The Practice and Promise of Virtual Project Management

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INTRODUCTION

Virtual projects are essential components of modern organizations that seek to be flexible and take advantage of distributed resources. A virtual project is a project in which team members are dispersed geographically and potentially on other dimensions, and are working together to accomplish a specific task under time and resource constraints. Because of their dispersion, team members have to rely on computer-mediated communication tools to do their work. Virtual projects are prevalent in software development and increasingly common in research and development, marketing, and customer relationship management, hence they are an important phenomenon for study. The challenge is to discover which practices and perspectives help to enhance the effectiveness of virtual projects, so that team members can leverage the advantages of virtuality while avoiding its pitfalls.

The relevant literature on this topic comes from many areas, including studies of virtual teams as well as the body of knowledge in project management. In this chapter, we bring together disparate fields and provide an integrated view of virtual project management. We begin by defining key terms and concepts in the context of an overall framework and briefly describe relevant knowledge from current research. We then discuss key issues and future trends for research, and conclude with overall observations and implications.

BACKGROUND AND FRAMEWORK

Figure 1 shows the overall framework for the discussion of key concepts that are relevant to the study of virtual projects. The classic input-process-output approach identifies factors that are relevant to effective project management in a virtual environment. The following sections define and briefly discuss each of the factors (see Khazanchi & Zigurs, 2005 for a more detailed discussion). The purpose is not to be comprehensive in all the factors that might affect project management, but instead to focus specifically on management issues that are particularly salient or problematic in virtual contexts.

Organizational and Social Context

The management of virtual projects does not occur in a vacuum. The characteristics of the organization itself are important to how such projects are managed, as is the larger social context, which can include governmental and environmental issues. Organizational norms affect how technology is adopted and used (Orlikowski, 1993; Orlikowski & Robey, 1991) and therefore are relevant to the setting for virtual projects. A detailed discussion of these contextual factors is outside the scope of this chapter.

Input Factors

Virtuality is a term that is defined in a variety of ways, but typically with respect to dispersion. Virtual teams can be dispersed on many dimensions, most often geographically, and also in time, organizational affiliation, culture, and technology. The greater the dispersion, the greater is the virtuality of the team (Katzy, Evaristo, & Zigurs, 2000; Watson-Manheim, Chudoba, & Crowston, 2002). Other views of virtuality include dynamic switching among defined requirements and

Figure 1. Framework for the study of virtual projects
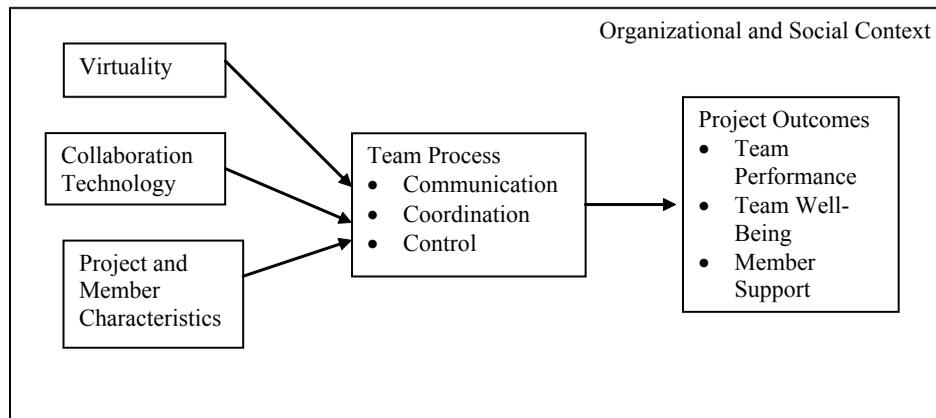
services (Mowshowitz, 1997) and extent of reliance on communication and information technologies (Dubé & Paré, 2004). Dispersion is an intuitively appealing characteristic by which to define virtuality, and technology is also an essential component of the ability to be virtual. Thus, we define *virtuality* as the extent to which project members are dispersed geographically and on other dimensions *and* rely on information and communication technologies for carrying out team processes and achieving project goals.

The second major concept is collaboration technology, which has also been characterized in different ways. The major challenge in defining collaboration technology is to avoid a monolithic view and be able to capture variability in technology features. Key perspectives on collaboration technology have defined it in terms of characteristics of media (Carlson & Zmud, 1999; Dubé & Paré, 2004), levels of support for information exchange or communication or information sharing (DeSanctis & Gallupe, 1987; McGrath & Hollingshead, 1994), and time-space configuration (Johansen, 1988). Consistent themes across different views of technology are that it must provide support for communication, for information exchange, and for structuring a team's process. Thus, we define *collaboration technology* as an integrated and flexible set of tools for structuring process, supporting task requirements, and communicating among project members. These characteristics are not fixed, but instead can be adapted by team members as they develop knowledge of the task, each other, and the technology itself (Carlson & Zmud, 1999).

