SDM Thesis Title

A Framework for Improving the Effectiveness of Distributed Project Teams

by

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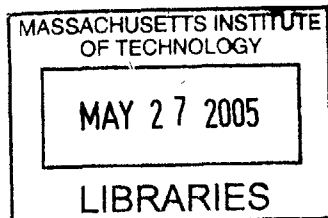
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Executive Summary

Thesis: The effectiveness of distributed project teams can be improved by taking a multi-dimensional approach. A framework for doing this is proposed.

Motivation:

Increasingly companies are finding they need to collaborate across boundaries – through projects involving multiple companies or different business units or because of the adoption of telecommuting; often these involve geographically distributed locations. Setting up and running such a team is subject to the normal issues about an integrated team, but may also be subject to additional challenges caused by distance, time-zone and cultural differences.

Organizations have approached this point from various starting points. Some began with video conferencing over ISDN networks for meetings or training and are now looking at how the Internet and related tools could improve their capabilities. Others are finding email exchanges and voice teleconferences do not provide a rich enough interaction among participants.

Technologies for collaboration have improved and companies are adopting them at an increasing rate, but the use of these advanced technologies does not ensure a team will be effective. Implementing technology solutions is not likely to improve operations if other

aspects of a distributed team are not also addressed. There is also often uncertainty about which technologies to adopt and how to use them effectively.

Companies often provide training in team operations to its managers and team leaders, but these often do not address the unique aspects of managing a distributed team.

There is a general sense that distributed teams just do not work as well as co-located teams, but there is a difficulty in measuring this and a lack of understanding of why and what could be done to improve them.

Primary Research Objectives:

- Define the critical success factors in setting up and managing a distributed project team
- Analyze the formation of distributed project teams in various environments
- Analyze the effectiveness of distributed project teams formed under various conditions
- Define ways to measure the effectiveness of project teams
- Identify the key factors that make a distributed project team effective
- Identify the role of collaboration technologies in making a distributed team more effective and identify how the technologies can best be used
- Establish best practices and lessons learned from several examples

1.0 Introduction

Focus areas

The focus of this work is on improving the effectiveness of distributed project teams – adopting a widely accepted definition of team as described in "Virtual Teams" as: "A team is a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems, and who manage their relationship across organizational boundaries.' (Cohen & Bailey, 1997, p. 241). This definition is general enough to capture traditional as well as virtual teams while precisely identifying the defining features of a team: its unity of purpose, its identity as a social structure, and its members' shared responsibility for outcomes." (Powell et al., 2004, 7).

From the same source, distributed, or virtual teams are defined as: "… groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks (Alavi & Yoo, 1997; DeSanctis & Poole. 1997; Jarvenpaa & Leidner, 1999). While they can be ongoing, virtual teams are often assembled on an "as needed basis" to cooperate on specific deliverables, or to fulfill specific customer needs (Chase, 1999; Lipnack & Stamps, 1997). Distinctive features of virtual teams include their preponderant - and at times exclusive - reliance on IT to communicate with each other, their flexible composition, and their ability to traverse traditional organizational

boundaries and time constraints. Virtual teams are often assembled in response to specific needs and are often short lived (Chase, 1999). This is not a defining characteristic of the virtual team but rather a byproduct of the specialized function they often serve." (Powell et al., 2004, 7).

We focus here on distributed project teams because this is an area that has been growing in importance in recent years. They also present some additional challenges beyond those normally seen in team work. Many of the issues raised here will also apply in other situations however. But, for example, brainstorming sessions, or periodic reporting of status from otherwise separate activities, or coordinating separate plans would probably not exhibit the same issues.

Distributed project teams will generally involve some members who are co-located in addition to some who are located at a distance. Due to the nature of project teams they will generally involve members from different job functions or departments and perhaps organizations and companies. Participants may come from different countries, in different time zones and different cultures. These are important as examples of crossing boundaries. It is in crossing boundaries of various types that differences become more of an issue.

The physical distances involved are not necessarily great, what is important is that not all the team members will be co-located. Working together at greater distances is likely to

introduce additional complications in the area of technology, but are also more likely to involve time zone, cultural and native language issues.

Distributed Project Teams (DPTs) are a specific instance of the larger Distributed Work topic. Distributed Work also includes individuals working away from the office doing a variety of tasks.

1.1 Questions raised

When organizations are considering distributed project work there are several questions that tend to rise. These are often mentioned in trade press articles.

Is distributed work something I need to be concerned about?

Why is this important?

Is this an area we need to invest in?

Is it worth investing in? – What is our return?

Should I be buying into some of these new technologies being hyped?

Is something more than technologies involved?

We have not been seeing the return on our investments in this area – why not?

What are the factors involved that affect the performance of distributed project teams?

What can we do to help ensure distributed project teams are effective?

These are some of the topics to be addressed in this paper.

2.0 Trends in Distributed Work

Background

2.1 Situational analysis – trends favoring distributed project work

There are several key trends in business that are fueling the need for many organizations

to consider distributed project team work:

- Internationalization/globalization – companies have multiple sites that must

  cooperate to get things done; companies are assuming more of a global viewpoint

  and require that teams work together across location boundaries. Companies may

  benefit from a local presence in markets they wish to enter – this may even be a

  requirement in some areas.

- Takeovers, mergers – existing structures, politics, ways of doing business must be

  brought together to achieve the desired payback. In some cases units are left

  independent, but increasingly there is seen the need to make these units work

  together. People from different units are often thrown together to work on

  common projects, and they may come with different mind sets. There may also

  be some conflicts or jockeying for position caused by takeovers and mergers that

  will impact the team dynamics.

- Telecommuting, remote offices, work at home – increasingly people are asking

  for options in terms of where they work from, and companies see this flexibility

  in terms of also reducing costs (work at IBM and Sun are examples). In a job

  market where there is competition for the best people companies may have to

demonstrate some flexibility is giving people the option to work outside the main office.

- Co-operation, partnerships – there is also an increasing trend for companies to cooperate on larger projects. They may do this to take advantage of expertise or skills each partner organization brings. To realize these benefits the companies work together and project teams may include members from the various partner groups. Again each company comes with their own way of doing things and looking at things, their own culture and processes. The relationship between the companies involved also may influence how the team members do their work – who is the prime contractor, who has the lead on a certain element, who has the power.

- Crossing boundaries – multi-discipline teams – even within a single company there is increasingly the need to bring together people with different skills and viewpoints from across the company. Sometimes this is termed as breaking down the barriers within a company to make for more efficiency.

- Competitiveness – many of the above are being driven by the need to be more competitive, or are being forced by increasing competition from outside. In order to survive or grow companies have to change how they are doing things.

- Access to expertise - even the largest and best of companies can't have all the skills or ideas they need to be the best – they must reach out across boundaries. In some cases specific technical or market expertise is necessary and it may not be possible or practical to relocate those experts to the home base.

- Recognition of value in diversity – this is another way of thinking about maximizing the use of available resources. By including others with different backgrounds or viewpoints, and those who are physically disabled, companies can reap the value of a diverse workforce.

2.2 Supporting Literature

Significant prior research has been done on distributed teams and distributed project teams, in part owing to the trends noted above and because many organizations are trying or considering their implementation

.

Several of the resulting documents provide some additional perspective on trends that are making distributed work more of a priority, and in some cases a necessity, for many organizations.

In "Managing Virtual Teams" the author quotes data from research firm Gartner, Inc:

> "A decade ago, *virtual teams* were almost nonexistent. Today, technology, globalization, and the need for fast responses to marketplace demands have dramatically changed the way business is conducted. According to research by Gartner, Inc., 137 million workers worldwide will be involved in some form of remote electronic work by 2003.
>
> While there is some debate about the number of teleworkers, recent research sponsored by the International Telework Association and Council shows that there were 23.6 million teleworkers in the United States in October 2000, compared to 19.6 million the previous year.

Gartner research analyst Waldir Arevoelo says the numbers are only going to increase. In the year 2000, 40 percent of an employee's time was spent working alone, 15 percent working with others in the same time zone and in the same place, 15 percent in a different place at the same time, and 30 percent at a different place and different time. The group projects that by the year 2010, employees will spend:

- 30 percent of their time alone

- 5 percent in the same place and time

- 25 percent in a different place and same time

- 40 percent in a different place and different time" (Solomon, 2001).

While this includes work in the broader category of distributed work, the data do indicate growing trends for workforce distribution that will impact distributed project team work, as these same employees may be participating in project teams.

In their review of current literature in "Virtual Teams" the authors cite several sources in noting the business trends that are pushing organizations to change their organizational structures and adopt distributed project work. They also note that organizations must address the challenges associated with these shifts:

"Global competition, reengineered product life cycles, mass customization, and the increased need to respond quickly to customers' needs are just some of the more pronounced trends currently driving organizational change (Grenier & Metes, 1995; Miles & Snow, 1986; Miles & Snow, 1992). Increasingly, successful organizations

are those organized in a dynamic network form that, using Information Technology (IT) as a primary enabler, can more quickly adapt to ever-changing competitive landscapes and customer requirements (Davidow and Malone, 1992; Jarvenpaa and Ives, 1994).

One of the building blocks of these successful organizations is the Virtual Team. Technological support for virtual teams and collaboration in distributed environments is now viable and widespread (Constant et al., 1996], As a consequence, a growing number of organizations are implementing them or plan to implement them in the near future (Lipnack & Stamps, 1997; McDonough et al., 2001), and their use is expected to continue to grow (Carmel and Agarwal, 2001; McDonough et al., 2001). While virtual teams offer a wide range of potential benefits to organizations (Townsend et al., 1998), implementations will be at risk if organizations fail to adequately address the many challenges present in the virtual context (Iacono & Weisband, 1997; Victor & Stephens, 1994)." (Powell et al, 2004).

