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ABSTRACT

Information technology management regularly grapples with decisions related to identifying and diffusing emerging technologies in their organizations. Prototyping methodology, a form of rapid application development, is usually suggested as a useful approach for custom systems development. An adapted form of the prototyping methodology may prove useful for understanding early adopter experimentation episodes in the context of new technology diffusion. A case study examines one university that utilized early adopters to initiate the diffusion of an emerging collaborative technology. Implications for practice and research are discussed.

Keywords

Early adopters, emerging technology, diffusion, collaborative technology, prototyping

INTRODUCTION

In general, organizations face difficult decisions regarding how to deploy information technologies to meet strategic goals. Constant change is the norm with hardware, software, and network connectivity solutions, especially in the area of collaboration tools. More recently, with the improved hardware configurations of individual computers and the prevalence of broadband network connections, the features of digital collaboration and communication are now available to the masses, rather than a select few individuals at research/R&D labs or Fortune 100 corporations. In fact, the wide availability of certain digital collaboration solutions makes it easier to configure enterprise solutions now than it ever was in the past. Yet, on a somewhat daily basis, organizational information technology (IT) units are assailed with multiple solution options and new emerging technologies that have rapid development/versioning processes. How can organizational IT units quickly determine if emerging technologies meet constituent needs and deploy them, when the technologies themselves and the ways in which they can be used continues to change?

This research-in-progress paper explores a particular kind of IT deployment that rests upon experimentation from the early adopters within the organization constituents. A qualitative case study approach (Yin, 1994) is used to explore common factors in each early adoption scenario that relate to the prototyping methodology used to involve the organization's constituents in the diffusion process of collaborative technologies. Multiple experimental use scenarios are described to provide insight into the role of the early adopters.

The remainder of this article is organized as follows: section 2 provides background on emerging technologies, early adopter characteristics, and a brief review of information technology diffusion strategies; section 3 describes the context and overview to the case study; section 4 presents qualitative use scenarios of early adopter experimentation with a specific collaborative tool within a university environment; and section 5 suggests implications for practice and future research.

BACKGROUND

An emerging information technology is a new technology that has not yet been fully exploited by an organization (Jessup & Valacich, 2006; Vogl, 2004), either due to its newness or the fact that some aspects of the technology are not yet in final form. A mutual dependence exists between organizations and information technologies (Jessup & Valacich, 2006). Organizational members, functions, and processes depend on the information systems and technologies that are available to them. At the same time, information systems and technologies are not fully realized until they are utilized by organization members, functions, and processes. Emerging information technologies are yet another challenge to manage as there tends to be little organizational knowledge in either the functional areas or the IT area regarding the specific features of the technologies and how these features might be best used by the organization.

Early adopters are individuals in a social system who tend to embrace new ideas quickly, relative to others in the same social system (Rogers, 1995). Early adopters are usually quite willing to participate in trial situations of new information

technologies and often are looked upon by others in the social system as opinion leaders or role models. According to Rogers (1995), "The early adopter decreases uncertainty about a new idea by adopting it, and then conveying a subjective evaluation of the innovation to near-peers through interpersonal networks" (p. 264).

Diffusion strategies for commercial software solutions are similar to those available for custom-developed software solutions: direct installation ("big bang" or "cold turkey"), parallel installation, single location installation, and phased installation (Hoffer, Jessup, & Valacich, 2005). The underlying approach to these strategies presumes there is already a current system that is being replaced and that the technologies are stable enough to support a "think/plan/implement approach" (Johansen, Sibbet, Benson, Martin, Mittman, & Saffo, 1991, p. 102). In the case of emerging information technologies generally, and collaboration tools specifically, these are not reasonable assumptions. The underlying hardware, software, and networks are susceptible to constant change such that trying to diffuse or implement collaboration tools according to the think/plan/implement approach may result in the implementation of an outdated or outmoded solution for the organization. A better approach is to attempt what Johansen et al., (1991) refer to as "aggressive experimentation" (p.102) to determine the pros/cons of deploying collaborative tools within a small portion of the organization. However, organizations must be aware that the experimentation approach requires a readiness to throw away the expensive technology if positive implementation results cannot be achieved within an agreed upon timeframe and/or budget.

