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MANAGEMENT OF VIRTUAL PROJECT TEAMS: GUIDELINES FOR TEAM LEADERS

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ABSTRACT

This article offers a set of guidelines to assist project leaders when managing virtual project teams. The guidelines were developed as a result of a panel at the celebration of the 30th anniversary of the founding of the MIS department at the University of Arizona. These guidelines include recommendations for addressing challenges that occur over the virtual team project life cycle, including identifying appropriate team members, establishing conventions and norms, and creating shared awareness. We also give practical advice on how to highlight successes and learn from mistakes to ensure ongoing development of leadership and participation skills that will enable project leaders to manage virtual teams successfully.

Keywords: virtual teams, virtual project teams, guidelines, leadership and participation.

Editor's Note: This article is based on the Virtual Teams panel held at The University of Arizona MIS Department's "Shaping the Future of IT" conference (November 3-6, 2004) in celebration of the 30th anniversary of the founding of its MIS Department. The panel consisted of the authors, with Bruce Reinig serving as the panel moderator. To maximize the relevance of the panel to the IS research community, the authors present their findings as a set of recommendations on managing virtual project teams.

I. INTRODUCTION

> "*We meet because people holding different jobs have to cooperate to get a specific task done. We meet because the knowledge and experience needed in a specific situation are not available in one head, but have to be pieced together out of the knowledge and experience of several people."*- Peter Drucker [1967]

Drucker's statement is as true today as it was nearly forty years ago. Although the environments in which people meet are changing, the need to share knowledge and experience is more important than ever. Practice and research continue to illustrate that meetings are essential for accomplishing work; however they also dominate employees' and managers' time and are often considered costly, unproductive, and not satisfying. Furthermore, meetings are steadily increasing in number and length [3M Meeting Network 1998].

A number of factors cause the workplace to transition toward virtual team environments, in which team members are distributed along a number of dimensions including geography and time. Human resource initiatives attempt to attract and maintain talent by allowing workers to telecommute. Leaders often find that the expertise required for a project is distributed among multiple organizations [Majchrzak et al. 2004]. Market pressures to reduce cycle time are increasing the need for team members to share knowledge.

These trends are illustrated by studies that monitored and assessed the use of technology in the workplace. For example, 3M reported that the percentage of meetings involving remote participants nearly quadrupled over a ten-year period [3M Meeting Network 1998]. Sixty-five percent of the respondents in another study reported that their company increased the use of virtual sales meetings over a three-year period [Cohen 2003]. Similar increases in the use of digital collaboration tools such as audio, video, and Web-based conferencing were also reported. [Goodridge 2001; Williams 2001; POLYCOM 2002]. The growing ubiquity of virtual teams also inspired an increasing number of researchers to study this emerging area [Powell et al. 2004].

Project leaders often struggle to manage virtual teams successfully. The first obstacle that needs to be overcome is the ineffective implementation and use of technology. However, Fontaine et al.[2004] reported that only 38% of business technology executives had a formal plan for deploying collaborative technologies. Even those who become accomplished at deploying collaborative technologies may find the social hurdles more challenging to overcome; the social challenges may well outnumber the technical challenges [Chaar et al. 1996]. For example, one common difficulty is miscommunication resulting from the loss of nonverbal cues and other communication techniques that occur in face-to-face environments. Such miscommunication often manifests itself in the form of differing expectations and inconsistent deliverables. The lack of communication richness in many virtual team environments makes it difficult to communicate effectively and work towards solving complex problems.

Nevertheless, an increasing number of project team leaders are required to work in virtual environments in spite of the technical and social challenges facing them. Our goal in this paper is to assist project leaders by providing guidelines for managing virtual teams through the various project stages. The guidelines are based on the authors' experiences in leading, participating, and researching virtual project teams and in developing virtual project team environments.

