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When information systems researchers refer to virtual teams, they usually mean a collection of knowledge workers, often located some distance from one another, who collaborate on some decision or decisions. Jack Becker, who contributes this month's interesting column, points out that this was not always the case—early assumptions about using technology for collaborative decision making assumed that decisions were made in high-tech rooms, same-time, same-place. His article is a natural progression from the March 2003 *Decision Line* column by Julie Kendall, who explained that distance between organizations is being redefined as e-distance. Jack, however, goes a step further and discusses how collaborative tools are being developed and re-defined to support teams. While Jack stops short of suggesting the advent of virtual tools and virtual technologies, he does adeptly pose the question of whether the technology or the team is more important for problem solving. Read on to discover the insights Jack reveals. (*Ken Kendall*, *ken@thekendalls.org*)

Collaborative Technologies and Virtual Teams: Which Is More Important—The 'Technology' or the 'Team'?

by Jack D. Becker, University of North Texas

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Some of us "old timers" may recall the promotional video produced at the University of Arizona in the late 1980s that compared modern meeting techniques with the techniques used by knights in the Middle Ages. Group systems software was somewhat humorously hyped as the first advance in meeting techniques since the Roundtable (see also, Nunamaker et. al., 1991). The new tools were called Electronic Meeting Systems, and they were built on top of the Group and Decision Support Systems tools of the 1970s and 1980s. Even though this was considered a new approach, it was still based on the ages old idea of face-to-face meetings at the same time and in the same place. The main feature of the new approach was a somewhat elaborate electronic meeting room, where participants would be able to offer their opinions through their own keyboards—thus, permitting all the essential elements of a GDSS, including parallel, anonymous communication, and session recording (Dennis & Garfield, 2003). Considerable time and effort would be poured into the design and construction of these single-site meeting facilities.

While collaborative technologies steadily progressed from their same-time, same-place origins to asynchronous, distributed systems, industrial psychologists were discovering that people who worked in groups, or teams, were also collaborating with other members of their teams at a distance and at different times. Together ,the technologists and psychologists gave birth to the notion of virtual teams (VT). While the precise origin of the term *virtual team* is not known, it is certain that Lipnack and Stamps (1997) helped to popularize the notion.

My personal involvement with virtual teams began in earnest in 1998 when I was given an opportunity to work with Rodger Ballentine. He was director for Grants Research in the Center for Study of Work Teams, which was in the UNT Psychology Department, and I was in my last year as director of the Information Systems Research Center in the Business Computer Information Systems Department. Our first casual observations were that collaborative tools have been around for decades, but it appeared that they were not used widely. Whereas cost might once have been an

important reason for their lack of use, it now appeared that other factors, such as lack of focus on developing basic team-building skills may have been at the heart of the problem. Indeed, the very definition of a team had been loosely handled in much of the IS/IT research. Over the course of the next four years, we were able to analyze virtual teams and collaborative technology used in more than 40 organizations using a detailed questionnaire with more than 400 questions. In addition, we were permitted to investigate two organizations in depth, which included unlimited onsite visits and focused interviews with whomever we wished.

While some of our work is still proprietary, several of our findings are starting to appear. In our Ballentine et. al. (1999) and our Becker et. al. (1999, 2001) articles we suggest that the success of virtual teams (VTs) required a balanced emphasis on both the implementation of good collaborative tools and the development of a high-quality collaborative work group environment. Other researchers have also noticed that there may be an overemphasis on the technology tools (Gopal & Prasad, 2000); while many others have examined factors such as management styles, individual and task characteristics, and group dynamics that help ensure the successful implementation and management of virtual teams (Horvath & Duarte, 1997).

In Becker et. al (2001) we proposed a Virtual Teaming Grid (see Figure 1) that may be used to assess an organization's virtual team development. Let me now provide our definitions for the two primary axes of this grid—teaming-effectiveness and collaborative tool pervasiveness.

Effective Virtual Teams

Virtual teams may be defined as small groups of people working across time and distance supported by computer and communications technologies (Lipnack & Stamps, 1997). Industrial psychologists argue that few organizations are true team-based organizations and even fewer are effective team-based organizations. When IS/IT researchers use the term *virtual team*, they are more likely to mean the more accurate, but cumbersome term *non-co-located collaborative work group*.

One of the most popular models for assessing team development is the S-Curved stage model by Tuckman (1965). Tuckman's model proposes that groups or teams go through four stages of development: Forming, Storming, Norming, and Performing. The 5th stage, Adjourning, was added by subsequent researchers (e.g., Harris & Sutton, 1986). When positioned on a graph with Time as the x-axis and performance on the y-axis, these five developmental stages of teams form a type of S-Curve. A classical hypothesis is that team performance may actually drop during the storming stage as the organization culture undergoes a sometimes-painful transformation.

Based on survey responses it was possible to create measures for both the stages of team development and the level of teaming effectiveness. The team-effectiveness measure was defined to be the product of the average of perceived team effectiveness and the perceived stage of development. Hence a team at the Norming stage (level 3), but with effectiveness of only 3.0 would result in a weighted average team effectiveness score of 9.0. The most effective teams (4.0 rating) at the Adjourning stage (or mature level 5) would have a team effectiveness score of 20.0.

Collaborative Technology Tools

In spite of a large quantity of research, no standard set of collaborative technology tools has emerged. The Becker et. al. (1999, 2001) study identified 18 types of collaborative technology tools. This scheme is a modest refinement of Johansen's (1979, 1991) 17 information technology support mechanism for work groups and Coleman's (1997) categories of GroupWare. The tool that we added was Web browsers. This is quite significant because in addition to being a collaborative tool in its own right, the WWW has truly enabled many of the collaborative tools to operate more effectively together.

