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**Project Management with Global Virtual Teams: Challenges and  
Framework**

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**Project Management with Global Virtual Teams: Challenges and  
Framework**

**by**

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**Thesis**

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## **Dedication**

To my parents, who taught me the importance of good education, you are my favorite first teachers. To my husband, the love of my life and my best friend, thank you for your patience, encouragement and support. To my son, mommy loves you!

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## **Abstract**

# **Project Management with Global Virtual Teams: Challenges and Framework**

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Abstract: Globalization, global competitive market forces and technological progress have made Geographically Distributed Development (GDD) possible and a necessity for most companies in the world. The software industry has consistently been at the forefront of exploring and implementing this business model.

This thesis studies the key drivers of GDD, identifies the major challenges which global virtual teams face and existing frameworks for successful global virtual teams. A case study is used to validate the challenges and concerns of managing a global virtual team and a framework is proposed to help overcome the challenges and enable successful global software development.

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## **Chapter 1: Introduction**

### **1.1 PURPOSE**

This thesis studies the significance of global virtual teams in today's global market. The research begins by understanding the key business drivers of global distributed development; followed by literature review of global virtual teams, their benefits and challenges and the success factors for implementing a global virtual team. The major challenges are analyzed using a case study with a global software team. A framework is proposed for best practices that help overcome the challenges and enable successful global software development.

### **1.2 EMERGENCE OF GLOBAL VIRTUAL TEAMS**

The use of global virtual teams is growing rapidly in traditional organizations<sup>1</sup> as well as emerging organizational forms such as virtual organizations<sup>2</sup>. Organizations are placing proportionately less reliance on traditional face-to-face groups to make decisions, preferring instead the speed, flexibility, and knowledge benefits of organizing dispersed members in virtual teams<sup>3</sup>. The United States Department of Transportation estimated that 8.4 million U.S. workers were members of virtual teams in the mid-1990s, predicting the number would grow to 30 million by the year 2000<sup>4</sup>. Furthermore, a recent survey on the use of product development teams in organizations suggests that the use of global

virtual teams is growing relative to other virtual or co-located teams<sup>5</sup>. For example, most of the top software companies have development efforts involving global virtual teams with members in multiple countries<sup>6</sup>.

Several technological and business factors have contributed to the emergence of global virtual teams. First, distributed work groups, such as global virtual teams, are made possible by advances in electronic networks that allow various forms of communication (e.g., electronic mail, chat rooms, etc.) between members located almost anywhere in the world<sup>7</sup>. Second, Townsend et al.<sup>8</sup> suggest several changes in the business context promote the use of virtual teams, including: (1) increasing prevalence of flat or horizontal organizational structures; (2) emergence of environments that require inter-organizational cooperation as well as competition; (3) changes in workers' expectations of organizational participation; (4) a continued shift from manufacturing and production to service and knowledge-work environments; and (5) increasing globalization of trade and corporate activity. The particular use of global virtual teams may be increasing due to this global dispersion and the need to integrate local expertise into tasks such as product development<sup>9</sup>. Speculation about virtual teams holds that this type of group offers much promise as an organizational design tool. Virtual teams are noted for their ability to combine global scale and scope with local presence and familiarity<sup>10</sup>. In the process, these teams are said to have the potential to overcome traditional boundaries of space, time, and organizations<sup>11</sup>. For example, project teams working virtually can benefit from the best skills or knowledge, regardless of location, and work literally around the clock<sup>12</sup>.

### **1.3 RESEARCH QUESTIONS**

1. What are the key drivers for global distributed development?
2. What is a global virtual team? What are the characteristics of a global virtual team?
3. What are the challenges faced by global virtual teams?
4. What are the essential building blocks that create a successful global virtual team?

### **1.4 ORGANIZATION**

Chapter 2 provides an overview of literature on globalization, which led to global distributed development with global virtual teams; virtual teams, their benefits and challenges. It also summarizes the characteristics of a virtual team and shows how it is different from traditional teams. Some existing frameworks on virtual teams, challenges and success factors are discussed here.

Chapter 3 introduces a global software team as a case study for a global virtual team. Using the case, this chapter identifies the challenges in implementing a global virtual team. Some challenges common to all global teams and some challenges specific to global software development are discussed here.

Chapter 4 analyzes the team in the case study based on two frameworks for success of global virtual teams. The first framework is the 4 node team framework by Lipnack and Stamps<sup>13</sup>. The second framework from Carmel's Global Software Teams<sup>14</sup> is

used because the case study is about a global software virtual team and some factors specific to the software industry are discussed here.

Chapter 5 summarizes the thesis goal and provides conclusions on best practices for global virtual teams. It answers the research questions and provides recommendations for successful implementation of global software teams. It uses the lessons learnt from the case study to provide recommendations and a revised framework for global virtual team success.

## Chapter 2: Literature Review

### 2.1 GLOBALIZATION:

“Globalization in terms of international economic integration has been enabled by a lot of factors. One of the most notable features of the new world economy has been the closer interconnection among countries of the developed and developing world: “The great novelty of the current era is the extent to which the poorer nations of the world have been incorporated in the global system of trade, finance and production as partners and market participants rather than colonial dependencies<sup>15</sup>.”

According to Blackwell handbook of global management, an important factor has been the relaxation of foreign direct investment (FDI) restrictions. “During the 1990s there were over a thousand changes around the world to national laws governing FDI; almost all of them had the effect of creating a climate more favorable to it”<sup>16</sup>.” These changes were complemented by an increase in bilateral investment treaties: in 1980 there were fewer than two hundred bilateral treaties in existence, while at the end of 1999 there were almost two thousand”<sup>17</sup>.

“Ability to travel around the world at speed of sound and reliable, inexpensive communications has shrunk the globe so effectively – diminishing physical boundaries – that corporations are now able to manage far flung operations. The UN estimates that there are 63,000 transnational corporations, and that these companies have 690,000 foreign affiliates spanning “virtually all countries and economic activities.” The foreign affiliates of the top 100 of these firms employ over six million people around the

world”<sup>18</sup>. “In addition; the rapid emergence of information services and the addition of new technologies, the Internet have dramatically accelerated the globalization process.

Both responding to and feeding the trend of globalization, companies are rapidly trying to globalize. There is a growth potential from international markets and new ideas and innovations are springing up in companies around the world. In the increasingly competitive market, this search for growth must be increasingly far-flung. For years, companies restructured and systematically wrung costs out of operations to improve profitability, to capture market share, or to stay in business. As these efforts achieved their limits, new areas of opportunity for increasing profits had to be found. They began to work across boundaries – internal product/service boundaries and national borders. Internally they developed new products and services and began selling “solutions.” Many companies moved from a strategy of “best product” to “total customer solutions.”<sup>19</sup> International markets also provided growth. As foreign firms entered a market, local companies had to adapt and they began expanding internationally to remain competitive in an increasingly complex global marketplace. The quest for growth has become continual, demanded by financial markets and shareholders. And international markets are where opportunities for growth are. Some companies continue to search for growth by expanding into new international markets and some are searching for it from innovations to be achieved by integrating and expanding their current global operations”<sup>20</sup>.

Another reason for companies to prefer operating in many countries is to spread the risks. If a company puts all its capital in a single country, it is susceptible to the economic variation factors in that country. Operating from several countries insures the company against such risks.

As organizations started facing challenges of changing consumerism due to globalization and the pressure to deliver high quality goods and services, competition and global market opportunities, one of the responses has been to buy global capacity and scope through mergers and acquisitions.

Several other factors contribute to firms expanding their business globally rather than locally<sup>21</sup>. Firms in extractive industry will go to the countries where they find the minerals (oil, copper etc) for example American, British and French oil companies in the Middle-East. Firms that produce labor-intensive goods expanded to countries with lower labor costs. Firms that produce goods with high shipping costs try to build plants close to their largest market. A firm that faces higher tariff or other barriers limiting its access to a foreign market can leap over that barrier by producing locally in the foreign market. Thus Honda, Nissan and Toyota began manufacturing in the United States in spite of higher production costs.

Global companies promise tantalizing possibilities, such as international brand recognition, greater market share, and top-line revenue growth. Yet succeeding internationally demands greater business discipline coupled with principles that ensure consistency of service, realistic expectations, and achievable goals<sup>22</sup>.

## **2.2 GLOBAL VIRTUAL TEAMS: DEFINITION**

A distributed work group, or virtual team, is a group of geographically dispersed individuals who collaborate primarily via information and communication technologies to accomplish an organizational task<sup>23</sup>. Virtual teams are often temporary or ad hoc groups focused on global tasks whose members cross professional, organizational, temporal, and cultural boundaries<sup>24 25 26</sup>. Global virtual teams are temporary, distributed work groups whose members: (1) focus on a common, global task; (2) span multiple boundaries (e.g., geographic, temporal, professional, organizational, cultural); and (3) interact primarily via information and communication technologies<sup>27</sup>.