In "Effects of Environmental Uncertainty on Organizational Intention to Adopt Distributed Work Arrangements", the authors continue on this point that adopting distributed work arrangements (DWAs) is a significant organizational change and that change and uncertainty in the market is a driving factor. In this paper the authors investigate how the company's environment and culture influences the likelihood of adopting distributed work and its subsequent success. They point out how factors such

the degree of competition and change in an industry, together with the company's view towards risk and complexity play an important role:

> "Adoption of DWAs as an alternative form of work arrangement for employees would necessitate fundamental and radical changes in structure, coordination and control mechanisms, and rewards systems in an organization and would, thus, constitute
>
> an innovation. It is a process innovation that could involve structural, administrative, and technological changes rather than a pure technological innovation.
>
> Research has established a significant positive relationship between environmental uncertainty and organizational innovations such as changes in organizational form, strategy, and culture. Organizations that perceive a high degree of environmental uncertainty were more likely to pursue an aggressive technology policy.
>
> … uncertainty due to restructuring of the labor market and increasing complexity of the competitive situation and customer needs, which are important elements of the organizational environment, motivates the search for a fundamentally new organizational response, such as the alternative offered by DWAs." (Sia et al., 2004)

Given the degree of uncertainty and change in many markets today this would help explain the increased interest in distributed work arrangements. This research also points out that distributed work is much more than a technological innovation – a theme we will explore more in the next section.

Consultant Bill Bruck notes the need to quickly pull together subject matter experts from different parts of an organization to respond to business needs:

"Agility. It's as critical a quality for today's corporation as it is for, say, an Olympic athlete. A company that can quickly respond to the whims of the marketplace, rapidly modify its products and services, and solve problems before they become disasters is a company that ultimately "takes home the gold." According to Bill Bruck, cofounder of Virginia's Collaboration Architects, LLC, the key is having a system in place that allows for the creation of what he calls "quick forming, quick dissolving" (or QF/QD) teams.

"Effective companies now are working in projects, and each project necessitates its own team of experts," he explains. "Perhaps these experts are people hand-selected from several departments across an organization. Perhaps they're members of a sister company, or they're freelancers or outside consultants. Perhaps they're a combination of all of the above. Regardless, any corporation that's going to compete in the 21st century must have the agility to create and utilize these QF/QD teams."

(Bruck, 2002)

Computer software development is one area that has been at the forefront of adopting virtual project teams, due in part to familiarity with the supporting technologies and a tendency to already have in place structured development methodologies and tools.

In addition, in "Challenges of Global Software Development" the authors identify often cited reasons motivating GSDs in this business area:

"Most major companies develop software products in a globally distributed fashion. For example, in year 2000, 185 of Fortune 500 companies outsourced software development to India alone and the amount of outsourcing grew at a 53% yearly rate according to report by the National Association of Software and Services Companies (NASSCOM 2000).

The often cited reasons motivating GSD are:

1. Limited pool of trained workforce

2. Necessity of getting closer to customers and using locality specific expertise to customize/localize the products

3. National policy in some countries where the government may be a customer requiring suppliers to locate R&D facility in that country as a condition of sale or a favorable tax treatment

4. Differences in development cost

5. Promise of round-the-clock development that could lead to shorter intervals"

They note that some of these factors essentially force companies into GSD, while others promise economic benefits. (Mockus & Herbsleb, 2001)

In "Get That Team Spirit" the authors add that there are fundamental shifts in how work is being done in software development:

"Projecting software-development trends out three, five, or even more years, it's easy to see how the lone software developer will be an anachronism. Software systems are getting bigger, more complex, and more distributed – and so are the teams of

programmers that build them. Assembling the programs of tomorrow will require more automated development tools and processes. And programmers disbursed around the world will increasingly rely on collaboration tools and techniques to get the job done." (Claburn & Babcock, 2004)

This article focuses on trends in software development, but the comments are applicable to a variety of systems engineering processes.

There are probably some advantages in implementing the development systems described for this set of users since they are already computer savvy and tend to be accepting of new technologies, however many of the issues we will uncover will still apply – particularly for those comfortable with the model of the lone software developer or guru.

Another view is presented in "Unforeseen Circumstances : Strategies and Technologies for Protecting Your Business and Your People in a Less Secure World" where the author writes about changes companies must make in light of recent terrorist activities and the resulting increased concern about security. In Chapter 2, Conquer Travel Fears with Virtual Meetings and Training, she covers how there is a shift to virtual meetings for safety reasons and to address concerns employees may have about traveling. In addition to the often cited cost savings due to reduced travel, she identifies the following additional advantages:

"Convenience and productivity – participants can quickly join a scheduled e-meeting from their desktop or home PC and can return immediately to productive work at its

conclusion. Scheduling is also eased by eliminating travel time and not having to work around when people will be working at the office. It is also easier to include part-time workers and those on leave if needed.

Attendance rates and punctuality are likely to improve – due to the increased convenience, reduced time commitment required and reduced distractions associated with getting people together.

The ability to record a virtual meeting – which is a part of many software packages.

Improved organization – in that the meeting leader will tend to do more advanced work in defining the agenda and will have to do more facilitation of the meeting.

Balancing personalities – participants can all be on an even footing and not be overwhelmed by some who tend to dominate in-person meetings. Personality conflicts may also be reduced." (Gutzman, 2002)

Though this material is not primarily about distributed project team work many of these points still apply. Organization and facilitation are important aspects of both co-located work and distributed work and probably needs more of a focus. Meetings should be well planned in advance and facilitated to ensure meeting set objectives in both cases. In project work participation tends to be more visible in that there are on-going meetings

and tracking of progress. Group feeling is something that is built up over time in a project team.

The point about increased flexibility for employees and the organization is stressed in a paper on trust and leadership in virtual teamwork:

"Virtual teams can also provide greater employee flexibility. Team members typically

have increased freedom in their schedules and are not necessarily confined to a traditional

workday or workplace. In some regard, virtual team schedules are analogous to

"flextime" arrangements, allowing employees the ability to perform tasks on their

own schedules. In addition, virtual teams provide dynamic team membership and

increase the number of tasks or projects that employees can work on simultaneously

(Cascio & Shurygailo, 2003).

It is plausible that individuals belong to more than one team at the same time and

have the flexibility to move from one team to another very easily. Moreover,

organizations have the ability to quickly pool resources from a variety of locations

by forming virtual teams to address specific organizational needs. Finally, the

September 11, 2001, attack on the World Trade Center resulted in decreased

business travel, which further increased the

need for virtual communication (Alavosious et al., 2002; Weber, 2001)." (Derosa et

al., 2004)

2.3 But adoption has not been as rapid or widespread as once envisioned

Despite recognition of the potential benefits noted above, adoption of distributed project work has not been as rapid as once envisioned. In this section some of the reasons for this are noted.

In "Effects of Environmental Uncertainty on Organizational Intention to Adopt Distributed Work Arrangements" the authors note:

> "Despite its many potential benefits, the adoption of DWA's (Distributed Work Arrangements) has not been as extensive as widely expected, particularly in Asia." (Sia et al. 2004)

They attribute this to an imbalance in the perceived complexity of the changes involved and their fit with the organization vs. the advantages expected. They also identified that organizations in environments of higher complexity tend to have relatively negative perceptions of DWA's advantage and compatibility. The authors suggest this could be explored further.

Several sources note that distributed project teams are not as effective as they should be, and this can discourage organizations considering their deployment.

In the paper "An Empirical Study of Speed and Communication in Globally Distributed Software Development" the authors report that distributed work items appear to take about two and one-half times as long to complete as similar items where all the work is co-located. Their research indicates this is generally due to having more people involved when making changes due to cross-site and coordination issues. Their research indicates delays are greater in distributed work when there is need for information, discussion or a decision. They believe this is due to the fact that distributed social networks are less effective than local social networks. (Herbsleb & Mockus, 2003)

Along the same lines, in "Virtual Teams" the authors note: "Traditional teams have generally been found to outperform their virtual counterparts with respect to the ability to orderly and efficiently exchange information and engage in effective planning (DeMeyer, 1991; Galegher & Kraut, 1994)."

Thus the efficiency of information exchange between sites seems to be one of the major issues. One potential reason for this is a limitation of the technologies used, as noted in: "Telecommuting: Problems associated with communications technologies and their capabilities". In this paper the authors investigate how the current state of communications technologies can be a limiting factor in making distributed work effective. (Gupta et al. 1995)

The reason is more likely to a combination of social issues, technology issues and process issues – these will be explored in more detail in the next section.

3.0 Challenges of Distributed Work/Distributed Project Teams

In creating an effective distributed project team organizations face many of the same challenges as with other teams, but must also face some additional challenges due to the nature of distributed work. These must be addressed to ensure the success of the team and its project. These can be categorized as follows:

3.1 Dealing with cross functional teams

As indicated above, cross functional teams are frequently the rule in project teams. These may be composed of people who do not know each other, who have different ways of operating/processes, different ways of thinking, and may have different norms of behavior. These can come from the fact that they are from different functional areas or different disciplines. They may have established ways of doing things in their normal/base area that may have evolved over time, are generally not documented, and are influenced by the individuals involved. In a cross functional team there may be less areas of commonality to start from, and work will have to be done to bring the team together.

3.2 Peoples' Behaviors

Some issues in any team relate to the differing social styles of the individuals involved. This has been known for some time, and some companies prepare team leaders or managers in understanding this through courses in social styles, behaviors and team building. However there is often an uneven understanding across the team on some of

these points, and some people may not be trained. Even if they are aware some people are flexible and others are not, or they find it harder to adapt to the styles of others.