II. GUIDELINES FOR MANAGING VIRTUAL PROJECT TEAMS OVER THE LIFE OF A PROJECT

This section presents a set of guidelines to assist project leaders when managing virtual project teams. These guidelines are illustrated in Figure 1 and follow the four stages of the project timeline across the horizontal axis.

First, during the pre-project stage, team leaders should work to establish priorities and identify which team members possess the necessary skills to carry out the anticipated project activities.

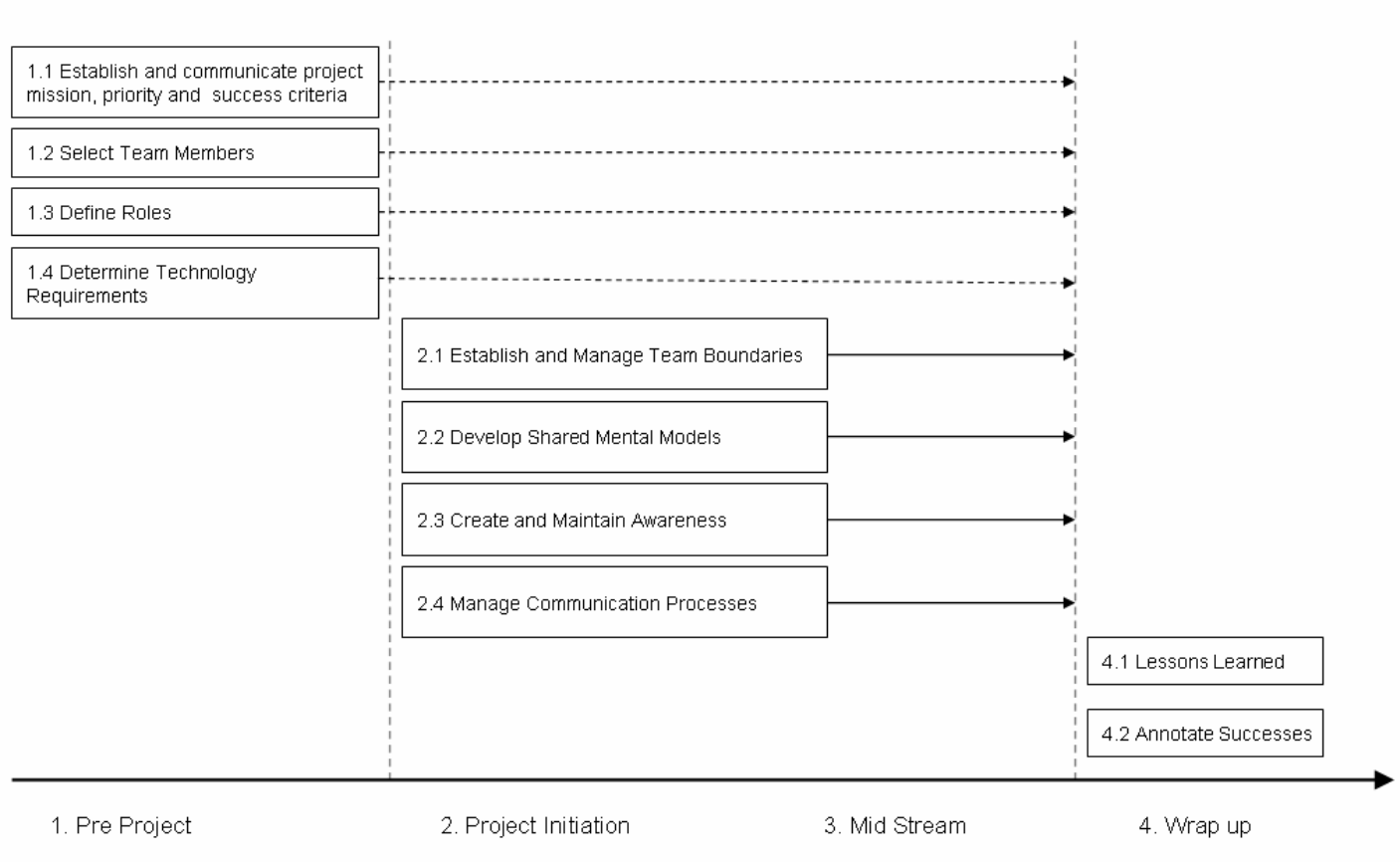

Figure 1. Guidelines for Managing Virtual Teams over the Life of a Project

Second, at the project initiation stage, leaders should define the rules to guide the project and the roles and expectations of team members, as well as identify appropriate technologies to support the virtual team.