## **2.3 VIRTUAL TEAMS: BENEFITS AND CHALLENGES**

### **2.3.1 Benefits of virtual teams**

Virtual teams are a result of increasing prevalence of flat organizational structures. The emergence of flat or horizontal organizational structures is a response to increasingly competitive environments brought by global competition and increased advancements in information technology<sup>28</sup>. Organizational flattening caused decision authority to move to the lower levels of organization, eliminating the need for several layers of management. With fewer layers of centralized, hierarchical management structure, organizations with a wide variety of product or service lines become characterized by structurally and geographically distributed teams. While the organization retains its collective talent, there is lesser opportunity for linkages to

facilitate traditional interaction. This kind of structural environment creates the need to reconstitute the benefits of large, resource-rich organization within the context of the new flattened organization<sup>29</sup>. Virtual teams allow this reconstitution to occur.

Virtual teams produce information-based products or services by accessing, sharing and processing electronic information and by building collaborative knowledge through electronic communications- network, shared databases, groupware applications and so forth<sup>30</sup>. Virtual teams can be collaboratively empowered. Since virtual team members are interacting through information technology, it is easy to enhance the quality of their work through collaborative software products and group decision support systems designed to facilitate work collaboration. A variety of software products have been designed to improve the quality of decision making and team creativity, as well as enhance team members' ability to work with data and create documents<sup>31</sup>.

A factor encouraging the development of virtual teams is the continued shift from manufacturing and production jobs to service and knowledge work. Production processes are often more structured and defined. Service activities often require cooperation of team members in dynamic work situations that evolve according to customer requirements. The hallmark of successful firms has been their ability to quickly respond and be flexible to their customer needs. This requisite flexibility fuels the movement from highly structured organizational forms to more ad hoc forms. Townsend describes virtual team flexibility when he states:

Virtual teams enable this organizational flexibility because they integrate the effectiveness of traditional teamwork with the power of advanced communication and information technologies, allowing them to accommodate increased dynamism in both team membership and task structure<sup>32</sup>.

In *Going Virtual*<sup>33</sup>, Ray Grenier and George Metes provide a succinct summary of virtual team benefits for organizations that find themselves in a complex task/rapid respond environment. Virtual teams:

- Effectively deal with the realities of time compression, distributed resources, increasing dependency on knowledge-based input, the premium on flexibility and adaptability, and the fact that most of the information we use today is in the electronic form
- Enable the recruitment of the best competencies available, not just those in the organization or the neighborhood.
- Take advantage of the electronic infrastructure, enabling teams to:
  - Work in parallel rather than serially
  - Have continuous access to the latest and best knowledge and information
  - Participate from their home-sites or local offices without abandoning other threads in their multiplexed work and home lives
  - Bring new team members up to speed through the online record of the ongoing work

- Capture their learning electronically, making it easy for other teams to access this learning, often in real time (Grenier and Metes, 1995).

Finally, optimal configuration, dynamic membership, and collaborative empowerment give virtual teams, productivity potential that exceeds that of traditional teams<sup>34</sup>.

### 2.3.2. Challenges with Virtual Teams

In “Global Virtual Teams” the authors Dube and Pare list the challenges of global virtual teams after interviewing 18 global virtual team leaders and members representing different industries both small and large scale.

Key Issues in implementing GVTs	
People	Technology
<ul style="list-style-type: none"> <li>• Culture</li> <li>• Language</li> <li>• IT Proficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Accessibility, reliability and compatibility</li> <li>• Appropriate technology use</li> </ul>

Table 1: Key issues in implementing Global Virtual Teams<sup>35</sup>

Based on the results of the interviews they conducted, Dube and Pare state that global virtual teams face far more significant challenges over localized traditional teams. The principle challenges facing organizations in implementing global virtual teams involve people and technology.

### **Culture**

Cultural diversity offers potential richness but it also represents an enormous challenge for global virtual teams. Organizational culture defines how people behave in any working context. In global virtual teams, culture and management styles often clash. The perception of rewards, recognition or good performance is different in different cultures. Communication styles also differ. In egalitarian culture (the west) it is normal to get into a heated argument in an email or in a meeting with a boss but in cultures where hierarchy is revered, this is not a norm. Notions of accountability can differ based on whether a culture is more collective or individualistic. Global virtual team managers and leaders should be aware of these cultural differences, understand their own biases and their affect on the judgments. Tolerance, empathy and the desire to discuss potential conflicting situations with an open mind are all necessary for members of global virtual teams to develop an effective level of team synergy.

The respondents in the study recommended that all members of a global virtual team be given cultural training at the beginning of a project. The cultural training should also include learning about organizational culture along with national cultures, no matter how experienced the team members are. Such trainings provide an excellent opportunity

to address the issues that might affect team performances such as normal working hours, expected behaviors, expected levels of performance and involvement, how decisions are made, how work will be reviewed and approved, how to resolve conflicts and the performance management process. Nothing should be taken for granted. The meaning of terms such as accountability, coordination, and collaboration-and how they should be operational within the team-also need to be discussed to ensure all team members share a common understanding. In short, bringing cultural issues, both national and organizational, to the surface in a positive light can help create a global virtual team that is enriched, and not paralyzed, by cultural differences.

**Language:**

Language represents a particular difficulty for global virtual teams. Since global virtual teams hardly meet face-to-face language plays an important role in communication. It represents a particular difficulty in distributed development. English is the de facto language of most linguistically diverse global virtual teams. However, while it may be typical to have English as a second language in many countries, it is not the case everywhere. Therefore, the fact that one or more team members must speak in a foreign language can easily impede team performance. Communication barriers become even more severe in an electronic context with asynchronous communication. For example, it is difficult to fully participate in a teleconference when one does not speak the language fluently. As a result, a team may lose vital ideas and information or take a wrong direction. Structured communication sessions directed by a formal leader can give

every member the time to speak. Tolerance and empathy are necessary to encourage participation in this context. Writing minutes at the end of an oral communication session will help assure all participants understood the same message.

Appropriate training in a foreign language (often English) is also highly recommended.

Finally, helpful technology such as grammar and spell checkers, as well as language translators, can be integrated into email software to facilitate communication.

### **Collaborative Technologies:**

It is widely recognized that collaborative technologies provide powerful support in making global virtual teams a reality. Team members can be linked through a variety of technologies including traditional ones like phones, fax machines, and email, and more advanced applications such as desktop videoconferencing, collaborative software, intranets, and virtual private networks. However, global virtual teams are likely to face unpleasant technological challenges such as hardware/software incompatibility, unreliability, or unavailability, especially connecting people in developing countries. The bandwidth and quality of telecommunications infrastructure is still not extensively developed within current advanced economies and is expensive to use in some countries.

Therefore, before starting a virtual project, a company must make sure the required technologies are accessible and compatible across the various sites and consider the issue of cost and performance. Different countries have different cost structures and bandwidth capacities regarding Internet access and use, and these must be considered in the design of a global virtual team. In addition, software applications must interface

reliably because when systems crash, connections are disrupted, data gets corrupted, global virtual team efficiency drops, and frustrations flare. “People in scattered locations must have reliable channels of communication and equal access to resources to avoid duplication of effort and redundant costs. Under-investing in technological infrastructure can bring virtual work to a standstill, even if other challenges are fully addressed.”<sup>36</sup>

Global virtual leaders must address hardware and software accessibility, reliability, and compatibility issues and ensure that all members' systems have adequate performance.

#### **2.4 SUCCESS FACTORS FOR A VIRTUAL TEAM**

According to Lipnack and Stamps, teams are the smart way to organize for flexible and cost-effective operations. With advance in technologies, team members no longer have to be in one location in order to work together. They can become virtual teams – teams with a common purpose that use technology to cross time-zones, distance and the boundaries of organizations<sup>37</sup>.

According to the model for successful virtual teams, there are three facets or nodes that matter: people, purpose and links.

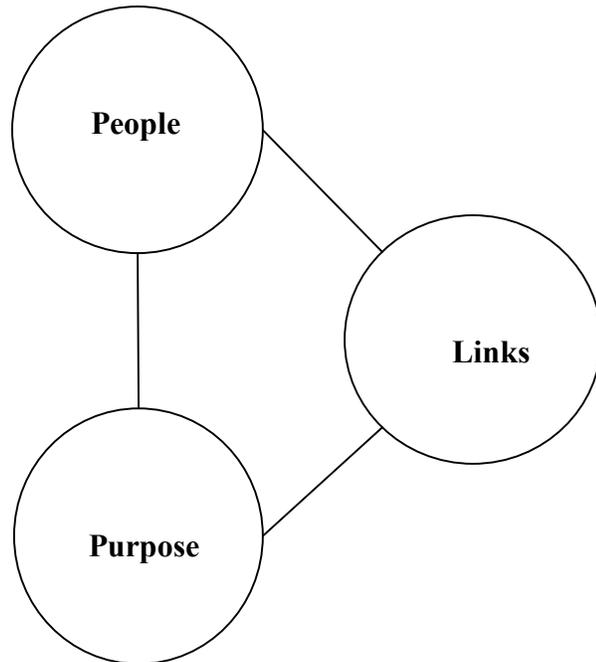


Figure 1: Virtual Team Model<sup>38</sup>

***People:***

The people node represents members of the virtual team, organizations, companies or countries. They are the core of the virtual teams with a few key characteristics. First, people should be independent and self-reliant. The next important characteristic is a shared leadership. “Every member of the virtual team plays a leadership role at some point in the process”<sup>39</sup>.