IT managers often find that prescriptive advice regarding how to deploy an emerging, collaborative technology is mixed at best. Some experts argue for the consensual development of a feasibility study, followed by targeted pilot studies within the organization (Hoffer, George, Valacich, 2006). Other experts, more attuned to the changing nature of emerging technologies (such as collaborative technologies) and their malleable features (Johansen et al., 1991; Morse, 1991), recommend experimenting to uncover the organizational impacts from using such systems. For a manager, a reasonable compromise may be to adapt the rapid application development methodology of prototyping for the deployment of collaborative technologies, as illustrated in Figure 1.

As shown in Figure 1, the prototyping methodology (adapted from Naumann & Jenkins, 1982) allows for the individual client (e.g. adopter or end user) to interact with the organization's information technology experts during the process of deploying the new collaborative technology within the organization. The individual identifies either a problem or opportunity in his/her work environment related to collaborative activities. Collaboration requirements are transmitted to the organization IT experts who respond by identifying and configuring a set of collaborative technologies (supported by the institution's infrastructure) to meet the individual's stated collaboration needs. In some cases, this may mean that several collaborative technologies are brought together in order to service the individual's needs. Thus, the resulting collaborative technology environment may reflect a mix of several technologies, loosely coupled or "cobbled" together (Morse, 1991) to provide a place for the individual's experimentation. The individual is then free to utilize the experimental scenario, and can engage in dialog **and action** with the organization IT experts to refine the collaborative technology environment for future use. Under the prototyping methodology for collaborative technology deployment, the individual is not solely a recipient of the deployed technology but is an active participant in shaping its use and diffusion throughout the organization. Early adopters are key people who can fulfill this experimentation and shaping role in the diffusion of new IT in the organization.

COLLABORATIVE TECHNOLOGY CASE STUDY

Data was collected from verbal and email communications between the early adopters and the organization's information technology staff. The content of the communications was reviewed for: reason for using the collaborative technology environment, collaborators, benefits, concerns, and collaborative technology features used. The summary is presented in Table 1 and represents four unique experimentation episodes with a collaborative technology. Before presenting the specific details of each of the experimentation episodes, the context for these episodes is presented, including a description of the organization, the diffusion opportunity, the collaborative technology, and the diffusion strategy.