Another set of issues may arise when we talk of people with different languages and cultures. In a practical sense people may be slower to comprehend a different language, or people may hesitate to speak up because it takes them longer, or they have difficulties expressing themselves. They may be less inclined to speak up due to insecurity about their command of the language, or due to differing social customs.

They may use words differently, or may have different meanings of the same terms. These differences can lead to confusion, frustration and misunderstandings, which can strain relations with others.

Examples:

- What does a 2PM meeting time mean? Is it to start exactly at 2PM in a designated time zone; is that an approximate time given some slack so one can actually join at 2:15? Or even 2:30?

- How is agreement signified vs. acknowledgement?

- How much personal space is customary?

- How are age, sex, or social status factors in how people interact?

This also extends to differently-abled people – such as the deaf, and those visually impaired. Some ways of communicating may leave some people out.

How does a team help ensure that all parties are included and participating?

A frequent topic in prior research on the behavior of people in teams has been the issue of trust – its importance in determining how effective a team is, and how it is developed. In their article "Interpersonal Traits, Complementarity, and Trust in Virtual Collaboration" the authors show how personality traits influence the tendency to trust potential partners in virtual collaboration, the tendency to initiate and participate in virtual collaboration and the tendency to be more effective in these activities. (Brown et al. 2004)

Another important aspect of how people interact in a team is based on their culture. There can be significant conflict within a team when these differences are not understood.

In "The contexts of knowing: natural history of a globally distributed team" the authors studied a distributed team in a global consumer products company. Among other aspects this study provides an excellent example of the issues of culture that can arise in a multinational team. The company established a new focal team to create and execute the marketing strategy for one of their major customers, whose headquarters was in France. This was a restructuring of what had been a geographically oriented team located in France. The new team was headed by and included several Americans. Among other factors differences in culture lead to conflict within the team which lead to the team being ineffective in reaching its goals.

The authors noted this:

> "An important difference between the original team and the new globally distributed team was the fact that the former did business following the French model, while

Morris expected the latter to follow the American business model. The French tend

to rely on long-term, personal relationships and networks for the conduct of daily

business, and generally respect the organizational hierarchy for purposes of

communication and coordination (Hall & Hall, 1990; Platt, 1996). On the other hand,

some observers of American corporate practices have noted that U.S. businesspeople

tend to be action-oriented and thus focused pragmatically on getting the job done; the

organizational hierarchy may be more or less salient, depending upon corporate

culture and the conditions at hand (Stewart & Bennett, 1991; see also Carroll,

1988)." (Baba et al. 2004)

3.3 Location differences

This is a fundamental aspect of distributed project teams, given the definition adopted –

participants will be working from different locations.

When participants are not co-located they must adopt different techniques for working

with people than they are familiar with. They have to do without some of these

mechanisms, or find alternatives. In the case of a mixed team, where some participants

are co-located and others at a distance, the whole team must be sensitive to these

differences and seek to overcome them.

When co-located there are opportunities for casual contact that tend to be lacking in a

distributed team. These casual contacts include opportunities for socialization, the ability

to just drop by someone's office for a quick question, opportunities for discussion before and after meetings and side discussions during a meeting. Among others, IBM Research has done work on the importance of immediate and casual contacts. One example of this is the idea of the 'knowledge accident' where an unplanned contact can lead to a significant breakthrough in thinking.

There may be a significant amount of non-verbal communication in an in-person meeting – by facial expressions, posture, etc. Studies have indicated that a great deal of information is exchanged through these non-verbal clues.

In a co-located team there is a greater likelihood that participants have met previously and know each other to some degree. They may have had the opportunity to work together previously and may have already established impressions, and perhaps trust, of other teammates.

Note that the difference in location does not have to be major for some of these problems to exist. In some cases there may be only a difference of a few miles between sites, yet there may be limited in-person contact.

In some organizations the value of face-to-face time is recognized and provisions are made for bringing teams together periodically to build and reinforce the team connection.

3.4 Time differences

Having team members in different time zones can cause problems in scheduling meetings for the team to meet as a whole for presentations or discussions, or for team members to meet for working sessions. A convenient time for some members may be during non-work hours for others. This may result in some people missing meetings and potentially causing them to feel out of the loop and less likely to fully participate. In some cases interactive meetings can be replaced by replays or asynchronous collaboration, though these lack aspects of working together with others.

Participants may adopt different work schedules to help address this, though this may have an impact on personal life and the ability to work with others at their location.

Of course time differences can also be viewed as an advantage of a distributed team in that work can potentially go on around the clock.

3.5 Appropriate organizational processes

Of course appropriate processes for running a team effort must in place for any team to be effective, but it may be more important in a distributed team that these processes are clearly understood and followed. This is in part due to an increased need for coordination among sites.

Processes should address:

- Meeting management

  - o Meeting facilitation

  - o Having an agenda, capturing minutes and action items

  - o Controlling discussions; allowing everyone an opportunity to speak

- Conflict and problem resolution

  - o How decisions are made

- The selection and use of appropriate tools for collaboration

  - o Document management; check-in/out process; approvals

- Project management

  - o Maintaining a master schedule; task assignments; status tracking

- Defining roles and responsibilities

- Facilitating communications among the team and to the rest of the organization

- Behavioral norms

  - o About interrupting, disagreeing, including others, respecting others

3.6 Supporting technology

As an alternative to in-person meetings and discussions companies look to technology to aid in team collaboration. In most cases some level of technology is already being used for co-located teams, such as telephone and phone mail systems, email, and shared data repositories, but these may need to be enhanced to better support people working at a distance. There may be a need for additional tools and more formal procedures. In some cases, new technology will have to implemented, such as video conferencing.

IDC is a research and consulting firm which focuses on trends in technology. In their white paper "There Should be More to Collaboration than Email" the authors cover email and other technologies and make the point that they are very useful and important technologies, but they are not used well.

In a distributed project team environment there may be significant differences in the technologies available to the different participants. There may be incompatible systems, equipment and training in their use. They are often significant differences in the type and bandwidth of communications available. Telephone connections may be limited to half-duplex where it is difficult to interrupt to make oneself heard. All these can cause frustration and make the affected participants at a distance feel less engaged.

4.0 Supporting Literature

Significant prior research has been done on distributed teams and distributed project teams, showing various views of what the important aspects are in setting up an effective distributed project team, and how these relate. The authors have taken different approaches, often based on their background and objectives. They have tended to focus on different aspects and grouped together topics in different ways. Several have proposed a framework to help in understanding how these elements relate and as an aid to thinking about them. Material is somewhat disjoint, but there are some commonalities, which will feed into the next section.

This section is a review of this prior work. In the next section the key elements derived from these works and additional research will be put into a proposed framework with some recommendations.

Several of these previous works have built on the work of others. Citations to the original source material have been left in to credit the authors and so that the reader may investigate topics in greater detail.

4.1 Selected Supporting Literature

Caucus Consortium provides consulting services to companies about effective project teams. In their white paper "How Companies Collaborate: Sharing Work Online", the author defines a set of critical success factors for project teams in the areas of task factors and process factors. These include:

> **"Task Factors**
>
> Task factors are ones that focus on "what" is being done, and the ways it is organized. Some of the most important task-related success factors include:
>
> - Explicit goals. Collaborative groups need to have a clear destination that everyone understands, if they want to maximize their chances of reaching it. Goals need to be explicitly shared, and clearly stated in ways that their achievement can be evaluated.
>
> - Clear roles and responsibilities. While it is important in all collaborations to be clear on everyone's roles and responsibilities, this is especially true when the group is not co- located. Even the simplest things like how often everyone agrees

to check in with the collaborative online tool, or who is supposed to take what action by when, can get very muddy in the online waters.

Process Factors

Process factors are ones that focus on the *people* who are doing the tasks – their motivations, relationships, and communication patterns. Common process success factors include:

- Goal alignment. Not only is it important that the organizational goals be clear and explicit, it is also important that the personal goals of those collaborating are in alignment with the organizational goals. For instance, if team members will lose power in the organization by virtue of the project, or not obtain the recognition they desire for their part in the project, then goals are not aligned.

- Ownership. Ownership is the degree to which each member of a project team feels that the project is *theirs*. Ownership is dependent on several factors, including the degree to which the individual feels that they have a voice in the process.

- Relationships. The success of a collaborative effort will correlate almost directly with the degree to which team members understand what each other is doing, value the contributions of others, and trust that they are all working towards the same end. Whenever people work together, they have some type of relationship. Collaborations succeed best when these relationships are characterized by respect, trust, and understanding.

- Development. Work groups go through "forming, storming, and norming" periods, before they settle into their working stage. A predictor of successful

collaborations is that the collaborating group successfully navigates the challenges posed in these earlier stages, and arrives at a working stage in which the energies of the group are not sidetracked, but are devoted to achieving project goals." (Bruck, How Companies Collaborate, 2000)

In "Virtual Teams: A Review of Current Literature and Directions for Future Research" the authors summarize previously published works and the results of research in the area of virtual teams. They identify some of the common points and organize them around a model:

"Consistent with previous virtual teams work, the review is organized around a life cycle model (Saunders, 2000) which includes four general categories of variables: inputs, socio-emotional processes, task processes, and outputs. Figure 1 presents the major issues that early virtual team work has identified in each of these categories.
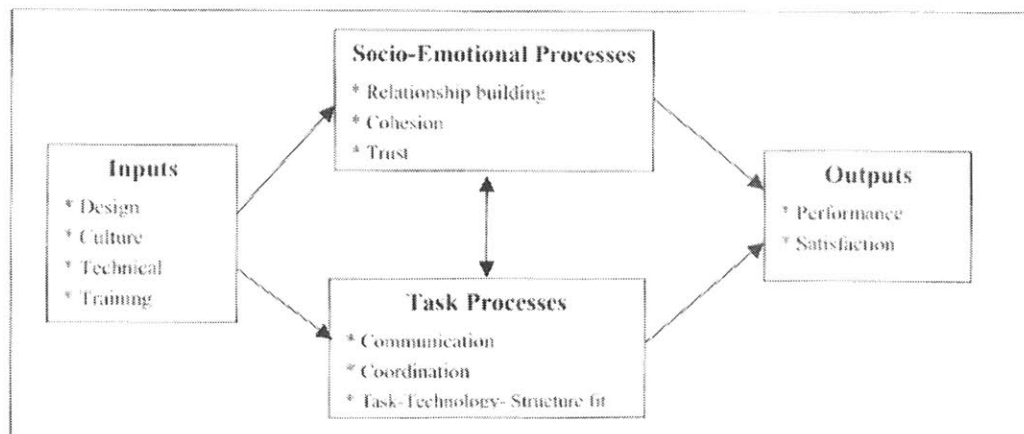

Figure 1 Major Issues Identified

(Powell et al. 2004)

Inputs

Inputs represent the design and composition characteristics of the virtual team and the endowment of resources, skills, and abilities with which the team begins its work. Inputs that have been investigated by previous research can be grouped under the labels of design, culture, technical expertise, and training.