The third major concept in the framework is *project and member characteristics*. Existing typologies of projects are based on such factors as the domain of the project (e.g., software engineering or construction), the extent of globalization, and project complexity, risk or scope (Palmer & Speier, 1997; Project Management Institute, 2004). The latter three factors are the most consistent ones (i.e., complexity, risk, and scope, and it is reasonable to classify most project characteristics under one of these three factors). Project complexity can be affected by the extent to which teams have variety in their size, culture, language, member characteristics, resources, and knowledge. Project scope can be affected by the extent of duration, innovation, and breadth. Project risk is defined typically in terms of different categories of risk in different phases of the project. Thus, project characteristics vary widely but can be examined across these common factors.

Several findings related to these input factors and their relationships with team process factors are worth highlighting. It is well established that the on-going process of team member communication can re-define input factors by a process of adaptation of both tools and team characteristics (DeSanctis & Poole, 1994). Virtuality clearly impacts the complexity of a project, in that the greater the temporal and geographic dispersion of team members, the greater the degree of communication, coordination, and control required. Research has shown that the impact of virtuality on project managers can be diminished by reducing temporal distance through collaboration with organizations in closer time zones and by reducing the intensity of collaboration

by giving up some part of control to localized teams (Dubé & Paré, 2004).

Previous research has shown that choice of collaboration technology and the nature of communication media (video, audio, text) affects communication characteristics such as concurrency and feedback (Baker, 2002). In fact, early use of rich media can alleviate some of the problems with team cohesion (Burke, Aytes, & Chidambaram, 2001).

Project and member characteristics can affect media choice; for example, different cultures have varying preferences for different forms of communication (Massey, Hung, Montoya-Weiss, & Ramesh, 2001). The diversity of project members in terms of language, culture, and knowledge of the project domain needs to be effectively managed because the diffusion of these differences can remove barriers to communication processes (Dubé & Paré, 2004). The complexity, scope and risk of a project dictate the degree of required coordination (Godart et al., 2001) and control mechanisms (implicit vs. explicit) that would be more effective (Godart et al., 2001; Kirsch, 1997).

Team Process Factors

Three key process factors are essential to the effective management of virtual projects: communication, coordination, and control. These three factors appear repeatedly in the literature on project management, and they are particularly vital for virtual projects. *Communication* is the process through which people convey meaning to one another through the exchange of messages and information to carry out project activities. *Coordination* can be defined as the mechanisms through which people, technology, and other resources are combined to carry out the activities required to attain project goals (Crowston, 1991). Finally, *control* is the process of monitoring and measuring project activities to anticipate and manage variances from plans and goals (Project Management Institute, 2004).

The research on these process factors suggests the following. The start-up process for virtual teams is especially important; it should include training (Chinowsky & Rojas, 2003) and appropriate "sandwiching" of same time/same place meetings with distributed work, to help teams get started and to develop effective communication (Rutkowski, Vogel, Bemelmans, & Van Genuchten, 2002; Chinowsky & Rojas, 2003). Management can mitigate the effects of the distributed nature of virtual

teams by reducing temporal and cultural distance to the extent possible (Carmel & Agarwal, 2001). One way to deal with temporal distance is by the use of temporal coordination mechanisms, that is, specific process structures (Massey, Montoya-Weiss, & Hung, 2003). In terms of control, the idea of a portfolio of control modes may be the most appropriate, namely, control mechanisms should be adjusted based on such factors as task characteristics, role expectations, project-related knowledge and skills, and availability of pre-existing mechanisms (Kirsch, 1997).

Team Outcome Factors

The output of any team activity is multi-dimensional, that is, it includes effectiveness as well as team member satisfaction and commitment. Time-interaction-performance (TIP) theory (McGrath, 1991) provides a systemic and multi-dimensional picture of team output. TIP theory posits three simultaneous aspects of team functioning: (1) *team performance*, which means getting the task done; (2) *team well-being*, or the relations among team members, and (3) *member support*, which is the relationship of the individual to the team. Each dimension has implications for team output, as Figure 1 shows. Thus, an effective team not only gets the task done, but it also has members who perceive they have contributed to the team, and there is a team-level sense of commitment and accomplishment.

The research on outcome factors can be highlighted as follows. Effectiveness requires a focus on human aspects and not just technology (Rutkowski et al., 2002), which reinforces the effectiveness as multi-dimensional. Team cohesion and process satisfaction are dynamic factors and teams are able to develop them by adapting to the use of computer-mediated tools over time (Burke et al., 2001). Member support also needs time to grow, and cultural compatibilities have to be carefully managed (Rutkowski et al., 2002). One consistent observation from this research is that managers of virtual projects must allow time for adaptation, both within the team and to the technology. Team development occurs over time through building team trust, establishing processes for conflict resolution, communicating expectations clearly, and providing structure for computer-mediated communication (Chinowsky & Rojas, 2003).

