Analysis of transcripts and documentary materials reveal that artefacts associated with ERP system delivery and support do not conform to everyday vocabulary and therefore need to be written down. Text-based communication media ensures accuracy and consistency throughout a project life cycle. For example, build scripts, test parameters and configuration elements can be communicated more accurately. Most of the communication behaviour models (see chapter 2 above), although contextually different, acknowledge that communication media vary in their ability to support information transmission. The media capabilities according to the media synchronicity theory are: parallelism, rehearsability, reprocessability, symbol variety and transmission velocity.

IST stakeholders made use of various technological solutions for their day-to-day communication. Some participants identify IM as being a very effective medium for one-to-one interaction. An earlier quote from a service management specialist:

"If I am having one-to-one with my colleague I use communicator" [IM](IST_ID2).

One reason for using IM was its ability to deliver short messages. Although it is an asynchronous text-based medium, there is a general expectation that message recipients should respond promptly, meaning that it imbibes some of the attributes of synchronous communication. Because members used it for one-to-one communications, there is a high degree of freedom and informality.

"There is no formal format [for communication] (IST_ID2)"

"(Usage) depends on what you want to achieve (IST_ID5)."

Converging with the literature on global projects with respect to communication, empirical research provides insights to the benefits and usage of various communication media by virtual teams. For example, Niinimki et al (2012) found IM to be informal, yet efficient. It has a positive impact on project communication and performance. This is because of its "near simultaneous delivery of messages" and the fact that grammar, spelling errors or shorthand are normally overlooked. In fact, the authors suggest that because little or no emphasis is made on communication etiquette (like in the case of emails), communication performance can be improved.

VoIP was another communication media discussed by respondents. VoIP allows voice and data to be transported over digital channels such as the Internet; therefore, it was very useful in making work progress visible. Most VoIP systems support display and writing; these capabilities enhance the demonstration of project components. Seemingly, the creation of shared understanding, progresses more efficiently when VOIP systems are used.

The media synchronicity theory articulates that synchronous communication such as video conferencing provides high velocity, low parallelism and low rehearsability (See chapter 2). An outcome of using this type of communication media is that team members experience high feedback on cues and signals.

Several researchers provide evidence in support of MST. For example, Deluca & Valacich (2006) applied the theory in their study of virtual teams involved in process improvement activities. The authors articulated that communication tools high in transmission velocity were very useful in building shared understanding and focus. Dennis & Garfield (2003) also conducted a study of

media capabilities, and communication behaviours. The study results indicated that the structural capabilities of a media affect the way a team functions, and subsequently its performance.

Notwithstanding the discussion above, one respondent explained that the overall usage of video for remote meetings was quite low in his site. Even when video conferencing was booked in, there were frequent cancelations and rescheduling of meetings.

> *"[…] we normally cancel [VC] meetings. It free ups time for me but sometimes you have made up your mind [to attend the meeting] and made your own schedule to align with that meeting and all of the sudden it is being moved or cancelled. But again, some of these things you can't eliminate them in an organization like this."*

In fact, the comments indicate that team members sometimes benefit from cancellations of meetings because it frees up time for other work.

IST stakeholders spoke about the relevance using workflow and information portals. Here, teams could not only trace their processes and progress, but they could navigate through 'issues'. IST members also made their work visible, using different flow diagrams and technologies as tools to capture and demonstrate incidences. What is apparent from the above findings is that information transmission within IST (conveyance) does not require people to be working together at the same time. These platforms allowed team members to visualize incidences and keep others informed on work progress.

In response to an interview question on when and why asynchronous communication systems should be used, a respondent states that emails can be used to inform others of work coming their way and to notify people of changing priorities.

> *"Email communication is one strong point for virtual team effectiveness. Team member would want to know in good time the piece of work that is coming their way (IST_ID5)"*

Embedded in comments on whether or not some electronic mediums are more effective for communicating with certain people, a respondent advocates email communication.

> *"Emails are useful because changing priority is something that people are not too comfortable with (IST_ID1)".*

In addition to unveiling patterns of technology-use, data analysis also revealed information on when and how IST stakeholders use face-to-face media. A face-style team meeting was usually triggered by 'major incident review'.

"I think, if we need to do a major incident review that involves talking to other members of my team, we have to come face-to-face."

It is not unreasonably to state that future performance and face-to-face interactions are related to each other.

"If we have got a major outage that we need to do review, I always like to do a face-to-face meeting (IST_ID2)."

Furthermore, face-to-face meetings were found to be an important way of reviewing end-of-year achievements (again demonstrating a link between future performance and face-to-face interaction). Face-to-face interactions were used to review technical challenges and to provide feedback on individual performance.

"[Face-to-face media is used] when we have what we call end of financial year meeting. Yes we would always like to come face-to-face (IST_ID1)".

Paradoxically, the IT consultant noted that face-to-face interactions could be a source of distraction. Recanting an experience from a strategy review meeting the respondent states:

"I am comfortable with the frequency of the meetings. Initially they wanted to have f2f meetings every month, but we realized that it wouldn't be sensible because of other piece of work that the members of the board have to do on their day-to-day job roles. So, we made it bimonthly. I am quite comfortable with that."

Within a development project context, frequent trips to a particular site may be unnecessary. And can cause delays.

5.6.2.5 Team Functions

As discussed in chapter 2, the Media Synchronicity Theory has been used to propose a relationship between media capabilities, communication processes and team functions (Dennis & Valacich 1999). With reference to team functions, it provides insights into how and to some extent, with whom an individual may communicate with. Dennis et al (2008) contributes to the understanding of team functions when they discuss 'user familiarity'. Relating this to MST, the authors argue that different members of a virtual team, performing the same task could have different levels of familiarity based on experience with the task, with each other and with the media.

The team functioning dimension of Media Synchronicity Theory was built on some fundamental assumptions of TIP Theory (Time Interaction Performance theory) (McGrath 1991). The theory focuses on the idea that virtual teams perform three functions: (1) member support (2) group-

well being and (3) production. Further, group development comes from performing activities associated with these three functions. Some of these activities are related to norms, values, ground rules for team interaction, members assuming roles, establishing status and member position.

- *Values & Norms:* With reference to how the team functions, some behaviours are manifestations of culture. IST provides similar observation:

> *"Some people speak very fast. While some people speak a-bit slower – like my self. So yes, culture is one very strong factor that could influence effective communication among different virtual teams* (IST_ID5)"

It is especially worth noting that there was no consensus to the role of culture within a project setting:

> *"I'll not say culture plays a role. I don't think so. "*
>
> *"[I don't] see culture playing any major role in selecting the means of communication I want to use (IST_ID1)".*

- *Trust in virtual Interaction:* To scrutinise the level of familiarity amongst project members, questions were also asked about "trust" within a virtual team. On how trust develops, here is what some respondents had to say:

> *"So for people that you have not met and shook their hand, I think it is very tricky to rely on everything they tell you. I'll give you one scenario when I was conducting an assessment interview. When I was doing the interview over Skype, I was asking for some evidence, a team member promised to send it to me and even do some screen shots; I was contemplating on how much I would believe what she is telling me. What I am saying is that for people that you have shook their hand before, the trust would be there. But for people you have never seen in your life, it is difficult (IST_ID1)"*

The respondent emphasised that it is difficult to trust someone you have not had physical contact with. Another respondent states that trust develops when you have to see and work with someone regularly.

> *"I think it is human nature that it is easy to build trust with people I see every day rather than people you don't see."*

In the above sense, how is effectiveness in project ensured? The empirical data points towards other situational factors (see below).

- *Authority, Seniority & Hierarchy:* With the view of adding value, people take on multiple roles. One participant emphasised that some virtual team members tend to take on multiple roles. They act as leaders within their teams or as 'auditors' across sub-groups. This has created opportunities for them to assume higher-level responsibilities beyond the remit of their assigned job.

> *"I take on other roles. For example, I ensure that the [various] teams are doing the right thing. I try to do some kind of gap analysis of where they are and where they should be"*

More specifically, a virtual team arrangement has enabled the alteration of management structure and processes within the ERP domain. This has resulted in some team leads acting as managers over their peers.

The above respondent used a real life scenario to illustrate when he extended his authority across other groups:

> *"We expect other teams to be aware of the level of backup that is being done on their behalf. For example, you have the developers, and the operations team. These people work side-by-side. You would expect that their data is running on an infrastructure and a back up software backs this data up. However, you don't just want those teams to assume that their data is being backed up and being restored – without them knowing what is being done on their behalf. Not only that, you want to ensure that the right policy is set. This is just one area there is influence over other teams because it is what you define in this area that would guide the (backup) team to define that policy. This is just the idea behind that (extending my authority across groups).*

Again, an operations infrastructure respondent assumes higher-level responsibilities within his team and across sub-groups. His motivation for establishing a lateral channel of communication with service providers, for example, was *"to ensure that [internal] customers receive adequate service to agreed SLA's* (IST_ID3)".

The literature suggests that when virtual team members either take on multiple roles, assume leadership or create lateral channels of communications, conflict and ambiguity is bound to arise (Bell & Kozlowski 2002). This is because they complicate decision-making.

According to the team functioning dimension of MST, activities that define group development and production functions mostly arise after a significant transition. This includes changing policies as observed in IST.

> *"Because as we progress, those policies change and we want to update ourselves. We are the team that role out those disciplines across the whole organization, so for us to do it effectively we must ensure that we are on the same page within my immediate team. We must ensure that we keep ourselves up to date with policies and processes and procedures to ensure that we are passing the right information. (IST_ID4)"*

What is apparent from the above comments is that successful conveyance and convergence of information can be beneficial to a virtual team.

- *Sustenance of Value:* At the end of every interview, participants were asked to mention any additional practice which might have been overlooked, but had influence on outcomes. There was no prevalent response.

5.6.2.5 Infrastructure

Generally, users were rarely satisfied with video conferencing for reasons such as connectivity.

> *"Meetings are cancelled if for any reason the virtual technologies are acting-up or not working properly."*

> *"Some time back, in one board that I manage, we had to cancel a meeting when we couldn't get the VC working properly. It causes delays if we can't get it right. This sometimes led to cancelation of meetings or presentations. "*

Network disruptions are a common occurrence in Nigeria. A number of factors such as the bandwidth, can influence the extent to which virtual technologies can be used for team meetings.

5.6.3 Summary

First, the analysis suggests that exploitation of technology, product design needs, and electronic integration of practitioners are working concurrently within the ERP programme. It creates an organisational architecture where there is a high level of interdependence; a recipe for temporal gaps (i.e. a gap of time, space, and even culture) (Watson-Manheim et al, 2002; Chudoba et al 2005).

Second, the findings indicate that even though individuals maintain ownership of tasks and work independently, they also continuously adjust to the work outputs of others. In this sense, the IST case may also be illustrative of one of the paradoxes in virtual teams (See Chapter 3). Dube & Robey (2008) articulated that at the heart of virtual teamwork are contradictions such as "interdependent" work being accomplished by members "independent" contribution.

Third, communication effectiveness is based primarily on the media adopted for handling virtual team tasks. In this regard, communication media affects the level of synchronicity experienced (Dennis et al 2008).

Together, the findings are consistent with the literature (Schweitzer & Duxbury 2010; Dube & Robey 2008; Watson-Manheim et al 2002) as well as the fundamental assumptions of the Media Synchronicity Theory. However, some additional findings not made explicit by the MST were also identified: it is reported that some communication behaviours are driven by infrastructure factor.

Chapter 6 : Discussion

6.1 Introduction

The previous chapter determined how the adoption of a virtual team strategy adds value throughout the duration of a development project and who appropriates that value. A model is developed based on the key findings (see Figure 6.4 below). It highlights both virtual team characteristics and their communication behaviours.

6.2 Virtual Team Domains (Distance and Work process separation)

The definitions of team virtuality are wide-ranging and encompass numerous concepts. Common conceptualizations in communication and teamwork literature relate to: boundaries, fault-lines and discontinuities. As discussed in Chapter 2, researchers have examined a variety of boundaries such as spatial (e.g. Suh et al 2011; Sarker et al 2011); configurational (e.g. O'leary & Mortensen 2010); intra-team boundaries[23] (e.g. Gibson & Gibbs 2006; Daim et al 2012) and temporal (e.g. Wilson et al 2013; Espinosa et al 2015). These streams of research have revealed differentiating factors among various types of virtual teams. Scholars have also highlighted the effect of different aspects of virtuality on performance (e.g. Bell & Kozlowski 2002; Schweitzer & Duxbury 2010). Despite the sound theoretical arguments in the literature, a virtual team strategy is not easy to understand or practice. This owes to the fact that 'virtual' is a relative term and there is a lack of proven best practices for working in a virtual environment.

Unsurprisingly, the first empirical observation was that a virtual team is not easily described. Participants could say they were implementing a virtual team strategy, but proving this was a totally different matter. On the one hand, it became obvious that a virtual team strategy had been widely accepted within their organisation, but it had not been deliberate or probably not well communicated. Their uses were copious, including being a by-product of their pursuit of 'faster communication plus quality service'. On the other hand, some individual references (to the virtual team concept) were ambiguous, in terms of participants not elaborating on what it means to be working in a virtual setting as opposed to non-virtual; or them having no direct opinion on communication issues. Thus, the virtual team practice (as opposed to theory) could be referred to as being unfocused.

[23] Intrateam boundaries include cultural, organisational, national and other socio-demographic differences differences.

However, the areas of virtual teamwork as conceptualized and practiced by research participants were: (1) distance awareness *(where people are)*, which was driven by network access, reporting lines, and socio-cultural boundaries; (2) work process separation *(how people work)*, which emerge from the fragmentation of work and autonomy.

These findings speak to relativity around the theory and practice of virtual work. It also demonstrates the value of Watson-Manheim et al (2002)'s concept of discontinuities. Generally speaking, discontinuities as opposed to boundaries or fault-lines, set focus on the underlying process issues and the potential challenges arising from unknown boundaries or invisible/difficult to identify boundaries (Watson-Manheim et al 2002;) (See chapter 3).

As discussed above, there was a consensus among the interviewees that the most critical feature of a virtual team was that they cross boundaries of space. For Chudoba et al (2005) this means that team members require some effort to interact in a face-to-face manner because they are separated by distance. In fact, the notion of 'distance' within a work arrangement has taken an increasingly expansive definition in literature. In the mid-70's it signified working from home (Nilles 1975). It later denoted the bringing together of skilled people (Bell & Kozlowski 2002) and the salience of work practices (Hightower & Sayeed 1996; Maznevski & Chudoba 2000; Cohen & Gibson 2003). More recently, the term 'distance' was expanded in studies on geographical dispersions (Chudoba et al 2005), and subsequently operationalized as one of the dimensions of virtuality that determines the degree to which an organisational team should be considered as virtual (Schweitzer & Duxbury 2010; Suh et al 2011).

In practice, however, there were some subtle structural differences between the three cases (i.e. ADT, BST and IST). From the analysis in Chapter 5, the researcher was able to deduce what the various work systems do. This corresponds with the characteristics that distinguished one virtual team strategy from another. For instance, ADT was a work system that played a dominant role in the design, delivery and extension of ERP system components. A virtual team strategy was used to connect project members and channel partners that were based in various locations. Additionally, it allowed for the coordination of activities within key areas of expertise, like *Networking, Application Design, Infrastructure* & *Oracle DBA.*

Work in ADT was flexible but not shift based. A 'day' required 8 hours of project-based activity - although team members did not have to adhere to the typical 9am to 5pm work model. That is, people could start and end work at any time, as long as they log in 8-hour on their time-sheet. This may help explain why ADT was not perceived as more 'temporally separated'. Temporal distance as described by Espinosa et al (2015) refers to "*the work schedule difference between two people, due primarily, but not exclusively to their time-zone separation"* (Espinosa et al 2015,

p. 152). Furthermore, the field study indicated that sometimes people modified their work schedule in order to overcome some of the challenges faced by virtual teamwork. In this regard, they worked at odd hours or exceeded their 8-hour workday in order to interact with those who did not operate from their site. Themes relating to communication practices and media choice would be discussed in a later section.

From analysis of secondary data, which include project documentation such as risk registers, it was made clear that a virtual team strategy increased communication overheads and risk of misinterpreting signals and cues arising from cultural and language differences. Hence, the ADT case may also be illustrative of socio-cultural boundaries and its impact on the perceptions of virtuality in teams. Some interviewees commented on cultural and language differences, especially regarding people's accents.

Notwithstanding the arguments above, 'distance' was not the only key aspect of team virtuality identified in this study. In the provision of an ERP system, ADT stakeholders utilized the software development concept of fragmenting design responsibilities to divide their work and limit interactions. Practitioners also used frameworks and diagrams as tools to capture and demonstrate requirements as well as visualise processes, and product backlogs.

It was also discussed a number of times in the interview that the fragmentation of the unity of work (such as ERP software components) meant that software teams - although independently working - could not complete an ERP project without relying on other people and sub-teams. Stakeholders were executing their task from different locations, including ERP design and implementation sites in Nigeria. In sum, work process separation had considerable effect on ADT member's interactions.

Table 6-1: Virtual Team Domains & Perceptions in ADT account

Virtual Team Domain	Area of Activity	Some Examples
Distance Awareness Work process separation	Network access & technology. Socio-cultural Autonomy & fragmentation of work. Reporting lines.	Connecting in-house software teams with channel partners; And the understanding that distance affects coordination of requirements. General perception of having to deal with multiple accents. Project members do not adhere to the typical 9am – 5pm work model. Project organisation gives ERP stakeholders some flexibility on work schedule. ERP software component being developed and deployed in physically separated locations, resulting in team members choosing a medium based on its capability to support project communication activities and quality. Lack of total control over task process; work allocated to people based on their specialization and domain knowledge: high level of interdependence and complexity in task

In the second case, virtual teamwork manifested slightly differently. As the BST account (section 5.6) demonstrated, a virtual team was designed to contain the most appropriate roles for an ERP implementation. The software system has a far-reaching organisational impact and therefore requires practitioners from areas such as sales, finance, human resource, and inventory management. The resulting structural characteristic is that project teams transcend boundaries of not only location but also function.

However, most of BST's operations were not very geographically dispersed. Team-level data suggested that members could walk or drive to have face-to-face interaction with one another. Most of the interviewees were relatively close to one another because they worked in the same city. Head office, a sales agency and a manufacturing site were just miles apart. The cost, in monetary terms, of arranging a face-to-face meeting was minimal. In other words, stakeholders had close geographic proximity, and so organising face-to-face meeting required little effort. As Schweitzer & Duxbury (2010) remarked, when the spatial distance between team members is small, a team may choose to have regular face-to-face meetings.

As alluded in Chapter 5, the manufacturing sector in Nigeria is constantly emerging so the ERP system needs to be flexible to accommodate uncertainty. Thus, a virtual team strategy allows the deploying organisation to not only comply with local agreements, but also respond promptly to the changing ERP system requirements. More specifically, virtual team interactions enable both convergence of knowledge and swift transmission of information (conveyance) between local employees and expert stakeholders.

As discussed earlier, work process separation involves fragmentation of unit of work and autonomy. BST did not exhibit the same characteristics as ADT in that they acted like an administrative unit and project organisation was akin to a Matrix structure (Mintzberg & Sumantra 2002). Division of work was not determined by the complexity of their task. Likewise, the proportion of time team members worked on an ERP related task varied. This was because development projects were not part of a BST member's day-to-day job description. In earnest, people held multiple organisational roles. On completion of a particular project phase or situation, stakeholders returned to their original function. For example, during high-level design, the role of BST was to convey information to the software system designers because they had limited knowledge of business processes and organisational policies.

By developing a strategy that improves intra-organisational activities, the ERP programme experience improved speed. With respect to theory, information conveyance facilitates speedy completion of a task, whilst convergence promotes task quality (Dennis et al 2008; Espinosa et al 2015).