Third, beginning with project initiation and continuing through out the mid-stream stage, leaders should work actively to manage team boundaries and establish working conventions and norms.

Finally, leaders should always strive to learn from their successes and failures, and identify lessons learned and successful work practices in the final wrap-up stage of the project. This final, wrap-up meeting should be scheduled at the project inception so that team members expect to participate and understand the full timeline of the project.

In the following sections we offer practical advice for virtual project team leaders for each stage in the project timeline.

PRE-PROJECT

Although some long-standing norms exist in establishing the project mission, funding, and priorities, in virtual project teams initial project planning is somewhat altered by the degree of virtuality and the experience of the team. Virtual team leaders should support and motivate individual team members actively to ensure their participation during critical project stages. They also need to ensure that additional collaborative equipment and/or communications to support participants at all locations is factored into the budgets and timelines to avoid delays. To establish realistic time lines, leaders must allocate time to integrate deliverables from multiple members into final team deliverables. Although it is not possible to cover all aspects of pre-project planning in a single paper, our guidelines focus on a number of the most critical ones that we encountered.

Establish and Communicate Project Mission, Priority and Success Criteria

Team leaders must establish and document both a clear project mission and a priority-level commitment with upper-management and the team participants. All of the team members should understand what constitutes project success and share the common goal of achieving that end. If goal alignment is not formally established among team members, individuals tend to pursue different priorities and virtual projects often fail.

Select Team Members

The selection of team members and definition of their roles should be an iterative process. Virtual team leaders often are given a broader selection from which to choose team participants than do traditional team leaders. Virtual team leaders must actively manage the combination of team member knowledge, background and work process familiarity to ensure project success.

Acquire Methodological and Domain Expertise

Researchers found that the selection of team members differs in a distributed environment compared to a collocated environment [Jarvenpaa and Leidner 1999; Pauleen and Yoong 2001]. Studies also showed that this selection can impact on the success and profitability of the projects managed [Lurey and Raisinghani 2001; Paul et al. 2004-2005]. In collocated teams, managers are limited in the team members from which to choose; whereas, in a distributed environment, managers can access more people to be team members and are provided with a larger opportunity to choose members whose skills more closely match the requirements of the project at hand.

Boe et al. [2002] divided expertise in project teams into domain expertise and methodological expertise. Domain expertise is knowledge in specific areas such as database systems, system analysis and design, or network security. Methodological expertise is knowledge in areas such as statistical analysis, development and application of surveys, or software engineering [Boh et al. 2002].

Management needs to deploy expertise in project teams so as to meet both the expertise requirements of projects and clients. It is the utilization of these types of knowledge, rather than the knowledge itself, that forms the basis of a firm's competitive advantage. Members with similar domain knowledge tend to be collocated while members with methodological expertise tend to be distributed across the organization.

Boh [Boh et al. 2002] showed that project profits were positively related to a match of methodological expertise with project requirements – distributed projects showed a stronger match of methodological expertise with project requirements than did collocated projects. This finding highlights the importance of the appropriate utilization of organizationally distributed expertise.

Seek Members with Work-Process Familiarity.

Work-process familiarity and Shared Mental Models (SMM) are related concepts that describe team members' cognitive aspects of work and task organization. SMMs are based on knowledge similarity within a team while work familiarity refers to knowledge that individual members posses [Espinosa et al. 2002]. The positive effects of both tend to be stronger for dispersed teams than for collocated teams, making it important for project managers to understand and recognize both.