Socio-Emotional Processes

The practitioner press points to relationship building, cohesion, and trust as fundamental processes that foster team effectiveness, while suggesting that virtual teams face significant difficulty in achieving them (Alexander, 2000; Kezsbom, 2000, Lipnack & Stamps, 2000; Solomon, 2001). Research on socio-emotional development in virtual teams has focused on relationship building in general, and more specifically on team cohesion and trust. Relationship building includes interaction processes designed to increase feelings of inclusiveness or belonging to the team that are hypothesized to foster cohesion and trust. Early work has established a positive link between socio-emotional

Process and outcomes of the virtual team project, while also confirming that virtual teams face unique difficulties in meeting socio-emotional needs of virtual team members (Chidambaram, 1996; Lurey & Raisinghani, 2001; Maznevski & Chudoba, 2001; Sarker et al., 2001).

Task Processes

Task processes are the processes that occur as team members work together to accomplish a task or goal. Major issues identified in the task processes category included communication coordination, and task-technology-structure fit.

Outputs

The virtual team research on outputs, or outcomes, has focused on the performance (i.e., effectiveness) of the team. Some papers have examined more specific aspects of performance such as decision quality, number of ideas generated, and/or time it took team members to reach a decision Besides the ultimate performance of the virtual team, satisfaction with the virtual team experience has also been examined."

(Powell et al. 2004)

This work includes some elements seen in previous works in the areas of Task Processes and Socio-Emotional Processes, but they add important elements in the Input and Output elements. In particular in the area of Inputs they address the overall design of the team, including its mission, and the importance of addressing cultural differences. They also highlight the need for training. In the Outputs area they discuss the measurements to be applied to a distributed team - including both performance (delivering the results) and in satisfaction (the value to the team members). This latter point is very important in

defining that one of the functions of a distributed project team is to improve the personal

connections within the organization.

In "Forming Virtual Teams" , the author, Shauna Wilson, offers guidance to

organizations planning to deploy virtual teams. A key aspect is in defining preliminary

work, which should include making sure the following are in place:

- The appropriate technology

- Computer skills for all virtual team members

- An understanding and knowledge of how to use problem solving tools by all team

  members, and an understanding of how to collaborate to resolve issues, create

  processes and communicate

- A method for ensuring cooperation

- A communications infrastructure

As noted in other sources, the importance of trust is highlighted here:

> "To build trust, a virtual team must create and own a simple definition of intent.
>
> Members also need to establish the team's own operating principles, roles,
>
> responsibilities, goals and metrics. Any questions should be clarified immediately."

A potential problem with virtual teams identified here is the lack of alignment of

objectives and measurements among the team members and with their 'home'

organization. Even if the team members agree and the team's objectives are aligned with

those of the organization and sponsor, there can still be conflict with the organizations and managers who are contributing participants to the team.

This article also identifies some of the technologies necessary to support the team's work - that there should be a mix of synchronous and asynchronous communications. Asynchronous communications capabilities should include: a shared file store, discussion boards, calendars, lists, chat rooms and push technology.
In addition to teleconferences, video conferences and e-meetings, synchronous communications should include: real-time chat, shared files, an interactive whiteboard and file transfer.

Some of the prior research is also valuable in highlighting some of the drawbacks of virtual teams. This is helpful for identifying areas that will need to be addressed to ensure an effective distributed project team.

"Drawbacks of Virtual Teams

Although there are numerous advantages to employing virtual teams, there are also a number of major disadvantages that result from virtual collaboration. As the spatial and temporal distance between team members increases, it is possible that communication becomes more challenging due to differences in culture, language, and access to technology, which can impede collaboration (Duarte & Snyder, 1999).

Moreover, the lack of physical interaction results in reduced verbal, social, and status cues that are typically present in face-to-face (FTF) communication (Kiesler, Siegel, & McGuire, 1984; Sproull, 1986; Weisband, 1992).

This may become especially important when team members are from different cultures, due to the fact that some cultures emphasize nonverbal cues and gestures in interpersonal interaction, which may lead to comprehension difficulties (Cascio, 1999).

Moreover, creating a sense of "shared space," or a place for individuals to come together and examine their work, is considered to be more difficult in virtual communication (Cohen & Mankin, 1999). Virtual team members might report feelings of social isolation due to the lack of FTF contact. Although new technologies such as "electronic hallways" help members to "socialize by the coffee pot or water cooler," or as they "walk down the hall" (e.g., Johansen, 1989), it is unclear whether these technologies serve as substitutes for FTF social interaction, and virtual teams may be more susceptible to problems of coordination and cohesion. Specifically, work performance may be impeded by coordination difficulties between members, and teams may be less cohesive due to the lack of FTF contact and the decreased proximity in these teams (Kiesler & Cummings, 2002).

From an evolutionary standpoint, synchronous FTF communication (using auditory sounds and visual cues) has been the primary mode of communication in the evolutionary history of human beings, which means that humans are optimized for FTF interaction (Kock, 2002). All other things being equal, humans prefer FTF

because it is the most natural form of communication. Furthermore, communication modes that are most similar to FTF interaction are more natural for humans. Most importantly, humans might not be optimized for many of the existing technological media, because many of these media suppress many of the features of FTF communication (Kock, 2002).

Trust in Virtual Teams: A Paradox?

It is no longer uncommon for communication to cross boundaries—both within and outside of an organization (Hinds & Kiesler, 1995). Even though advancements in communication technologies might significantly facilitate virtual team collaboration and ultimately enhance team performance, it is important for virtual team members to develop strong interpersonal dynamics and support mechanisms, as even the most advanced information technologies only partially contribute to the success of these teams (Lurey & Raisinghani, 2001). Zaccaro and Bader (2003) contend that development and maintenance of trust may be one of the most important factors contributing to virtual team success, given the obstacles that may impede the establishment of trust in these teams.

Nohria and Eccles (1992) suggested that FTF interaction is vital for the development and sustenance of trust. Virtual team members who never meet FTF, or who have very few meetings, may be less willing to trust other team members, as FTF contact is important for reinforcing social similarity, shared values, and expectations (Jarvenpaa & Leidner, 1999).

In addition, the role of initial trust in these contexts may become paramount. In contrast to FTF teams in which the focus has been on relationship building prior to working on tasks, Hart and McLeod (2003) show that a task focus early on is important to team building in virtual teams. Jarvenpaa and Leidner (1999) reported that a type of "swift trust" developed in global virtual teams but also noted that this trust was fragile. Increased cultural diversity may also be an important factor in the formation of trust in virtual teams, as team member values may impact the formation of trust (Jones & George, 1998), and increased levels of diversity may lead to more discomfort and lower levels of trust (Kipnis, 1996). On the other hand, the lack of physical cues inherent in current virtual teamwork may suppress some of the discomfort associated with diversity and instead highlight the similar adaptive problems all team members are facing. If diversity cues (e.g., physical appearance, olfactory cues, accents, mannerisms) are not salient, but task and technology factors are at the forefront, impressions of others may be formed more by task performance and technological acumen. It may be that the swift trust found by Jarvenpaa and Leidner could serve as a starting point, but that an emphasis on performance and task-related matters, such as reported by Hart and McLeod (2003) and Benoit and Kelsey (2003), may better enable virtual teams to include diverse members in a trusting environment than FTF teams can. Although the data are equivocal, it is expected that trust will have an important impact on virtual team performance, team members' attitudes such as team member satisfaction, and team behavioral outcomes such as absenteeism and turnover (Costa, Roe, & Taillieu, 2001)."

(Derosa et al. 2004)

The authors of "The myth of the boundaryless organization" argue against a technologically focused approach to distributed work. Through two case studies they present how the tendency to focus on collaborative technologies as the answer is short-sighted, and that organizational and business issues must also be addressed.