Table 6-2: Virtual Team Areas & Perceptions in BST

Virtual Team Domain	Area of Activity	Some Examples
Distance Awareness	Location. Network access & technology.	BST members initiating change from sales, manufacturing and head office site.
Work Process Separation	Socio-cultural. Reporting lines.	Connecting with people from other functional boundaries.
		Having to deal cultural and tribal issues.
	Autonomy	Indications that distance affect how requirements are negotiated. ERP projects reliant on those who have knowledge of organisational process, local content policies.
		Using technology to contribute to development of indigenous employees; bringing knowledge to bear in solving problems without the need for expert relocation.
		Requires low level of interdependence and complexity in task.

In the third case account, group-level data did not indicate that IST had an explicit virtual working strategy. Rather, the interview data illustrated interdependent action of sub-teams and individuals within them - as they functioned around the clock to provide and support IT related services. In addition, 'remote connection' ensured that proximity was not critical to their task. Hoch & Kozlowski (2014) described proximity (distance in miles) as one of the seven indicators of geographical dispersion. Their operationalization of this component of team virtuality was in part based on the work of O'Leary & Cumming (2007).

Most IST interviewees commented that one way a virtual team strategy could be conceived under their work condition was through electronic workflow across physical sites. With respect to communication, interactive dashboards and workflow diagrams were tools that aided the amount of information transmitted within virtual team members. This supported incident review and resolution. Frameworks such as ITIL were also used to support the fragmentation of work and standardization of processes.

Other team design elements include, the use of hot desk and members working from home. The latter was nonetheless rare and discouraged by managers.

Drawing from the literature supported by this study, it is argued that as the distance between team members increase (e.g. different city, or different region), it gets more difficult to get individuals and teams to exchange information in a face-to-face fashion (Herbsleb & Grinter 1999; Chudoba et al 2005; O'leary & Mortensen 2010). Wiredu (2011) also contributes to the understanding of virtual team domains, but like Magni et al (2013), they collected data from software development respondents as opposed to infrastructure support. In this regard, more research is needed on other forms of virtual collaboration.

Table 6-3: Virtual Team Areas & Perceptions in IST

Virtual Team Domain	Area of Activity	Some Examples
Distance Awareness. Work process separation.	Network Access & technology.	The substituting of mediated communication for transportation to sites when having to provide support.
	Socio-cultural. Autonomy Reporting.	Physical distance between managed service partners, server sites and application deployment locations. This introduces language and cultural challenges when resolving issues.
		Hot desk allowing team members to work in any site on a temporary basis.
		Monitoring activities & SLA for service providers and local IT necessitates virtual team leaders to extend their authority over multiple teams and members to assume roles.
		Requires high level of interdependence but with individual independent contribution.

The understanding and practices of ADT, BST & IST shows that a virtual team spans degrees of virtuality. The evidence from an ERP programme, then, is consistent with research (e.g. Chudoba et al 2005; O'leary & Cunnings 2010; Schweitzer & Duxbury 2010), which suggests that distance and work characteristics are key components of the virtual team strategy. They however, put in motion mediating processes. ADT, BST and IST interviewees engaged in boundary-spanning activities (task and social information) as well as media decisions.

6.3 Aspects of Virtuality with Communication Media Capabilities & Performance.

The fragmenting of product-design responsibilities made communication systems important if the virtual team must sustain its value. In fact, the three cases researched showed that individuals behaved differently based on the set of tools, protocols, and policies available to them. By shifting to an appropriate communication media, they increased their chance of being effective. For example, in ADT, face-based interactions were better used for verification of requirements. In addition, 'quality' appeared to be a common goal that engendered high levels of face-based interaction, and consequently synchronicity. When a lot of emphasis was put on the quality of information exchanged, communication media high in feedback tended to be more acceptable.

Face-based media (face-to-face, video conference) supports a high level of synchronicity because it provides immediate feedback as well as supports a variety of symbols (from gestures to body language, the tone of voice, etc.). For ADT, these were vital to their performance. Accuracy was important in the design and deployment of an ERP platform.

As discussed above, face-style meetings allowed individuals to make project inputs as well as obtain commitments from other. Interviewees considered it to have the best capability for bidirectional feedback. However, some comments in the BST data suggested that face-to-face communication could be detrimental to team performance. Respondents revealed that the way some seniors use face-to-face media negatively affects project work. Even though face-to-face communication could provide high synchronicity, the contrary occurred occasionally. Such situations are affected by social functions (in the section below).

Besides engaging in face-to-face interaction, ERP stakeholders also engaged in Video conferencing (VoIP)[24].

> *"[Video conference] can be quite useful to give everyone the option to obviously contribute, and you can then tell them 'this is what I would be doing', this is 'how long I expect it to take'. There would be mutual consent as well."*

[24] Note, due to the fact that research data was collected via interview questions and secondary documentation, it was difficult to ascertain the frequency of their use. The interview questions did not inquire about the frequency of media usage.

VoIP is another same-time media with bidirectional feedback

On the one hand, ADT members preferred to communicate using video rather than emails, when discussing details of a software product. VoIP provided a rich environment for demonstrating ERP capabilities as well as exchanging information about units of code. It provided an enabling environment where developers could verify information and clarify issues with analysts. Conversely, BST members tended to accept emails as a suitable communication channel. According to MST, virtual team members have the ability to rehearse messages before dispatching them.

Emails support a low level of media synchronicity. By using email, virtual team members can transfer information amongst themselves. The Media Synchronicity Theory suggests that emails are appropriate for conveyance, but are not very suitable for converging on shared meaning because it offers limited emotional, attitudinal and normative cues such as gestures, body language. Also, messages from multiple senders are not transmitted simultaneously, making it unfitting for group discussion. From media-dependent theories (See chapter 2) and the work of Dennis et al (2008), when a task requires detail discussion or group decision-making, having a channel that supports immediacy of information feedback and restricted number of concurrent transmission of information between the team members is considered to be more appropriate.

It is important to re-emphasize the distinction between synchronous, asynchronous and synchronicity. When things are synchronous, they are taking place at the same time. A simultaneously occurring conversation between team members is synchronous. However, this kind of communication only produces synchronicity when the parties have common objectives and shared norms. Synchronicity by definition is the state of working together, simultaneously, with a common objective (Dennis et al 2008, p.581). In other words, working together, at the same time, without a common agenda does not generate synchronicity by itself. More importantly, a threshold level of synchronicity is suitable for either information transmission or information processing. In the Media Synchronicity Theory, these two communication processes are referred to as conveyance and convergence, respectively. If the conveyance process is not initiated, information relevant to a particular task remains unavailable. On the other hand, without sufficient convergence it may be impossible to create the shared understanding needed for the completion of the task.

The case evidence suggests that communication systems that support storage and tracking features help asynchronous activities. Thus, virtual team members can review work items a number of times. Tracking and storage capabilities also make it easy to examine team decisions at a later date. This was particularly useful for ADT members who worked with

complex software objects and had flexible hours. An earlier quote from an integration specialist:

> *So what we have is a system in place, which is like a content management system that maintains our requirements and notes, where different parts of the development team have access to the information. We tend to work with numbers, like a reference number for each individual request. That is something like a change request number. What that means is, it's easy for you to then track request. What you'll find is, we send emails, [but] imagine they are two guys on a project, one is in Lagos, one is in Abuja, they start communicating, and all of the sudden the project [phase] gets completed, two months down the line a new person is assigned to a project because there are new requirements and they need to obviously know what's been going on before. It may be very difficult to sieve through the emails or find those that worked before to give you documentation (ADT_ID4)"*

IST also had high affinity for communication systems that enable tracking and support. Their operation involved incident review and resolution.

Recall, the principle of media synchronicity suggests that decomposing communication media into its constituent components facilitates a more accurate portrayal of how a media, such as asynchronous technology creates variation in team performance outcomes. The structures provided by a medium include: rehearsability, reprocessability, parallelism, symbol sets, Transmission Velocity.

Nonetheless, making sense of the findings is challenging because media decisions can be perplexing. People choose when and how to use communication media for a variety of reasons (Dennis et al 2008). For example, respondents used conference systems for a number of reasons, ranging from promoting their skills to task coordination.

> *"Two ways I use conferencing calls, I use it from the point of view of collaborating with other team members and use it from a sales perspective as well. Selling my abilities, my accomplishment on a task [PROMOTING SELF] or as a first point of call. But hardly to notify someone else that I'm having a problem. Because it can be quite uncomfortable. At least if they read your email, and invite you for a conference call, then you know that there is a possibility someone has found a solution. Or it's already been escalated. You can then take that risk [with a conferencing system] (ADT_ID5)".*

The latter part of the comment above explains when a conference meeting is less appropriate. The ADT respondent notes that it is not well-fitted for notifying colleagues that he is having a problem. A BST interviewee also reflected this finding. He reports that video conferencing starts getting uncomfortable when people have to discuss their problems with the virtual team.

> *"In an email, it is not that hard to probably articulate problems and share them [But] often when conferencing you'll find people trying to put holes in your challenge, trying exactly to show it's your problem (BST_ID6).*

Another point that resonates with this respondent is that individuals try to avoid new responsibilities.

> *[People criticize and assign blames] Just to make sure it's not their responsibility to fix. And often you need a manager to sit back, read it and tell you how we'll proceed (BST_ID6)"*

Of course, applying the Media Synchronicity theory provides some insights into this communication behaviour. It is suggested that conferencing systems have low information processing characteristics. This may restrict a virtual team's ability to review information and think through the content of messages shared during conference meetings. The duration between sending a messages and receiving of a response is generally shorter in a video conference session, therefore people do not have time to consider previous messages relevant to solving the new problem. The implication is that people would end up avoiding responsibilities or assigning blames, rather than examining what has been shared. When conferencing systems are in use, rehearsability and reprocessability of messages is also reduced.

Email, on the other hand, has high information processing characteristics. It supports detailed review of message content as well as the deliberation on previously received information. As the BST respondent argues (above), with emails it is not that hard for an individual to articulate problems or develop an understanding of its solution.

Furthermore, an interesting finding from the ADT case was that, asynchronous mediums (such as online forum exchanges and boards) were truncated by the use of other asynchronous communication media, most often documents or portal resources like recorded videos/webinars. It is to be noted that most BST respondents did not perceive the use of online forums as a practice that has influence on their performance.

As discussed in Chapter two and three, MST has developed over the last 15 years to explain communication performance and has been applied in the prediction of media choice (e.g. in Carlson & George 2004). Of course, the effectiveness of the virtual team strategy and the performance of an individual are linked to the efficacy communication media. That said, communication behaviours also develop around a few thrusts/ media conditions, including: reliable connections and power supply. Individuals use communication systems to connect to others and access work items: collecting, demonstrating and displaying information/knowledge. This would be discussed in the next section.

6.4 Infrastructure

The emergent framework (below) outlines the existence of quasi-external agents. Virtual team members (leaders or peers) cannot always create their communication environment. They cannot do this because of their reliance on agents such as network operators, regulators and power generators (as vital in the Nigerian work context). For this reason, a reliable connection was a necessary condition for communication performance. Connectivity is best thought of as an infrastructure component. It refers to the extent to which communication can proceed uninterruptedly and as planned.

Furthermore, virtual team members rely on a '*code of connection'*. Virtual team members cannot always create their communication environment because of the need to adhere to regulatory frameworks. In describing how environmental factors have an impact on the effectiveness of a virtual team, an ADT interviewee with international consulting experience reports on constraints to information transmission.

> *"A risk is government policy around information security framework. If for example, [an international partner] want to outsource support to a company in Australia or china that are not part of the EU – what level of security clearance would you want to put them through to allow them to dial-in into the system? What level of trust or confidence [exists] that they would not mess-up with data? Is the code of connection framework the same? Is there any correlation between the countries policies or framework? How much data can we trust them with? – so those are the kind of risks that I think companies have to take in a virtual working scenario (ADT_ID7)".*

Although the above comment articulates communication within an outsourcing relationship, it highlights some necessary requirements for virtual collaboration.

An IST respondent who discusses the risk in virtual teamwork, raises a similar point.

> *"It is a bit tricky if the virtual team country that we make our connection is not using the same information framework as ours."*

Another respondent expresses a similar idea, but from a different perspective:

> *"… [There is] data protection, which is why the wrong person shouldn't get access (to information). And there are different regions as well and different countries have their own laws to make sure that a person sees the right information.*

In sum, code-of-connection is categorized as an infrastructure component in this study because it involves quasi-external agents. They make communication take place.

There is a dearth of academic research examining infrastructure factors, regardless of the fact that it influences communication within organisations that adopt a virtual team strategy. For example, the choice of media and the way in which it was used was in many ways constrained by regulatory frameworks, stable and reliable network connections. Thus, there is evidence for improving MST by creating a proposition that integrates infrastructure.

6.5 Findings related to Familiarity with Media

Another observation with regards to the case analysis was that there were very few references to *technology illiteracy* in the data. In fact, the transcripts with direct reference to this component were from BST. Cross-case analysis suggests different reasons for the above observation (See below).

First, ADT and IST respondents worked within a technological domain (software development/delivery and support respectively). This implies that their skills and comfort with technology was high. It may have influenced their perception of media appropriateness and the confidence they had in their media decision.

Second, the rapid changing nature of the business led to the initiation of many ERP modification/extension projects. Therefore, it is not unreasonable to state that because ADT respondents participated in many projects, they had more opportunities to use various technologies to coordinate their work. The effect is that their experience and skills using these technologies must have increased over time.

There are several models in the literature that explains people's familiarity with a media. As highlighted in Chapter 2, 'Adaptive Structuration' has been a prominent theory used by

researchers to examine how technology is used differently. With the Adaptive Structuration Theory, for example, scholars have examined the active role of people (i.e. their training and experiences) in media decision (Majchrzak et al 2000). Adaptive Structuration helped Espinosa et al (2015) explain the technology-related work practices that occur across temporal boundaries and its impact on performance. However, unlike the suggestions of structuration theory (Majchrzak et al 2000; Orllikwoski 2002; Espinosa et al 2015), the Media Synchronicity Theory offers a means for: (1) gaining insights on the level of synchronicity needed in the development of understanding (2) making sense of how information is disseminated within a virtual team. According to MST, improved conveyance or convergence is achieved by adjusting the level of user familiarity with the media.

6.6 Boundary-Spanning Communication

From earlier discussions, tasks such as software development with a virtual team, IT management or Business Service deliberations – all involve both conveyance and convergence. These two processes are equally important for task completion and communication effectiveness. According to the Media Synchronicity Theory, every task involving more than one person necessitates a combination of the various communication processes. Specifically, researchers suggest that the conveyance and convergence concepts are logically independent, but there is however a reciprocal relationship between them.

Data analysis showed that information exchange across spatial and functional boundaries was critical to ERP product design, and re-design needs. However, most BST specialists claimed to know exactly what needed to be done for a project to be a success. This suggests a weak focus on innovation and learning. When questioned on performance related issues, emphasis was not placed on a wider community. That is, generating knowledge – through online forums.

Conversely, a majority of ADT interviewees reported that they were vested in their practice. Interviewees actively sort out information from a wider software community. Interacting with members of a community enabled interviewees integrate diverse perspectives in the problems they solved. Going back to the literature, Wenger (1998) noted that practice occurs in a community of people with a shared enterprise. He uses the term 'negotiation of meaning' to describe the process by which practice takes place. Interestingly, this process is similar to those discussed by Dennis et al (2008). A key distinction nonetheless is that in Wenger (1998)'s conceptualization, practitioners eventually found their own place within the community as communication occurs over time. Wenger refer to this as "identity of

practice". The Media Synchronicity theory does not explicitly articulate these situations. The interviewees did not directly discuss the development of identity – reaffirming the suitability of MST in interpreting the research findings. However, the development of identity can be implied from the following ADT respondent comment:

> *"Before the end of every project you would know who to trust, trust me! From the technical perspective, who you trust is based on the experiences they have had. Technical wise, I can learn from anyone, so I can learn from someone junior to me as long as you can defend the reason why I should take your options. I am quite open-minded from that perspective. The problem is that, there is a danger where because he is junior he can't know more than me. But this is wrong because as long as the person is quite open to technology and learning, there are chances that there are things they know that you don't know."*

What also stands out from the comments is that when communication occurs over a period of time, trust develops.

In this study context, it is not unreasonable to state that being actively engaged in a community was more relevant to ADT than BST. Previous studies reveal that software tends to be very complex (Espinosa et al 2007) and the complexity dictates the conveyance of knowledge across the boundaries of a single functional unit (Magni et al 2013). Likewise, a software entity can experience many order-of-magnitude improvements within a short period necessitating Application developer to stay informed (Maruping et al 2009). Software developers are always diagnosing and inquiring in order to accomplish the ERP design, and re-design needs.

Indeed, there is a consensus within the academic community that convergence needs both subjective and social interpretation (Espinosa et al 2015). Researchers who work within the interpretative boundary acknowledge how different domains (e.g. mental models) typically produce interpretive differences (Ananth et al 2011). In such situations, they strive to resolve "discrepancies in meaning" or assist in the creation of "common meaning". People create and use meaning to interpret events; 'meaning' involves how messages are understood. Furthermore, researchers argue that to construct meaning, virtual team members transmit information, share their individual understandings (Dennis et al 2008), debate differences among their interpretations (Espinosa et al, 2015), explain mix-ups, and

arrive at a consensus (Chudoba et al 2005). Face-to-face and VOIP meetings provide good opportunities for ERP stakeholders to achieve the above objectives.

As highlighted in the analysis in Chapter 5, most participants admitted to have better levels of interactions with people who share their professional language (not evaluated for IST). This represents a form of shared mental models. For organisational theorist, shared methods enable team members predict and explain messages such as system data and development information (Carlson & Zmud 1999; Dennis et al 2008; Kock 2004). It also allows people to generate expectations on what is to happen next within their project environment (Vlaar et al 2008). Of course, multiple mental models could exist within a team. Some examples within this study context are mental models associated with the software task, configuration files, schemas, ERP (e.g. system rules, enterprise architecture), project governance and methodology. Together, they facilitate interaction, communication and consequently varying levels of synchronicity.

A finding from the work systems under study was that ERP project stakeholder constantly sought and assembled information from multiple sources. The media richness theory (Daft & Lengel 1986) provides some explanation to this behaviour. It suggests that organizational units have informational requirements and people act on these requirements to reduce uncertainty and equivocality in its task. The Media Synchronicity theory offers a more appropriate interpretation of this behaviour (with respect to the study design) because it does not categorize media as rich (or not rich) but rather it focuses on the capabilities of the media and the communication processes needed to accomplish a task. Likewise, successful communication occurs when individuals share their understanding. This involves the desire to transmit information and enact a shared mental model.

6.7 Team Functions

As discussed in the section above, communication is central to the dynamics of virtual team interaction. However, data analysis reveals some situational factors that influence how and to some extent, with whom an individual may communicate with. Team function in the context of this study refers to the mechanism or interaction rules by which a virtual team - and the individual - is managed as they try to achieve their objective (Dennis & Valacich 1999; Gallivan 2001). These mechanisms include: business defining the appropriate behaviour (team control), a team member's actions being guided by individual objectives (personal control) (Belenger & Collins, 1998). Of course, some interaction rules are the

manifestations of culture (social controls), which carries on throughout the life cycle of projects.

Rules, here, describe values, beliefs, worldviews and attitudes, which are associated with a particular individual and group's well-being and their ability to accomplish an assigned task. This idea has been a key element in TIP theory (Time Interaction and Performance) of which the third dimension of MST was derived (Dennis & Valacich 1999).

In a statement about how task and individuals were primed for a response/reply, control and situational influences were discussed:

> *"…if I feel I need whatever they are saying just to cover your ass, I just send an email. Just so we are on the same page and he acknowledges (ADT_ID3)"*

In communication situations where interviewees prioritised self-protection, emails were used.

Furthermore, a virtual team may have governance systems that influence the transmission of new information or discussion on previously conveyed information.