The Becker et al. (1999, 2001) taxonomy contained the following set of 18 collaborative tools:

1. E-mail/ Electronic Messaging
2. Audio Conferencing
3. Collaborative Presentation Software
4. Conference Room video-conferencing
5. Desktop Videoconferencing
6. Discussion Databases
7. Document Management Software
8. Electronic Whiteboarding
9. Group Authoring
10. GDSS
11. Group Scheduling and Calendaring
12. Knowledge Management systems
13. One-way Bulletin Boards (BBS)
14. Personal Communication Tools (includes laptops, cell phones, pagers, etc.)
15. Project Management Software
16. Remote Dial-Up Access
17. Web Browsers
18. Work Flow Management Systems.

Note that GDSS is listed as one of our collaborative tools. Practically speaking, fewer than 10 percent of the organizations we investigated actually used an integrated GDSS package

The collaborative tools measure was defined as the weighted sum of its frequency of usage and its extent of usage for each of the 18 collaborative tools. The frequency of usage (daily, weekly, monthly, yearly), and the extent of usage (percentage of employees that use the tool) for each collaborative tool were reported in survey question 16.

For example, e-mail was generally used daily (score 4 for daily usage, 3 for weekly usage, 2 for monthly usage, 1 for annual usage, and zero for not used) by nearly 100 percent of the employees in an organization; hence, its score would be close to 4.0. Tools with scores close to 4.0 were considered to be pervasive tools; this metric was called a pervasiveness measure of collaborative tool utilization. Finally, the pervasiveness scores for all 18 tools were averaged together to get an overall collaborative technology tool score. The maximum average is 4.0 on this scale (Figure 1).

While so-called GDSS tools were not widely used, there emerged a standard suite of the six most popular collaborative tools: E-mail, personal communication tools (cell phones, pagers, etc.), Web browsers, audio conferencing, group calendar scheduling, and remote dial-up.

The Virtual Teaming Grid

Organizations were then positioned on the Virtual Teaming Grid (Figure 1) according to their team effectiveness and collaborative tool pervasiveness scores. Team effectiveness scores for organizations in our study ranged from 2.2 to 17.5, while per-

vasiveness scores ranged from close to zero to 2.5.

Organizational members were interviewed to validate the correctness of their placement on the grid. A remarkable level of consistency was discovered. The Virtual Teaming Grid was then divided into approximate equal grouping of firms and defined as follows: Quadrant I was referred to as the Low Techno-Teaming Groups quadrant (18 firms), Quadrant II was referred as the Techno-Enthusiasts quadrant (10 firms), Quadrant III was the Teaming-Enthusiasts quadrant (10 firms), and Quadrant IV was the High-Performing Virtual Teams quadrant (8 firms). Several major consulting firms were found in Quadrant IV. Incidentally, the median scores for our sample were 10 for team-effectiveness and 1.0 for collaborative tool pervasiveness.

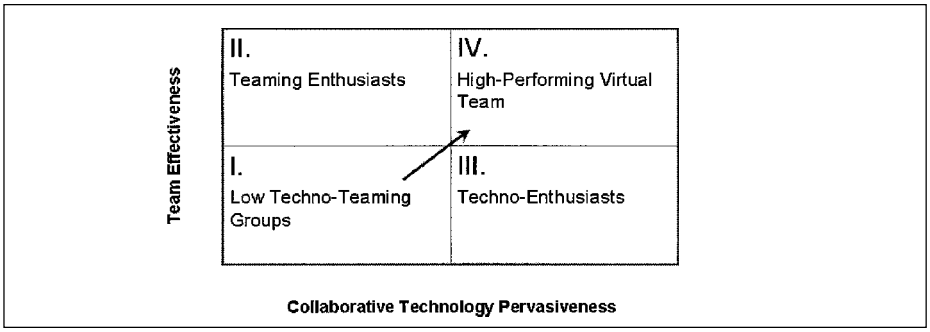

Figure 1: Virtual teaming grid.

Best Practices Observed

When the management practices of the Quadrant I teams were compared with the management practices of the Quadrant IV teams, the following significant differences were discovered: Quadrant IV firms placed a much higher premium on collaborative tool training, ease of collaborative tool usage, quality and availability of technical support, and the importance of a face-to-face kickoff event for new virtual teams. Quadrant I firms placed more importance on the need for group facilitation or leadership. Both groups placed high importance on the ability to communicate non-face-to-face, setting well-defined goals, assessing performance, planning and managing task completion, and defining a standard set of collaborative tools.

Summary and Conclusions

So which aspect is more important for understanding virtual teams: the "technology" or the "team"? My response is that both are equally important. Furthermore, virtual team research truly requires a cross-disciplinary view of the deployment of virtual teams, or collaborative work groups. Few organizations are truly "Quadrant IV" virtual teaming organizations.

We have proposed a taxonomy that includes 18 categories of collaborative tools that may be used to assess the actual pervasiveness of collaborative technology usage in an organization. In addition, we defined a measure for teaming effectiveness that uses Tuckman's teaming stages as its basis. Firms may be grouped according to their teaming and technology scores on our Virtual Teaming Grid. High-performing virtual teaming organization can be reasonably compared to low-performing virtual teaming organizations.

While several appealing findings concerning management practices and characteristics of the high- and low-performing organizations emerged, the small size of the sample precluded any rigorous analysis of the findings. However, there does appear to be sufficient evidence and incentive for many more studies of this nature as well as a revisit to many earlier studies that fail to properly classify the level of virtual team maturation.

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