> "We offer two cases: The first relates to a major international bank, which made the false assumption that introducing collaborative technologies would lead to the dismantling of organizational boundaries that led to its failure to present a common front on a global scale. Instead, the initiative led to the creation of *electronic fences*. The second case shows evidence of experimentation, learning, and concern for the management and facilitation of collaboration across boundaries."
> (Newell et al. 2001)

In "Global Virtual Teams" the authors report their findings from in-depth discussions with 18 leaders of global virtual teams in several industries. They identified the following key issues:
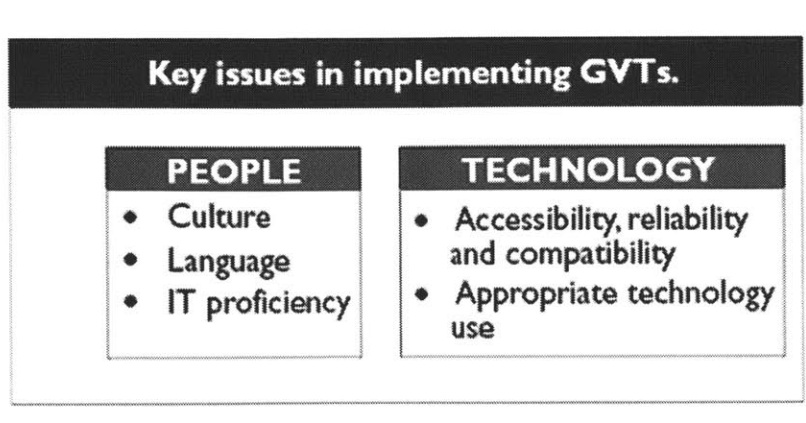
Figure 2 Key issues in implementing Global Virtual Teams

(Dubé & Paré. 2001)

"Our findings suggest GVTs confront significant challenges over and above more localized virtual teams. Indeed, the principal challenges facing organizations in deploying GVTs involve people and technology (see the accompanying figure).

Cultural diversity represents an enormous challenge for GVTs but also offers potential richness. National and organizational cultures define how people behave in any working context. In a GVT, cultures and management styles often clash. For example, people from different cultures may have different ideas about what constitutes good performance.

Communication styles may also differ. Furthermore, notions of accountability can vary according to whether a culture is more collective or more individualistic. GVT leaders should be mindful of these issues and understand their own cultural biases and how they may affect their judgments. Tolerance, empathy, and the desire to discuss potential

conflicting situations with an open mind are all necessary for members of a GVT to develop an effective level of synergy.

Our respondents recommended that all members of a GVT be given cultural training at the beginning of a project. Learning about national, organizational, and even functional cultures can be very useful, no matter how experienced the team members. Such training should address issues that might affect team performance such as normal working hours;

expected behaviors; expected levels of performance and involvement; how decisions are made; how work will be reviewed and approved; and how to resolve conflicts. 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 to the surface in a positive light can help create a GVT that is enriched, and not paralyzed, by cultural differences.

Language represents a particular difficulty for GVTs. English is the de facto language of most linguistically diverse GVTs. 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. 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.

It is widely recognized that collaborative technologies provide powerful support in making GVTs a reality. GVT 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, GVT managers are likely to face unpleasant technological challenges such as hardware/software incompatibility, unreliability, or unavailability, especially connecting people in developing countries. Even narrowband ISDN infrastructure is still not extensively developed within current advanced economies and is expensive to use in some countries.

Therefore, before starting a virtual project, its sponsors, with the help of IT specialists, 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 GVT. In addition, software applications must interface reliably because when systems crash, connections are disrupted, data gets mangled, GVT member 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. Underinvesting in technological infrastructure can bring virtual work to a standstill, even though other challenges are fully addressed.

GVT leaders must address hardware and software accessibility, reliability, and compatibility issues and ensure that all members' systems have adequate performance." (Dubé & Paré. 2001)

This article provides excellent information about the issues covered, along with sound recommendations. In particular they stress the importance of training in some key areas for participants. However they do not cover other key areas such as organizational processes and the importance of having a clear purpose, which were addressed in other works.

Several studies have focused on distributed work in the area of software development. This is due to the fact that software development is a relatively new area; it is a well structured area that has been the focus of much research in general. This area has

experienced and continues to experience significant growth, and for many of the factors identified above it is a global business.

In Challenges of Global Software Development the authors identify some of the problems associated with GSDs in that area:

- "Infrastructure – lack of or differences in infrastructure, including network connectivity, development environment, test and build labs, and change and version management systems
- Coordination - interdependencies among work items and difficulties of coordination
- Communication across sites (identified as potentially the largest source of problems) – differences in backgrounds, processes, training, cultures, languages, and lack of unplanned, casual contact.
    o Informal communication mechanisms, which are important for reacting quickly, may not exist.
    o There may be less knowledge of who the experts are in a given area
    o Lack of trust and willingness to communicate openly"

(Mockus & Herbsleb, 2001)

An important issue that was brought up in several earlier works was about barriers between groups. These may be organizational, cultural or political and may be

exacerbated by the lack of alignment in the objectives of the groups involved. An example of this is noted in a thesis by Cheryl Oates:

> "A major factor contributing to the problem of door sag is the apparent lack of teamwork in resolving the issue. Perceived barriers between groups within the door systems team has inhibited effective communication and negatively affected teamwork. Differences in education level, experience and functional alliances are but a few of the barriers that the team must overcome to build more effective communication and teamwork." (Oates. 1996)

Many of these lessons-learned relate to teams in general; distributed teams are subject to some of the same issues, but these may be exacerbated by the element of not being co-located.

In a thesis by Steven C Gerber and James W. Pennito entitled "Virtual Teams at Work: One Manager's Story", there is an analysis what it takes to have an effective globally dispersed team (GDT) and a proposed framework.

The authors noted that they had originally intended to focus on the application of information technology to address the need for virtual teams. But their research lead them to realize that technology is only one element – a necessary one, but not sufficient to ensure effective virtual teams.

In their research they reviewed previous work in this area by several authors. One such

work was by Smith and Katzenbach (1993), where four necessary characteristics of an

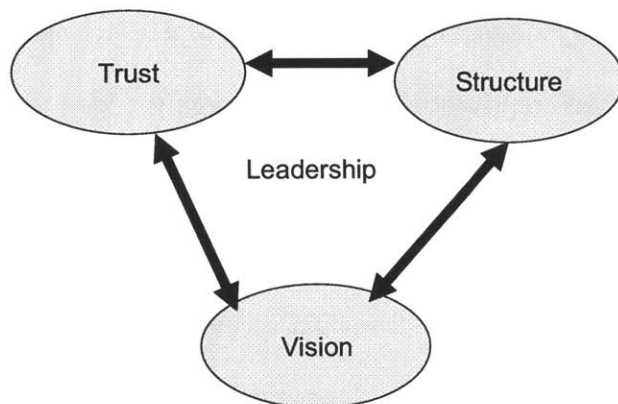effective team were identified as:

Complementary Skills

Accountability

Common Approach

Common Purpose

They used these works as a basis to develop a conceptual framework for looking at GDTs

which focuses on Trust, Structure and Vision as key aspects.

Figure 3 A Framework for Global Dispersed Teams

(Gerber & Pennito. 2000)

Here Trust includes building relationships, empowerment, and common purpose.

Structure includes organization, roles and responsibilities, operating guidelines, rewards

and recognition, and hiring, orientation and training. Vision includes common purpose, alignment and shared values. Leadership provides commitment, design, stewardship and leader traits. They also stress that Communication is a critical element.

This view is similar to that proposed in this thesis, though expressed in a different way. This view also does not address the role of technology as an enabler.

On the role of technology in supporting distributed project teams, several previous works outline how available technologies can be used.

A key role for technology is in facilitating communications among team members. Basic tools include the telephone and email. These can be enhanced to provide multi-party teleconferencing and email team lists. Beyond that organizations can look to threaded discussion forums, calendaring, shared data repositories, instant messaging, video conferencing and electronic meetings.

In "Creating and Maintaining an Online Community", from Q2Learning, the author defines stages of technology and the needs they support. Needs range from access to a sense of place, communications and group memory:

	Stage 1	Stage 2	Stage 3	Stage 4
Technology				
Access and Use	• Access to Web-based tools is unreliable or at dial-up speed • Participants use incompatible tools.	• Access to Web-based tools is reliable and at broadband speed. • Participants use different tools that offer basic compatibility.	• Participants use the same tools, providing compatibility of advanced features.	
Sense of Place	• No technology is available to provide the group a sense of place.	• A basic website is available as a "place" for the team to store files. • The website does not provide spatial metaphors, copresence features or news and events. • There are no integrated discussions.	• The website integrates file management, news and events, and discussion features. • The website does not provide spatial metaphors. • The website may have simple profiles. • The website does not provide robust copresence features such as presence indicators, instant messaging, participant thumbnails and "featured participant" blocks. • Although basic interaction features may be available, the site "feels" like a website rather than a virtual community center.	• The website integrates file management and content management with rich discussion and copresence features. • The website may also integrate other groupware tools such as polling and decision support. • Rich community management tools are available to community organizers. • The site "feels" like a virtual community center rather than a website.
Communications	• Email and telephone are the primary or sole communications technologies. • No asynchronous group communication tool is available. • No synchronous Web-based group communication tool is available.	• Synchronous Web meeting technology is available, but no instant messaging or chat technology is available. • Simple asynchronous discussion board technology is available.	• Instant messaging and/or chat technology may be available. • Robust discussion forum technology is available for asynchronous discussions.	• Asynchronous discussion forums are integrated with email, instant messaging and synchronous Web meetings.
Group Memory	• No technology for community file sharing and archiving discussions exists.	• The website provides basic file storage features. • There is no technology for archiving discussions.	• Easily managed, multilevel folders organize files. • File storage is not integrated with desktop applications. • Discussions are archived and simple search capability provided.	• File storage is integrated with desktop applications via drag-and-drop technology. • Discussions are archived and robust search capability provided.