> *"But there are some other groups who, because of the level of information available and the way the department is being run [TEAM CONTROL], they need to meet every week or every other week to discuss issues and advise everyone on what is going on and share information."*

> *"Sometimes I use video conferencing for planned meeting sessions [...] but I think it boils down to the structure and infrastructures that have been put in place. If I weren't in an organisation that makes emphasis on planning, I would probably just be using phones. (ADT_ID9)"*

Team control (including top management) has an effect on communication media behaviours.

Social controls are 'expressions of belief' in specific culture (Belanger & Collins, 1998). They shape attitudes, behaviours and expectations in a particular communication situation. As highlighted in Chapter 5, the Nigerian culture advocates respect to elders. For example, the data reveal that junior colleagues were afraid of speaking out and challenge the hierarchy even when the (leaders/elders) break team ground rules. Challenging superiors to their face can be breaking social norms and was therefore avoided. The BST case portrays hierarchy, seniority and authority as having a direct link on work and group development. It had an impact on technical problem solving.

Culture plays a positive (prominent) role in virtual work, but it can also constrain the success of group task, as was indicated in BST account. Interview data suggested that the risk to cohesion increased whenever seniors leveraged on face-to-face media to make changes in projects without enough mutual consent; more specifically, when they misused face-to-face communication. Thus, conflict occurs when people have interest that is inconsistent with the desires of others.

The literature chapter articulates that through informal interactions, members are able to meet social and relational concerns as well as develop skills. A mentoring role was also found to enable this process (Suchan & Hayzak 2001). ADT provides similar observation.

6.8 Connecting the findings together

This study suggests an extended model of virtual team performance, one that integrates the findings with the assumptions in the literature (Dennis & Valacich 1999; Dennis et al 2008). It integrates components of virtuality with media synchronicity and communication performance. It also makes explicit the role of infrastructure. The overall implication of the findings for virtual team research is that virtuality plays a role in performance.

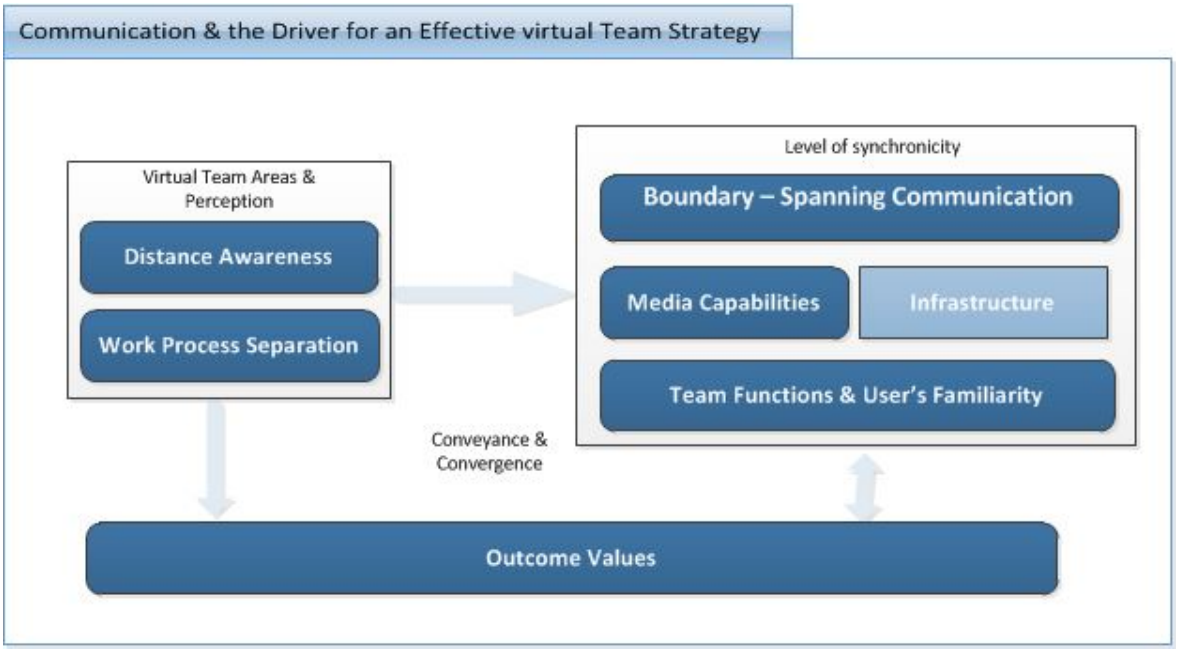


Figure 6-1: Factors leading to Virtual Teamwork and Communication Performance

Whatever the value a virtual team strategy provides an individual, respondents did not usually find it difficult to assess it. Every time they worked from home, for instance, must have allowed them to assess communication performance, satisfaction and task performance.

It has been revealed that the three work systems possess characteristics that distinguish them from one another (see Chapter 5). Nonetheless, the tasks they strive to achieve are not different from work systems to work system. Differences lie primarily in how the team functions and the situational factors team members encounter.

Some context specific communication behaviours were also identified, like team members being afraid to challenge to their senior. From the BST account, for example, this was explained by the perceived cultural impact on team function. This plays a role in whether or not a virtual team strategy adds value throughout the duration of a development project.

It is also revealed in this study that member's familiarity with communication media, task and other internal or external stakeholders can serve as a catalyst for achieving goals.

Table 6-4: Input, Mediating & Outcomes

Input/Start Variables	Mediating	Outcomes
Distance Awareness. Work process separation.	Linkage between media capabilities and communication performance Members assuming multiple roles as well as lateral channels communication focus. Relationship with their community Norms, values (including culture) and tribal syndrome is associated team functions. Linkage between communication and task completion, expertise and shared methods (not evaluated in IST). Connecting with and disconnecting from others is shaping the virtual team strategy (infrastructure factors) Legacy policies on communication Technology illiteracy	Speed and accuracy of reaction to varying demands. Cohesion & Coordination of activities Monitoring & compliance to Agreements. Knowledge impact

Going back to chapter 4, a key feature of template analysis is the ability to modify an analytic template. Recall, the initial template was constructed from the conceptual framework developed for this study. The framework was based on the guiding principles of MST (Dennis & Valacich (1999) and the generic I-P-O model. However, a full analysis of transcripts revealed some section of texts that were relevant to answering the research question, but inadequately covered by the initial template. As prescribed by King (2012), these findings necessitate changes to the template. Multiple changes were made, including:

- Creation of a new top-level theme: Infrastructure.
- Splitting the top-level theme on Virtual Team Areas into two: Distance and Work Process Separation.
- Conceptualizing some themes as integrative themes. They are 'conveyance', and 'convergence'. Integrative themes, as described by King (2012) are themes that "pervade much of the data" (p.432). King (2012) advocates multiple ways of treating integrative themes: (1) they can be handled as stand-alone themes, but the drawback is that its relationship with other components may be lost during whilst presenting results (2) making them sub-components of each main theme, but this has the potential of

underemphasising their relevance to the study. The preferred approach is to link them to other themes "laterally". This can be observed in the discussions above.

Communication behaviours are underpinned by infrastructure; the efficacy of the communication media also requires the communication process proceeding uninterruptedly and as planned. This factor is not made explicit in Media Synchronicity theory. Table 6.5 below illustrated some of the variances and plausible explanations.

Table 6-5: Environmental & quasi-external agents

Initial Research Propositions Based on Original MST	Evidence not made explicit by MST
MST proposes that in order for media to be used successfully in the achievement of a task, the most effective media choice must consider the combination of two basic communication processes required for performing any kind of task. The communication processes are: information transmission (conveying information) and information processing (convergence of shared meaning)	Complexity as a result of: (1) Network failure: Network downtimes from the CDMA & GSM operators were unscheduled and random. (2) In Nigeria mobile internet access is expensive and is sold in capacity bundles which promote short term usage such as emailing and posting. Thus, media with low synchronicity such as emails most times lead to more effective communication processes. (3) In addition to the Network operators pricing structure & capacity limited bundling; the restricting bandwidth speed and download-limits accommodated email use for group discussion & fact-finding, more than bandwidth intensive usage like video calling. (4) Power supply: MST doesn't explain how participants alter their behaviour to compensate for factors such as disruption in power supply. Power cuts from the National grid were unregulated and frequent. In sum, to achieve certain tasks the virtual group should be able to sustain simultaneous and continuous connection of all its members throughout the duration of information transmission & processing. Hence, synchronicity is aided by infrastructure.

It is worth noting that these components do not necessarily function independently of one another, but they overlap as evidenced by the re-occurrence of lower level codes between them.

In sum, the theoretical framework produced in the study builds on media synchronicity theory (MST). It however promotes the role of environmental factors and quasi-external agents in communication and virtual teamwork. New propositions that describe the relationship between the level of synchronicity, communication and effectiveness has also been identified. It has been argued that face-to-face communication media, for example, is not always used to transmit

information in projects efficiently, and effectively, as it is sometimes abused. Likewise, the findings have shown that when communication occurs within a virtual team setup, the cultural background of the communicating participants may not only affect the effectiveness of the various media capabilities, but also how individuals respond.

The components of the virtual team domain (distance awareness & work process separation) represent the structural characteristics of tasks within a development project. They provide insight on where people are, and how they can work. Conversely, it is the integration of the two elements (virtual team areas and level of synchronicity) that is key to determining whether or not, a virtual team strategy adds value throughout the duration of a development project.

6.9 Summary

This study provides evidence that different work systems could have different design/focus on virtual work and use media or set of media capabilities differently. Likewise, some groups are better at managing work process separation than others and could have different information transfer needs. It is also reported that some communication behaviours are driven by infrastructure.

The study agrees with the extant literature that communication effectiveness has social elements. These include trust and control mechanism. The next chapter would provide an overview of the research project.

Chapter 7 : Conclusion

7.1 Introduction

The previous chapter has provided the results of this study. A data analysis process revealed many insights into aspects of virtuality and communication.

The structure of this chapter is as follows: First, the research questions are reviewed. Then, the limitations and contributions of the study are discussed. The last section is an overview and areas for further development.

RQ1: Does the adoption of a virtual team strategy create value through-out the duration of a development project?

To answer the question of value creation, this study establishes that a virtual team is able to integrate the strategic partners associated with an ERP programme. It encourages interactions and learning across various organisational boundaries. Additionally, executive management are able to demonstrate compliance to local regulations such as the *build-extract-employ agreements*. But at another level, we have to wonder what exactly does this mean. It was difficult to keep the teams productive during group meetings. Strong personalities and tribal sensitivity stood in the way. Project teams lost focus due to the misuse of face-to-face media to instruct changes. The potential consequences were poor documentation and the creation of a bad record keeping culture. This tended to have an impact on the various stakeholders' ability to meet their goals. So it is not unreasonable to wonder if a virtual team strategy actually added value throughout the duration a development project, having considered the kind of complexities and communication behaviours that were found. Certainly, the strategy creates value during project inception phases. The same cannot be said about execution phases.

The use of a virtual team, although effective for ensuring compliance with local agreements and pooling people from various locations without physically moving them around, requires mechanisms for guaranteeing productivity. For example, because of BST's compliance with *the local content* policy of direct native hire, the promise of an effective virtual team could only be achieved if there was a downward flow of knowledge from experts to the indigenous employees. Likewise, ADT needed periodic face-based communication. This was necessary in order for team members to complete some tasks. High synchronicity media (face-to-face and video conferencing) were extremely useful during the execution phases as team members were always verifying and

validating requirements. Of course, members (both young and experienced) learned from each other in the process.

RQ2: Are there any risks to such a strategy and what could hinder its realization?

As illustrated earlier, managers need to balance the benefits of a virtual team strategy against drawbacks of the context in which members communicate. Some factors also jeopardize its effectiveness.

(1) Familiarity amongst participants

The researcher found that irrespective of the formal frameworks, supportive ethos and shared patterns of behaviours available to a virtual group; conflict in later stages of projects still arose. This observation has not been widely discussed in the communication media literature.

Some researchers argue that established groups have practices in place to support its members and ensure group well-being. In this regard, they discuss behaviours such as team members re-applying existing norms to routine tasks (Kock 2005; Dennis & Valacich 1999; Kock & Lynn 2012). The exception to this rule in this study is depicted below.

When it comes to re-applying norms to task, socio-emotional conflicts - usually born out of tribal sentiments - does not always guarantee group well-being. Like in the BST account, it tends to impede team members' abilities to create strong and tangible social relationships within their work environment.

Misunderstanding arising from some actor's desire to have just enough co-located interaction with distant colleagues can also be cited as a challenge to group well-being. These observations were coded under *'virtual mind-set'*.

Notwithstanding these findings, some empirical research has suggested that conflict within a diverse work group can actually be beneficial to its development and performance. For example, Carte & Chidambaram (2004, p. 458) cited the work of Rahim (1985), where the author noted that conflict contributes to a "critical review of options".

Consequently, based on the findings, the researcher puts forward the following proposition: The conflicting expectations amongst the actors that make virtual work possible are inseparable from factors relating to performance. Managers should be aware of this when selecting media for development projects.

(2) Group Discipline Issues

Going back to the literature, as highlighted in Daft & Lengel's theory on communication media (1986), "richness" of media plays an essential role in virtual team effectiveness. The authors noted that effective leaders are in favour of face-to-face meetings for equivocal communications, such as team discussions or fact-finding exercises. Equivocal tasks involve people making judgement. The logic is that face-to-face interaction allows team members to benefit from not only verbal cues, but emotional, normative and attitudinal signals as well. Dennis and Valacich (1999) complement Daft & Lengel's position with the following view: *"For group communication processes in which convergence is the goal (recall, convergence refers to generation of shared meaning), use of media providing high synchronicity (high feedback & low parallelism) will lead to better performance." (p.7)*

So, choosing media such as face-to-face is expected to de-escalate conflicts or clarify misunderstandings in the work environment and thereby contribute to virtual team effectiveness. The evidence in BST questions these positions for a number of reasons. Nigeria is infested with strong personalities and tribal rivalry, so face-to-face interactions amongst project peers could result in heated arguments. In some cases, people resort to name-calling. Consequently, it could be inferred that very little progress is made in such a communication environment. Therefore, the use of a media that provides high synchronicity would not necessarily lead to better performance – whenever strong personalities & tribal sensitivity exist.

(3) Attention paid to hierarchy

Another situational factor that influences the extent to which a communication environment for a virtual group would be effective is: the extent to which attention is paid to hierarchy. The BST case illustrated how social hierarchy was closely linked with factors related to control mechanisms and technical problem-solving. Older virtual team members sometimes employed face-to-face communication to influence the direction of project work. Based on this finding, the researcher puts forward the following proposition: Indirect control methods based on hierarchy contribute to project deliveries.

(4) Competing rules

Nevertheless, the result is somewhat inconclusive as evidenced below. Culture obviously plays a critical role in virtual work, but it can also constrain the success of group tasks, as was indicated in BST account. Interview data suggested that the risk to cohesion increased whenever seniors leveraged on face-to-face media to make changes in projects without enough mutual consent;

more specifically, when face-to-face communication was misused by them[25]. The following proposition further illustrates the link between communication media viability, interaction rules and team effectiveness (Figure 6.1 above). Uncertainty and ambiguity within a development project can be influenced by social hierarchy. Project managers should be aware of these issues and be ready to conceive and enforce rules that mitigate the negative effect of culturally informed behaviours. This finding is echoed by general statements in cultural analysis (Ardichvill et al 2006) and social functions (McGrath 1991).

(5) Uninterrupted communication process

The results clearly show that environmental factors have an impact on the effectiveness of a virtual team. The choice of media and the way in which it is used is in many ways constrained by stable and reliable network connections. More so, network cuts reduce the transmission velocity in communication. Based on this finding, it is proposed that: successful virtual collaboration requires reliable connections. Thus, project managers should be aware of the fact that communication media is underpinned by infrastructure components.

7.2 Limitations of Research

First of all, this study was on the Nigerian Operations of an ERP programme, of which the communication process of the virtual group may be unique to it. So, even if the findings are promising, generalizing the lessons learnt to other ventures or industrial projects may be farfetched.

Second, a number of conceptual papers promote cost reduction as one of the key benefits that organisations extract from their adoption of a virtual work environment. This was hardly a subject of discourse probably due to the sample (i.e., the study focused on the middle-operating echelon of an organisation, and not the strategic apex). The research design may have prevented financial aspects from being emphasized in the case study.

To capture as much information relevant to answering the research questions, many techniques were used. This included: background reading, review of projects from technology evaluation portal, document inspection, and semi-structured interviews. This was an exhaustive process. Nonetheless, the inherent practicality of alternative methods such as ethnography and focus groups strengthened the researchers resolve in the chosen methods. Ethnography would have required spending months at a time observing the practitioners in the context of their work.

[25] See chapter 6 where it was highlighted that the Nigerian culture advocates respect to elders; junior colleagues were afraid to speak out and challenge their hierarchy even when they break team ground rules. Hence, challenging superior to their face can be seen as breaking social norms.

Having limited personal resources, restricted site access and most importantly, the distributed nature of virtual work, added to the difficulties of using this method. It would have been desirable, however, to follow a particular virtual team from a project inception phase to completion in order to understand all their communication. Future studies could be longitudinal.

Lastly, triangulation of data from a wide range of sources was beneficial to this study; nonetheless, additional interviews with other business practitioners may help strengthen the conclusions.

7.3 Research Achievements & Implications

This research makes contributions to academic and business practice. Some findings are re-emphasised in the section below.

7.3.1 Implications for the field of virtual work and communication media.

Reviewed in Chapter 2 & 3, this research owes its origin to the line of reasoning put forward by some academic scholars: Watson-Manheim et al (2002); Chudoba et al (2005); Schweitzer & Duxbury (2010) and Dennis & Valacich (1999). Watson-Manheim et al (2002) tried to understand virtuality and its impact in an organisation. The study was based on what the authors called discontinuities – the factors that contribute to a reduction in cohesion. What Watson-Manheim & her colleagues realized was that in a virtual environment there are different phenomena that create gaps in work context, i.e., team distribution, work place mobility, and a 'variety of work practices'. Chudoba et al (2005) agreed with this premise and extended it. In their empirical study on virtuality in the global organisation – Intel – they discovered that 'multi teaming' was another discontinuity in the virtual work environment. They also found that 'mobile work' and 'variety of work practice' have a negative impact on performance. Interestingly, an earlier internal study within the same organisation identified three factors that control the flow of information: social interactivity, knowledge networking and work predictability. The authors argued that these factors also have significant implications for the impact of virtuality on performance.

Dube & Robey (2008) studied factors that could bridge these gaps. In essence, the ability to perform effectively in a virtual environment was based on certain 'continuities' in communication and collaboration. To support their thesis, the authors suggested that at the heart of virtual teamwork is a paradox (i.e. a set of contradiction in media choice and aspects of communication that leads to particular outcomes). Although, Dube & Robey did not examine the contextual issues surrounding virtual team design and communication behaviours, their study revealed 5 sources of performance: virtual work requiring physical presence; flexibility aided by a structure; interdependent work being supported by independent contributions; task-orientation needing social interaction; Mis-trust being a key component in establishing trust (Dube & Robey 2008, p.9). These paradoxes complemented the findings of Watson-Manheim et al (2002).

Schweitzer & Duxbury (2010) developed a conceptual framework after reviewing existing literature on the subject. The framework was used to support a quantitative study of virtual teams within a Canadian multi-national organisation. The authors measured virtuality in teams along three dimensions (team time worked virtually, member virtuality and distance virtuality), and discovered that virtuality had a negative effect on two key aspects of team effectiveness:

member satisfaction and team member's perceptions of their performance. Schweitzer & Duxbury also observed that the more virtual a team was (i.e. virtuality was represented as a continuum rather than a dichotomy), the more these two measures of team effectiveness were negatively affected.