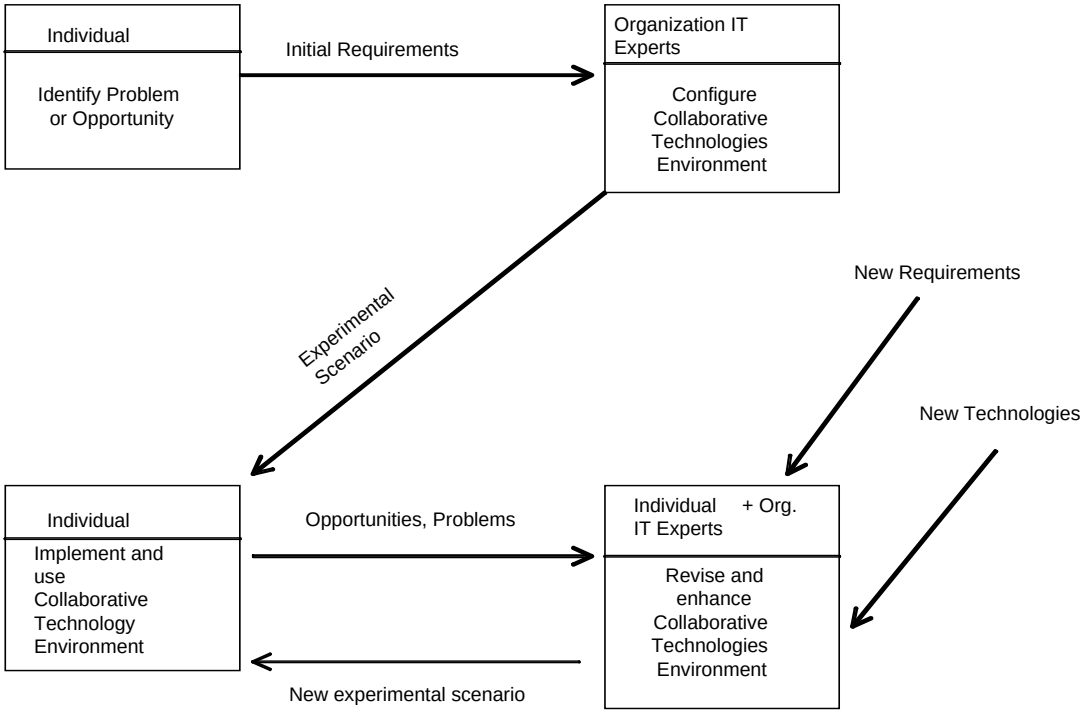

Figure 1. Prototyping Methodology of Collaborative Technologies Deployment

Factors	**E-Learning**		**E-Meetings**	
	Use Scenario 1	*Use Scenario 2*	*Use Scenario 3*	*Use Scenario 4*
Collaboration Reason (Opportunity)	Teach advanced topic with university consortium participants	Teach content for licensed certification	Collaborate on research	Collaborate on decision-making
Collaborators (Collab. Tech Environment)	Professor, Scientific Experts, students in North America & Europe; 50+ people	Professor, Working Professionals	Co-authors in SW, SE, MW regions of US	Executive committee; Conference, Program committee; 5-10 people in 4 MW states
Benefits (Feedback)	- latest expert material, presented without revisions - diverse discussions - low cost guests -free client software	- on-demand course content (Different time) - synchronous discussion (same time)	- no travel costs - interactive design of research model - Mac & Windows inter-operability - social presence	- no travel costs - group note-taking - verbal and video consensus - team cohesion
Concerns (Feedback)	- time zone - marginal video	- student motivation	- slow home connection	- client freezes - lag
Features used (Collab. Tech Environment)	- whiteboard, chat - PowerPoint, videoconferencing	- videoconferencing	- videoconferencing - whiteboard - MS Office docs	- videoconferencing - whiteboard, chat - recording

Table 1. Summary of Collaboration Experimentation

Setting and Organizational Structure

The organization is a small, regional university located in a northern, rural area of the Midwest with an approximate community population of 10,000. The university employs approximately 407 faculty, 752 professional staff, and 341 unionized staff members while enrolling around 6000 undergraduate and 1000 graduate students. The total budget for centrally-allocated IT expenditures for 2004-05 was $1,249,000 including staff salaries; it is difficult to estimate the budgeted amounts of IT expenditures that are distributed across campus in academic units and various specialized campus units. In the early 1990's, the university decided to decentralize computing services & support for the entire campus and now maintains a only a small, core set of centralized IT services for the university as a whole. In fact, the provision of technologies in the support of the instructional mission of the university is ***not*** included in the centralized campus IT service under the current organizational structure. Rather, the support of educational technologies and service to instruction is distributed among the academic units, a separate unit responsible for classroom technologies and distance learning, and a separate unit responsible only for the server and network connections for the course management system (WebCT).

Diffusion Opportunity

For years, the university has wrangled faculty into special videoconference rooms for e-meetings and distance learning. An oft-cited difficulty with the diffusion of this technology solution was that faculty did not want to the leave their office or their computer in order to use these special rooms. When a new Dean of the Graduate School was hired, he brought a vision and enthusiasm for improving the university's use of collaborative tools for learning and research collaboration. Instructional tools already in use included streaming media (RealNetworks), rich content creation (Media Site), and a course management system (WebCT). At his prior university, the new Dean had experience using a web-based videoconferencing solution with extensive collaboration tools. In particular, he had direct experience in using this solution to continue teaching a student who was confined due to chemotherapy. He shared this poignant story with various constituents across campus, and also provided demonstrations of using the technology by accessing the server at his prior university. Thus, he provided tangible examples at his new institution without there being a need for additional, new investment just to experience the possibilities that this technology could provide. The unofficial feedback was positive, though skepticism prevailed as this kind of solution was very different from the current vision of learning and research collaboration tools already implemented on campus.