Work-process familiarity contributes to project success in that team members with work familiarity in similar tasks are more likely to have stronger SMMs. Because SMMs tend to develop as the team works together, exchange information and train together on similar tasks [Levesque et al. 2001] these will be discussed in the Project Initiation section.

Work-process familiarity is the specific knowledge that workers have about aspects of the workplace, task environment, people and tools [Goodman and Shas 1992]. When workers have

familiarity with their application domain and shared knowledge of the task and each other they are more coordinated and perform better [Faraj and Sproull 2000]. While some aspects of work-process familiarity, such as familiarity with team members, may have to be established, other aspects such as knowledge of the application domain, tools, and workplace can exist beforehand and can be used as a basis for team selection.

Define Roles

Initially, the start of a project that will be conducted by a Virtual Team appears to be similar to any other undertaking in the business or academic world. That is, the selection of the work to be performed needs to be balanced against alternative projects, and the funding estimates and man-power need to be approved.

The selection of the Virtual Team members requires some additional attention, however. The success of a mission is often directly connected to the group effectiveness, and the effectiveness has been connected to the group cohesion [Cohen and Bailey 1997] and group norms [Malhotra and Majchrzak 2004]. For people working on a Virtual Team, those norms and cohesions are not a given. For this reason, the Team Leader must look at not only the skills and experience of the potential participants, but should also ensure that the project has been clearly defined and emphasizes the priority of the desired outcomes.

After all, a person's attraction to a group is connected to his/her assessment of the consequences of group participation [Coalter and Hunton, 1999; Lembke and Wilson, 1998]. That, in turn, is linked to how clearly the nature of the group and its goals were delineated, how likely it is that the goal will be achieved, and how closely the characteristics of the group match the person's needs and values.

In co-located projects, camaraderie and ad hoc meetings often solve unexpected problems that arise, however, these solutions are difficult to achieve in virtual projects. An experienced and skilled participant who has worked on previous Virtual Team projects knows that without clearly seeing the paths to the defined goals, they will not likely be achieved.

Therefore, the Team Leader is not only looking for someone who has the necessary skills and experience, but must ensure that the individual selected sees the route to individual goal success. The role that each participant will have must be addressed during the selection process. The Team Leader may have questions about how group cooperation will be achieved, the amount of individualism accepted in the group, and the support infrastructure that will be available to the group members.

Further, the Team Leader must understand that the higher the differences in culture and group norms among team members, the more likely it is that members will have concerns and doubts that must be monitored and addressed in a timely way throughout the project life-cycle. This understanding is especially necessary for team members new to the virtual team experience. Virtual project leaders should anticipate non-shared group norms among diverse teams and weigh the costs of diversity against its benefits.

This individual attention to detail and the concomitant dialogue with each of the Team Members will almost certainly pay off in the initial stages of the project by setting appropriate expectations.

Another requirement that must be ensured is the time-limit and financing of each team member because unexpected changes in a Virtual Team's structure can cause significant deleterious affects on project completion. Additional budgeting must be set aside for required meeting travel, and the collaboration equipment and software needed for communication during the project lifespan.

Determine Technology Requirements

Team leaders must identify the special technological needs of the project and their team members. This requirement includes determining what technologies will be used to communicate (e.g., conference calls and video conferencing) and what training, if any, will be required for team members. For example, special technology needs often include high-resolution graphics, broadband network speeds, audio and/or video capabilities, or group decision support technology. However, all technological decisions should be made in terms of organizational policies and technologies regarding security (e.g., firewalls and the ability to communicate outside organizational networks). Technological requirements vary substantially from project to project, but it is important to factor in procurement, installation, budget, and training early in the project. A minimum set of required technology for participation should be established and installed for all members as early as possible. In our experience, this step is frequently overlooked and can lead to project startup delays for some members.