***Purpose:***

“Purpose is important to any organization but it is critical to virtual organizations and teams because purpose is the glue that holds them together. A team stays together only if there a robust shared purpose that is agreed upon by all the members of the team. In a virtual team, a purpose is more than a mission statement. Purpose should be translated into action steps that become the basis for the work people do together in a team. Purpose requires cooperative goals, interdependent tasks which produces concrete results”<sup>40</sup>.

***Links:***

Links represent the multiple media that is used for collaboration in a virtual team. Links are connections that are more than just technology<sup>41</sup>. Links should produce interactive communication that over time can develop into trusting relationships.

	<b>INPUTS</b>	<b>PROCESSES</b>	<b>OUTPUTS</b>
<b>PEOPLE</b>	Independent members	Shared leadership	Integrated levels
<b>PURPOSE</b>	Cooperative goals	Interdependent tasks	Concrete results
<b>LINKS</b>	Multiple media	Boundary-crossing interactions	Trusting relationships

Table 2: Virtual Team Principles<sup>42</sup>

**2.5 GLOBAL SOFTWARE DEVELOPMENT**

Geographically distributed development (GDD) and Global Software Development (GSD) are terms that refer to distributed development model. Software has been an excellent and the most widely successful industry in using global virtual teams. This thesis aims to work with understanding challenges of working with global software teams and propose a workable model or best practices based on challenges discussed from a case study of global software team of a small company and its subsidiary in another country.

In his book “Global Software Teams”<sup>43</sup> Carmel identifies five “centrifugal forces” - the problems that pull apart global software teams and proposes six “centripetal forces” to counter the centrifugal forces that make an effective global team.

### 2.5.1 Carmel's Centrifugal forces:

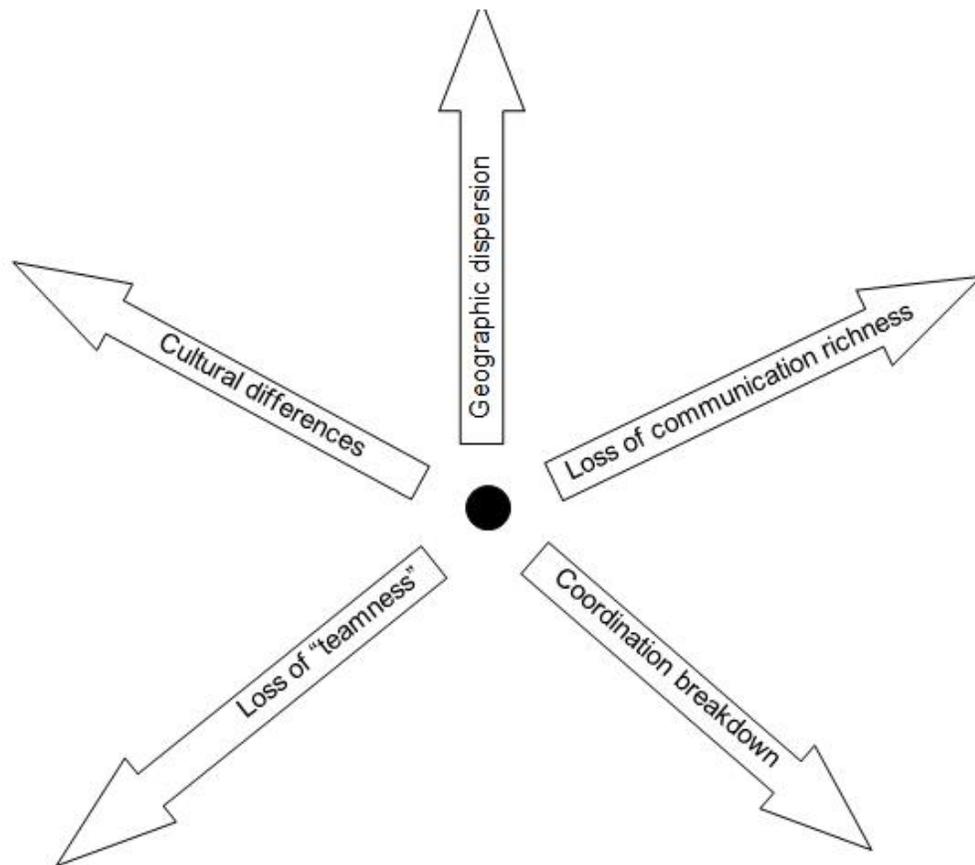


Figure 2: Centrifugal forces of Global Software Team<sup>44</sup>

***Dispersion:***

Distance brings a big challenge to working with teams. It is easy to manage a co-located team rather than dispersed. In a seminal 1997 study, technology management scholar Tom Allen tabulated communication frequency of over 500 individuals in seven organizations over the course of six months. Using the data he developed a profound relationship between distance and communication as shown in Figure 3.

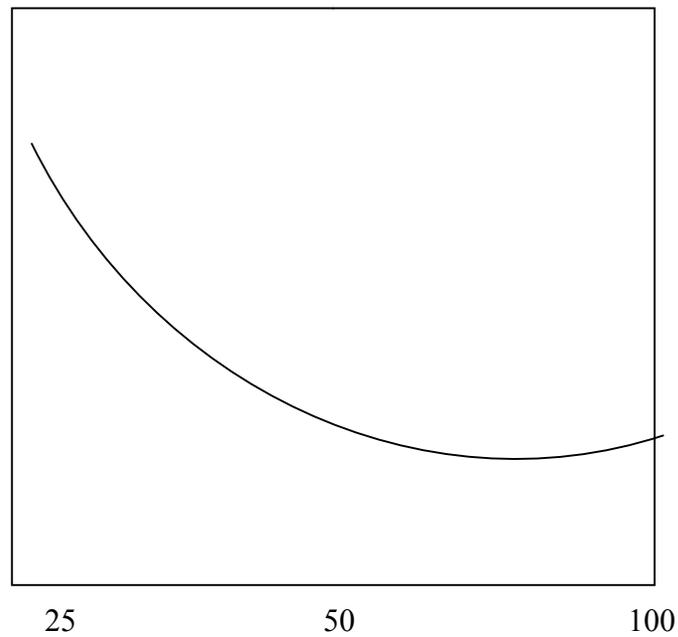


Figure 3: Relationship of distance to probability of communication<sup>45</sup>

Carmel mentions that collocation and dispersion are related to the age-old continuum of centralization and de-centralization in organizations. Organizations centralize for the following reasons<sup>46</sup>

- Control
- Less duplication and waste of effort
- Better ability to maintain corporate culture
- The need for developers to be near major markets and customers
- The company's focus on short product life cycles and product innovation breakthroughs.

Decentralized development has its own advantages. There is local expertise, faster response times , flexible team that works well for changing specifications and best talents working together regardless of location. Companies must find the right balance between central control and local autonomy to bring out the best results.

***Breakdown of traditional control and coordination mechanisms:***

The overhead of control and coordination associated with any software project is astounding and dispersion creates even more burden on the control and coordination mechanisms. Because of distance people cannot coordinate informally in the hall way or over cubicle walls. Even a quick phone call needs to be planned because of time zone differences.

### ***The loss of “communication richness”***

Carmel describes that we humans prefer different kinds of communication for different kinds of tasks. Highly important or personal tasks are best done with “rich” media of communication<sup>47</sup>. Rich communication is defined as two-way interaction involving more than one sensory channel. This means common media like telephone and email are not “rich” enough. In global teams it is difficult to work with available media and communicate purpose and vision to all groups and cultures in a way that it appeals the emotional and motivational levels of these different groups.

### ***Loss of “teamness”***

Team based projects are highly successful because team work creates synergy, ideas and innovations better than individuals. A real team is perceived as a team by its team members<sup>48</sup>. With dispersed teams, the diversity requires more time to get to consensus. The feeling of one team is more in homogeneous co-located team than in diverse dispersed teams. Distance impedes building trust and relationships in teams.

### ***Cultural differences***

Understanding and managing cultural differences in a global team are important to avoid miscommunication, distribute the right tasks and motivate different groups with a common vision. Cultural differences in a software team surface in more nuanced facets

of software development that are difficult to pinpoint in a study. For example, a culture that is more comfortable with ambiguity (low “risk avoidance”) will be comfortable in early stages of design to leave some issues unspecified. Teams from linear time cultures (who tend to be more punctual) will perform better at the end of the development cycle during crunch time to meet deadlines.

Geert Hofstede and Edward T. Hall have had a profound impact on the way that we understand cultural difference. Each identified a set of fundamental cultural differences that are also referred to as dimensions as shown in the table below.

<p><b><i>Hofstede’s dimensions of national culture</i></b></p> <ul style="list-style-type: none"><li>• Revering hierarchy</li><li>• Individualism/Collectivism</li><li>• Taking care of business</li><li>• Risk avoidance</li><li>• Long term orientation</li></ul> <p><b><i>Hall’s dimensions of national culture</i></b></p> <ul style="list-style-type: none"><li>• Space</li><li>• Material goods</li><li>• Friendship</li></ul>
--

Table 3: Dimensions of national culture

- Time
- Agreement

Table 3 continued: Dimensions of national culture

### **2.5.2 Carmel's Centripetal Forces**

Carmel talks about six centripetal forces, the solutions, which exert force inward within the global software team making it more effective. These centripetal forces are necessary to counter the centrifugal forces, the unique problems, which propel the team outward from the center<sup>49</sup>. These forces are telecommunication infrastructure, the collaborative technologies, and the software development methodology that becomes the language of the development team, the product architecture that helps with task allocation, team building and managerial techniques.