Collaborative Technology

The collaborative technology provides a web-based video conferencing solution, but also has substantial collaboration features above simple audio and video transmission. Marratech, a Swedish company, is the provider of the server and client software enabling the collaboration. Marratech operates with client software on an individual's computer and connects to a server to provide a collaboration channel. The server allows for both a "Public" room and a number of "Private" rooms to be configured at the university. Client software provides audio, video, public and private chat, and a shared workspace for each session participant, and is provided at no cost to individuals. The client software is available for Windows, Macintosh, and Linux operating systems. Many first-time users find the interface and software features to be user friendly or at least easy to learn quickly. Many of our faculty early adopters were able to be up and running in about 30 minutes *without* formal or lengthy instruction.

Diffusion Strategy

After a period of six months, the new Dean had convinced a total of three to five campus constituents to experiment with the Marratech solution for their academic endeavors involving collaborators located in distant geographic situations. As these early adopters began to use the tools for meetings, distance learning, interviews, and graduate defenses it became clear that a campus installation of Marratech was necessary so "private rooms" for our constituents could be configured. The campus unit responsible for distance learning technologies and support became the organizational vehicle through which future experimentation activities were funneled. The new Dean used his start-up funds to make an initial, one-year investment to support one manager (server) on a Dell computer and 20-seat licenses for about $25,000. The cost number included remote end-user training to the staff responsible for local support of Marratech and a one-year maintenance contract, in addition to the hardware & licensing expense. The acknowledged strategy was that if the solution successfully diffused throughout the university, additional seats could be licensed and a redundant server could be added.

This diffusion approach did not follow the accepted methodology for deploying a new technology tool on campus. The typical methodology would require a broadly representative committee to review user needs, evaluate products, propose funding and amount of on-going technology support, and might involve changing some business processes or functions. Rather, this "grass roots" approach involved several substantial risks: limited centralized tech support for the campus installation, expecting faculty constituents to determine the usability of the solution for their academic needs, and expecting

faculty members to invest their time in learning the features in the absence of specific training or user support materials. At the same time, these risks were counterbalanced with the promise of tangible rewards for the early adopting faculty constituents, especially in terms of saved time and travel dollars along with the comfort of working on their own computers when offering distance learning offerings for the university. With each additional use of the videoconferencing solution, faculty members increased their expertise with the tools and learned to apply the solution to several novel academic situations.

QUALITATIVE USE SCENARIOS

We now describe four experimentation episodes of using the videoconferencing tool during the early diffusion period on campus: two examples of e-learning collaboration, one example of research collaboration, and one example of virtual decision-making meetings.

Experimentation Episode 1

For Spring 2006, a faculty member had scheduled a e-learning course to be offered using H.323 videoconferencing[i] with several sites in North America and one site in Europe. In most cases, this form of a e-learning course would require participants at each site to come to a special room where the technology infrastructure was installed and to bring individual copies of instructional materials (PowerPoint slides, notes, handouts, etc.). This solution was not web-based but uses high-speed Internet or ISDN transmission for the live, two-way interaction. This faculty member also needed to travel much of the semester and to introduce/provide guest lecturers for his class while he was traveling. Just weeks before the course was to begin, he began experimenting with the Marratech solution as a way to deliver his scheduled e-learning class. He downloaded the Marratech client and installed a webcam to his laptop and made the decision that Marratech was to be used rather than the H.323 videoconferencing. Remote students were sent the URL for downloading the Marratech client software. Students and faculty were located in Mexico, United Kingdom, Canada, and the U.S., so the time zone differences were manageable for this learning situation. The faculty member(s) were excited to engage in dynamic interaction with students rather than lecturing with PowerPoint slides. In some cases, video was marginal, but the students found it acceptable and spontaneous and the audio was clear. Informal student feedback indicated that the Marratech solution provided a recognizable e-learning world for today's "Net Generation" students (Oblinger & Oblinger, 2005).