The current study agrees with this premise (virtuality as a continuum), but it qualifies it, with respect to communication media. First, it was found that virtual teamwork is characterised by multiple components. Each of the components tends to be driven by a different kind of discontinuity. In this sense, virtual teams may actually be advantaged by a particular discontinuity but disadvantaged by others. This understanding led to the development of the theoretical model above (figure 6.1).

Second, this model clarifies the inputs and processes that result in cohesion and focus. In fact, the measure of effectiveness was predicated on the media synchronicity theory (Dennis & Valacich 1999; Dennis et al 2008), which states that to perform effectively, people need to communicate effectively. It is important to match the capabilities of the medium to the needs of communication processes (i.e. information processing and information transmission). The media capabilities, according to the media synchronicity theory, include: transmission velocity, parallelism, rehearsability, re-processibility, and symbol variety. However, this study draws new propositions that may enhance MST.

7.3.2 Implications for researchers

The main achievements of this research are highlighted below:

There was a successful review and integration of appropriate literature. The researcher also compared existing frameworks for analysing virtual teamwork and communication effectiveness; spotting areas of confusion or lack of application (Sandberg & Alvesson 2011).

One of the areas of complication within the literature was on how virtual teams should be studied and analysed. That is, whether or not the level of analysis should be the individual, a whole task, a group or embedded organisation. In recognising this dilemma, a conceptual framework was developed. Reviewed in Chapter 2, MST for example, moves the level of analysis away from the task performed by a team (e.g. distributed software development, procurement, relationship with value chain partners, the content of tasks such as idea generation) to the communication processes underpinning those tasks (i.e. conveyance and convergence). This, in effect, improves the generalizability of the findings. Furthermore, as most modern teams have access to a myriad of tool, MST gives primacy to the media capabilities as opposed to the wide range of devices available to them.

The virtual team concept has a history of experimental and quantitative research, so this study offered insight with a qualitative methodology. Utilizing an Interpretivist approach within a real-world project environment made it possible to empirically see the existence of virtual team initiatives in the Nigerian Operations of an ERP programme, and in what sense they may exist. The researcher was able to distil the characteristics of teams and the communication practices that enable people to be effective. Even more important than this, the study identifies some situation where the mis-use of communication media led to loss of cohesion.

Essentially, the researcher revealed the benefits gained by using template analysis in information systems research. The analytic tool, combined with a Visual Understanding Environment (VUE), made the search for patterns across the entire data set easy and traceable. More so, the various context and communication pathways (both human & technical aspects) were visualized and documented.

The researcher continued to pursue media synchronicity theory (MST) attempting to improve it. Consequently, an enhanced communication model, which promotes the role of environmental factors in virtual teamwork, has been produced. The model compensates for the mixed findings in the Nigerian context. The model has added new propositions as well as revised some of the original propositions. For example, it has made explicit, the role of quasi-external agents in the communication process. Likewise, the findings have shown that when communication occurs within a virtual team setup, the cultural setting of the communicating parties does not only affect the effectiveness of the various media capabilities, but also how individuals respond. Subsequently, the convergence of understanding amongst those involved in the communication is also affected. Further, the components of the virtual team domain (distance & work process separation) represent the structural characteristics of tasks within a development project. They provide knowledge on where team members are and how they work. The model proposed in this study illustrates that it is the integration of the virtual team domain and synchronicity components that is key in determining whether or not a virtual team strategy adds value throughout the duration of a development project.

Based on the above discussions, the following gaps identified in Chapter 3 have been: (1) the need for more field based studies as opposed to laboratory studies (2) the need to empirically validate the aspects of virtuality as well as create a more holistic framework (3) the need to examine commonalities among various teams within a particular project domain (4) the need to relate the process of virtual team working using theories of communication media behaviour (5) the need to expand knowledge on team virtuality and effectiveness to other organisational settings as well as

generating insights from other perspective; the geographical context – sub-Saharan Africa is a source of contribution.

7.3.3 General Implications for Organisational Management Functions

Virtual teamwork has led to successful product launches. Unfortunately, senior management has not really focused on developing a clear vision of a virtual strategy. Organisations could adopt the following recommendations.

(1) Project directors should realize that even a collection of non-experts – at inception phases - can succeed, provided some critical and integral components are rightly assembled during the project execution phases. Some of these components involve knowledge communication. Chapter 5 provides specific examples of how this actually happens.
(2) Organisations should incorporate 'virtuality as strategy' into medium and long-term planning of their process improvement programmes. With understanding that virtual teamwork in not only about extending workplace services to other locations, but can be about improving cooperation amongst organisations and teams that constitute the extended partnering network. In addition, leaders should introduce formal processes to track the results. Management training programs should also be enhanced, to reflect these issues.
(3) Managing a programme with geographically distributed participants is a tedious task. The complexity of the process increases when some participants are in Nigeria. First, the risk to building and maintaining team cohesion increases due to tribal differences grounded in the culture and geographical distribution of people. Socio-cultural problems are also exacerbated by strong personalities. Second, as the analysis in chapter 6 makes clear; for millions of workers in Nigeria, stable electricity is out of their reach. Unless organisations re-think their work strategy, performance would remain low for many years to come. Likewise, people working from home may not have the same purchasing power for retail broadband access as large multinational corporations, thus practitioners should transform the way communication performance within such virtual teams are measured.
(4) Having multiple systems of communication - with varying capabilities - available to individuals and teams undermines the efficacy of project communication plans. It makes it difficult for its frameworks (e.g. information needs) to be strictly followed. Consequently, a vital role of virtual team leaders is to react and re-shape how communication systems are introduced and used throughout the duration of a project.
(5) Whilst creating communication plans is a starting point in complex projects, it is exactly that, a starting point. Proactive steps are essential to ensure not only that the rules are

implemented through the project life cycle, but all virtual team members (senior and junior) are aware of them and abide by them. As such, there is a need for adoption of tools that provide visibility.

(6) Recall, the BST account provided inconclusive results with regards to use of communication media. This may be because they were culturally diverse and thus technology was used differently across different sub-cultures. With this information in mind, it is important for project managers to identify the communication channel preference of members of their team and cater to their needs. These findings also challenge the software vendor's attitude that technology is one-size-fit-all.

(7) The challenge of communication might be best mitigated by a new information system design. For example, a middleware application may be developed to support automatic routing of information based on predetermined communication rules and individual preference.

7.3.4 General Implications for IT Application Designers

Software system designers can use these findings to explore new ways of developing unified communication infrastructures. The model could allow designers to think systematically about the various aspects of virtuality that need to be supported and thus make informed decisions about the communication behaviours they really want to influence. This study and the model presented herein can also help software marketers discuss the features that make their products unique.

7.4 Recommendation for further research

First, the research did not attempt to generate a systematic comparison between all the sub-groupings (Males versus Females; Age differences; Cultural Orientation). The questions at the centre of the analysis were: does a virtual team strategy add value throughout the duration of a development project.

Second, this work can be extended through more study on the relationship between the factors identified in the model. Likewise, research could look into different contexts such as, in the public sector or non-profit organisations.

Third, future research can investigate whether the factors associated with the usefulness of systems of communication can be mapped onto the different phases of a project life cycle.

A simulation-based tool can be built based on the framework, to provide researchers and practitioner's a handy/useful tool to assess and compare the influence of the different factors. This may supplement empirical data on the subject and make visualization of scenarios possible.

Another avenue for research is analysing the cost and benefits of adhering to 'local content' in business terms. Local content is a practice where indigenous people and local partners are favoured over others.

On a final note, future studies could look into the impact of virtual team members taking instructions from both organisational hierarchy and social hierarchical structures.

7.5 Researchers Reflections on the Project Experience

Some of the challenges experienced during the data collection and analysis process provided learning opportunities for the researcher. As expected, the first few interviews were nerve-racking in that the researcher was somewhat a novice. The lack of interviewing skills reflected in time management, and overall composure during those sessions. However, as more participants were interviewed, the researcher quickly gained the investigative skills and self-confidence required by a qualitative researcher, including being able to ask questions in a coherent manner. Hand notes became more focused and less of a distraction. Interruptions were significantly reduced as attentiveness during interview sessions increased.

Innovative problem-solving was another skill that was improved. The researcher was able to use prior experience and adapt them to new situations as new challenges arose. Furthermore, networking with more experienced IS and IT practitioners gave me a good understanding of cutting-edge technologies and practices that are currently being used in a business environment.

The researcher also enhanced negotiation skills as was demonstrated in the ability to ensure that interviews were scheduled in suitable locations, and at appropriate times. In fact, certain participants required extra motivation to make out time to participate. On those occasions, free lunch was used to incentivise participants to make their break time available for interviews. Likewise, whenever informants insisted that interviews would cause disruption in their daily routine, telephone interviews were offered as a way of minimizing its effect.

While concluding, it is worth stating that the data analysis was not without its own challenges. First, creating a definitive coding hierarchy was extremely difficult because every new data, feedback or document threatened to push analysis back into the thematic coding process. However, template analysis provided some structure to help in this process. Second, the enormous volume of coded text made selecting themes to present in the narrative chapter a little challenging. It was difficult to stop asking questions of the data. In fact, the researcher was so consumed by the research questions, and at the same time, so frustrated by the amount of data collected for analysis. Fourth, understanding the entire ERP process was a long and daunting task.

Lastly, being both a researcher and practitioner complicated the analysis process because the researcher was constantly striving to minimize biases and remain open to data.

Despite these unpleasant data analysis experiences, there were learning opportunities. The researcher learnt how to look at a situation, consider the facts, manipulate the data and draw tangible conclusions. Of course, the ability to ask fact finding questions, and uncover the story behind the data indicates an enhancement of managerial skill. The researcher also learnt how to examine the patterns in which work was performed, efficiently allocate personal resources and be a self-learner.

7.6 Summary

This research provides an understanding of how the adoption of a virtual team strategy creates value throughout the duration a development project. It looks at the context in which such teams are conceived, and then examines the technical and social systems that facilitate communication performance. An ERP programme within the Nigerian context provided an interesting research environment because of the sheer diversity of its stakeholders and reach of its processes and teams.

In chapter 2, a conceptual framework for virtual teamwork was developed. The framework was based on two guiding principles: the communication model developed by Dennis & Valacich (1999) (i.e. media synchronicity theory) and the generic I-P-O model. MST was used to analyse the factors associated with communication effectiveness in an organisational setting. The IPO model, on the other hand, was to identify and describe situational forces related with virtual work. Through a move from conceptual framing to field data as supported by the adopted research approach, the researcher was able to revise some initial theoretical propositions (Eisenhardl & Graebner, 2007). Recall, the objective was to understand and explain the problem (issues of virtual teamwork with respect to communication practices) in its contextual setting.

In Chapter 3, a range of relevant literature were reviewed and synthesised. Subsequently, there were critical discussions in chapter 4 on research methodologies and approaches. The justification of a qualitative interpretive research was clearly articulated.

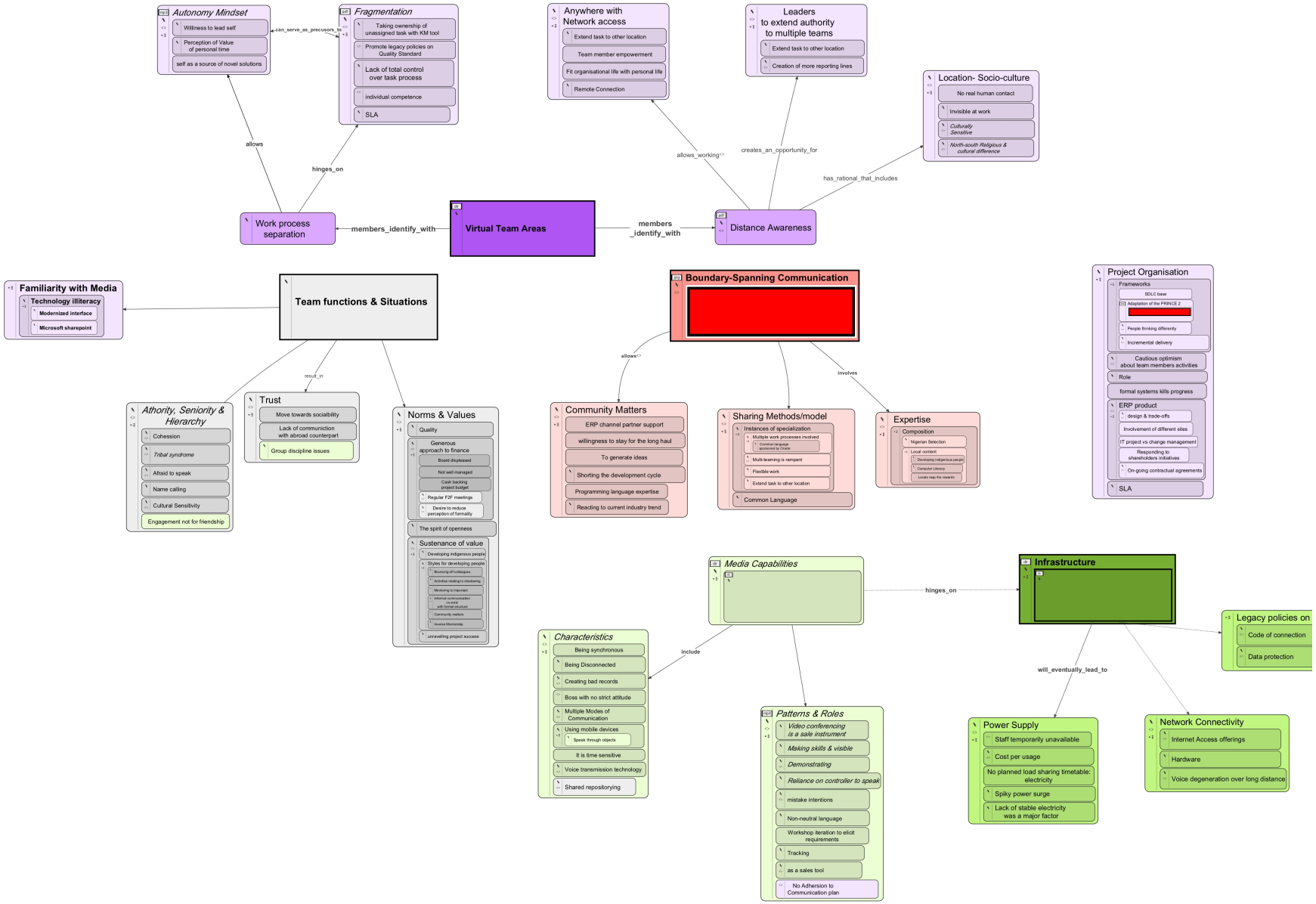
Chapter 5 and 6 provided the findings. Discussions were also backed up with literature, whenever appropriate. These chapters showed that communication behaviours within a virtual environment develop around a few concepts and thrust. A model was developed. It illustrated why the design, behavioural and performance issues associated with a virtual team arise.

Chapter 7 drew out the lessons that can be learnt from this research. This thesis provided, what is hopefully, a toolkit for managers who want to promote more effective communication.

To conclude, the research questions are answered herein by this thesis, which argues that deploying virtual teams can be beneficial in development projects, but risky. Primarily, communication performance is constrained by the nature of control mechanisms, intellectual and material assets.

Appendix A

- **Template from study**
- **Template Analysis Revision History**
- **Interview Guide**
- **Some Scenarios & Illustrative notes**


Autonomy Mindset
Williness to lead self
Perception of Value of personal time
self as a source of novel solutions
can_serve_as_precusors_to
Fragmentation
Taking ownership of unassigned task with KM tool
Promote legacy policies on Quality Standard
Lack of total control over task process
individual competence
SLA
allows
hinges_on
Anywhere with Network access
Extend task to other location
Team member empowerment
Fit organisational life with personal life
Remote Connection
Leaders to extend authority to multiple teams
Extend task to other location
Creation of more reporting lines
Location- Socio-culture
No real human contact
Invisible at work
Culturally Sensitive
North-south Religious & cultural difference
allows_working
creates_an_opportunity_for
has_rational_that_includes
Work process separation
members_identify_with
Virtual Team Areas
members _identify_with
Distance Awareness
Familiarity with Media
Technology illiteracy
Modernized interface
Microsoft sharepoint
Team functions & Situations
result_in
Athority, Seniority & Hierarchy
Cohesion
Tribal syndrome
Afraid to speak
Name calling
Cultural Sensitivity
Engagement not for friendship
Trust
Move towards sociality
Lack of communiction with abroad counterpart
Group discipline issues
Norms & Values
Quality
Generous approach to finance
Board displeased
Not well managed
Cash backing project budget
Regular F2F meetings
Desire to reduce perception of formality
The spirit of openness
Sustenance of value
Developing indigenous people
Styles for developing people
unravelling project success
Boundary-Spanning Communication
allows
involves
Community Matters
ERP channel partner support
willingness to stay for the long haul
To generate ideas
Shorting the development cycle
Programming language expertise
Reacting to current industry trend
Sharing Methods/model
Instances of specialization
Multiple work processes involved
Common Language
Multi-learning is rampant
Flexible work
Extend task to other location
Common Language
Expertise
Composition
Nigerian Selection
Local content
Developing indigenous people
Computer Literacy
Locals reap the rewards
Project Organisation
Frameworks
SDLC base
Adaptation of the PRINCE 2
People thinking differently
Incremental delivery
Cautious optimism about team members activities
Role
formal systems kills progress
ERP product
design & trade-offs
Involvement of different sites
IT project vs change management
Responding to shareholders initiatives
On-going contractual agreements
SLA
Media Capabilities
hinges_on
Infrastructure
Legacy policies on
Code of connection
Data protection
Characteristics
Being synchronous
Being Disconnected
Creating bad records
Boss with no strict attitude
Multiple Modes of Communication
Using mobile devices
Speak through objects
It is time sensitive
Voice transmission technology
Shared repositorying
include
Patterns & Roles
Video conferencing is a sale instrument
Making skills & visible
Demonstrating
Reliance on controller to speak
mistake intentions
Non-neutral language
Workshop iteration to elicit requirements
Tracking
as a sales tool
No Adhersion to Communication plan
will_eventually_lead_to
Power Supply
Staff temporarily unavailable
Cost per usage
No planned load sharing timetable: electricity
Spiky power surge
Lack of stable electricity was a major factor
Network Connectivity
Internet Access offerings
Hardware
Voice degeneration over long distance

Template Revision History

S/N	Version	Notes/Reason for revision
1	TA_Version_1	First Version of Template, using Microsoft Office tools, particularly Excel Pivot table.
2	TA_Version_1_VUE	Modification of template to help illustrate concept mapping techniques to some students of MAN 1009 during group tutorial session. April, 2014
3	TA_Version_2_VUE_MAY	Re-labelling/tagging of Data items, using VUE. Including, insertion of new codes and adjusting coding hierarchy as well as embedding nodes with source data.
4	TA_Version_3_VUE	Merging of task context from initial template with "aspect of virtuality" initial template.
5	TA_Version_3B_VUE	Re-organizing template separating "cooperation for task" as an integrative theme. The theme cut across much of the data. The researcher decided against making it a separate higher order theme because it cut across much of the data. Making it a sub-theme of every main theme would have reduced its significance in the data.
6	TA_Version_4_NEWDATA	Updated Version of Template, with the themes that emerged from the data that were independent of the priori.
7	TA_Version_4B_Submission	Including two more integrative themes into the study "Having expectations" and "Role played by actors".
8	TA_Version_Upgrade	Addressing comments on 'ERP project level data' from upgrade seminar: supervisor & internal examiner review (March 22, 2015).
9	TA_Version_Upgrade_New	Updated Template after re-analysing data as three independent work system – merging and deleting some codes.
10	TA_Version_Check_B4_Submission	Quality check: feedback from a practitioner, another documentary inspection and literature - resulting in further modification of template.
11	TA_WithNO_Connectivity	(Final)Template reviewed after submission of Updated analysis to supervisor. This included amending virtual mind-set component.
12	TA_FInal	Review sequel to viva report. Involves making themes consistent across cases and in line with conceptual framework.