Figure 4 Stages of Technology

(Bruck, Creating an Online Community, 2004)

A consulting firm specializing in collaboration, Caucus Consortium, expands on the ideas of necessary communications technologies by discussing the evolution of these technologies over time. They make the point that technology is moving to an integration of the technologies mentioned above into a more well integrated set of tools – often termed an online workplace:
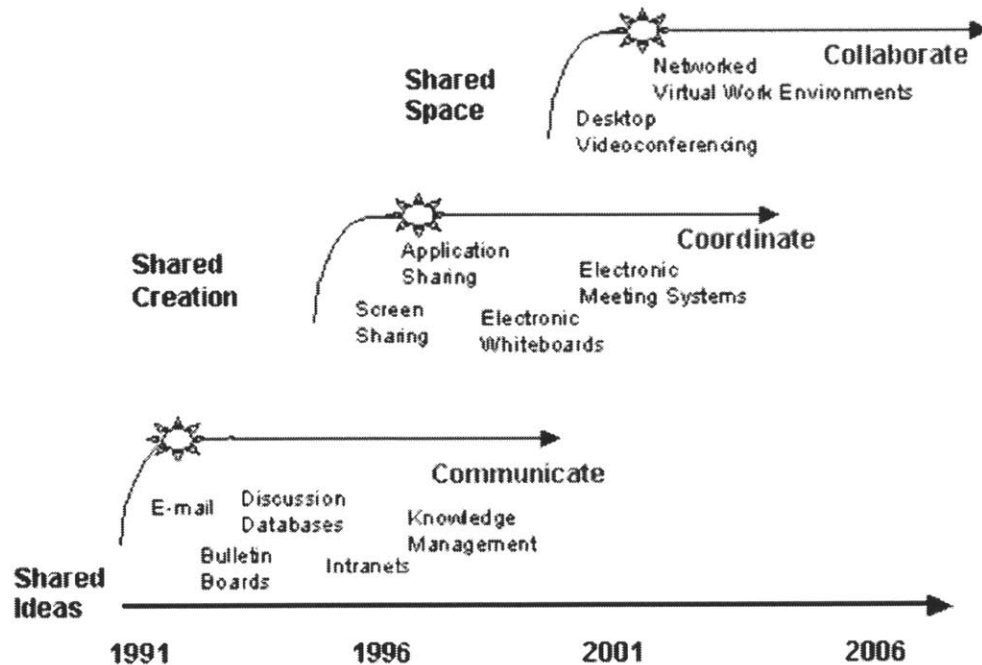
Figure 5 Evolution of Technologies

Source – GartnerGroup (qtd in Bruck, ,How Companies Collaborate, 2000)

In another thesis, entitled "Organizational Team Characteristics That Enable Successful Projects at NASA", Timothy J Flores outlines what it takes to create a successful team and makes specific recommendations:

"Recent studies have concluded that the team environment plays an important role in the success or failure of projects and the transitions within them. This research will attempt to uncover those characteristics that tend to most influence the decisions, execution and outcome. This research will explore the requirements, metrics, and management necessary for creating successful team characteristics that enhance a project's ability for success.

Strategic	Grouping	* Create a flat and flexible organization. * Let team members fall where they fit not necessarily having to fill functional slots. * Allow the team to follow through the entire project where practical. * Use common groups cautiously and make sure they acquire the required information to get the job done.
	Linking	* Collocate as much of the team as possible. * Open informal communication links that don't necessarily have to follow the hierarchial chain of command. * Allow for information exchange between functional groups for problem solving. * Create an environment that information flows both up and down the chain. * Use organizational expertise and partner wherever possible. * Never underestimate the power of face-to-face communication. * Never let personalities influence the amount of communications.
	Alignment	* Create a challenging environment. * Establish a esprit-de-core among team members if possible. * Reward teamwork as well as individual efforts. * Facilitate resource sharing among functional groups. * Make resource replacements quickly and efficiently.
Political	Stakeholders	* Establish clear and well understood stakeholder roles & responsibilities. * Manage stakeholder influence and participation.
	Interest & Goals	* Communicate the mission goals and objectives to the entire team. * Manage the differences between the goals of each stakeholder. * Balance realistic expectations of faster, better, cheaper.
	Power & Politics	* Create a trusting work environment. * Distribute the decision making as far down as possible. * Use constant peer reviews within the team. * Adopt tools that create added value to the project, question everything else.
Culture		* Establish a people first environment. * Create an environment where the culture can be created to accomplish the mission. * Adopt formal risk management practices.

Figure 6 Lessons learned in creating a successful team

(Flores. 2001)

The focus in this research is on teams in general, and in fact the author recommends co-located teams where possible. The author makes other recommendations which are, in most cases, consistent with those for a distributed project team – particularly about the importance of a clear purpose and alignment of objectives. Each organization will have issues that are particular to their own environment and these should be taken into account.

In "Five challenges to *virtual* team success: Lessons from Sabre, Inc.", the authors examine the strategies that one large company, Sabre, Inc., has successfully used in setting up and managing distributed project teams. They have examined some of the conventional wisdom about virtual teams to determine how applicable those really are, and reworked them as necessary to reflect what Sabre has experienced. For each of these major challenges they then document the lessons learned.

Conventional Wisdom. Virtual Team Challenges. and Lessons Learned from Sabre

Conventional Wisdom	Virtual Team Challenge	Lessons Learned from Sabre
Building trust in virtual teams is extremely difficult, given the limited face-to-face interaction.	Establishing trust based on performance consistency rather than social bonds.	• Rapid responses to virtual teammates foster trust. • Establishing norms around communication patterns is key. • Team leaders play important roles in reinforcing timeliness and consistency of team interaction. • Levels of trust based on performance compensate for lack of social interaction.
Virtual teams will struggle with creating synergy.	Overcoming group-process losses associated with virtual teams.	• Extensive training in virtual teamwork helps overcome process loss. Training in virtual team leadership, conflict management, and meetings management is particularly valuable for overcoming process loss. • Adaptation of decision-making software facilitates problem solving and decision-making.
Virtual team members experience isolation and detachment.	Creating a virtual environment of inclusiveness and involvement.	• Consider individual differences in preferences for working virtually when selecting virtual team members. • Give virtual team members a realistic preview of the potential for feeling detached. • Team leaders play a critical role in maintaining continuous contact with remotely situated virtual team members. • Redesign job assignments to provide virtual team members with occasional face-to-face customer contact to reduce isolation. • Convene face-to-face meetings for virtual team members at company-sponsored conferences.
Because of the need to communicate via information technology, selection of virtual team members overemphasizes technical skills and underemphasizes interpersonal and teamwork skills.	Identifying virtual team members who have a healthy balance of technical and interpersonal skills.	• Use behavioral interviewing techniques and simulations as part of the selection process. • Use panels of current virtual team members to help recruit and select new team members and ensure the appropriate balance of technical and interpersonal skills. The panel approach has the additional benefit of building support and facilitating socialization of the newly selected virtual team member.
Assessment and development of virtual team members is very limited in the virtual team environment.	Establishing the appropriate quantitative and qualitative data for accurate assessment of virtual team members. Developing creative approaches for providing feedback, coaching, and support for virtual team members.	• Use of a comprehensive "balanced scorecard" approach provides valuable quantitative data on team performance. • Monitor group communication archives to assess subjective factors, including idea generation, leadership, and problem-solving skills. • Use team-member peer reviews to assess contributions to team effectiveness. • Use "richer" communication media, including video conferencing, for performance evaluation feedback. • Identify on-line training and development resources to address virtual team members' knowledge, skills, and abilities in need of further improvement.

Figure 7 Lessons learned at Sabre, Inc

(Kirkman et al. 2002)

This is an extremely valuable approach in that it integrates many of the topics discussed

in the previous works and adds the value of having learned through experience.

Another set of lessons learned comes from "Managing Virtual Teams". Some of these are similar to the above, but others present a different view. Again these build on previously discussed topics and will serve to guide the recommendations that will follow is this paper.

Tips for Successful Virtual Teams

1. Select people who are self-starters, strong communicators, and have other good *virtual*-team skills.

2. Keep projects task-focused so team members will be able to gauge their progress and know if they are on target.

3. Keep team interactions upbeat and action-oriented.

4. Standardize common protocols.

5. Create clear goals.

6. Celebrate reaching targets.

7. Create shared space--a *virtual* water cooler--where people can interact beyond the scope of work.

8. Identify the barriers to collaboration that you want to overcome.

9. Identify what people should do when a crisis occurs. Whom should they contact? What is the decision-making hierarchy?

(Solomon, 2001)

In addition to understanding what some of the key aspects are it is also important to have a way to measure the effectiveness of a distributed project team.

Certainly this can be measured by to what degree the team meets objectives set for the team/project, but we may need a broader view. The team could meet the objectives, but be dysfunctional, potentially causing bad feelings in the future. On the other hand a team could strengthen the organization by improving connections among parts of the organization and contributing to the organization's learnings. In tough competitive markets organizations want to maximize value in multiple ways.

4.2 Summary Points

Key points from the above literature include:

- Define explicit goals for the team

- Define clear roles and responsibilities

- Ensure proper alignment of goals

  o Personal goals should be aligned with organizational goals

  o Ensure other organizations involve all buy-in

  o Seek confirmation from Executive management

- Establish a sense of ownership within the team

- Foster relationships of trust, respect and understanding among team members

- Ensure appropriate training is provided

  o In technologies being used

  o In working with others, cultural sensitivity, social styles

  o In managing a distributed team

- Be aware of cultural differences and work with them

- Be aware of other differences in time, language, access to technology

- Clearly define the team's outputs or outcomes

  - Include performance and team satisfaction

- Define how the team and its members will be assessed

- Ensure appropriate communications infrastructure and technologies are available and usable

- Create a sense of 'shared space'

- Compensate for the lack of non-verbal cues in communications

- Provide some level of face-to-face contact

- Provide a means for social or informal contact among team members to foster a sense of team

- Try to select team members who can fit in a distributed project team

- Value the diversity of the team

- Define processes for conflict resolution

- Define appropriate behavioral norms for the team

- Teams are often not created in a vacuum – be aware of history and politics

This is a fairly inclusive set (by design in selecting the research included), but it is a rather long list. In the following section these will be grouped to make them easier to work with.