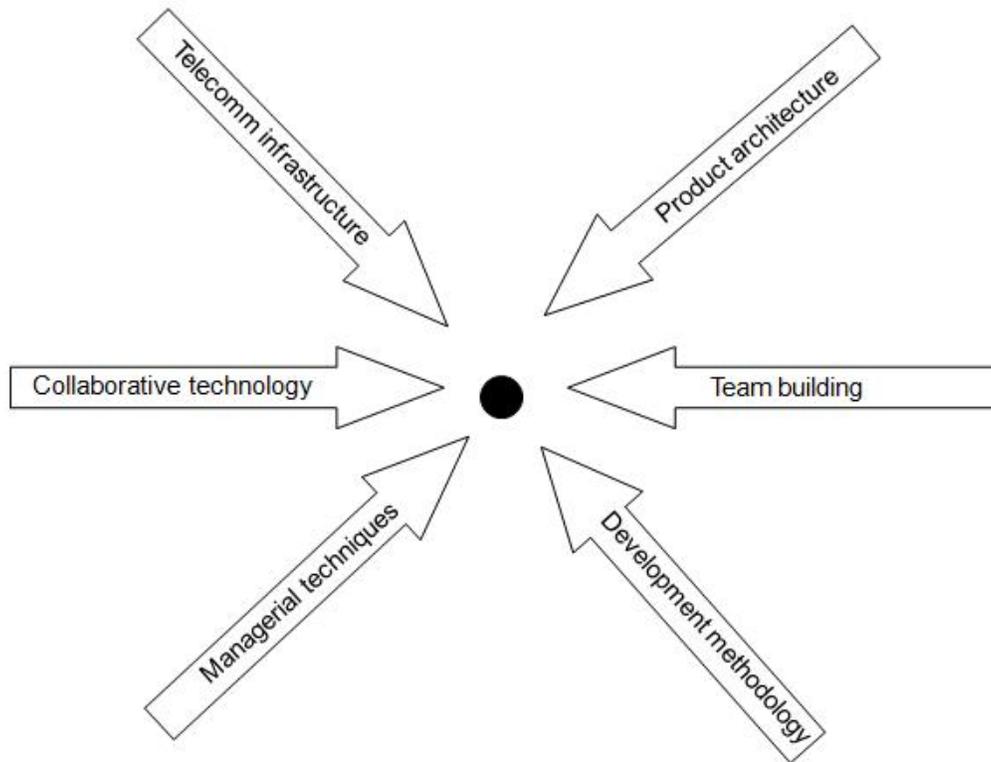


Figure 4: Centripetal Forces of Global Software Teams<sup>50</sup>

### Chapter 3: Case Study of a Global Software Team

This chapter is based on a case study of the virtual teams in a software product and services company hereby referred to as ABCCorp. The team for the software development department was divided between its headquarters and a branch in India as shown below

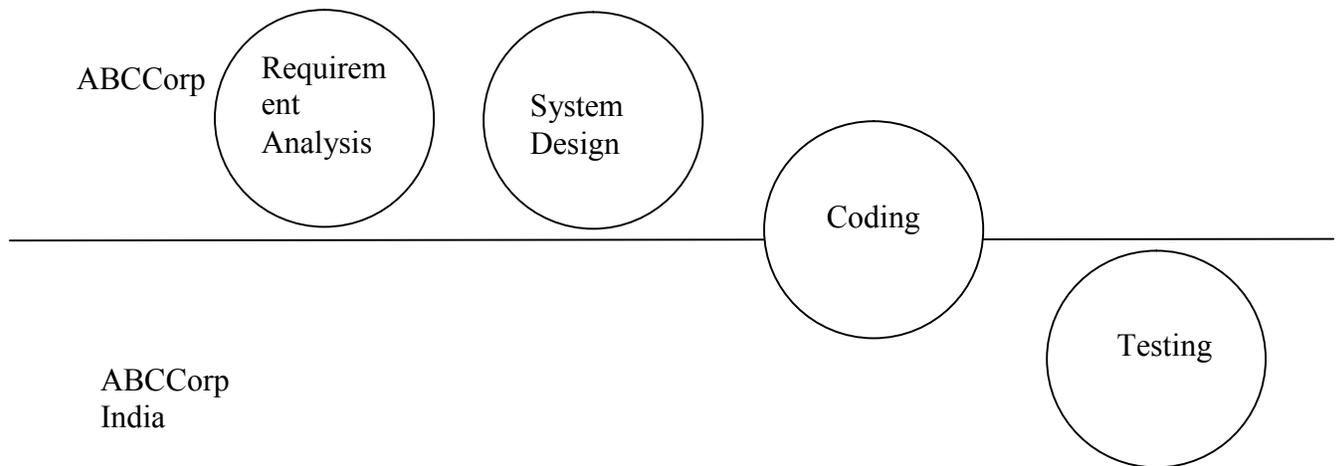


Figure 5: Global Software Development involving Company ABCCorp and its subsidiary in India.

This thesis aims to understand the challenges involved in working with this team, identify factors that help improving the team effectiveness and come up with a framework and best practices for a successful global virtual team.

### **3.1 CONTEXT:**

At the time of this study, ABCCorp is a privately held small business software company. While most virtual teams are built to solve a particular problem as a new project and then the team is disbanded after the project is complete, this particular structure in ABCCorp was envisioned as a long term team structure for the company. In the initial set up of this team, the team in the headquarters consisted of project manager, business analysts, software engineers who would design and implement the software. The offshore team in India consisted of quality assurance and test engineers. The team covered two time zones and without a budget for frequent travel, various communication technologies were used by the team. The communication mainly happened through email, telephone, collaborative online internal web site that served as knowledge center and some tools that helped distributed software development.

### **3.2 CHALLENGES FACED:**

#### **Strategic Challenges:**

The first strategic challenge faced by ABCCorp was lack of experience governing a remote operation, lack of development infrastructure and the high cost of initial set up.

The next challenge involved understanding the characteristics of people who make a successful virtual team. This led to retention problems and as you can see in the section below, this problem contributed to the challenge of building trust among team members.

#### **Organizational Challenges:**

Like any global software development team, ABCCorp had to work with challenges involved in team members belonging to different locations that had different organization structures. Some challenges with working like this were - understanding different escalation levels and different approaches in responsibility sharing.

#### **Cultural Challenges:**

In the literature review chapter, we saw how cultural differences can be the root cause of misunderstanding and communication issues. Since the two companies involved were of opposite cultural values, there was a lot of difference in how team members interpreted each other's actions. For example ABCCorp in India revered hierarchy (see

Table 3 continued: Dimensions of national culture) and were reluctant to speak up when they saw issues in design, flaws in logic or lack of understanding of a requirement. Since India was involved in quality assurance and testing it was important for them to think critically and speak up their opinions during the early stages of development. Other differences involved were expression/reservation in communication, avoiding uncertainty, time orientation (fixed/flexible). Since cultural differences will exist and cannot change, it was in the company's best interest to understand these differences, make sure that the team members understood them and cultivate policies that worked well with both the cultures.

#### **Trust and Relationship Challenges:**

Building trust among team members was extremely difficult because of no face-to-face meetings. At ABCCorp, travel was limited to recruitment/selection and initial training for budgetary reasons. As a result the team members struggled to build synergy and at times felt isolated and detached.

Any team, co-located or virtual, needs to progress through the psychological stages of development that was first modeled by Tuckman. This model shows that a team goes through three stages before it finally starts performing. The team forming stage helps the members to understand their roles, the tasks and their objectives. The storming stage involves conflicts and confusion of roles and tasks. In the norming stage, the team resolves some early conflicts, develops protocols and norms and team cohesion begins. It

is not until after this stage that a team starts performing and works towards a common goal<sup>51</sup>.

<b>Forming</b>	The team forms and gets to know each other. Roles , objectives and tasks are identified
<b>Storming</b>	Conflicts break out over roles, objectives, task allocations and goals
<b>Norming</b>	The team begins to form norms and protocols for working together
<b>Performing</b>	The team begins to perform well, working together toward a common goal. Conflicts are handled constructively

Table 4: Tuckman’s model of team psychosocial developmental maturity<sup>52</sup>

For dispersed teams, the earlier stages take longer to complete because of distance between team members. It is not until three or four product development cycle that teams start performing.

At ABCCorp, added to this challenge there were retention challenges in the team in India, which meant that the global team constantly went through the four stages with new team members and never performed to a full potential of the envisioned global virtual team.

**Communication Challenges:**

Communication among virtual teams is a complex and fundamental process that implies a detailed analysis of the team members and organizational aspects according to the technology being used<sup>53</sup>. In a software development life cycle, the early stages involve project/products requirement specifications and the design. These stages are fairly complex and they set the stage for a shared vision and a goal. “Any task that requires intense cooperation needs richer communication”<sup>54</sup>.

At ABCCorp, the communication problems were because of lack of awareness regarding teammates, such as when they are available, what they are working on, and what factors influenced their work. There were also challenges making the group communication practices to be formal and common among team members because of the extra efforts required to introduce a new technology and poor infrastructure in the remote location. Cultural and language differences added to inefficiency in communication. The focus for resolving the communication loss was on the information and communication technology rather than understanding the underlying causes such as team relationships, trust, formal processes and cultural differences.