Interview Guide

Respondents, Projects, Organisation

- *About self (site, identity, age, residency)*
- *Can you tell me how the business unit works in general?*
- *Current job/role?*
- *How long have you been a member of this team?*
- *Could you tell me more about the proportion of time devoted to team?*
- *Please tell me about your projects.*
- *What did you do? Who were the people involved in the project? And who did you/they offer service to?*
- *Do you undertake any other assignments besides those of the team?*
- *Probe on selection process*

Key concepts from conceptual framing addressed in interview questions:

Virtuality context

- *What does it mean to be working in a virtual setting as opposed to non-virtual?*
- *What is your opinion about its potential for an organisation?*
- *What are the risks to such a strategy?*
- *What's your thought on the skills that is needed for a virtual team?*

Levels of connectedness

- *With respect to what you said about a virtual setting, about how many projects have you participated in?*
- *How was work organized?*
- *Where does individual authority to decide or act begins and ends?*
- *How much of the work involves face-to-face interaction?*
- *Can you describe some of the problems that are faced on a daily basis?*
- *Probe on - The kind of problems that merits a group effort / How the team makes decisions*
- *Where do you get the information, knowledge required for your work? How adequate are they for your needs?*
- *Probe - what sort of information is shared? Are there preferred formats, protocol?*

Systems of Communication & Effectiveness Component

- *What do you think about the current systems available?*
- *Probe – What/Are they any specific strategies/techniques for sharing information in a virtual setting?*
- *When/why are synchronous and asynchronous features of communication media used (Clarify with scenarios if necessary).*
- *Are some electronic mediums more effective when communicating with certain people?*

- *What should a success communication look like?*
- *What do you think can be done to improve the usefulness of communication channels in general?*
- *Could you think of other factors including technological & human practices that could help such teams become more-or-less effective in a virtual setting.*
- *(Given what has been said about the technology, do you think using multiple technologies plays any role in your job?)*

Further Clarifying/ scenario questions:

- *"Virtual team": what does that phrase mean to you?*
- *How often was your work delayed by another project member (member of team)? Why do you think that happened? (Probe on past most significant incidence)*
- *What are some of the mechanisms the team uses to communicate?*
- *What's you thought on how are meeting are held?*
- *Let's take a scenario here. Let's assume you're working on a project, and you've realized there is an issue, no one is around you at the moment - What are the processes involved in resolving the issue. (Probe - Why do you use this medium? Are they any ground rules that guide how you make decisions on it? How is accountability and responsibility for team outcomes shared).*
- *What can you say about the member's individual talents and abilities to contribute?*
- *(Please think of a virtual project you have worked on, what do you feel contributed to your success?)*
- *What are your thoughts about effective management of a virtual team?*
- *Do you find it easier working with some particular type of people?*
- *What are your thoughts on how trust develops in a virtual setting?*
- *Probe - How do new team members access critical information to learn about earlier work?*

Future Plans:

- *What do you think motivates people to want to work with the same virtual team members on other projects?*
- *Do you have any particular experience you can talk about?*

General:

- *Are there any practices that we haven't discussed so far that have an influence on team effectiveness?*

(It is to be noted that the researcher benefited from a modified version of the data collection instrument used by Gibson & Gibbs (2006), Schweitzer & Duxbury (2010) and Hoefling (2003))

Exemplar Scenarios & Sample Notes

Below are some scenarios and illustrative notes that give contextual meaning to the content of tasks and communication processes.

Name	*Testing component; TASK INTERDEPENDENCE SCENARIOS (M04)*
Proximity becomes less important when the group is testing complex new features of their software. *Generally speaking, on completion of development of software components, unit and user test scripts are produced. Testing is performed in a test environment at key business hubs. Information associated with the test is transmitted from one person to another. The digital communication system used during testing allows both parties re-examine test-related messages. These messages include text, error screen shots, and analytic models. During these process, team members deliberate on the information received or sent until they are understood and then further actions agreed. Messages are aggregated from multiple sources and in different formats.* *If a test is successful, changes are signed off by all the relevant stakeholders, including functional managers. Subsequently, the system component is presented to the users for trial. During this process, there is near constant communication with testing staff.* *If all goes well, changes are implemented into the live environment. If a change control was opened, it must be closed down.*	

Name	*Conflict; Virtual strategy for Procurement*
The procurement stakeholders are heavily reliance on the virtual team strategy to execute their day to day task and processes. This reliance on working virtually has partly been responsible for making them operationally efficient. *However, according to the procurement respondent, senior management and operating level employees seem to have very different perspectives on issues such as how conflicts between people should be resolved. One group promotes traveling to the manufacturing sites. The other group tend to prefer phone calls.*	

Name	*Manufacturing internally integrated with product design; Change Request*
Other Label	*ADT – BST linkage*
One scenario that illustrates virtual teamwork/intra organisational relationship is defining new requirements for the Enterprise System. In this context, task is overseen by team managers held on staff with local units. New changes or functionality are raised by a functional manager, such as procurement/ business process owners. Information is passed electronically to the in-house application development team - as a change control request. If the development team considers the scale of change to be large enough, the manager is asked to provide a "User	

Requirement Specification". Emails and a customized spread sheet are used. User requirements are followed by a more detailed "Functional Requirement Specification".

Functional requirements are written in conjunction with analysts. The analyst then works with other application specialists across the organisation and partnership – irrespective of their location - to produce a final "Technical Specification". Whenever changes are small, only the experience of the analyst at the requesting location is needed. A requirement may involve any number of people working on it. At least one person has ownership of a particular requirement, at a particular time. Conversely, if the requirements are large, a full-flesh project is initiated.

Name	*Design needs; Secondment basis Scenarios*

New functionalities highlight the strong interdependence between work in various geographical locations as well as the relationship between different ERP stakeholders. You could find business process owners that normally handle administrative services being transferred to the ERP support on a secondment basis to work with an application specialists.

Projects within the ERP programme do not maintain full free-standing operations in functions such as finance, audit, and procurement. Also, legal requirements, policy documentation, necessitated the participation of a range of expertise (e.g., HR, audit, finance). Team members are all disseminating knowledge and skills.

The ownership of the case organisation affects the composition of projects. Shareholder Executives have to approve projects; therefore, they encourage synergies between businesses in terms of common usage of resources. Development and maintenance of systems using specialists from other businesses is usually free. But some specialists provide support on a cross-charge basis. However, it also depends upon their current workload. Creating a resource pool has been talked about but has not been actively pursued.

There is evidence that some team members, who were working from the same location, were not always working on the same project concurrently. This is in the functional managers comment that when project team members are based in the same site (feet/meters apart from each other), it does not mean that they would be working on team related task at the same time. And weekly time allocated to project varied.

Name	*Formulating plans for IT; TASK INTERDEPENDENCE SCENARIOS*

Communication for a simple sub-task like 'defining system users' involves three key places: a requestor location, head office site and other sites where the software component would be designed and deployed. IST is responsible for developing an extensive framework for the IT infrastructure.

Name	*Documents communication links; Content of initiating task*

The initiating document (e.g. change control request) could originate from any functional manager in any location and at any time. They are authorized by quality assurance representatives. Technical specs& high level designs are also produced based on a consensus from internal and external experts. This leads to the actual development process. It is perhaps plausible to state that they have to be back-and-forth communication between team members until certain tasks are completed.

Further, the content management platform is used by in-house application specialist. By default, it forwards work items (comments, discussions, etc.) to all those involved in a particular project, including those members of the past projects or people in project that don't require particular correspondence. Using content management platforms was implied as being a non-substitute for periodic face-to-face meetings.

Name	*Pre-customization of Solution; Skills Dependence SCENARIOS (M13)*

In the ERP Programme, the resultant enterprise system requires an exhaustive and thorough implementation process, which can only be done by individuals with complementary skills set.

The implementation of ERP components is in phases. Consequently, they chose an incremental delivery method. New sub-systems are used in parallel with legacy systems. An industry report state that, 3rd party ERP partners do benefit from this implementation approach as it ties-them-in and significantly raises the cost of switching to other products and partners.

There is high vendor dependence as evidence by the ERP implementation approach: pre-customization of the ERP application, and having more functionalities incorporated as users get familiar with the system and related processes.

These requirements provide the motivation for the following adaptation of communication media behaviours in a virtual team environment.

Name	*Creating of shared knowledge base*

Knowledge sharing sessions help in the creating of shared knowledge

> *"But sometimes we also do in-house training. This is a refresh (sic) of all our disciplines (e.g. incidence management, change management, configuration management, release management & capacity management). Although we have all the documentation around those disciplines in the knowledge-based portal but sometimes within ourselves, we always try to do some kind of refresh."*

Name	*Styles for developing people; Joining a new team*

The evolving project requirements necessitated the changing of team composition. People where regularly moved around. As a consequence, there was frequent exchange of information between in-comers and exiting members.

Inexperienced team members had an active role right from inception. This appears to be important in promoting further virtual interaction.

> *"When I joined, I imagined it would be difficult being the only team member with no prior [experience and the lack of experience meant that collaboration tool had not been used before]. But in reality, it is not an issue...*
>
> *…Each [project activity] is an opportunity to try new features, pickup new skills and [get better at using the tools available]"*

The lack of experience in this narrative suggests that the collaboration tools available to the team might have not been used before by the team member. Yet, the interviewee seems to participate in project activities quite enthusiastically and even seems happy to learn and use new technologies

Name	*Creating share knowledge base; Training Infrastructure (M14)*

As part of the orientation for some business process owners and functional teams, employees undertook intensive short courses in project management & details, and application packages. Training was delivered via links to external resource portals, classroom training options, conferencing sessions and webinars. Web based training was facilitated by the internet and provided a unique opportunity for team members' on-staff at various sites to be taught concurrently, and in a uniform manner.

With client project team members and key users, although there are formal class training programmes in place, they benefitted greatly from web-based opportunities.

Name	*Investment-based interactions; Committed Relationships SCENARIOS (M16)*

The Joint Venture is basically financially related; unit grouping allows enhancement of potentials between affiliate companies. "For the last 4 years we have been on the path to becoming a more integrated team, rather than a company [operated] of individual investors…" Integration is] driven by the ERP system.

The Joint Venture originally focused on a regional market. However, since the mid 2000's it has been pursuing an aggressing West-African strategy. This has involved a series of acquisitions. In this regard, employees utilise a number of collaboration and communication technologies. These include: project management tools, instant messaging, VoIP, bug reporting tools, video for remote meetings, emails, global information repositories, and traditional telephone/mobile.

Name	*North-south difference; Religion*

For Muslims believers, Fridays is a day of worship. The Nigeria population is split almost 50-50 amongst the Muslim and non-Muslim citizenry. The thing is that Nigeria is administered as a federation of 37 states. Some are in the Muslim north, others in the Christian dominated south. Knowing about religions orientation was evidenced by some respondents:

> *"They're people, who, emmm, who could, (exhales), for example, in this part of the world, Saturday and Sunday are the week-holidays, but those across - in [let say the north] they work until Thursday but Friday can be half-day. So you have that cultural difference"*

Name	*Cultural sensitivity; identity; location-distance diversity*

Cultural difference exists in different forms and was recognised by people in different ways. For example:

> *"So you need to be able to know that, ok, if there is a job that needs to be done, well, you're not going to be looking to say – am not going to get this done and pushed out by Friday morning when it's going to someone in [the North] who needs it urgently, because [on] Friday they are not going to be at work [all day as they could be Muslim believers]. So it's just being aware of whom it is you're dealing with, where they are located – and just stuff that (inaudible)…your etiquettes. Communicating with people; you've got to be respectful, you're going to be morally upstanding, sticking out for the person who-is always right (avoiding stereotyping). If you've got all those things deep down – you're ok. (Interviewee remembering another line of reasoning), phone calls and all those other things are very helpful. They kind-off improve upon, ummm, they help improve the communicativeness of any engagement you have.*

Apparently, being sensitive to other people's culture was described as a critical success factor for improving interactions.

Name(s)	*Diversity; Language*

Based on the seer diversity and reach of Business services, issues of tribal identity can be described and evidenced.
The country has only one official language. As discussed earlier, the nature of the ERP programme, the process manufacturing market and the diverse work means that the system operates in various regions.

As people work across the different states of the federation, languages and cultural background in effect vary from person to person.
Although English is the official corporate language in Nigeria, the level of fluency and influence of first language accents, may still pose a threat to communication within the work place.

These challenges constitute barriers to communication. Can find same in Shachaf (2008) and Zhang & Lowry (2008) study.

Name(s)	*Adaptation of prince 2; Frameworks; Workflow*

To manage the workflow, a hybrid project management framework is used. It combines PRINCE 2 with waterfall or other methodologies at the implementation stage. PRINCE 2 is used to manage, and control the overall programme, including the various projects. It is also used to monitor budget, timelines, resources, risks, assumptions and dependencies.

Name	*Framework; Delivery SCENARIOS*

The technical development process had a 30-day life-cycle for each major delivery. Analysts worked with texts and used stories and context diagrams to describe their requirements.

Formal procedures exist to facilitate ongoing functioning of a virtual team. Service Managers have been trained in ITILL. It specifies some processes with an organization & its team members need to comply with. These include: managing and transmission of information across organizational boundaries.

SDLC is implemented.

Name:	*Data packet size; Network Operators*

Secondary data from the NCC (Nigeria Communication Commission) archive suggests that bad internet connections can happen for a variety of reasons and there include: wholesale broadband offerings, volume of traffic, restriction placed on the cellular network and so on. Further, data and voice communication differ in packet size. This means that the use of voice communication over transmission lines is considerably more expensive than data.

Analysis of project RAID documents reveals another factor that was perceived to have an impact on modes of communication: the vandalization sabotage of telecom infrastructure by disgruntled community youths or criminal gangs. In all the sites of where participants were domiciled, no wired telecom service was available. As a consequence, the organisation subscribes to broadband access from wireless-based telecomm companies (i.e. CDMA & GSM operators) implementing 3G, EDGE, and LTE networks.

Household subscriptions are also delivered by fixed wireless technologies.

Name	*Divergent world views; Mental models*

Whilst shared mental models exist, people also have divergent world views. This differences is more vivid between technical and non-technical people.

> *"When it comes to our itinerary; the business [guys], bless them, and technical guys are like different. The business guys or should I say not technical people come up with [the] plan in their head, while the technical guys are more realistic. They come up with the requirements in their head as if it's done already so they don't integrate well with the developers. So it's very useful to have someone who is technically inclined [to be] resourcing as opposed to someone who isn't.*

Name	*Management; Committed Relationships (M26)*

The operating structure is based on loosely linked autonomous units. Nonetheless, a senior managing directors' group is responsible for matters relating to people, investments and change management.

In the context of project team composition, the central organisation rarely took rural dwellers in for middle or executive position, except they had grown through the ranks.

Name	*Perception of formality; Handling Conflict*

Operational stakeholders and project executives saw the relationship between the various workplaces and sub-groups differently. On the one hand, an operating-level employee believed that the executives were still very 'traditional' in the sense that they prefer team managers to engage in face-to-face conversations - even to address minute conflict issues. On the other hand, the executive's stated goal was to reduce the perception of formality. There was a rather generous approach to finances, in terms of project traveling budget.

Rival agenda has resulted in clashes between executive management and operational-level practitioner before. In the real sense, it may be difficult to maintain a healthy work environment.

Looking at the segregated as ADT, resolving conflict face-to-face was problematic in that it did not often pass individual outlook. Or as explained by the interviewee with four years working experience on virtual team, some policies are "[inconsistent with] how I would like to work". Another complaint of incursion into enjoyed autonomy is:

> *"[do you know] we tried to avoid those meetings (SCOFFs) 'we'd not achieve anything' [for that day if meetings must be face-to-face]".*

Name	*Work processes*

The initial condition that needs to be satisfied for a virtual team strategy to emerge and for the team to subsequently add value is for the distance separation between people and the fragmentation of work. In all the support activities reference by respondents, work coordination was simplified through significant frameworks and models used between the various team members. Coordination was also simplified via reduction in interdependence between the different ERP components. For example, connectivity configurations did not have to interfere with the database schemas responsibilities. The key to making this feasible was the utilization of a skills framework for ERP support.

Within every project, support team members, although generally knowledgeable in all areas, had to specialize in a particular domain. The service management specialist did not have to border himself with the specific details of data storage. Likewise, local IT support analyst did not need a fine grain understanding of the hardware environmental variables in host server locations. Such work separation has been formalized in various industry process documents. Of course, without a structure to facilitate the coordination within the various stakeholders, virtual team work would have been quite tedious within the ERP programme.

It has been reported that from the mid-2000's, most enterprise system providers initiated or proffered cloud based solutions. These were provisions permitting organisations to source IT platforms or software services without actually owning the infrastructure or knowing exactly where they are based. This innovation meant that the various technical artefacts could become more separable. Therefore, a working virtually can happen within a team and at the project organisation level (between teams e.g. local IT and Application partners) as described in IST_ID3's comment.

Name	*Member role (M29)*

In the data segregated for BST, Extensions and modification project were underpinned by software change request and the deployment of add-on ERP modules. For example, when manufacturing execution was being developed, a respondent report that their task shifted from operational to project based. In this regard, new roles were created. For example, a new role of functional project manager – logistics was created for a participant who was a procurement specialist.

In the data segregated for ADT, there is had a clear ERP project management structure; the roles of stakeholders are relatively static. The virtual work arrangement didn't seem to spawn changes in roles or division of work. ERP projects where common (e.g. Plant Maintenance Systems, customer management, mail handlers, the payroll system interface, weight bridge truck scale and manufacturing execution - changes). The channel partners were also always involved in in-house operations. Also, the development of a new ERP component did not warrant the creation of new work roles or changes in divisions of labour. For instance, software tester remained software testers in and out of every project.

In the data segregated for IST, each person plays a vital role because they possess unique competences relevant to the support of the various system. They are both workers and leaders in their own right. For the same reason that distance is an important feature of virtual team work, team members can be independent from the organization location.

Name	*Cost*

In an ERP programme, it is sometimes unfeasible to have all technical artefacts developed and managed by a single entity. From the data segregated for IST, a consultant interviewee believes that the fact that people don't have to be in the same location to work together has financial rewards for a project organisation:

> *[Working in a virtual setting] reduces cost. This means people don't have to be in the same location to collaborate.*

However, throughout the interview session, only one comment suggests a possible relationship between virtuality and operating cost.

Name	*Mental models; Conformance to standards & Common language (M31)*

Comments related to 'the kind of information that is exchanged' hints at conformance to standards and the existence of a common language. These include: COA – Accounting principles, Analytical breakdown (i.e. cost centres, responsibility centres, and products descriptor) and Management Allocation Guide.

A power point training slide notes:

> *"The [manufacturing process's] Common Language is sponsored and developed by the [Division] to help to operate efficiently and achieve synergy in a multi-local organization…Being built on a vision for [the business's] operations management; it encapsulates rules & practices, integrating them into daily management…It standardizes the structure of information, enabling to share information easily…It is the basis to measure performance and benchmark"*

What's more, when it comes to integration or migrating legacy data, conformance to standards and common language also means that, diverse system modules could be coupled together to meet the desired business needs.

Name:	*Moving around; aspect of virtuality*

During the heavy raining season in the Southern Nigerian cities, it can be extremely difficult for people to get to work on-time or shuttle between multiple site offices. The poor condition of the roads and drainage systems in South-west Nigeria is a contributing factor.

With regards to working from home, its not unreasonable to think that because people work from any location, including their homes, the line between work and life may become blurred. That is, it may be difficult to identify when organisational work or personal life starts and ends.