5.0 Proposed: A multi-dimensional approach to thinking about DPTs

Building on the above, 4 key aspects have been defined to help an organization assess its potential for implementing effective DPTs and to guide their implementation:

Purpose

Team Operations

Human Interaction

Technology and Tools

5.1 Purpose

This includes having a clearly defined mission and objectives that are aligned with the organization's mission and the missions of the supporting groups. It also includes clearly communicating this to participants and other stake-holders and getting their buy-in.

As mentioned above the team may have objectives beyond the delivery of a result or product – it may also be charged with building connections within the company and breaking down existing barriers.

It is important to understand how the DPT is viewed within the organization. Is it mainstream or a side activity of lesser importance? DPTs may draw resources from various other groups and these may have different views of the DPT and its importance.

There may also be issues about power – who will gain or lose. These issues can doom a project before it really begins.

It is also important to understand how the performance of team members will be assessed. How is the DPT work considered along with other work that may be done with other teams or in the home org? It is important that objectives be aligned.

5.2 Team Operations

This includes the extent to which processes are defined, or in practice, and how well they are followed.

It also includes having rules or norms for behavior, such as ensuring all participants are included in discussions and encouraged to participate, that individuals not dominate discussions or silence others and that there is the ability to disagree.

This category covers items related to team processes both within the team and how the team relates to the larger project and organization. DPTs may have to follow a structured process even more than collocated project teams in order to overcome barriers induced by the physical distance between the members. Apart from good project planning and management, DPTs need to agree on a formal meeting process. Pre-distributed, clear agendas and meeting goals are proposed, as well as quick check-ins from members at the beginning of each session and quick summaries at the end by the meeting coordinator. Adopting a formal process is a skill that can be learned and DPT leaders should receive training and gain some exposure to the leverage effect that a formal process can have on

the overall team effectiveness. Not only must there be some formal process for how the team works, but the members of the team need to have a common understanding of the team objectives and approach, and must buy into those.

This category comprises such elements as agreement on project objectives, agreement on tools and processes to be used and the definition and use of formalized processes for conducting DPT meetings. Some elements of this category are the responsibility of the DPT members, but some are beyond their control and may need to be negotiated with others (such as dictation by company management what tools or processes will be used on the project).

Management has to provide appropriate support, ensure training is made available, and provide appropriate tools for use by the DPT.

The role of team leader is also critical for some of these functions.

5.3 Human Interaction

This includes the behaviors of the individuals; to what extent these are factors and how they are handled. This includes politics, leadership, addressing cultural differences and behavioral norms.

Human Interactions covers the aspects of how people relate to each other and how they interact; basically their behavior. These include members' behavioral styles and personalities, mutual acceptance and what we empirically call "chemistry" - meaning how well the team members feel about working together. This is influenced by the social

styles of the team members. The importance of recognizing these needs can be seen in examples where a distributed team has access to adequate technology and follows a formal process, but where the team members don't accept or even don't respect each other. However good each member's individual skills and qualities, such a DPT will face problems early on, since hard feelings will prevail, hampering cooperation and overshadowing all other potential benefits. Though issues in this area relate to personal behavior there are things that can be done to make people more aware of style differences and training can help people handle those. Behavioral norms should also be worked out within the team to help team members better handle differences.

In most cases, the members of the DPT are directly responsible for the aspects of human interaction: each team member chooses how to interact with the others, such as whether or not they will follow established processes and how often they will meet in person. This tends to be less structured than Team Operations, and is often overlooked, but it is very important – for any interactions. It tends to get more complex when there are many people; cliques to groups may form; behavior may be different when there is an audience.

How the DPT is viewed in terms of the other parts of the org can be important. Do the team members have a 'home' organization different than the DPT? How are potential differences in priorities handled? How does the home organization view the DPT? – is it important, or a waste of time? These can all influence the behavior of participants.

Team members should be sensitive to accommodating differences such as language, culture, time zone, and time lag.

5.4 Technology and Tools

This category includes what technologies are available to help teams, how are they used, and how effective they are.

This category includes how members of the team connect and what tools they need to enable them to work better together.

There is a range of technologies that may be employed. A baseline technology may be the use of speakerphones for teleconferencing. However, even these can range from low quality phones to sophisticated equipment with multiple wireless headphones and microphones for individual use by the team members. Members at a distance may suffer from poor connections and an inability to interrupt the conversation to ask questions or make a point. Other advanced technologies include instant messaging, shared file repositories, videoconferencing equipment, screen sharing and application sharing between individual PCs. Ideally, technology should provide ways to remove the barriers between distant and local members. It should be able to convey verbal and non verbal messages (body language) in an easy to use, intuitive way. DPT members should receive training on the use of the tools and also have different alternatives, in order to focus on the ones that best fit the team's specific subject and idiosyncrasies.

Some level of connectivity between sites is required for a distributed team. The specific technologies used in conjunction with that will vary depending on the circumstances, the nature of the work, the experience of the team members and the task.

Work in this area includes the selection and implementation of the appropriate technologies and the supporting infrastructure.
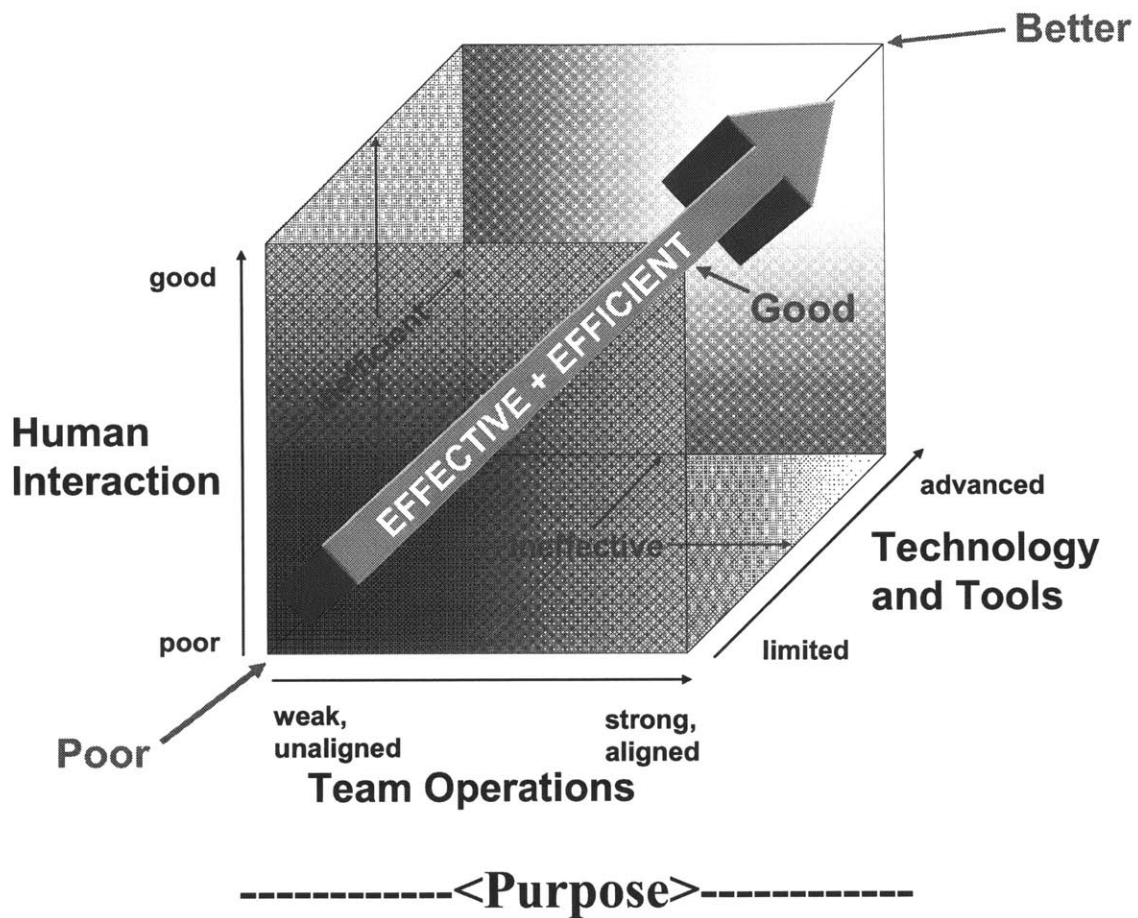
5.5 Visual Model

Based on the above, a framework has been defined to help in visualizing how these factors relate. This framework is also intended to serve as a way of helping an organization visualize their current readiness for proceeding with the implementation of DPTs, or understanding where they need additional focus.

This project applies a systems engineering approach – viewing a DPT as a system. One important component of this study is the proposal of a new, three-dimensional way of more simply representing the effectiveness of DPTs via a graphical model. The representation in the following figure is a cube, where the Z-axis represents the Human Interaction factors, the X-axis Team Operations and the Y-axis Technology and Tools. Serving as the foundation for the cube is Purpose.

On the **Human Interaction** axis (Z-axis), the effectiveness of the DPT is ranked with respect to human and behavioral characteristics. Human interactions can range from poor to excellent. The X-Y plane, which is defined by a "poor" ranking (value of zero) of human factors represents an area of ineffectiveness of the DPT, where people are

basically not getting along with each other. No matter how great the technology and team processes are things will probably not work out.

Figure 8 A Visual Model for Distributed Project Team Effectiveness

A Visual Model of DPT Characteristics

Human Interaction issues in DPTs can sometimes be addressed up front by selecting people who have compatible social styles and have proven their effectiveness on colocated teamwork. It has been noted that interactions are more effective when DPT

members already know each other and have positive experience working together in the past, so this may also be a consideration. It may not always be the case however that team leaders can hand pick participants, or they may not know the potential participants well enough to anticipate how they will interact. In those cases the team will have to work things out and use tools such as training and setting behavioral norms to help improve team interactions.