Experimentation Episode 2

In another part of the university, an academic unit offers an e-learning program for professionals working towards a licensed certification who cannot meet during the day when they are conducting their work. In this scenario, a "blended" approach to e-learning has been developed to meet this need. The course content is available "on-demand" using rich media content (using Media Site) wrapped in a course management tool (WebCT) for authentication purposes. Additionally, the students gather synchronously once a week during the evening to discuss the content they studied during the week. The Marratech videoconferencing technologies are used to support this weekly interaction and discussion. Thus, with high-speed Internet, a computer, web cam and web browser these e-learning students can continue their required and necessary education toward certification.

Experimentation Episode 3

One of the challenges for faculty members located at our university is that we are located in a remote rural area where travel to other sites is limited due to the availability of flights, geographic distance, and the cost (both in time and dollars) of traveling to other locations for collaborative research and professional activities. A researcher used the Marratech collaboration solution to facilitate her research of collaborative technologies with colleagues located on the West Coast and the South-Eastern regions of the U.S. This faculty member has been using the videoconferencing solution for weekly e-meetings with fellow researchers for about six weeks. Prior to the introduction of the videoconferencing solution, audio conferencing via telephone had been used. The research group used the Marratech technologies to easily share Microsoft Word documents of an in-progress research paper among group members on Windows and Macintosh platforms. Additionally, the shared workspace of the whiteboard was utilized for interactive sessions of designing, drawing, and revising a research model. Positive outcomes of the videoconferencing solution include easy facilitation of meeting notes & project responsibilities, simple sharing of research documents, interactive design of research models, the added benefit of being able to work from either home or university offices, and high satisfaction with being able to see co-researchers on a regular basis.

Experimentation Episode 4

As a result of early experimentation with the Marratech solution for e-meetings, a faculty member involved with the initiation of a newly-forming, regional, professional organization presented an opportunity to the Executive Board of this group to use the Marratech solution for regular meetings of the Board. The Executive Board had been using telephone audio conferencing, but were anticipating the need to involve decision-makers involved with the planning of an upcoming inaugural conference. The Executive Board was searching for alternatives to the audio conferencing solution, as it was limited to five participants and upcoming meetings could involve nine or more participants. Two months into the inception of this regional, professional organization a decision was made to move regular meetings to the collaborative technologies and videoconferencing features of the Marratech solution at our university. The Executive Board members have now conducted two e-meetings with Marratech: the first among the five members of the Board to "try out" this e-meeting solution and the second among the board members and the conference leadership. An initial research study of this interaction is reported elsewhere (Vician & Powers, 2006), but early results are more positive than negative. The Marratech solution allowed this group to connect decision-makers located in five states and jump-start a regional, professional organization in only two months without the need for travel. One speculation about the success of this organizing effort is the ability of this collaborative technology solution to provide the necessary social/relational support to this newly formed group.

CONCLUSION

This case study has investigated the use of early adopters within a campus community as a means of positively influencing the diffusion of information technologies. As an initial study, it raises implications for future practice and research. For practice, concerns include: sustainability of the diffusion curve (Rogers, 1995) over time, human resource management issues (e.g., reward/evaluation structures) related to the reliance on faculty members to provide IT selection and experimentation functions for the organization as a whole, and the organization structure implications of "outsourcing" what is typically considered to be functional responsibilities of an IT group to the constituents of an organization. Future researchable questions include: When is using the "aggressive experimentation" approach (Johansen et. al, 1991) instead of more formal IT deployment approaches based on consensus (Hoffer, George, & Valacich (2005) a better idea; and, What social dynamics and outcomes are possible in the newer environment of e-meetings from the desktop?

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[i] H.323 is a signaling protocol, which sends signals to and receives signals from remote parties for communication.