Name	*Technology*

When work is separated by time, certain forms of technology are legitimized:

> *the technology a team employs must be taken into consideration before anyone can determine whether a particular virtual team is [characterized by] real time.*

The respondent also reports that KM technologies, for example enable his team continuously interact even though their work is separated by time. He made reference to the fact that even when some team members are co-located – due to their hot desk policy and regular site/audit visits; work was still performed virtually because the use KM results in temporal distribution. Although in this scenario, the entire team doesn't transcend boundaries of space, but a great proportion of team's task is still performed virtually.

Name:	*Media Available; Nature of technology*

Across the data set, various features of communication received attention from respondents.

"Most of the communication systems available today are tri-play, which means they offer telephony, videoconference and allow email mobility. With content management & cloud storage coming into the picture now, they are more or less quadrilles".

Basically, each of the business locations has all four of those and not just asynchronous features. The fact of the matter is that, if you want to have video capabilities available to your team, for instance, you would actually need to have telephone services.

Of course, by using multiple systems (synchronous & asynchronous) simultaneously, a kind of electronic integration is fostered among individuals and teams that have members operating from multiple sites offices. People are able to work together on complex ERP tasks – irrespective of their location - because their processes (i.e. task) and now computerised information systems are streamlined together. Likewise, information systems make it possible to integrate a range of professionals from business partners and semi-affiliate companies.

Multiple tools are used:

"Multiple technologies play a key role in the success of my job because without multiple means of communication, I'll have to be traveling 40 miles every week"

" Not [being] restricted to one set of communication"

IST's work conditions required stakeholders to regularly attend to information (inquiries & queries) from different sources and system users. With regards to asynchronous communication three web-based technologies were discussed: Email, workflow management for specialists (including content & cloud based storage) and messaging services. In asynchronous communication the sender and receiver may not be in different places.

What's more, the various data and data sources show that different virtual teams made investments in communication systems in order to enhance their own operations. On request, ICTs and network hardware devices were provided to individuals and teams. This comprised of standard Microsoft applications for reporting; process-control and monitoring tools for dedicated team (e.g. JIRA, for the application specialists, ITSM tools for service management), portals, email and telephoning infrastructures (e.g. VOIP phones & software).

Appendix B

- **Some definitions**
- **Exemplar Work Items**

Some definitions

Words	Meaning
Development projects	*In development projects, novelty and creativity is expressed, therefore, a significant degree of risk and uncertainty is involved. The potential for misalignments in communication and work design can be enormous.*
Formalized systems of communication	*Formalized systems of communication are used to access information that could be useful to others.*
International Joint ventures	*An international joint venture is defined as a project situation where organisational work cross organisational boundaries (PMBOK). Work may be temporary or repetitive with the aim of developing a product, effecting change or implementing a service.*
Project work	*Its is an atypical work that has special aims with the flexibility to cater from new tasks*
Programme	*A programme is a collection of projects. In this study it is treated as a single entity. But whenever specific distinctions exist in the sub task, they have been appropriately emphasised.*
Web Service, SOAP, XML	*Web based description and messaging protocols*
Asynchronous Communication	*This occurs when information is received at a different time.*
Managed Service	*This is the practice of allowing a 3rd party service provider to oversee the running and daily operations of information technology and systems*
Work items	*These are individually traceable task that can be assigned-to or executed by a person.*
Internet connected environment	*An internet connected environment is a collection of devices that are connected over the internet and are effectively used for the purpose of collaboration (P. Burnap)*
Risk	*This is a threat waiting to exploit the vulnerabilities on a process or an asset*

- Exemplar component transmitted & visualized and communicate to facilitate better decisions.

References

Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)(Kock, 2004)))(Kock, 2004))(Kock, 2004)()(Kock, 2004) (Kock, 2004)((Kock, 2004))(Kock, 2004)

AHUJA, M.K. & GALIVIN, J.E. 2003. Socialization in Virtual Groups. *Journal of Management.* 23, 2, 161 – 185.

AIKEN, M., WANG, J., GU, L., & PAOLILLO, J. 2011. An exploratory study of how technology supports communication in multilingual groups. International Journal of e-collaboration. 7, 1, 17 -29.

ALAMI, A., WONG, B. & MCBRIDE, T. 2008. Relationship Issues in Global Software Development Enterprises. *Journal of Global Information Technology Management,* 11**,** 49-68.

ALDEA, C. C., POPESCU, A.-D., DRAGHICI, A. & DRAGHICI, G. 2012. ICT Tools Functionalities Analysis for the Decision Making Process of Their Implementation in Virtual Engineering Teams. *Procedia Technology,* 5**,** 649-658.

ALGE, B. J., WIETHOFF, C. & KLEIN, H. J. 2003. When does the medium matter? Knowledge-building experiences and opportunities in decision-making teams. *Organizational Behavior and Human Decision Processes,* 91**,** 26-37.

ALHAWARY, F. A. 2012. Factors Affecting Virtual Team Works Collaboration: A Case Study in the Jordanian Royal Medical Services. *Journal of Information & Knowledge Management,* 11**,** 1250020.

ANDERSON, A. H., MCEWAN, R., BAL, J. & CARLETTA, J. 2007. Virtual team meetings: An analysis of communication and context. *Computers in Human Behavior,* 23**,** 2558-2580.

ANDERSON, W.N. & HILTZ, S.R. 2001. Culturally heterogeneous vs. culturally homogeneous groups in distributed group support systems: effects on group process and consensus. Proceedings of the 34th Annual Hawaii International Conference on System Sciences.

ANANTH, C.,NAZARETH, D. & RAMAMURTHY, K. 2011. Cognitive conflict and consensus generation in virtual team during knowledge capture: Comparative effectiveness of techniques. *Journal of Management Information Systems, 28, 1, 311 - 350.*

ARMSTRONG, D. J. & COLE, P. 2002. Managing distance and differences in geographically distributed work groups. *In:* HINDS, P. & KIESLER, S. (eds.) *Distributed Work.* Cambridge, MA: MIT Press.

ARDICHVILI, A., MAURER, M. LI, W., WENTLING, T. & STUEDEMANN, R. 2006. Cultural influences on knowledge sharing through online communities of practice. *Journal of Knowledge Management.* 10, 1, 94 - 107.

ARVAPALLY, R.S. & Liu, X.F. 2011 “Empirical evaluation of intelligent argumentation system for collaborative software project decision making”, at Intelligent Systems Center research symposium, Missouri University of Science and Technology.

AUBERT, B. A. & KELSEY, B. L. 2003. Further Understanding of Trust and Performance in Virtual Teams. *Small Group Research,* 34**,** 575-618.

BAILENSON, J. N., YEE, N., BLASCOVICH, J., BEALL, A. C., LUNDBLAD, N. & JIN, M. 2008. The use of immersive virtual reality in the learning sciences: Digital transformations of teachers, students, and social context. *The Journal of the Learning Sciences,* 17**,** 102-141.

BAILEY, D. E., LEONARDI, P. M. & BARLEY, S. R. 2012. The Lure of the Virtual. *Organization Science,* 23**,** 1485-1504.

BALTHAZARD, P. A., WALDMAN, D. A. & WARREN, J. E. 2009. Predictors of the emergence of transformational leadership in virtual decision teams. *The Leadership Quarterly,* 20**,** 651-663.

BALTHAZARD, P., POTTER, R.E & WARREN, J. 2004. Expertise, extraversion and group interaction styles as performance indications in virtual teams: how do perceptions of IT’s performance get formed. *ACM SIGMIS Database. 35, 1, 41 -64.*

BALTES, B.B., DICKSON, M. W, SHERMAN, P.M ,BAUER, C.C. & LAGANKE, S. J. 2002. Computer-Mediated Communication & Group Decision Making: A meta-analysis. *Organizational Behaviour & Human Decision Processes.* 87, 1, 156 – 179.

BARRICK, M.R., BRADLEY, B.H. & COLBERT, A.E. 2007. The moderating role of topem management team interdependence: Implications on real team and working groups. *Academy of Management Journal.* 50, 3, 544- 557

BARCUS, A. & MONTIBELLER, G. 2008. Supporting the allocation of software development work in distributed teams with multi-criteria decision analysis☆. *Omega,* 36**,** 464-475.

BARUCH, Y. & LIN, C.-P. 2012. All for one, one for all: Coopetition and virtual team performance. *Technological Forecasting and Social Change,* 79**,** 1155-1168.

BEAUBIEN, J.M & BAKER, D.P. 2004. The use of simulation for training teamwork skills in healthcare: how low can you go? *Qual Saf Health Care.* 13

BELL, B. S. & KOZLOWSKI, S. W. J. 2002. A typology of virtual teams - Implications for effective leadership. *Group & Organization Management,* 27**,** 14-49.

BENBASAT, I., GOLDSTEIN, D. K. & MELISSA, M. 1987. The Case Research Strategy in Studies of Information Systems. *MIS Quarterly,* 11**,** 369-386.

BELENGER, F. & COLLINS, R.W. 1998. Distributed work arrangements: A research framework. *The information society.* 14, 2, 137 - 152.

BENBUNAN-FICH, R., HILTZ, S. R., & TUROFF, M. 2001. A comparative content analysis of face-to-face vs ALN-mediated teamwork. *Proceedings of the 34th Annual Hawaii International Conference on*, Maui, HI, USA.

BEISE, C. , EVARISTO, R., NIEDERMAN, F. 2004. Virtual Meetings and Tasks: From GSS to DGSS to Project Management. *Proceedings of the 36th Hawaii International Conference on System Science*

BEISE, C. 2004. IT Project Management and Virtual Teams. *SIGMIS'04, April 22 - 24,* Arizona, USA

BITEKTINE, A. 2007. Prospective Case Study Design: Qualitative Method for Deductive Theory Testing. *Organizational Research Methods,* 11**,** 160-180.

BJARNASON, E., SMOLANDER, K., ENGSTRÖM, E. & RUNESON, P. A theory of distances in software engineering. *Information and Software Technology*.

BJORN, P. & NGWENYAMA, O. 2009. Virtual team collaboration: building shared meaning, resolving breakdowns and creating translucence. *Information Systems Journal,* 19**,** 227-253.

BLUEJEAN (September 24, 2012) *Fly me to the room: A Government Video Conferencing Collaboration report.* Retrieved November 2013. www.teleworkexchange.com

BLOMQUIST, T., HALLGREN, M., NILSSON, M. 2005. Development of virtual teams and learning communities. *Formex*

BRYANT, P. T., ALBRING, S. M. & MURTHY, U. 2009. The effects of rewards structure, media richness and gender on virtual teams. *International Journal of Accounting Information Systems,* 10**,** 190-213.

BURRELL, G. & MORGAN, G. 2005. Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate life. Ashgate Publishing Company. USA.

BULLINGHAM, L. & VASCONCELOS, A. C. 2013. 'The presentation of self in the online world': Goffman and the study of online identities. *Journal of Information Science,* 39**,** 101-112.

BURKE, K. & CHIDAMBARAM, L. 1999. How much bandwidth is enough: A longitudinal examination of media characteristics and group outcome. *MIS Quarterly,* 23**,** 557-580.

CABALLER, A., GRACIA, F. & PEIRÓ, J. M. 2005. Affective responses to work process and outcomes in virtual teams:effects of communication media and time pressure. *Journal of Managerial Psylchology,* 20.

CARLESS, S. A. & DE PAOLA, C. 2000. The Measurement of Cohesion in Work Teams. *Small Group Research,* 31**,** 71-88.

CARLSON, J. R. & ZMUD, R. W. 1999. Channel Expansion Theory and the experential nature of media richness perception. *Academy of Management Journal,* 42**,** 153-170.

CARLSON, J.R, & GEORGE, J.F.2004. Media appropriateness in the Conduct and Deceptive Communication: The Relative Influence of Richness and Synchronicity. *Group Decision and Negotiation.* 13,2, 191-210.

CARMEL, E. & AGARWAL, R. 2001. Tactical approaches for alleviating distance in global software development. *IEEE Software,* 18**,** 22-29.

CARTE, T. & CHIDAMBARAM, L. 2004. A Capabilities-Based Theory of Technology Deployment in Diverse Teams: Leapfrogging the Pitfalls of Diversity & leveraging its potential with Collaborative Technology. *Journal of the Association for Information Systems.* 5, 11.

CHANG, C. M. 2011. New organizational designs for promoting creativity: A case study of virtual teams with anonymity and structured interactions. *Journal of Engineering and Technology Management,* 28**,** 268-282.

CHUDOBA, K. M., WYNN, E., LU, M. & WATSON-MANHEIM, M. B. 2005. How virtual are we? Measuring virtuality and understanding its impact in a global organisation. *Information Systems Journal,* 15**,** 276-306.

COHEN, S. & BAILEY, D. E. 1997. What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management,* 23**,** 239-290.

COHEN, S. & GIBSON, C. 2003. In the beginning: Introduction and framework. *In:* GIBSON, C. & COHEN, S. (eds.) *Virtual Teams That WOrk: Creating Conditions for Virtual Team Effectiveness.* San Francisco, CA, USA: Jossey-Bass.

COLLIS, J. & HUSSEY, R. 2003. Business Research: A Practical Guide for Undergraduate & Postgraduate Students, *Palgrave Macmillan,* Houndmills, Bassignstoke.

CONNELL, A. F. & NORD, W. R. 1996. The bloodless coup: The infiltration of organisation science by uncertainty and values. *The Journal of Applied Behavioural Science,* 32**,** 407-427.

CONTRACTOR, N. & EISENBERG, E. 1990. Communicationa Network and New media in organization. *In:* FULK, J. & STEINFELD, C. (eds.) *Organization and Communication Technology.* Newbury Park, CA, USA: Sage Publications.

CONWAY, M. E. 1968. How do committees invent?design organisation criteria. *Datamation***,** 28-31.

CORBIN, J., STRAUSS, A. 2008. Basics of Qualitative Research: Techniques & Procedures for Developing Grounded Theory. 3rd ed. Thousand Oaks, CA: Sage.

COUSINS, K. C., ROBEY, D. & ZIGURS, I. 2007. Managing strategic contradictions in hybrid teams. *European Journal of Information Systems,* 16**,** 460-478.

CRABTREE, B. F. & MILLER, W. L. 1999. Using codes and code manuals: a template organizing style of interpretation. *In:* CRABTREE, B. F. & MILLER, W. L. (eds.) *Doing Qualitative Research.* 2nd ed. Newbury Park, CA: Sage.

CRAMTON, C. D. 2001. The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science,* 12**,** 346-371.

CRESWELL, J. W. 2003. *Research Design: Qualitative and Quantitative Approaches,* Thousand Oaks, Sage.

CURSEU, P. L., SCHALK, R. & WESSEL, I. 2008. How do virtual teams process information? A literature review and implications for management. *Journal of Managerial Psychology,* 23**,** 628-652.

DAFT, R. L. & LENGEL, R. H. 1986. Organisational information requirement, media richness and structural design. *Management Science,* 32**,** 554-571.

DAIM, T. U., HA, A., REUTIMAN, S., HUGHES, B., PATHAK, U., BYNUM, W. & BHATLA, A. 2012. Exploring the communication breakdown in global virtual teams. *International Journal of Project Management,* 30**,** 199-212.

DAMIAN, D., SHAW, M. L. G. & GAINES, B. R. A Study of Requirements Negotiation in Virtual Project Teams. ECIS 2000 pROCEEDINGS, 2000.

DEKKER, D. M., RUTTE, C. M. & VAN DEN BERG, P. T. 2008. Cultural differences in the perception of critical interaction behaviors in global virtual teams. *International Journal of Intercultural Relations,* 32**,** 441-452.

DELUCA, D., GASSON, S. & KOCK, N. 2006. Adaptations that virtual teams make so that complex tasks can be performed using simple E-collaboration Technologies. *International Journal of e-collaboration,* 2**,** 64-89.

DELUCA, D. & VALACICH, J. S. 2006. Virtual teams in and out of synchronicity. *Information Technology & People,* 19**,** 323-344.

DELONE, W.H. & MCLEAN, E. R. 2003. The Delone & Mclean Model of Information Systems Success: A ten year update.*Journal of Management Information Systems.* 19, 4, 9-30

DENNIS, A., FULLER, R. & VALACICH, J. 2008. Media, tasks, and communication processes: A theory of media synchronicity. *MIS Quarterly,* 28**,** 1-20.

DENNIS, A. R. & KINNEY, S. T. 1998. Testing Media Richness Theory in the New Media: The Effects of Cues, Feedback, and Task Equivocality. *Information Systems Research,* 9**,** 256-274.

DENNIS, A. R. & VALACICH, J. S. 1999. Rethinking Media Richness: Towards a Theory of Media Synchronicity. *Proceedings of the 32 Hawaii International Conference on System Sciences*.

DENNIS, A.R & GARFIELD, M.J. 2003. The adoption and use of GSS in project teams: towards more participative processes and outcomes.*MIS Quarterly. 27. 2*

DESANCTIS, G. & GALLUPE, R. B. 1987. A foundation for the study of group decision support systems. *Management Science,* 33**,** 589-609.

DESANCTIS, G. & POOLE, M. S. 1994. Capturing the Complexity in Advanced Technology Use - Adaptive Structuration Theory. *Organization Science,* 5**,** 121-147.

DUBERLEY, J., JOHNSON, P., & CASSELL, C.M. *Philosophies underpinning qualitative research. In:* SYMON, G. & CASSEL, C. (eds.) *Qualitative Organisational Research: Core Methods & Current Challenges.* Thousand Oaks, California: Sage.

DUBÉ, L. & ROBEY, D. 2008. Surviving the paradoxes of virtual teamwork. *Information Systems Journal,* 19**,** 3-30.

DUNN, K. KOHLBECK, M.K. & MAGILIKE, M. 2009. Future profitability, operating cash flows, and Market valuations associated with offshore arrangement of Technology jobs. *Journal of Information Systems.* 23, 2, 25 - 47.

EARLEY, P. C. & MOSAKOWSKI, E. 2000. Creating Hybrid Team Cultures: An Empirical Test of Transnational Team Functioning. *The Academy of Management Journal,* 43**,** 26-49.

EASTERBY-SMITH, M., THROPE, R., & LOWE, A.2004. Management Research. 2nd ed. London: Sage Publications.

EDWARDS, H. K. & SRIDHAR, V. Analysis of the Effectiveness of Global Virtual Teams in Software Engineering Projects. 30th Hawaii International Conference on System Sciences, 2005 Hawaii. IEEE.

EISENHARDT, K.M & GRAEBNER, M.E. 2007. Theory building from cases: opportunities and challenges. *Academy of Management Journal.* 50, 1, 25 - 32.

EL-SHINNAWY, M. & MARKUS, M. L. 1997. The poverty of media richness theory: explaining people's choice of electronic mail vs. voice mail. *International Journal of Human-Computer Studies,* 46**,** 443-467.

ESPINOSA, J. A. & CARMEL, E. 2004. The impact of time separation on coordination in global software teams: a conceptual foundation. *Journal of Software Process: Improvement and Practice,* 8**,** 249-266.

ESPINOSA, J. A., CUMMINGS, J. N., WILSON, J. M. & PEARCE, B. M. 2003. Team boundary issues across global firms. *Journal of Management Information Systems,* 19**,** 157-190.

ESPINOSA, J. A., DELONE, W. & LEE, G. 2006. Global boundaries, task processes and IS project success: a field study. *Information Technology & People,* 19**,** 345-370.

ESPINOSA, J.A., SLAUGHTER, S.A., KRAUT, R.E. & HERBSLEB, J.D. 2007. Familiarity, complexity and team performance in geographically distributed software development. *Organisation Science,* 18,4, 613 - 630

ESPINOSA, J.A.,NAN,N. & CARMEN,E. 2015.Temporal Distance, Communication Patterns, and Task Performance in Teams. *Journal of Management Information Systems.* 32,1,151-191

ETIM, A. S. & HUYNH, K. 2015. The Use of Social Media and COllaborative Tools for Virtual Teaming - A Global Market Reach Out By NaviBank. *International Journal of Management & Information Systems,* 19.