**Collaboration/Team Operation Challenges:**

The telecommunication and internet infrastructure as the backbone for collaboration technologies was a challenge initially because high speed internet standards were not equal at ABCCorp and its subsidiary in India. For a software development team

this was a critical factor for project success because of interdependency in tasks between the two locations. As the analysis of infrastructure capabilities and limitations of the remote team matured, policies that made the most efficient use of infrastructure emerged. These changes included having a backup service provider, dividing the network into different groups based on their demands of infrastructure speed and changes in the collaboration technologies used.

Distributed team members need personalized access to project knowledge bases, discussions and business processes essential to their work. Establishing a collaborative environment enables increased responsiveness, speeds up problem solving and decision making and keeps all members up-to-date with the project activities. The set of collaborative tools started with telephone, email and then progressed to audio and video conference and web project collaboration software. Video conference turned out to be a very useful alternative to costly face-to-face travels and helped overcome problems of asynchronous communication of email and voice mails during important decision making and issue resolution stages of critical tasks. It also helped sharing files and presentations during meetings that enhanced meeting productivity. Among other collaborative tools Wiki, software that can be used to create a collaborative web site, in particular was extensively used. It contained information about team members, project requirements, processes and guidelines, project status and common debugging and coding tips among others. This software brought the team together by enabling contribution from all team

members, providing greater visibility of the project and has become a single place for information exchange.

## **Summary**

This case study of a global software development team involving ABCCorp and its subsidiary in India shows how virtual teams face multiple challenges including uncertainty in strategy, organizational challenges, cultural differences, communication and coordination challenges. In the next chapter, we will discuss the framework that addresses these issues.

## **Chapter 4: Case Study Analysis**

This chapter uses two models to analyze the findings in the case study from the previous chapter and provides recommendations.

### **4.1 PEOPLE-PURPOSE-LINKS-TIME MODEL**

The four dimension model by Lipnack and Stamps explains the four key dimensions essential to the success of a virtual team.

#### ***People:***

The people node represents members of the virtual team, organizations, companies or countries. They are the core of the virtual teams with a few key characteristics. At ABCCorp and at its India counterpart, the focus on selecting the right people was on the people with the right technology skills. But based on the literature and some of the strategic and team building challenges we faced it can be suggested that there are many more characteristics to consider while selecting members of a virtual team. Because virtual teams work in a highly dynamic environment and are characterized by knowledge-based work, it is important that the team members have the ability to make quick decisions and have a sense of ownership. With the overhead involved in communication and coordination with virtual teams, it becomes important that team members are self-reliant and independent.

***Purpose:***

In the book “Virtual Teams: The new way to work”<sup>55</sup> authors Lipnack and Stamp suggest that the dimension “purpose” is critical to virtual organizations because it is the glue that holds them together as a team. A team can stay together only if they have a shared goal that everyone works toward. The shared goal of a company should be broken into smaller cooperative goals and interdependent tasks for members of the team. From the case study and interviews with managers in the company, we realized that the structure of the team and some of the processes did not help members understand the purpose of their tasks. One example of this was that the testing and quality assurance team was isolated from the requirements gathering team and was only provided with one or two major sessions on requirements supplemented with documents. This did not give them a strong business context which resulted in poor understanding of the purpose of the project which in turn created poor results.

***Links:***

In the model, links represent the multiple media that is used for collaboration in a virtual team. The authors state that links should produce interactive communication that over time can develop into trusting relationships. In the case study we have seen how collaboration technologies like video conferencing and wiki help in bringing the team together by allowing them to contribute to project activities and keeping everyone informed.

***Time:***

According to the model, the dimension time is not simply a calendar time but includes other key time elements like “process time” and “phase time” which are required for the successful execution of a distributed project. Process time involves elaborate planning on how work is done in a virtual distributed environment. Phase time involves understanding the cycle of processes – beginning, middle, end and repeat. These time dimensions help develop the right management strategies for a distributed project and help the people, purpose and links work over time.

**4.2 CARMEL’S CENTRIPETAL FORCES**

In the literature review chapter, we saw that Carmel talks about six centripetal forces, the solutions, which exert force inward within the global software team making it more effective (See Figure 4) . Let us take a look at each one of those factors and see how ABCCorp rated against these factors.

***4.2.1. Telecomm Infrastructure***

The telecomm infrastructure is the centripetal force that enables a virtual distributed team to communicate, collaborate and work seamlessly. Since the time Carmel wrote about it, there have been great advances in communications and internet technology and their availability in many countries. At ABCCorp, basic infrastructure

like email, telephone, network security technology called the virtual private network, along with latest infrastructure of high speed and high quality video and audio conference helped the team greatly to work together to share information and tasks regardless of the fact that it is a distributed global team. The high speed infrastructure is the foundation to using any collaboration software effort in a virtual team. This “force” when properly invested in, provides working alternative to the loss of “communication richness” and the coordination problems that we saw earlier. We should keep in mind though that excellent infrastructure does not always negate the need for face-to-face meetings.

#### ***4.2.2. Product architecture***

Software product architecture determines how tasks are allocated among the members of the distributed team. In his book, “Global Software Teams”, Carmen discusses three different approaches to task allocation – module based allocation, phase based allocation and integrated allocation. Success or failure of the task allocation implementation depends on the quality of the product architecture. Proper product architecture is based on the principle of modularity that helps decomposing a complex task or a problem into independent sub tasks or modules. Even at the early stages of the company growth at ABCCorp, decisions made favored spending a lot of time on designing and stabilizing the architecture. The strong architecture foundation facilitated a successful task allocation method with the team in India. A mix of module based allocation and phase based allocation was chosen depending on the stage of the product

life cycle. Task allocation was smooth and it survived multiple teams over time because the product architecture supported such a strategy.

#### ***4.2.3. Team building***

Trust, relationship and good communication are the most important factors to build a successful team from disparate work units. Let us examine each of these factors and how they worked for ABCCorp and ABCCorp, India.

“Virtual team requires trust to make it work: technology on its own is not enough”<sup>56</sup>. Jones and Bowie (Jones and Bowie 1998) argue that ‘the efficiency of virtual corporations depends on features - speed and flexibility - that require high levels of mutual trust and cooperation’. There are several models about trust that explain that teams gain trust slowly as they progress through the cycle of product development working together, the classic example of Tuckman’s model of team development explains three stages which a team undergoes before it finally becomes productive<sup>57</sup> (See Table 4). There are similar models of team maturity and trust progression but there is one different theory called swift trust that can be applied to virtual teams. Swift trust theory explains that individuals thrown together into a team quickly gain trust by believing that the team members, like themselves, were chosen for reliability and competence. This happens only if there is early on role legitimization of the team members about their expertise and past relevant experience if any. At ABCCorp, multiple factors led to lack of trust, it was neither built swiftly nor progressively. Communication was formalized because it became hard to track issues and analysis with different time zones. This helped tracking project

status but did not work towards building trust or effectiveness because most of the communication initially was using email and phone. Later on, multiple video conference devices over high bandwidth were added at both sides which helped with synchronous communication with the team. Personal bridges in the form of one or more people travelling from the headquarters to India also helped gain trust. Several activities that focused on team building were introduced. It was observed that when trust was at higher levels, even the old communication methods of email and phone in later stages of the project life cycle worked effectively.

#### ***4.2.4. Development methodology***

Development methodology for a software company is what manufacturing process is to an automobile company. When teams are dispersed and management becomes complex, having a commonly understood development methodology becomes a common language that bridges developers at all the sites. There are two fundamental approaches to software development: i) the linear or waterfall model or ii) the prototyping or iterative model. The classic model is the linear or waterfall model in which each stage of the software development life cycle must be completed fully before the next stage starts. This model is easier when dispersed teams are involved because there is less uncertainty and each stage hand off is well defined. However for any product development the requirements necessitate that the product development be flexible and dynamic and the iterative approach to software development supports this. In the model,

the product in complete is developed in iterations. Feedback is used to enhance the product concept and continuously improve on the specifications. The challenge with dispersed teams is to make sure there isn't a fundamental difference in the development methodology at different sites. At ABCCorp, the headquarters was able to influence the subsidiary to standardize on the development methodology. As the company matured, the capability of the methodology, standards and documentation also improved.

#### ***4.2.5. Managerial Techniques***

The main goals of software development are: on-time delivery, reduced costs, and innovative and high quality products. A software team that is geographically dispersed is faced with additional risks when it tries to achieve these objectives. Good strategic vision and managerial techniques are necessary to harness the full potential of a global software team. Along with the fundamental techniques of project management which are: creating a statement of work, using consistent techniques for estimating costs and times, building a work break down structure, taking into account task dependencies and critical path, creating a project budget and managing risk , global management also needs to map the stakeholders at various sites, be wary of cultural values for rewards, recognitions and promotions, conflict management and travel for face-to-face meetings with each site. ABCCorp made the common mistake of choosing the individual with the strongest technical skills to fill the role of a global software manager. According to Carmel the ideal global project manager has a good balance of technical, managerial and global

skills. The accidental global manager who considers technical skills as the strongest and most important quality does not last long in a global team.