RESEARCH ISSUES AND FUTURE TRENDS

Patterns of Effectiveness

The management of virtual projects is fundamentally different from that of traditional projects. Intuitively one would expect consistent differences in how managers deal with coordination, communication, and control in virtual projects. Using Alexander's notion of patterns (Alexander, 1965; Alexander, Ishikawa, Silverstein, Jacobson, Fiksdahl-King, & Angel, 1977), our research has focused on describing patterns of effective virtual project management that reflect these differences (Khazanchi & Zigurs, 2005). Given Alexander's notion of a pattern as a *three-part rule that expresses a relationship among a specific context, a problem, and a solution*, we identified an initial set of patterns with regard to coordination, control and communication that are common across virtual projects. This stream of research needs further development. If such effective patterns exist, we need to know how they can be translated into processes that impact project management in a virtual or non-virtual setting. Further, there is a need for more research into the possibility that patterns can be used as critical checks and/or design principles for guiding virtual projects.

Role of Communication

Another issue that is reinforced throughout this research is the critical importance of communication for effective management of virtual projects. Communication is important in and of itself, as well as through its relationship to coordination and control. Communication is essential for building trust, providing feedback, and communicating context (Avolio, Kahai, & Dodge, 2001; Khazanchi & Zigurs, 2005; Maznevski & Chudoba, 2000; Sarker & Sahay, 2002).

Collaboration Technology

The nature of collaboration technology for virtual projects is a continuing challenge. Fundamental leaps in technology developments can be impossible to foresee, often because of an inherent focus on incremental change from existing practices and tools. E-mail is still widely used as the "lowest common denominator," even with all its shortcomings in the face of complex needs for communication, coordination, and control. Many issues remain unresolved.

Ease of use of technology has already been mentioned, including the need to trade off comprehensiveness against accessibility and rapid adoption. Integration of tools is also essential. As e-mail spam challenges the attention and patience of users, the trend of using more lean and focused technologies such as wikis (editable Web sites), blogs, instant messaging, and/or Web-based file sharing may provide a potential technological answer for virtual project teams (Conlin, 2005; Hof, 2005). Our study of virtual project management in five global firms confirmed many previous observations that e-mail is still the dominant tool of choice for communication and coordination among virtual team members (Khazanchi & Zigurs, 2005).

In addition, the issue of team member "presence" and the need to communicate context in virtual project team interactions continues to be critical to understanding how project teams can build trust and shared understanding. It seems that lean tools such as wikis (versus feature-rich groupware tools) may provide the flexibility and ownership that create an ideal circumstance for engendering improved communication, enhancing credibility of shared information, building trust, and developing a shared understanding of the project.

Along these same lines, peer-to-peer applications such as Groove® have also emerged as potential tools that can provide anywhere/anytime access and an integrated environment for communication, coordination, and project management. But such tools are not a panacea. Team members must still develop norms for seemingly simple issues like posting and responding, as well as more complex aspects of coordination. Awareness of the presence of other members in a collaborative workspace is possible with a variety of tools, but awareness of team member attributes must still be managed and explicitly shared. Attributes may include culture, language, expectations, and communication style.

The issue of whether information should be "push versus pull" remains an open debate and highly individual in terms of preference. A "push" tool would automatically send information to all team members, while a "pull" tool would wait for members to retrieve that information. E-mail is the classic example of a push tool, while intranets and other team spaces are pull tools. Push tools create higher awareness, but can be intrusive and time consuming to manage.

Software Project Management

Finally, there is a growing need to better understand how communication, control and coordination vary across stages or phases of virtual software development projects. This is particularly important in the current context where software off-shoring, dual shoring and near-sourcing is an important component of a firm's information technology project portfolio. Whether one views the software development process in terms of the popular PMI PMBOK® model (Project Management Body of Knowledge) (Project Management Institute, 2004) or IBM® Rational® Unified Process® (RUP®), it seems evident that extensive communication and co-ordination and, to a lesser extent, control are needed in the early stages of software development, and substantively greater coordination and work synchronization are needed during the construction phase of software development. This assertion needs further investigation since it can lead to best practices that impact virtual project management.

CONCLUSION

The management of virtual projects remains a challenging endeavor. Existing research provides many guidelines on different pieces of the puzzle. We have presented an integrated framework for understanding those key pieces. Researchers have a full agenda of interesting questions, and managers have both problems and opportunities. The promise of virtual teams lies in the manager's ability to identify what is different and what remains the same, and to be able to integrate human with technological resources in a way that makes use of unique capabilities of all available resources.

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KEY TERMS

Collaboration Technology: An integrated and flexible set of tools for structuring process, supporting task requirements, and communicating among project members.

Communication: The process through which people convey meaning to one another through the exchange of messages and information to carry out project activities.

Control: The process of monitoring and measuring project activities to anticipate and manage variances from plans and goals.

Coordination: The mechanisms through which people, technology, and other resources are combined to carry out the activities required to attain project goals.

Task Effectiveness: A measure of successful attainment of a team's goals with respect to the deliverable; one of three key dimensions of time-interaction-performance theory.

Team Well-Being: The relationship of the individual to the team; one of three key dimensions of time-interaction-performance theory.

Virtual Project: A project in which team members are dispersed geographically and potentially on other dimensions, and are working together to accomplish a specific task under time and resource constraints.

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Virtuality: The extent to which project members are dispersed geographically and on other dimensions *and* rely on information and communication technologies for carrying out team processes and achieving project goals.