FAHEY, R. VASCONCELOS, A.C. & ELLIS, D. 2007. The impact of rewards within communities of practice: a study of the SAP online global community. *Knowledge management research & practice. 3,* 5, 186 - 198.

FANG, C., NUNAMAKER, J. F., ROMANO, N. C. & BRIGGS, R. O. A collaborative project management architecture. 36th Annual Hawaii International Conference on System Science, 2003 Hawaii. 12 pp.

FRASER, S. & MANCL, D. 2008. No Silver Buller: Software engineering reloaded. *IEEE Software 25, 1, 91 - 94.*

FAVELA, J. & PENA-MORA, F. 2001. An Engineering Education. *IEEE Software***,** 47-53.

FIOL, C. M. & O'CONNOR, E. J. 2005. Identification in face-to-face, hybrid, and pure virtual teams: Untangling the contradictions. *Organization Science,* 16**,** 19-32.

FLICK, U. 2009. An introduction to qualitative research. 4th eds. London: Sage

FULLER, C. M., MARETT, K. & TWITCHELL, D. P. 2012. An Examination of Deception in Virtual Teams: Effects of Deception on Task Performance, Mutuality, and Trust. *IEEE Transactions on Professional Communication,* 55**,** 20-35.

GATLIN-WATTS, R., CARSON, M., HORTON, J., MAXWELL, L., & MALTBY, N. 2007. A guide to global virtual teaming. Team Performance Management. 13, 1, 47 – 52.

GALBRAITH, J.R. 1973. Designing complex organisation design. Addison - Wesley Publishing Company

GALLIVAN, M. J. 2001. Striking a balance between trust and control in a virtual organisation: a content analysis of open source software case studies. *Information Systems Journal,* 11**,** 277-304.

GERRING, J. 2007. Case Study research: Principles and practices. Cambridge, UK: Cambridge University Press.

GIBSON, C. B. & GIBBS, J. L. 2006. Unpacking the concept of virtuality: The effects of geographical dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly,* 51**,** 451-495.

GILSON, L. L., MAYNARD, M. T., JONES YOUNG, N. C., VARTIAINEN, M. & HAKONEN, M. 2015. Virtual Teams Research: 10 Years, 10 Themes, and 10 Opportunities. *Journal of Management,* 41**,** 1313-1337.

GIURI, P., RULLANI, F. & TORRISI, S. 2008. Explaining leadership in virtual teams: The case of open source software. *Information Economics and Policy,* 20**,** 305-315.

GILL, J. & JOHNSON, P. 2010. Research Methods for Managers. 4th edition. London: SAGE Publiations Ltd

GLANCY, F. H. & ISENBERG, S. K. A conceptual e-learning framework, extending media synchronicity theory. European, Mediterranean & Middle Eastern Conference on Information Systems (EMCIS20011), 2011. 636-649.

GOFFMAN, E. 1990. *The Presentation of Self in Everyday Life*, Penguin Books.

GONZÁLEZ-NAVARRO, P., ORENGO, V., ZORNOZA, A., RIPOLL, P. & PEIRÓ, J. M. 2010. Group interaction styles in a virtual context: The effects on group outcomes. *Computers in Human Behavior,* 26**,** 1472-1480.

GOPAL, A. & PRASAD, P. 2000. Understanding GDSS in symbolic context: shifting the focus from technology to interaction. *MIS Quarterly.* 24,3, 509 - 546

GREENBERG, P. S., GREENBERG, R. H. & ANTONUCCI, Y. L. 2007. Creating and sustaining trust in virtual teams. *Business Horizons,* 50**,** 325-333.

GRIFFITH, T. L., SAWYER, J. E. & NEALE, M. A. 2003. Virtualness and knowledge in teamsL Managing the love triangle of organizations, individuals, and information technology. *MIS Quarterly,* 27**,** 265-287.

GUPTA, A., MATTARELLI, E., SESHASAI, S. & BROSCHAK, J. 2009. Use of collaborative technologies and knowledge sharing in co-located and distributed teams: Towards the 24-h knowledge factory. *The Journal of Strategic Information Systems,* 18**,** 147-161.

GURKAN, A., IANDOLI, L. KLEIN, M. & ZOLLO, G. 2010. Mediating debate through online large-scale argumentation: Evidence from the field. *Information Sciences* 180, 19, 3686 – 3702.

HACKMAN, R. 1990. *Groups that work and those that dont,* San Francisco, Jossey-Bass.

HARVEY, M., NOVICEVIC, M. M. & GARRISON, G. 2004. Challenges to staffing global virtual teams. *Human Resources Management Review,* 14**,** 275-294.

HAZEMI, R., HAILES, S. & WILBUR, S. 1998. Supporting Asynchronous Collaboration in Academia. *In:* HAZEMI, R., HAILES, S. & WILBUR, S. (eds.) *The Digital University.* Springer London.

HENTTONEN, K. & BLOMQVIST, K. 2005. Managing distance in a global virtual team: the evolution of trust through technology-mediated relational communication. *Strategic Change.* 14, 2, 107 – 119

HERBSLEB, J. D., MOCKUS, A., FINHOLT, T. & GRINTER, R. E. 2000. Distance, dependencies and delay in a global collaboration. *ACM Conference on Computer Supported Collaborative Work*.

HERBSLEB, J.D., & GRINTER, R.E. 1999. Architectures, coordination, and distance: Conway's law and beyond. *IEEE Software.* 16,5,63-70

HERBSLEB, J.D., PAULISH, D.J., BASS, M. 2005. Global software development at siements: experience from nine projects. *ICSE: Proceedings of the 27th International Conference on Software Engineering,.* Missouri, USA

HERBSLEB, J. D., & MOCKUS, A. 2003. An Empirical study of speed & communication in global distributed software development. *`IEEE Transactions on Software Engineering.* 29, 6, 481 - 494

HEEKS, R., KRISHNA, S., NICHOLSEN, B. & SAHAY, S. 2001. Synching or sinking: global outsourcing relatiionships *IEEE Software.* 18, 2

HIGHTOWER, R. T. & SAYEED, L. 1996. Effects of communication mode and prediscussion information distribution characteristics on information exchange in groups. *Information Systems Research,* 7, 4, 451-465.

HINDS, P. J. & BAILEY, D. E. 2003. Out of sight, out of sync: Understanding conflict in distributed teams. *Organization Science,* 14**,** 615-632.

HINDS, P.J. & MCGRATH, C. 2006. Structures that work: Social structure, work structure and coordination ease in geographically distributed teams. Proceedings of the 20th Conference on Computer Supported Cooperative Work, Banff, Alberta, Canada.

HINDS, P.J & MORTENSEN, M. 2005. Understanding conflict in geographically distributed teams: The moderating effects of shared identity, shared context, and spontaneous communication. *Organisation Science.* 16, 290 - 307

HOCH, J. E. & KOZLOWSKI, S. W. 2014. Leading virtual teams: Hierarchical leadership, structural supports, and shared team leadership. *Journal of applied psychology,* 99**,** 390.

HOFSTEDE, G. 2001. Culture's Consequences: Comparing Values, Behaviors, Institutions and Organisations across Nations. *In:* PUBLICATIONS, S. (ed.) 2nd ed. Thousand Oaks, CA: Sage Publications.

HOFEFLING, T. 2003. Working virtually: Managing people for successful virtual teams & Organisations. Virginia: Stylus Publishing

HOLDEN, M.T. & LYNCH, P. 2004. Choosing the Appropriate Methodology: Understanding Research Philosophy. *The Marketing Review.* 4, 397 - 409.

HORWITZ, F. M., BRAVINGTON, D. & SILVIS, U. 2006. The promise of virtual teams: identifying key factors in effectiveness and failure. *Journal of European Industrial Training,* 30**,** 472-494.

HOSSEINI, M. R. & CHILESHE, N. 2013. Global virtual engineering teams (GVETs): A fertile ground for research in Australian construction projects context. *International Journal of Project Management,* 31**,** 1101-1117.

HUANG, R., KAHAI, S. & JESTICE, R. 2010. The contingent effects of leadership on team collaboration in virtual teams. *Computers in Human Behavior,* 26**,** 1098-1110.
HUGHES, J. & SHARROCK. W. 1990. The philosophy of social research. 3rd edition. Longman: Harlow.
HUNT, S. D. 1991. Positivism and Paradigm Dominance in Consumer Research: Toward critical pluralism and rapprochement. *Journal of Consumer Research.* 18, 1, 32 -44
HUSSEY, J. & HUSSEY, R. 1997. Business research: a practical guide for undergraduate and postgraduates students. Basingstoke: Macmillian.
ILGEN, D. R., HOLLENBECK, J. R., JOHNSON, M. & JUNDT, D. 2005. Team in organizations: From input-process-output models to IMOI models. *Annual Review of Psychology,* 56**,** 517-543.
INTERNATIONAL-LABOUR-ORGANSITION(ILO) 2013. Global Employment Trends: Recovering from a second Jobs dip.
INTERNATIONAL-TELECOMMUNICATIONS-UNION(ITU) 2009. Measuring the Information Society.
INTERNATIONAL-TELECOMMUNICATIONS-UNION(ITU) 2012. Measuring the Information Society.
JARMAN, R. 2005. When Success Isn't Everything – Case Studies of Two Virtual Teams. *Group Decision and Negotiation,* 14**,** 333-354.
JASIMUDDIN, S. M., CONNELL, C. & KLEIN, J. H. 2012. Knowledge transfer frameworks: an extension incorporating knowledge repositories and knowledge administration. *Information Systems Journal,* 22**,** 195-209.
JASIMUDDIN, S. M., CONNELL, C. & KLEIN, J. H. 2014. A decision tree conceptualization of choice of knowledge transfer mechanism: the views of software development specialists in a multinational company. *Journal of Knowledge Management,* 18**,** 194-215.
JOINSON, C. 2002. Managing virtual teams. *HR Magazine,* 47**,** 68-73.
KANAWATTANACHAI, P., & YOO, Y. 2002. Dynamic nature of trust in virtual teams. *Journal of Strategic Information Systems.* i11 4, 187 - 213
KAYWORTH, T. R. & LEIDNER, D. E. 2000. The Global Virtual Manager: A Prescription for Success. *European Management Journal,* 18**,** 183-194.
KAYWORTH, T. R. & LEIDNER, D. E. 2002. Leadership effectiveness in global virtual teams. *Journal of Management Information Systems,* 18**,** 7-41.
KAY, J. 1993. Foundation for corporate success: How business strategies Add value
KEITH, M., DEMIRKAN, H., & GOUL, M. 2008. The influence of collaborative technology knowledge on advice network structures. *Decision Support Systems.* 50, 1, 140 - 151
KERSLEY, B. ALPIN, C., FORTH, J., BRYSON, A., BEWLEY, H., DIX, G. & OXENBRIDGE, S. 2005. Inside the workplace: First finding from the 2004 Workplace Employment Relations Survey. London: Department of Trade & Industry.
KELLOGG, C., ORLIKOWSKI, W.J. & YATES, J. 2006. Life in the trading zone: structuring across boundaries in post bureaucratic organisations. *Organisation Science. 17, 1, 22 - 44*
KING, N. 2012. Doing Template Analysis. *In:* SYMON, G. & CASSEL, C. (eds.) *Qualitative Organisational Research: Core Methods & Current Challenges.* Thousand Oaks, California: Sage.
KIESLER, S. & CUMMINGS, J. 2002. What do we know about proximity and distance in work groups? In *Distributed Work.* HINDS, P. & KIESLER, S. eds. MIT Press, Cambridge, MA.
KIRKMAN, B. L. & MATHIEU, J. E. 2005. The dimensions and antecedents of team virtuality. *Journal of Management,* 31**,** 700-718.
KIRKMAN, B. L., ROSEN, B., GIBSON, C. B., TESLUK, P. E. & MCPHERSON, S. O. 2002. Five challenges to virtual team success: Lessons from Sabre, Inc. *Academy of Management Executive,* 16**,** 67-79.
KIRKMAN, B. L., ROSEN, B., TESLUK, P. E. & GIBSON, C. B. 2004. The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal,* 47**,** 175-192.

KIRKMAN, B. L., ROSEN, B., TESLUK, P. E. & GIBSON, C. B. 2006. Enhancing the transfer of computer-assisted training proficiency in geographically distributed teams. *J Appl Psychol,* 91**,** 706-16.
KLEIN, J. H., CONNELL, N. & MEYER, E. 2005. Knowledge characteristics of communities of practice. *Knowledge Management Research & Practice,* 3**,** 106-114.
KLEIN, M. 2007. The MIT Collaboratorium: Enabling Effective Large-Scale Deliberation for Complex Problems. *MIT Sloan Research. 4679 – 08.*
KLIMOSKI, R. & S., M. 1994. Team mental model: Construct or metaphor. *Journal of Management,* 20**,** 403-437.
KLITMØLLER, A. & LAURING, J. 2013. When global virtual teams share knowledge: Media richness, cultural difference and language commonality. *Journal of World Business,* 48**,** 398-406.
KOCK, N. 2001a. The ape that used email: Understanding e-communication behaviour through evolution theory. *Communication of Association for Information Systems,* 5**,** 1-29.
KOCK, N. 2001b. Asynchronous and distributed process improvement: the role of collaborative technologies. *Info Systems Journal,* 11**,** 87-110.
KOCK, N. 2004. The Psychobiological Model: Towards a New Theory of Computer-Mediated Communication Based on Darwinian Evolution. *Organization Science,* 15**,** 327-348.
KOCK, N. 2005. Compensation Adaptation to Media Obstacles: An experimental study of process redesign dyads. *Information Resources Management Journal,* 18**,** 41-67.
KOCK, N. & LYNN, G. S. 2012. Research Article Electronic Media Variety and Virtual Team Performance: The Mediating Role of Task Complexity Coping Mechanisms. *IEEE Transactions on Professional Communication,* 55**,** 325-344.
KRATZER, J., LEENDERS, R. T. A. J. & VAN ENGELEN, J. M. L. 2006. Managing creative team performance in virtual environments: an empirical study in 44 R&D teams. *Technovation,* 26**,** 42-49.
KRIPALANI, M. & ENGARDIO, P. 2003. The Rice of India. Business Week.
LAU, D. C. & MURNIGHAN, J. K. 1998. Demographic Diversity and Faultlines: The Compositional Dynamics of Organizational Groups. *The Academy of Management Review,* 23**,** 325-340.
LEE-KELLEY, L. 2006. Locus of control and attitudes to working in virtual teams. *International Journal of Project Management,* 24**,** 234-243.
LEENDERS, R. T. A. J., VAN ENGELEN, J. M. L. & KRATZER, J. 2003. Virtuality, communication, and new product team creativity: a social network perspective. *Journal of Engineering and Technology Management,* 20**,** 69-92.
LEWIS, M. W. 2000. Exploring Paradox: Toward a More Comprehensive Guide. *The Academy of Management Review,* 25**,** 760-776.
LI, J. & HAMBRICK, D.C. 2005. Factional Groups: A New Vantage on Demographic Fault lines, Conflict, & Disintegration in Work Teams. *Academy of Management Journal.* 48, 5, 794 – 813.
LIN, C., STANDING, C., & LIU, Y. 2008. A model to develop effective virtual teams. *Decision Support Systems.* 45, 4, 1031 – 1045.
LU, M., WATSON-MANHEIM, M. B., CHUDOBA, K. M. & WYNN, E. 2006. How does virtuality affect team performance in a global organisation? Understanding the impact of variety of practices. *Journal of Global Information Technology Management,* 9**,** 4-23.
LIU, X. WANCHOO, R. & ARVAPALLY, R. S. 2011. Empirical study of an intelligent argumentation system in MCDM. *International Conference on Collaboration Technology & System (CTS)* 125 -133.
LUREY, J. S. & RAISINGHANI, M. S. 2001. An empirical study of best practices in virtual teams. *Information & Management,* 38**,** 523-544.
MAGNI, M., MARUPING, L.M., HOEGL, M. & PROSERPIO, P. 2013. Managing the Unexpected Across Space: Improvisation, Dispersion, and Performance in NPD Teams. *Journal of Product Innovation Management.* 30,5, 1009-1026
MAISTER, D.H. 1997. Managing the professional service firm. *Free Press Publishers, New York*

MAJCHRZAK, A., RICE, R. E., KING, N., MALHOTRA, A. & BA, S. 2000a. Computer-mediated inter-organizational knowledge-sharing: Insights from a virtual team innovating using a collaborative tool. *Information Resource Management Journal,* 13**,** 44-53.

MAJCHRZAK, A., RICE, R. E., MALHOTRA, A., KING, N. & BA, S. L. 2000b. Technology adaptation: The case of a computer-supported inter-organizational virtual team. *MIS Quarterly,* 24**,** 569-600.

MALHOTRA, A., MAJCHRZAK, A. & BENSON, R. 2007. Leading Virtual Teams. *Academy of Management Perspectives,* 21**,** 60-70.

MALHOTRA, A., MAJCHRZAK, A., CARMAN, R. & LOTT, V. 2001. Radical Innovation Without Collocation: A case study at Boeing-Rocketdyne. *MIS Quarterly,* 25**,** 229-249.

MARKS, M. A., MATHIEU, J. E. & ZACCARO, S. J. 2001. A temporally based framework and taxonomy of team processes. *Academy of Management Review,* 26**,** 356-376.

MARKUS, L. 1983. Power, politics and MIS implementation *Communications of the ACM,* 26**,** 430-444.

MARKUS, M. L. 1994. Electronic mail as the medium of managerial choice. *Organisation Science,* 5**,** 502-527.

MARKUS, M.L. MANVILLE, B., AGRES, C. E. 2000. What makes virtual organisation work?. Sloan Management Review. 13 - 26

MARUPING, L. M., X. ZHANG, X., VENKATESH, V. 2009. Role of collective ownership and coding standards in coordinatiing sepertise in software project teams. *European Journal of Information Systems.* 18, 4

MARTINS, L. L. & SHALLEY, C. E. 2011. Creativity in Virtual Work: Effects of Demographic Differences. *Small Group Research,* 42**,** 536-561.

MARTINS, L.L & SCHILPZAND, M. C. 2011. Global Virtual Teams: Key Developments, Research Gaps & Future Directions. *Research in Personnel & Human Resources Management, 1 – 17.*

MASSEY, A. P., MONTOYA-WEISS, M.M & HUNG, Y. 2003. Because time matters: Temporal coordination in Global virtual project teams. *Journal of Management Information Systems.* 19, 4, 129 – 155.

MATHIEU, J., MAYNARD, M. T., RAPP, T. & GILSON, L. 2008. Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse Into the Future. *Journal of Management,* 34**,** 410-476.

MAY, A. & CARTER, C. 2001. A case study of virtual team working in the European Automotive Industry. *International Journal of Industrial Ergonomics,* 27**,** 171-186.

MAZNEVSKI, M. & CHUDOBA, K. M. 2000. Bridging space over time: Global virtual team dynamics and effective. *Organization Science,* 11**,** 473-492.

MCDONOUGH, E. F., KAHN, K. & BARCZAK, G. 2001. An investigation of the use of global, virtual and colocated new product development teams. *Journal of Product Innovation Management,* 18**,** 110-200.

MCGRATH, J. E. 1991. Time, Interaction, and Performance (TIP): A theory of groups. *Small Group Research,* 22**,** 147-174.

MCGRATH, J. E., ARROW, H. & BERDAHL, J. L. 2001. The study of groups: Past, present, and future. *Social Psychology Review,* 4**,** 95-105.

MEYERSON, D. & MARTIN, J. 1987. Cultural change: An Integration of three different views. *Journal of Management Studies.* 24, 6, 623 – 647.

MILES, M. B. & HUBERMAN, A. M. 1994. *Qualitative Data Analysis: An Expanded Sourcebook,* Beverly Hills, CA, Sage Publications.