#### **4.2.6. Collaborative Technology**

According to Carmel, the centrifugal forces of distance, coordination breakdown, and communication losses need to be counterbalanced by an abundance of communication between the dispersed sites. A large portion of communication in co-located teams that help towards product development comes from informal meetings and chat that encourage creative thinking and act as technology sources. Collaborative technologies help achieve this missing natural coordination in co-located teams visible in global teams. Carmel talks about two types of collaboration technologies: generic and the ones that support software engineering. Generic technologies are the usual and well know tools in a work environment – email, web, audio and video conferencing, chat, voice mail and telephone. The second category of collaboration technology caters to the global software teams and helps with the following functions

Software Configuration Management (SCM)
Project Status
Notification Services
Project Scheduling and tasking
Process Management

Table 5: Collaborative Technology to support Software Engineering <sup>58</sup>

Programming tools
Bug and change tracking
Team memory and knowledge center.

Table 5 continued: Collaborative Technology to support Software Engineering

Software Configuration Management (SCM) tool helps with coordinating software code modification by team members dispersed globally. It works as both a mechanism for control and a mechanism for coordination. As a control tool, it sets a formal work flow process that needs to be followed by every team member. As a coordination tool it lets the local team members work on the distributed project by providing an easy mechanism to always get the latest changes submitted by the team and merge their local changes into the project that others can see.

With the advance of Web 2.0 it has become easy to implement some of the collaborative tools whose purpose is to serve as team knowledge center. At ABCCorp, wiki was used and a formal process was set up to overcome wiki's limitations of allowing edits to pages. Designated editors were assigned to logically divided groups of pages and some common pages and forums were left for everyone to edit and share. Team status and project status pages gave a 360° view of the project.

The key to successful implementation and use of collaborative tools is to decide on a list, select and standardize the tools needed by the team. For selecting a tool, check if there is already an in house tool that serves the purpose well. In-house web based tools generate enthusiasm and usually have better support because problems can be fixed at a

faster rate. For software that is purchased or used from an online open source community, check the support, reliability and business cases for the tool to see if it fits the team's needs. And lastly, team members need to be trained on how to use these tools effectively.

## **Chapter 5: Summary, Conclusions and Recommendations**

The first section of this chapter summarizes the thesis background and purpose; the next section revisits the research questions from the first chapter and provides conclusions based on the study in the previous chapters. The last section of this chapter provides a revised framework for successful global virtual teams based on the literature review and the case study analysis.

### **5.1 SUMMARY**

Several technological and business factors led to the emergence of global virtual teams. Increasing globalization and advanced telecommunications infrastructure make it easy for people to communicate and work together from anywhere in the world. The expansion of markets globally to increase revenues created the need for local expertise in global markets, which led to setting up offices globally. Another factor is the increasing focus of companies to sell services and knowledge based solutions which required less structure and more flexibility. Service activities often require cooperation of team members in dynamic work situations. Virtual teams enable this kind of flexibility through the support of collaborative technologies. Virtual teams are members of a distributed work force who hardly meet face-to-face and interact primarily via information and communication technologies.

Organizations can realize many benefits by implementing virtual teams. Project teams working virtually can benefit from best skills and knowledge and across the

boundaries of time and space unlike traditional teams. Virtual teams allow recruitment based on competency and not based on location. They help deal with the realities of compressed time, need for flexibility, dependency on knowledge-based input and the fact that most information in this age is stored in electronic format. The advantages of virtual teams include parallel work, continuous access to the latest knowledge and technology while allowing members to work from their home sites. Since virtual teams require information to be stored in electronic forms, this allows new members to speed up their learning by accessing this information of ongoing work. Virtual teams through the empowerment of collaborative technologies have the potential to be far more productive than traditional teams.

While virtual teams enable companies to solve important challenges of global business, many important issues should be addressed to successfully work with virtual teams. We have seen how virtual teams provide significant benefits but companies must be careful to address challenges and avoid pitfalls to realize the full potential of these benefits.

## **5.2 CONCLUSIONS**

The first chapter of this thesis introduced the following four research questions

1. What are the key drivers for global distributed development?
2. What is a global virtual team? What are the characteristics of a global virtual team?

3. What are the challenges faced by global virtual teams?
4. What are the essential building blocks that create a successful global virtual team?

This section summarizes the answers to these questions.

**1. What are the key drivers for global distributed development?**

Several external factors attribute to organizations moving from rigid hierarchy local teams to a flatter global virtual organization. These include

- a. Globalization of business, competition and customer relationships
- b. The increasing demand of businesses requiring faster response times, speed, flexibility and ability to work with dynamic requirements
- c. A shift in focus from manufacturing and production to providing services and overall solutions which requires knowledge based input and work
- d. The increased problems and cost of travelling and working from client sites
- e. The advance of information technology that allows immediate and productive information exchanges, enabling team members to be able to work from anywhere in the world.

Virtual teams enable organizations to harness vital resources, regardless of the location. The collaborative nature of virtual teams makes it ideal for dynamic and flexible nature of global business. But before an organization decides to start a virtual team, it should assess whether virtual teams is appropriate to the situation presented.

Organizations need to review their employee skill base, leadership ability, technical infrastructure, product architecture and culture to determine if they are ready to use virtual teams. Before employing a virtual team the company must assess the following questions

- What benefits are realized working with geographically dispersed teams?
- Does the product architecture support distributed product development?
- Do we have the proper technical infrastructure to support virtual teams?  
Are we willing to invest in such infrastructure and do the benefits outweigh the costs incurred?
- Do employees possess the required characteristics to work in a virtual environment? Are they independent, self-motivated and willing to communicate in a virtual environment?
- Do we have collaborative software products to support virtual teams? Can we invest IT in dedicated support for collaborative software?
- What are the risks involved in introducing virtual teams?

Organizations should answer these questions and assess if the benefits of going virtual outweigh the risks and there is a true potential that cannot be achieved with traditional teams.

## **2. What is a global virtual team? What are the characteristics of a global virtual team?**

A team is global and virtual when the team members

- span multiple boundaries (geographic, temporal, professional, organizational and cultural)
- hardly meet face-to-face
- work and communicate mainly through collaborative software technologies

These differences between traditional co-located teams and geographically dispersed teams require that specific characteristics are met by members of the global virtual team to make it work.

### **Virtual team characteristics**

- Independence

In the book “Virtual teams” Lipnack and Stamps<sup>59</sup> explain ice hockey as an analogy to the dynamic nature of virtual teams. In virtual teams, all members have a role, work towards a common goal, have knowledge of the common protocols and start contributing and working together when most of the times they don’t personally know the other members they are working with. This cooperation works best with independence.

Virtual team members need to understand their individuality and also understand how they integrate into the team. Designating expertise based roles help making the connection between the individual “me” and the group “we” in a team. It is also important to note that people should know the vision and the purpose so that they simply don’t lean towards the role or the organization box they belong to. To an extent, virtual team members self-manage. The team members should be independent, self-reliant and have the ability to make quick thoughtful decisions while following the commonly agreed upon protocols. Encouraging this individuality helps motivating a virtual team member to cooperate towards a common goal. Every team member should have the right balance of independence and interdependence to work successfully in a virtual team.

- Shared leadership

Every virtual team member must assume a leadership role at some point, in one project or the next. Virtual teams have a lot of coordination overhead compared to traditional teams and this overhead is reduced when team members assume responsibility of virtual leadership. These leadership roles are not the formal authority role but are rather created by influence. There are two main types of leadership roles in virtual teams – task leadership and social leadership. Task leaders have the expertise on the knowledge required, decisions to make and the activities to perform to get tasks done. Social leaders are people who take the lead to create a feeling of group identity, personal satisfaction and cohesion in the team which is equally important for the success of a virtual team.

This concept of shared leadership gives an opportunity to involve the best minds and most experienced people wherever they might be located.

### 3. What are the challenges faced by distributed development?

Virtual teams face the same set of challenges as co-located team but they also have additional challenges due to distance and time. Most of the challenges are in areas like communication and trust. The table below summarizes the challenges of global virtual teams that we saw in the case study and elsewhere from the literature.

Virtual Team Issues	Impact
Strategic Challenges	<ul style="list-style-type: none"> <li>• Virtual teams need to be bound by a strong purpose and a shared goal to be able to work together successfully.</li> <li>• Lack of strategic vision impacts the team's cohesiveness and focus</li> </ul>
Organizational Challenges	<ul style="list-style-type: none"> <li>• Virtual teams need to map stakeholders at every site and make sure there are shared leadership and a common goal that everyone agrees upon.</li> <li>• Too much power to one site, conflicting local interests are examples of organizational challenges that causes imbalance and distrust in the teams.</li> </ul>

Table 6: Virtual team challenges

Cultural Challenges	<ul style="list-style-type: none"> <li>• Culture defines organization norms and sets expectations.</li> <li>• The diversity of virtual team members and lack of cultural training can lead to misunderstandings.</li> <li>• Virtual teams need a supportive culture that encourages information sharing and teamwork.</li> </ul>
Trust and Relationship Challenges	<ul style="list-style-type: none"> <li>• Trust and relationship building is critical to a team's cohesiveness and success.</li> <li>• Virtual teams are characterized by speed and flexibility which require high levels of trust. Virtual teams will eventually collapse if there is no trust.</li> </ul>
Communication Challenges	<ul style="list-style-type: none"> <li>• Infrastructure tools support communication in virtual teams but the technology alone is not enough.</li> <li>• Difference in languages and culture adds to communication challenges in virtual teams.</li> <li>• Lack of effective communication leads to lack of trust and reduces productivity.</li> </ul>
Collaboration/Team Operations Challenges	<ul style="list-style-type: none"> <li>• Virtual teams share information and communicate using collaborative technologies.</li> <li>• Insufficient infrastructure impacts the team's ability to communicate and collaborate on dependent tasks.</li> </ul>

Table 6 continued: Virtual team challenges

#### **4. What are the essential building blocks that create a successful global virtual team?**

From the analysis in this research, the most important factors that lead to the success or failure of virtual teams are 1) selecting the right people that have the essential characteristics a virtual team needs along with being fit for the job 2) clarifying a purpose and having a strategic vision 3) having a robust technical infrastructure that is complemented by the right choice of collaborative software tools. In the next section, we will discuss the framework for success that shows these key elements along with their enablers.