PROJECT INITIATION

The next step in a virtual project is to start the project. In this subsection we discuss areas important to virtual teams including:

- establishing boundaries,
- developing shared mental models,
- creating awareness and
- managing communication processes.

Problems frequently occur when virtual team leaders fail to manage these issues adequately at project initiation and throughout the remainder of the project life cycle. Those who participated in face-to-face projects may take these issues for granted as they often occur more naturally in co-located environments.

Establish Virtual Team Boundaries

Teams are groups of individuals within or across organizations who are working together and sharing responsibility for the outcomes of a project. It is generally assumed that team members know who is a member of the team and who is not. This identification is the concept of a team's boundaries. Membership in a team and the team's boundaries can be misunderstood in both collocated and dispersed teams. In collocated settings, team members are more likely to recognize more of the people who are members than in dispersed teams [Mortensen and Hinds 2002]. In dispersed teams lack of recognition may be caused more by the phenomenon of 'out of sight, out of mind'. Most teams experience some boundary disagreement; but managers tend to have a stronger idea of who is on a team.

In dispersed teams work is frequently organized to allow subgroups to form. The result is reduced interaction with the larger team and a reduction of the tight coupling within the team, which in turn reduces member salience and can lead to boundary misunderstandings [Olsen and Olsen 2000]. Boundary agreements are likely to improve over time as interactions increase and more contextual information is shared.

Increased communication among all team members increases member salience. Encouraging or designing interdependence of subtasks increases interactions and thereby increases salience of membership. Salience of membership in distributed teams is also increased by the unique knowledge which each member contributes. Dispersed teams often consist of members with specialized expertise and access to resources, services, or customers unique to their geographic location. These unique skills tend to make team members more reliant on each other in completing a task or project and therefore enhance their understanding of team boundaries [DeSanctis and Monge 1999; Mortensen and Hinds 2002].

Develop Shared Mental Models

Shared Mental Models (see above) are based on knowledge similarity within a team. Most research in this area argues that shared mental models are a precondition for well-coordinated team action [Mortensen and Hinds 2002] and enable organizations to be flexible and robust. Teams that share understanding of the group's task and each other are more coordinated because members understand how their work contributes to group outcomes [Espinosa et al. 2002]. In addition, team members attribute SMMs of the team as more valuable for dispersed teams than for collocated teams [Espinosa et al. 2002]. Many team members indicated that prior knowledge of colleagues in other sites helps offset problems associated with distance.

Team members who disagree about who is on the team (boundary misunderstandings), do not share experiences. Their uneven communication patterns contribute to impaired development of SMMs [Klimoski and Mohammed 1994].

Create and Maintain Awareness

Awareness is an understanding of the activities of others, which provides a context for your own activity [Dourish and Bellotti 1992]. Awareness reduces the effort needed to coordinate tasks and resources by providing a context in which to interpret utterances and to anticipate others' actions [Gutwin et al. 1996].

Weisband [2002] identified four types of awareness:

- Activity awareness is knowledge about the project-related activities of other team members.
- Availability awareness is knowledge of when others are available to meet, or participate.
- Process awareness is a sense of where members' tasks fit into the stages of the project, what the sequence of steps is for the project, and what needs to be done to move on.
- Social awareness is knowledge about the members, their social situation and what they do outside of work

Alternatively team members can show awareness deficits. Numerous different types of awareness deficits are outlined in research papers. For example, the key awareness deficits given by Jang et al. [2000] are

- Lack of awareness of what remote team members are doing on a daily basis.
- Lack of awareness regarding each other's availability.
- No knowledge of colleagues' key task requirements and deadlines.
- Lack of knowledge about how team members felt about an idea or suggestion.

Studies show that:

- frequent and early communication is a precursor for establishing awareness among team members and
- continuous communication is necessary for sharing information about the group and the activities related to the task and for informing others about the progress of the work.

[Rasker et al. 2000; Weisband 2002; Majchrzak et al. 2004].