MINOCHA, S. & MORSE, D. R. 2010. Supporting distributed team working in 3D virtual worlds: a case study in Second Life. *Interactive Technology and Smart Education,* 7**,** 200-219.

MINTZBERG, H. & SUMANTRA, G. 2002. *The strategy process*. Harlow: Financial Times Prentice Hall.

MONTOYA-WEISS, M. M., MASSEY, A. P. & SONG, M. 2001. Getting it together: Temporal coordination and conflict management in global virtual teams. *Academy of Management Journal,* 44**,** 1251-1262.

MONALISA, M., DAIM, T. , PRANABESH, D., MIRANI, F., & BHUSHAFI, V. 2008. Managing Virtual design team. Research- Technology Management 51, 4, 48 - 59.

MUETHEL, M., GEHRLEIN, S. & HOEGL, M. 2012. Socio-demographic factors and shared leadership behaviors in dispersed teams: Implications for human resource management. *Human Resource Management,* 51**,** 525-548.

MUNKVOLD, B. E. & ZIGURS, I. 2007. Process and technology challenges in swift-starting virtual teams. *Information & Management,* 44**,** 287-299.

MURUGESAN, S. 2007. Understanding Web 2.0. *Journal of IT professional.* 9, 4, 34 – 41.

NAIK, N. & KIM, D. 2010. An Extended Adaptive Structuration Theory Framework for Determinants of Virtual Team Sucess. *Sprouts: Papers on Information Systems,* 10.

NANDHAKUMAR, J. & BASKERVILLE, R. 2006. Durability of online teamworking: patterns of trust. *Information Technology & People,* 19**,** 371-389.

NATIONAL-ARCHIVES-&-RECORDS-ADMINISTRATION 2011. Promoting Efficient Spending. *In:* FEDERAL-REGISTER (ed.). The White House: Presidencial Document.

NGUYEN, T., WOLF, T. & DAMIAN, D. 2008. Global Software Development and Delay: Does Distance Still Matter? **,** 45-54.

NGWENYAMA, O. K. & LEE, A. S. 1997. Communication richness in electronic mail: Critical social theory and the contextuality of meaning. *MIS Quarterly,* 21**,** 145-167.

NIINIMÄKI, T., PIRI, A., LASSENIUS, C. & PAASIVAARA, M. 2012. Reflecting the choice and usage of communication tools in global software development projects with media synchronicity theory. *Journal of Software: Evolution and Process,* 24**,** 677-692.

NILLES, J. 1975. Telecommunications and organisational decentralization. *IEEE Transactions on Communication.* 10, 1142-1147.

OCKER, R. 2002. The mediating effect of group development on satisfaction in a virtual and mixed mode environment . Paper presented at the 34th Hawaii Conference on system sciences, Hawaii.

O'LEARY, M. B. & CUMMINGS, J. N. 2007. The spatial, temporal, and configurational characteristics of geographic dispersion in teams. *MIS Quarterly,* 31**,** 433-452.

O'LEARY, M. B. & MORTENSEN, M. 2010. Go (Con)figure: Subgroups, Imbalance, and Isolates in Geographically Dispersed Teams. *Organization Science,* 21**,** 115-131.

O'LEARY, M. ORLIKOWSKI, W. & Yates, J. 2001. Distributed work over the centuries: trust and control in the Hudson's bay company (1670 – 1826). In *Distributed Work.* HINDS, P. & KIESLER, S. eds. MIT Press, Cambridge, MA.

OLSON, G. M. & OLSON, J. S. 2000. Distance matters. *Human-Computer Interaction,* 15**,** 139-178.

ORLIKOWSKI, W. J. 2000. Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science,* 11**,** 404-428.

ORLIKOWSKI, W. J. 2002. Knowing in Practice: Enacting a Collective Capability in Distributed Organizing. *Organisation Science,* 13**,** 249-273.

OSHIRI, I., KOTLARSKY, J. & WILLCOCKS, L. P. 2007. Global Software development: Exploring socialization and face-to-face meetings in distributed strategic projects. *The Journal of Strategic Information Systems.* 16, 1, 25 – 49.

ORTIZ DE GUINEA, A., WEBSTER. J. & STAPLES, D.S 2012. A meta-analysis of the consequence of virtualness on team functioning. *Journal of Information & Management.* 49, 6, 301 - 308

PALVIA, P., MAO, E., SALAM, A.F.,& SOLIMAN,K.S. 2003. Management Information Systems Research: Whats there in a methodology? *Communications of the Association for Information Systems.* 11, 16

PATTON, M. Q. 2002. *Qualitative Research and Evaluation Methods,* Thousand Oaks, CA, Sage.

PAUL, D. L. & MCDANIEL, R. R. 2004. A field study of the effect of interpersonal trust on virtual collaborative relationship performance. *MIS Quarterly,* 28**,** 183-227.

PAUL, S., SEETHARAMAN, P., SAMARAH, I. & MYKYTYN, P. P. 2004. Impact of heterogeneity and collaborative conflict management style on the performance of synchronous global virtual teams. *Information & Management,* 41**,** 303-321.

PAULEEN, D. L. & YOONG, P. 2001. Facilitating Virtual Team Relationships via Internet and Conventional Communication Channels. *Internet Research,* 11**,** 190-203.

PEARLSON, K. E. & SAUNDERS, C. S. 2001. There's no place like home: Managing telecommuting paradoxes. *Academy of Management Executive,* 15**,** 117-128.

PICCOLI, G., POWELL, A. & IVES, B. 2004. Virtual teams: team control structure, work processes, and team effectiveness. *Information Technology & People,* 17**,** 359-379.

PINJANI, P. & PALVIA, P. 2013. Trust and knowledge sharing in diverse global virtual teams. *Information & Management,* 50**,** 144-153.

POTTER, R. E. & BALTHAZARD, P. A. 2002. Virtual team interaction styles: assessment and effects. *International Journal of Human-Computer Studies,* 56**,** 423-443.

POLZER, J. T, CRIP, B. C. & JARVENPAA, S. L. & KIM, J. W. 2006. Extending the fault-line model to geographically dispersed teams: how collocated subgroups can impair group functioning. *Academy of Management.* 49, 4, 679 – 692.

POWELL, A., GALVIN, J. & PICCOLI, G. 2006. Antecedents to team member commitment from near and far: A comparison between collocated and virtual teams. *Information Technology & People,* 19**,** 299-322.

QUINN, J.B & HILMER, F.G. 1994. Strategic Outsourcing. *Sloan Management Review. 34, 4. 43*

RAFAELI, S. & RAVID, G. 2003. Information sharing as enabler for the virtual team: an experimental approach to assessing the role of electronic mail in disintermediation. *Information Systems Journal,* 13**,** 191-206.

RAGHURAM, S., TUERTSCHER, P. & GARUD, R. 2010. Mapping the field of virtual work: A cocitation analysis. *Information Systems Research,* 21**,** 983-999.

RAMESH, V. & DENNIS, A. R. 2002. The Object-oriented Team: Lessons for virtual teams for Global Software Development. *IEEE***,** 212-221.

REED, A. H. & KNIGHT, L. V. 2010a. Effect of a virtual project team environment on communication-related project risk. *International Journal of Project Management,* 28**,** 422-427.

REED, A. H. & KNIGHT, L. V. 2010b. Project Risk Differences Between Virtual and Co-Located Teams. *Journal of Computer Information Systems,* 51**,** 19-30.

RETTIE, R. 2005. Social presence as presentation of self. *8th Annual International Workshop on Presence.* London.

REZGUI, Y. 2007. Exploring virtual team-working effectiveness in the construction sector. *Interacting with Computers,* 19**,** 96-112.

RIOPELLE, K., GLUESING, J., ALCORDO, T., BABA, M., BRITT, D. & MCKETHER, W. 2003. Context, task and the evolution of technology use in global virtual teams. *In:* GIBSON, C. & COHEN, S. (eds.) *Virtual teams that work: Creating conditions for evvective virtual teams.* San Franscisco: Jossey-Bass.

RICO, R. MOLLEMAN, E., SANCHEZ-MANZANARE, M. VAN DER VEGT, G. S. 2007. The effect of diversity fault-lines & team task autonomy on decision quality & social integration. *Journal of Management. I 33, 1, 111 – 132.*

ROBBINS, S. P. 2005. Organisational Behavior. *Pearson Education : New Jersey.*

ROBEY, D., KHOO, H. M. & POWERS, C. 2000. Situated learning in cross-functional virtual teams. *Technical Communication,* 47**,** 51-66.

ROCKMANN, K. W. & NORTHCRAFT, G. B. 2008. To be or not to be trusted: The influence of media richness on defection and deception. *Organizational Behavior and Human Decision Processes,* 107**,** 106-122.

ROGER, E.M. 1986. Communication Technology: The New Media in Society , New York: *The Free Press.*

ROSEN, B., FURST, S. & BLACKBURN, R. 2006. Traning for virtual teams: an investigation of current practices and future needs. *Human Resources Management Review,* 45**,** 229-247.
ROBERT, J & OYUNG, R. & PACE. 2005. Working virtually: challenges of virtual teams
SANDBERG, J. & ALVESSON. 2011. Ways of constructing research questions: gap-spotting or problematization? *Organisation. 18, 1, 23 - 44.*
SARKER, S., AHUJA, M., SARKER, S. & KIRKEBY, S. 2011. The Role of Communication and Trust in Global Virtual Teams: A Social Network Perspective. *Journal of Management Information Systems,* 28**,** 273-309.
SARKER, S., LAU, F. & SAHAY, S. 2001. Using an Adapted Grounded Theory Approach for Inductive Theory Building About Virtual Team Development. *Database fo Advances in Information System,* 32**,** 38-56.
SARKER, S. & SAHAY, S. 2004. Implications of space and time for distributed work: an interpretive study of US-Norwegian systems development treams. *European Journal Information System,* 13**,** 3-20.
SAUNDERS, C.S. & AHUJA, M.K. 2006. Are all distributed teams the same? Differentiating between temporary and ongoing distributed teams. *Small Group Research.* 37, 6, 662 - 700.
SAUNDERS, M., LEWIS, P. & THORNHILL, A. 2009. Research methods for business students, 5th ed., Harlow, Pearson Education.
SCHWEITZER, L. & DUXBURY, L. 2010. Conceptualizing and measuring the virtuality of teams. *Information Systems Journal,* 20**,** 267-295.
SHACHAF, P. 2008. Cultural diversity and information and communication technology impacts on global virtual teams: an exploratory study. *Information & Management,* 45**,** 131-142.
SHANNON, C.E. & WEAVER, W. 1949. The mathematical theory of communication, Urbana, IL. *University of Illinoise Press.*
SHORT, J., WILLIAMS, E., & CHRISTIE, B. 1976. The social psychology of telecommunications. New York: Wiley.
SMITH, J.A., JARMAN, M. & OSBORN, M. 1999. Doing interpretative phenomenological analysis. *In Qualitative Health Psychology:Theories & Methods. 218 - 240.* London: Sage.
SPROULL, L. & KIESLER, S. 1986. Reducing social context cues: Electronic mail in organizational communication. *Management Science,* 32**,** 1492-1512.
SRIDHAR, V., PAUL, R. ,NATH, D., & KAPUR, K. 2009. Analyzing factors that affect performance of global virtual teams. Retrieved November 2013 from https://www.researchgate.net/publication/228613306_Analyzing_Factors_that_Affect_Performance_of_Global_Virtual_Teams
STAKE, R.E. 2006. Multiple Case Study analysis. *Gilford Press*. New york NY.
STAPLES, D. S. & WEBSTER, J. 2008. Exploring the effects of trust, task interdependence and virtualness on knowledge sharing in teams. *Information Systems Journal,* 18**,** 617-640.
STEWART, G. L. & BARRICK, M. R. 2000. Team structure and performance: Assessing the Mediating role of intrateam processes and the moderating role of task type.*Academy of Management Journal.* 43, 2, 135 -148.
STRAUB, D., & KARAHANNA, E. 1990. The changing role of telecommunications technologies in the workplace: Email, voice-mail & fax. Working Paper Series, MISRC-WP-90-10, Management Information Systems Research Center, University of Minnesota.
SUCHAN, J. & HAYZAK, G. 2001. The communication Characteristics of Virtual Teams: A Case Study. *IEEE Transactions on Professional Communication.* 44, 3.
SUH, A .,SHIN,K.S.,AHUJA,M.,& KIM,M.S.2011. The Influence of virtuality on social networks within and across work groups; A multilevel approach. *Journal of Management Information Systems,* 28,1,351-386
SWIGGER, K., HOYT, M., SERÇE, F. C., LOPEZ, V. & ALPASLAN, F. N. 2012. The temporal communication behaviors of global software development student teams. *Computers in Human Behavior,* 28**,** 384-392.

SWINTH, K.R & BLASCOVICH, J. 2002. Perceiving and Responding to Others: Human-Human and Human-Computer Social Interaction in Collaboration in Virtual Environment.

THATCHER, S. M. B., JEHN, K. A. & ZANUTTO, E. 2003. Cracks in diversity research: The effects of diversity faultlines on conflict and performance. *Group Decision and Negotiation,* 12**,** 217-241.

TIMMERMAN, C. E. & SCOTT, C. R. 2006. Virtually working: Communicative and structural predictors of media use and key outcomes in virtual work teams. *Communication Monographs,* 73**,** 108-136.

TIDWAL, L. C., & WALTHER, J.B. 2002. Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluation: Getting to know one another a bit at a time.*Human Communication Research,* 28, 3, 135 - 151

TOWNSEND, A. M., DEMARIE, S. M. & HENDRICKSON, A. R. 2001. Desktop video conferencing in virtual work groups: Anticipation, system evaluation and performance. *Information Systems Journal,* 11**,** 213-227.

VALACICH, J. S. PARANKA, D., GEORGE, J.F., & NUNANMAKER, J.F. 1993. Communication parallelism and the new media: A new dimension for media richness. *Communication Research.* 20,2, 249 - 276.

VAN FENEMA, P. C. & QURESH, S. 2004. A Phenomenological Exploration of Adaptation in a Polycontextual Work Environment. *ERIM Report Series Research in Management.* The Netherlands: Rotterdam School of Management.

VAN DER KLEIJ, R. SCHRAAGEN, J.M. & WERKHOVEN, P. 2009. How conversations change over time in face-to-face and video-mediated communication. *Small Group Research.* 40, 4, 355 -381

VAN RYSSEN, S. & GODAR, S. H. 2000. Going international without going international: multinational virtual teams. *Journal of International Management,* 6**,** 49-60.

VERBURG, R.M, BOSCH-SIJTSEMA, P. & VARTIAINEN, M. 2013. Getting it done: Critical success factors for project managers in virtual work settings. *International Journal of Project Management*31, 68 - 79

VLAAR, P.W.L., van FENEMA, P.C, & TIWARI, V. 2008. Cocreating understanding and value in distributed work: How members of onsite and offshore vendor teams give, make, demand, and break sense. *MIS Quarterly.* 32, 2, 227 - 255.

VOGEL, D., VAN GENUCHTEN, M., LOU, D., VERVEEN, S., VAN EEKOUT, M. & ADAMS, A. 2001. Exploratory research on the role of national and professional cultures in a distributed learning project. *IEEE Transactions on Professional Communication,* 44**,** 114-126.

VORAKULPIPAT, C., REZGUI, Y. & HOPFE, C. J. 2010. Value creating construction virtual teams: A case study in the construction sector. *Automation in Construction,* 19**,** 142-147.

WAKEFIELD, R. L., LEIDNER, D. E. & GARRISON, G. 2008. A Model of Conflict, Leadership, and Performance in Virtual Teams. *Information Systems Research,* 19**,** 434-455.

WARING, T. & SKOUMPOPOULOU, D. 2012. Through the kaleidoscope: Perspectives on cultural change within an integrated information systems environment. *International Journal of Information Management,* 32**,** 513-522.

WARING, T. & WAINWRIGHT, D. 2008. Issues and challenges in the use of template analysis: Two comparative case studies from the field. *The Electronic Journal of Business Research Methods,* 6**,** 85-94.

WARKENTIN, M., SAYEED, L. & HIGHTOWER, R. 1997. Virtual teams versus face-to-face teams: An exploratory study of a web-based conferencing system. *Decision Science,* 28**,** 241-262.

WASKO, M. M. & FARAJ, S. 2005. Why should I share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice. *MIS Quarterly,* 29**,** 370-381.

WATSON-MANHEIM, B. M., CHUDOBA, K. M. & CROWSTON, K. 2012. Perceived discontinuities and constructed continuities in virtual work. *Information Systems Journal,* 22**,** 29-52.

WATSON-MANHEIM, M. B. & BELANGER, F. 2007. Communication media repertoiores: Dealing with the multiplicity of media choices. *MIS Quarterly,* 31**,** 267-293.

WATSON-MANHEIM, M. B., CHUDOBA, K. M. & CROWSTON, K. 2002. Discontinuities and continuities: a new way to understand virtual work. *Information Technology & People,* 15**,** 191-209.

WEICK, K.E & MEADER, D.K. 1993. Sensemaking and Group Support Systems. *In Group Support Systems: New Perspectives, L.M.* Jessup & J.S. Valacich (eds), New York: Macmillian, pp. 230 - 252

WILSON,J., CRISP, C.B, & MORTENSEN, M. 2013.Extending construal-level theory to distributed groups: Understanding the effects of virtuality. *Organisation Science,* 24,2,629-644

WIREDU, G. O. 2011. Understanding the functions of teleconferences for coordinating global software development projects. *Information Systems Journal,* 21**,** 175-194.

WIXOM, B. H. & WATSON, H. J. 2001. An empirical investigation of the factors affecting data ware housing success. *MIS Quarterly,* 25**,** 17-41.

WOLF, T., NGUYEN, T. & DAMIAN, D. 2008. Does distance still matter? *Software Process: Improvement and Practice,* 13**,** 493-510.

WORK, B. 2007. System Thinking Study Guide, Cardiff University

XI, Z. & ZHENJIAO, C. How to encourage knowledge sharing in global virtual teams: Aspects of structuration theory. Information Management and Engineering (ICIME), 2010 The 2nd IEEE International Conference on, 16-18 April 2010 2010. 349-353.

XUE, Y. J., SANKAR, C. S. & MBARIKA, V. W. A. 2005. Information technology outsourcing and virtual team. *Journal of Computer Information Systems,* 45**,** 9-16.

YIN, R. K. 2003. *Case study research: Design and methodss,* Thousand Oaks, CA:, Sage.

YOO, Y. & ALAVI, M. 2001. Media and Group Cohesion: Relative Influence on Social Prescence, Task Participation, and Group Consensus. *MIS Quarterly,* 25**,** 371-390.

ZHANG, D. & LOWRY, P. B. 2008. Issues, Limitations, and Opportunities in Cross-Cultural Research on Collaborative Software in Information Systems. *Journal of Global Information Management,* 16**,** 61-84.

ZHANG, S., TREMAINE, M. , EGAN, R., MILEWSKI, A. PLOTNICK, L., O'SULLIVAN, P. & FJERMESTAND, J. 2008. Occurrence and effects of leader delegationtion in virtual teams; Hawaiian International Conference on System Sciences, IEEE.

ZIGURS, I. 2003. Leadership in virtual teams: Oxymoron or opportunity? *Organizational Dynamics,* 31**,** 339-351.

ZIGURS, I. & BUCKLAND, B.K. 1998. A Theory of task/technology fit and group support systems effectiveness. *MIS Quarterly,* 22.3

ZIMMERMANN, A. 2011. Interpersonal Relationshps in transnational, virtual teams: towards a configurational perspective. *International Journal of Management Reviews,* 13**,** 59-78.

ZOLIN, R., HINDS, P., FRUCHTER, R. & LEVITT, R. S. 2004. Interpersonal trust in cross-functional, geographically distributed work: a longitudinal study. *Information and Organization,* 14**,** 1-26.