### **5.3 RECOMMENDATIONS**

Based on the virtual teams' research, the case study and analysis based on existing frameworks and best practices, several recommendations can be applied to the case of the global software virtual team and for the success of any global virtual team in general. While the people-purpose-links model by Lipnack & Stamps addresses the important characteristics for a virtual team, some of the factors in the Carmel's centripetal forces take into account important enablers for the tactical operations of a virtual team. The recommendations listed below show how both the team characteristics and the forces that are supposed to bring virtual teams together are the building blocks to a successful implementation of global virtual teams and distributed product development.

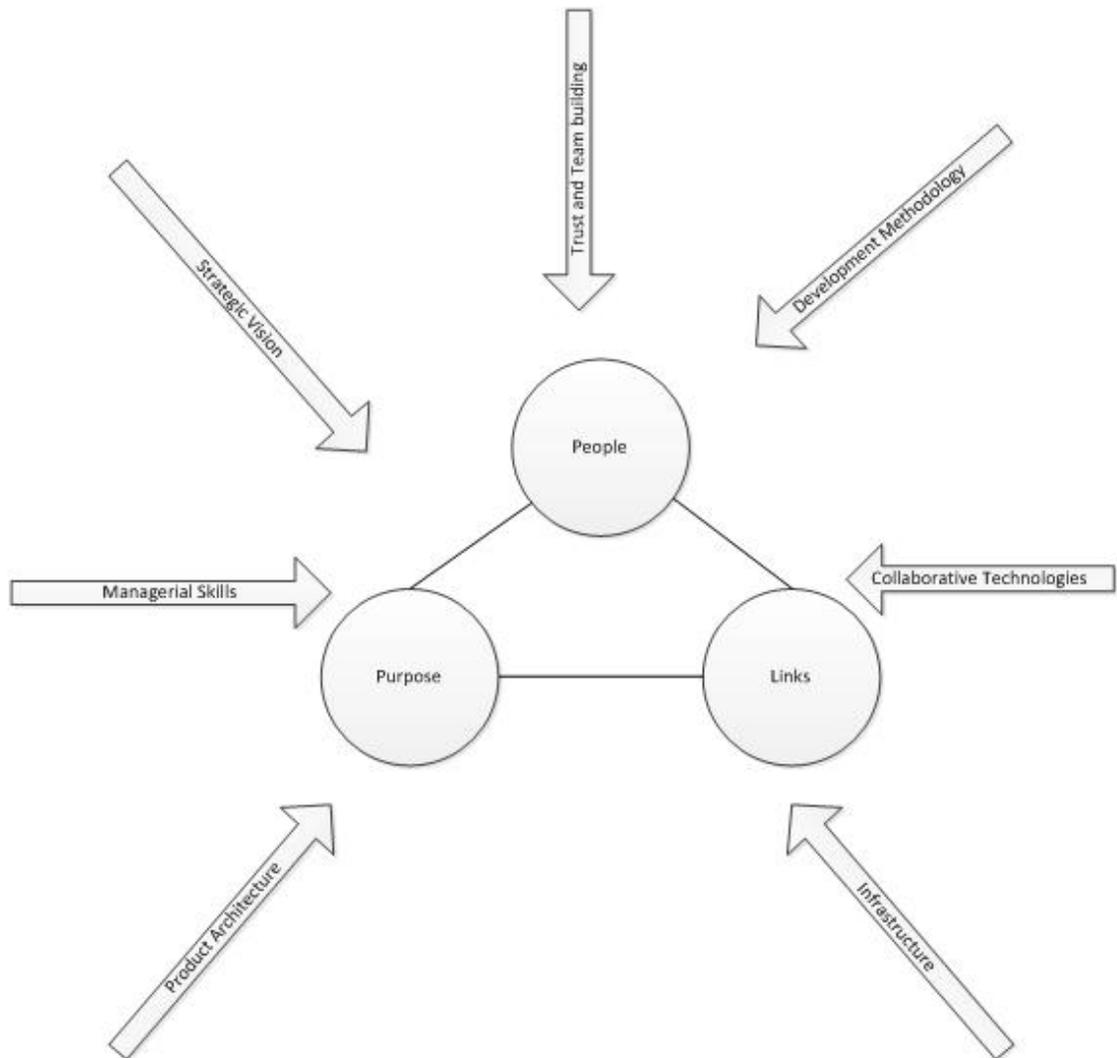


Figure 6: Framework for a successful global software team

### 1. Purpose

Purpose is the crucial binder that holds any team together. It is more important for virtual teams to share a common purpose and work towards it because a global virtual team involves multiple stakeholders. A team can stay together only if they have a shared

goal that everyone works toward. There are three main elements to developing and conveying a purpose for a global virtual team.

### ***1.1 Strategic Vision***

Strategic vision is critical to the success of any business and in the case of a global company, the strategic vision acts as a shared goal that trickles down from the top to the lowest level of individual team members. It is important that the shared goal of a company should be broken into smaller cooperative goals and interdependent tasks for members of the team. In terms of project management, virtual team managers should outline the purpose of a project during project definition phase. This helps team members understand the importance of a project and how their contribution helps achieve the purpose.

### ***1.2 Managerial Skills***

Every successful project needs the fundamental techniques of project management which are: creating a statement of work, using consistent techniques for estimating costs and times, building a work break down structure, taking into account task dependencies and critical path, creating a project budget and managing risk. A global project management also needs to map the stakeholders at various sites, be wary of cultural values for rewards, recognitions and promotions and a good strategy in place for conflict management. A good global manager has the right balance of technical,

management and global skills. We have also seen how distributed teams differ fundamentally culturally; and how culture affects communication, individual task motivations, rewards and recognition. Cultural differences cannot be changed, effort should be made to understand the differences, respect them and know how to cope with them.

### ***1.3. Product architecture***

This recommendation is relevant to the software industry that the case study focused on. Product architecture in a way helps define the purpose of a global software team. Well-defined product architecture is based on modularity that breaks down a complex piece of work into simpler independent tasks that can be later integrated into a single solution. So a strong product architecture forms the basis of individual task allocation in a global virtual team, most importantly it enables task allocation and task management with global virtual teams. It also establishes a sense of ownership at each site, for each team member that again ties back to their purpose in a project.

## **2. People**

### ***2.1 Trust and Team Building***

In a global virtual team, lack of personal contact makes building trust and relationships hard. Experience shows that there is no better time to begin building trust in

a team than during the project kick-off. It is recommended that an effort should be made to have a face-to-face meeting or at least invest in high quality video conference for a near-real face-to-face meeting for the project initiation. This meeting provides a venue to introduce team members, share a vision and explain communication and development protocols. It is also helpful to follow up with the entire team on meetings for major milestones, talk about roadmap and lessons learned. Other team building activities include providing a 360<sup>0</sup> view of the project status that also shows tasks by peers and other teams. Personal bridges in the form of some people acting as a cultural liaison also helps building relationship and trust among teams. When there are different sites involved, care should be taken to not assign too much power and leadership to the headquarters. To sum up, building a unified team is the essence of successful global distributed development. A unified team shares leadership and trust, is productive and focuses on various team building aspects and activities.

### ***2.3. Development methodology***

In the author's opinion, the development methodology a global software team follows, contributes as a helping force for the people node of the virtual teams model. This is because the development process acts as a communication mechanism; it is a common language that developers at all sites share. When the methodology is standardized, whether it is the linear model or the iterative model, each team member knows exactly what to do at a particular stage in the development process. Even when there is a standard process, effort should be made to document and agree on the

terminology used, for example what does a “code complete” mean or when is a bug said to be “fixed” or “verified”. As a company matures, it should invest time in improving the methodology capability, document the new standards and change in processes.

## **Links**

### ***2.1 Infrastructure***

Carmel’s centripetal force talks about telecomm infrastructure but in the 12 years since he wrote that book, there has been great advance in network infrastructure throughout the world. The challenges no longer lie in setting up reliable infrastructure at developing countries but there are still concerns on network latency, authentication and data security. We saw in the case study that investing in infrastructure technology helps correct team building and team productivity issues. When there is a global team, infrastructure investment should be an important commitment because without good infrastructure, tasks and communication cannot operate smoothly which will lead to delays and frustrations. Continuous effort to explore new technology and improve infrastructure increases the effectiveness of virtual teams and reduces remote costs.