Teams that establish successful interaction styles early on in the project tend to be more successful [Jarvenpaa and Leidner 1999; Weisband 2002]. In addition, the team leader can have a profound and positive effect in helping the team to establish awareness. Effective project leaders who initiate task demands and show consideration for members early on help set the stage for successful future interactions and performance [Weisband 2002].

Manage Communication Processes

Team leaders must initiate and manage a formal structure to the process that will guide the ongoing interactions of the team members. This structure includes establishing conventions to align expectations. For example, team leaders might specify a specific response time for email, such as twenty-four hours, to ensure that senders do not feel that they are being ignored by receivers. Field researchers note that some virtual team members feel isolated when they do not receive prompt feedback from others [Jarvenpaa et al. 1998]. Such feelings disrupt the trust building process and can lead to a dysfunctional virtual team.

Team leaders need to ensure that their team members are committed to using the agreed upon technology from the pre-project stage. For example, when team members use different technologies, they may resort to trial and error when attempting to establish connectivity and waste time trying to establish a working communication medium.

Team leaders must establish specific process structures at both the project and the task level. At the project level, leaders need to develop an overall strategy and agenda for the entire project and each task. Internal to each task, local process structures need to determine such things as managing communication turns, the process for modifying an agenda and deciding whether tasks will be completed synchronously or asynchronously. When communication is synchronous, conventions are needed to guide communication turn-taking so that no one member unduly dominates group discussion. For asynchronous communication, participants need to respond in a timely manner to keep communication and progress actively moving forward. Decisions also need to be made to determine which work elements can be completed separately and combined later and which tasks need to be worked on collaboratively at the same-time.

It is important for team leaders to make their team members appreciate that their electronic communication is preserved and endures beyond the moment that the interaction took place. The advantage of this quality is that it allows absent team members to catch up on missed communication. However, the disadvantage is that members may be more reluctant to share off-the-wall ideas, knowing that they will be preserved even if they are not well received.

MID STREAM

Many of the guidelines introduced at the beginning of the project need to be actively managed throughout the life of the project. These guidelines may evolve (such as SMMs) or may need to be reinforced (such as team boundaries).

Several of the guidelines from the project initiation stage need to be maintained, reiterated, or reinforced on an ongoing basis during the life of the project. The team boundaries can change during a project, due to subgroups moving in and out of the awareness of the main group, changes in team membership, and inclusion of new team members. The team leader must ensure that the team boundaries are understood by all team members. As part of the conventions agreed upon, teams should meet occasionally with all team members participating, along with visuals such as team member pictures or video if possible, to reinforce an understanding of team boundaries and to provide a basis for developing relationships and engaging in sense-making.

Most distributed teams are only partially distributed, that is some of the team members are collocated and some are remote. These collocated members can form subgroups that can work independently of the larger team. This reduced visual access with the larger team can lower team member salience and can cause misunderstandings of team boundaries if not managed properly. An understanding of team boundaries and how boundaries can positively impacts inter-member awareness and SMMs is important.

Shared Mental Models often change as the project progresses. Team leaders need to ensure that group member mental models do not diverge as subgroups form to work on different pieces of the project. The effects of SMMs tend to be stronger for geographically distributed teams than for collocated teams [Espinosa, et. al, 2002]. These models are more important and play a stronger

role within the members or subgroups that work remotely. Therefore development or use of SMMs across the project team may be uneven.

WRAP-UP

As virtual projects end, the geographic and temporal separations can make it easy for leaders and team members to forgo the important step of project wrap-up or close-down. This step is an opportunity to discuss what worked and what did not work. The deliverables from this step allow leaders and members alike to hone their skills and expand their knowledge about working successfully in virtual team environments. We find it useful to evaluate knowledge learned about the virtual project process and methods separately from the domain-specific content of the project. In this subsection we focus solely on the more general area of managing the process and methods for virtual project teams. Specifically, we examine the need to identify the lessons learned to help future teams identify pitfalls to be avoided and make better decisions about managing their virtual project teams. We also discuss the need to recognize and annotate successes to promote value-added work processes for future virtual project teams.