Also, to the extent that this is feasible, DPT members should have the option of refusing to work on a DPT, without consequences. It may also be desirable to remove someone from the team who demonstrates an unwillingness or inability to get along with others. It is preferable to modify the composition of a team and settle for a slightly different, but more motivated skill-set, than to obligate people to participate in a distributed team when they don't want to.

Some face to face human interaction should be provided, if possible, to assist in building team cohesiveness and facilitate the development of trust. Provision should also be made for time for less formal interaction, which often functions as a pressure valve that smoothes out latent conflicts.

The **Team Operations** axis (X-axis) represents to what degree formal processes are in place, effective and adhered to. The Y-Z plane, which represents very poor team operations models a situation where members of the DPT do get along well and have access to adequate technology for their operations, however there is a lack of effective

team processes. A DPT that meets without a clear agenda and plans, lacks effective follow-up and clear responsibilities is not performing efficiently.

The Y-axis, labeled **Technology and Tools** represents the availability and usability of the technology and tools used by the DPT. The limited technology area might be characterized by the use of telephones and email, or low speed data communications. It is interesting to note that a team that has good human interactions and team processes may well perform well, though it may be frustrating. Technology should be viewed more as an enabler to improve team operations. In this regard this is unlike the other dimensions.

One motivation behind this 3-D representation is to expose the fairly common and false belief that "the more advanced the technology and tools used, the better the DPT will operate". It is also easy to blame failures on the lack of good technology. This representation shows that technology only has measurable leverage if the two other factors are fairly well satisfied.

Underlying the cube is **Purpose.** Without a clear purpose that is aligned with the organization's goals, then any work accomplished by the team is likely to be a waste.

Another way of looking at this representation is as a colored cube. This is illustrated in the following figure.
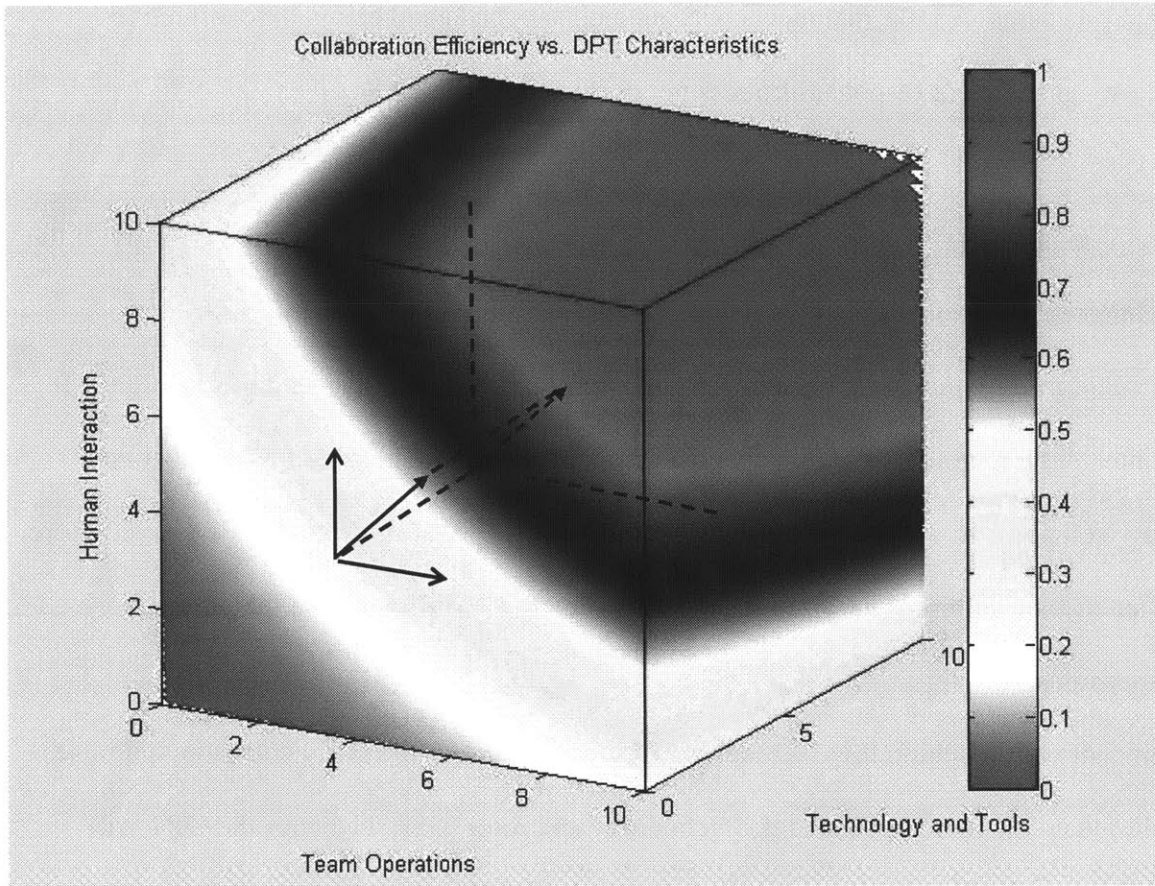
Figure 9 Regions of Iso-Effectiveness

Regions of Iso-Effectiveness.

Each colored region of the volume of the cube above represents an area of "iso-

effectiveness". In other words, every point within the green region represents the same

level of DPT effectiveness. The combined effect of measures taken in each axis alone is

the vector sum of the uni-dimensional increments of the effectiveness. Therefore, if

budget and time is allocated for DPT members to meet in person (increment in the

Human Interaction axis) and this action is coordinated with improvements in team

process, the combined effect (with no added technology) takes the teams effectiveness of

the team from the green region to the border line between magenta and red.

6.0 Recommendations

The framework defined in Section 5 can be used to organize the key points identified in the supporting literature in Section 4 and the additional research conducted for this paper:

Figure 10 Recommendations

Focus Area	Recommendation Actions
Purpose	- Define explicit goals for the team - Ensure the alignment of team goals with organization and participating groups - Seek confirmation from Executive management - Define how the team and its members will be assessed - Include in team mission the objective of improving connections within the organization
Team Operations	- Define clear roles and responsibilities - Define processes for team operations - Define processes for conflict resolution - Define a set of behavioral norms to be followed - Ensure appropriate training in team operations, working with others and technology - Ensure communications are effective and include everyone - Consider the use of a team facilitator to help get the team

	going
	• Seek complementary skills in defining the team
Human Interaction	• Establish buy-in with team members
	• Establish a sense of ownership within the team
	• Foster relationships of trust, respect and understanding
	• Maintain awareness of differences in culture, language, time zone and available technology
	• Try to select team members for fit in a distributed project team
	• Consider replacing team members who do not fit
	• Create a sense of 'shared space'
	• Provide opportunities for face-to-face contact
	• Compensate for the lack of non-verbal cues in communications
	• Provide a means for social or informal interaction among team members
	• Be aware of existing barriers between organizations and the politics and history around those – seek to break those down
Technology and Tools	• Ensure appropriate infrastructure is in place
	• Consider differences in capabilities among sites
	• Select appropriate tools for collaboration
	• Ensure usability of selected tools

	• Ensure users are trained in the use of technology

Using the effectiveness framework defined above organizations should assess where they are at in terms of the major areas defined, and where they might need to improve. An example of an assessment matrix is included below. Focus on those areas where there is the greatest potential return.

7.0 Summary

Distributed project teams can be an effective way for organizations to address some of the pressures they are facing. Careful consideration should be given to how these teams are set up and operated so as to achieve their objectives. Guidance in how to do this is available in this document and in others referenced. Technology is available and is being improved rapidly, but this is not largely an issue of technology. Focus should be put on team processes, human behaviors (people) and having a clear purpose.

This paper has defined the critical success factors in setting up and managing a distributed project team based on previous research and new thinking about how these can be viewed in a multi-dimensional model.

Areas for future work

Additional work should be done on measuring team effectiveness and what influences that beyond what is noted here.

Additional cases should be studies to expand the set of lessons learned and determine best practices.

Further work could be done on understanding how different types of work and different organizational types may have different characteristics.

Notes from this paper could be shared with those developing future technologies so that they can better meet the needs of distributed project teams as outlined here.

Additional work could be done in recommending technology solutions for specific needs.

List of Figures:

Definitions of terms:

DPT – Distributed Project Team

DWA – Distributed Work Arrangements

FtF – Face-to-face (referring to in-person meetings)

GSD – Global Software Development

GVT – Global Virtual Team

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Planning Assessment

Attached is an example of a questionnaire that may help in assessing how well prepared an organization is for running effective DPTs.

Figure 11 Sample Planning Assessment Form

Aspect	Measurement	Range; examples	Rating
Team Operations:			
Process	Degree to which processes are defined	Do not really exist (0) Exist but not documented (5) Cover most aspects of team ops (9)	
	Degree to which processes are followed in practice	Not really (0) Sometimes (5) Rigorously (10)	
	Degree to which training is provided		

	Degree to which people are trained		
Human Interactions:			
Behavioral rules	Degree to which these are documented Degree to which these are followed		
	Degree to which training is available in social behavioral styles Degree to which employees are trained in this		

	Degree to which these factors are considered when teams are formed		
Technology:			
Key capabilities	Providing key capabilities		
Usability	Ease of use		
	Availability of supporting infrastructure		
	Degree to which training is provided		
	Degree to which tools are used		
Purpose:			
	Degree to which purpose is clearly		

	articulated		
	Degree to which purpose is aligned with larger goals		
	Degree to which purpose is		