### ***3.2 Collaborative Technology***

We have seen how collaborative technologies in the case study helped foster communication in dispersed teams by both serving as a means of informal

communication that co-located teams are used to and also by formally introducing new efficient communication methods without which it becomes hard to track progress and route work in a dispersed team. The key to successful use of collaborative technologies is to select the right mix of tools which balance synchronous tools like video conference, chat and asynchronous tools like email and web; standardize their use and train members on how to use them. For a global software team, there are additional collaborative tools specific to software development called software configuration management tools that help communicate project status, track issues and automatically notify team members on task status changes that affect their task list.

## Bibliography

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- 1 Ancona, D. G. and D. F. Caldwell, "Bridging the Boundary: External Activity and Performance in Organizational Teams," *Administrative Science Quarterly* 37: 634-665 (1992).
- 2 Mowshowitz, A. 1997. Virtual organization. *Commun. ACM* 40, 9 (Sep. 1997), 30-37. DOI= <http://doi.acm.org/10.1145/260750.260759>
- 3 Huber, George P. and C. Brad Crisp. 2003. Organizations, Information Systems Impact on. In *Encyclopedia of Information Systems*. Vol. 3. Edited by Hossein Bidgoli. USA: Elsevier Science.
- 4 Horvath, Lisa and Tobin, Timothy J. *Twenty-First Century Teamwork: Defining Competencies for Virtual Teams*. Academy of Management Meeting. 1999
- 5 McDonough, Edward F., III, Kenneth Kahn, and Gloria Barczak, "An Investigation of the Use of Global, Virtual, and Colocated New Product Development Teams," *Journal of Product Innovation Management* 18 (2):110-120 (2001).
- 6 Carmel, Erran, "The Explosion of Global Software Teams," *Computerworld* 31 (49): C6 (1997).
- 7 Jarvenpaa, Sirkka L. and Blake Ives, "The Global Network Organization of the Future: Information Management Opportunities and Challenges," *Journal of Management Information Systems* 10 (4): 25-57 (1994).
- 8 Townsend, Anthony M., Samuel M. DeMarie, and Anthony R. Hendrickson, "Virtual Teams: Technology and the Workplace of the Future," *Academy of Management Executive* 12 (3): 17-29 (1998).
- 9 McDonough, Edward F., III, Kenneth Kahn, and Gloria Barczak, "An Investigation of the Use of Global, Virtual, and Collocated New Product Development Teams," *Journal of Product Innovation Management* 18 (2):110-120 (2001).

- 
- 10 Bartlett, C. A. and S. Ghoshal. 1989. *Managing Across Borders: The Transnational Solution*. Boston: Harvard Business School Press.
  - 11 Lipnack, J., & Stamps, J. (1999). *Virtual Teams: The New Way to Work*. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19.
  - 12 Carmel, Erran, "The Explosion of Global Software Teams," *Computerworld* 31 (49): C6 (1997).
  - 13 Lipnack, J., & Stamps, J. (1999). *Virtual Teams: The New Way to Work*. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19
  - 14 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall.
  - 15 Sachs, J. (2000), *International economics: Unlocking the mysteries of globalization*, in P. O'Meara, H. D. Mehlinger, & M. Krain (eds.), *Globalization and the Challenges of a New Century: A Reader*.
  - 16 De Cieri, H. (2005, September). *Blackwell handbook of global management: A guide to managing complexity*. *Journal of International Business Studies* 36 (5), 593-594
  - 17 De Cieri, H. (2005, September). *Blackwell handbook of global management: A guide to managing complexity*. *Journal of International Business Studies* 36 (5), 593-594
  - 18 De Cieri, H. (2005, September). *Blackwell handbook of global management: A guide to managing complexity*. *Journal of International Business Studies* 36 (5), 593-594
  - 19 See Hax, A. C., & Wilde, D. L. II (2001), *The Delta Project*. Basingstoke: Palgrave, for a discussion of these strategic options.
  - 20 De Cieri, H. (2005, September). *Blackwell handbook of global management: A guide to managing complexity*. *Journal of International Business Studies* 36 (5), 593-594
  - 21 Kenen, P. B. (2000). *The International Economy*. Cambridge: Cambridge University Press.

- 
- 22 D'Antoni, Helen. 2005. "COMPANIES THAT GO GLOBAL LOOK AT BASIC ISSUES." *InformationWeek* , no. 1034: 70-70. Academic Search Complete, EBSCOhost (accessed July 10, 2009).
- 23 Townsend, A. M., S. M. Demarie, and A. R. Hendrickson (1998). Virtual teams: Technology and the workplace of the future. *Academy of Management Executive* 12 (3), 17-29
- 24 Jarvenpaa, S. L. and D. E. Leidner (1998). Communication and trust in global virtual teams. *Journal of Computer-Mediated Communication* 3 (4), 79-815
- 25 Lipnack, J., & Stamps, J. (1999). Virtual Teams: The New Way to Work. STRATEGY AND LEADERSHIP. 27 (1), 14-19.
- 26 Maznevski, M. L. and K. M. Chudoba (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science* 11 (5), 473-492
- 27 Crisp, C.B. and Jarvenpaa, S.L. (2000) 'Trust over time in global virtual teams', Proceedings of Academy of Management Meeting, Toronto.
- 28 Bettis R. and Hitt M. "The New Competitive Landscape", *Strategic Management Journal*(1995).
- 29 Townsend, Anthony M., Samuel M. DeMarie, and Anthony R. Hendrickson, "Virtual Teams: Technology and the Workplace of the Future," *Academy of Management Executive* 12 (3): 17-29 (1998).
- 30 Grenier, R. and Metes, G. (1995) *Going Virtual: Moving Your Organization into the 21st Century*, Upper Saddle River: Prentice Hall.
- 31 Schrage, M. (1995). *No more teams! : Mastering the dynamics of creative collaboration*. Doubleday.
- 32 Townsend, Anthony M., Samuel M. DeMarie, and Anthony R. Hendrickson, "Virtual Teams: Technology and the Workplace of the Future," *Academy of Management Executive* 12 (3): 17-29 (1998).
- 33 Grenier, R. and Metes, G. (1995) *Going Virtual: Moving Your Organization into the 21st Century*, Upper Saddle River: Prentice Hall.

- 
- 34 Townsend, Anthony M., Samuel M. DeMarie, and Anthony R. Hendrickson, "Virtual Teams: Technology and the Workplace of the Future," *Academy of Management Executive* 12 (3): 17-29 (1998).
- 35 Dubé, L. and Paré, G. 2001. Global Virtual Teams. *Commun. ACM* 44, 12 (Dec. 2001), 71-73. DOI= <http://doi.acm.org/10.1145/501347.501349>
- 36 Dubé, L. and Paré, G. 2001. Global Virtual Teams. *Commun. ACM* 44, 12 (Dec. 2001), 71-73. DOI= <http://doi.acm.org/10.1145/501347.501349>
- 37 Lipnack, J., & Stamps, J. (1999). Virtual Teams: The New Way to Work. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19.
- 38 Lipnack, J., & Stamps, J. (1999). Virtual Teams: The New Way to Work. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19.
- 39 Lipnack, J., & Stamps, J. (1999). Virtual Teams: The New Way to Work. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19.
- 40 Lipnack, J., & Stamps, J. (1999). Virtual Teams: The New Way to Work. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19.
- 41 Lipnack, J., & Stamps, J. (1999). Virtual Teams: The New Way to Work. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19.
- 42 Lipnack, J., & Stamps, J. (1999). Virtual Teams: The New Way to Work. *STRATEGY AND LEADERSHIP*. 27 (1), 14-19.
- 43 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall.
- 44 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall.
- 45 Allen T. Ibid

- 
- 46 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall.
- 47 Trevino, L. K. L. E. B. E., R. H. Lengel, and R. L. Daft (1987, October). Media symbolism, media richness, and media choice in organizations: A symbolic interactionist perspective. *Communication Research* 14 (5), 553-574.
- 48 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall
- 49 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall
- 50 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall
- 51 Tuckman, B. (1965). Developmental sequence in small groups. *Psychological bulletin*, 63, 384-389
- 52 Tuckman, B. (1965). Developmental sequence in small groups. *Psychological bulletin*, 63, 384-389
- 53 Schiopoiu Burlea, A. (2007). The communication process in virtual teams. *Informatica Economica*, 1(41), 113-116.
- 54 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall
- 55 Lipnack, Jessica; Stamps, Jeffrey. *Virtual Teams : People Working Across Boundaries with Technology*. Hoboken: Wiley, 2000.  
<http://utxa.ebib.com.ezproxy.lib.utexas.edu/patron/FullRecord.aspx?p=469095> (accessed October 24, 2011)

---

56 C Handy. "Trust and the virtual organization: how do you manage people whom you do not see?" *Harvard Business Review*, 1995: 40-45

57 Tuckman, B. (1965). Developmental sequence in small groups. *Psychological bulletin*, 63, 384-389

58 Carmel, E. (1999, January). *Global Software Teams: Collaborating Across Borders and Time Zones*. Prentice Hall.

59 Lipnack, Jessica; Stamps, Jeffrey. *Virtual Teams : People Working Across Boundaries with Technology*. Hoboken: Wiley, 2000.  
<http://utxa.eplib.com.ezproxy.lib.utexas.edu/patron/FullRecord.aspx?p=469095> (accessed October 24, 2011)