Lessons learned

In our experience working on virtual project teams, we often observed that more can be learned from failure than can be learned from successes. Even though people are more willing to discuss successes, it is just as important to draw out the mistakes and failures so that they are not likely repeated. Team leaders should ensure that what went wrong is discussed thoroughly and how those mistakes can be avoided in the future.

It is easy to move through the final stages of a project, glossing over the less successful or downright unsuccessful aspects of its execution. The Virtual Team which overlaid the plans and timelines of their work with the additional issues of non-collocation and attendant challenges may be even more loathe to dig deep for the lessons learned. All the more reason to ensure that each team member finds a way to contribute what he or she took away from the experience, and to offer suggestions for improvement on future projects.

The Wrap-up meeting should be part of the original project timeline and include all members, even those who phased out of full-time contribution before project completion. Prior to the last meeting, each participant should be given a final assignment to come prepared to share their individual experiences and to be informative to others. It is their last chance to speak their mind. The goal of this feedback is to bring focus to aspects of the process which were un-examined or worked around during the urgency to meet deadlines.

The stated assignment should cover the domain-specific issues (technology, budget), as well as the issues unique to working in a virtual team environment. Ideally, these findings can be developed to a short but succinct working document that will be available to leaders of future virtual projects.

Recognize Successes

As with most projects, the wrap-up includes the review of the quantitative and the qualitative measures that were initially part of the program. Equally important, and usually easier to attain, is the collection of project successes. These successes are not necessarily the stated goals from the project mission, although confirming to project contributors that they were able to achieve their objectives is satisfying.

Instead successes should include discoveries: methods and results that were at least on a par with the expected, hopefully more so. Here, an emphasis on the aspects of the collaborative nature of the participants should be celebrated and give testimony to their ability to overcome any initial apprehensions towards working on a virtual team.

III. IMPLICATIONS AND CONCLUSION

The guidelines we propose in this paper contain implications for virtual project team leaders and members and for the high-level managers who sponsor the project. The implication for virtual project team leaders are that many of the requirements for traditional projects must be executed in a more detailed and explicit manner. Decisions about standards in terms of technology and communication process can result in a more pronounced impact if they are not made early and managed carefully. The lack of face-to-face discussions and co-located meetings, in which non-verbal cues help to establish team cohesion, make it necessary for team leaders to work harder at building, maintaining, and helping others establish relationships. Nonetheless, virtual teams offer project leaders an opportunity to bring a wider array of talent and viewpoints to bear on their projects because they can select team members from a larger pool and possibly from outside of their immediate organization. The implications for virtual team members include assisting in the development of the conventions and methods used by the virtual team and adopting them for their own use as they participate in the project.

Those who fund virtual project teams need to be aware that virtual environments impact both budgets and schedules. Budgetary impacts include funding for technology, services, and potentially travel expenses which occur above and beyond those of collocated teams. Virtual teams may also encounter domain specific budgetary needs. Scheduling impacts include time delays for virtual collaboration, a need for faster procurement processes, and a longer period of time for upfront startup and installation of technology.

Organizations continue to require collaboration to achieve their goals; however, the importance of well designed and executed collaboration increases significantly in virtual team environments. We note that, although many organizations are implementing virtual teams, most organizations do not plan specifically for working in virtual environments. This paper is an attempt to assist virtual project team leaders who are beginning to establish plans for managing technology, processes, and people in virtual environments.

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EDITOR'S NOTE: The following reference list contains the address of World Wide Web pages. Readers who have the ability to access the Web directly from their computer or are reading the paper on the Web, can gain direct access to these references. Readers are warned, however, that

1. these links existed as of the date of publication but are not guaranteed to be working thereafter.
2. the contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. the authors of the Web pages, not CAIS, are responsible for the accuracy of their content.
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