CHAPTER 10

Collaborative Computer-Supported Technologies and Group Support Systems

Learning Objectives

- Understand the basic concepts and processes of groupwork, communication, and collaboration
- Describe how computer systems facilitate communication and collaboration in an enterprise
- Explain the concepts and importance of the time/place framework
- Explain the underlying principles and capabilities of groupware, such as group support systems (GSS)
- Understand the concepts of process gain, process loss, task gain, and task loss and explain how GSS introduces, increases, or decreases each of them
- Describe indirect support for decision making, especially in synchronous environments
- Become familiar with the GSS products of the major vendors, including Lotus, Microsoft, WebEx, and Groove
- Understand the concept of GDSS and describe how to structure an electronic meeting in a decision room
- Describe the three settings of GDSS
- Describe specifically how a GDSS uses parallelism and anonymity and how they lead to process/task gains and losses
- Understand how the Web enables collaborative computing and group support of virtual meetings
- Describe the role of emerging technologies in supporting collaboration
- Define *creativity* and how it can be facilitated by computers

People work together, and groups make most of the complex decisions in organizations. The increase in organizational decision-making complexity increases the need for meetings and groupwork. Supporting groupwork where team members may be in

different locations and working at different times emphasizes the important aspects of communications, computer technologies, and work methodologies. Group support is a critical aspect of decision support systems (DSS). Effective computer-supported systems have evolved to increase gains and decrease losses in task performance and processes. In addition, creativity is an important element of decision making that collaborative computing can enhance. The sections of this chapter are as follows:

10.1 Opening Vignette: Collaborative Design at Boeing-Rocketdyne

10.2 Making Decisions in Groups: Characteristics, Process, Benefits, and Dysfunctions

10.3 Supporting Groupwork with Computerized Systems

10.4 Tools for Indirect Support of Decision Making

10.5 Integrated Groupware Suites

10.6 Direct Computerized Support for Decision Making: From Group Decision Support Systems (GDSS) to Group Support Systems (GSS)

10.7 Products and Tools for GDSS/GSS and Successful Implementation

10.8 Emerging Collaboration Support Tools: From VoIP to Wikis

10.9 Collaborative Efforts in Planning, Design, and Project Management

10.10 Creativity, Idea Generation, and Computerized Support

10.1 OPENING VIGNETTE: COLLABORATIVE DESIGN AT BOEING-ROCKETDYNE

PROBLEM

Boeing-Rocketdyne, a major U.S. manufacturer of rocket engines, faced a bold challenge: Drive the cost of rocket engines down 95 percent, be able to get the engine to market 10 times faster than it had been able to do in the past for space shuttle main engines, and increase the useful life of a rocket engine by a factor of three. Obviously, this required a radically new design, significant creativity, and unusual innovation. None of the technical senior managers at Boeing thought this was possible. Only a daring program manager was willing to try to respond to the challenge.

SOLUTION

The company created an eight-person team including experts from business partner organizations. Most members were in different locations, up to 1,000 miles away. Most members spent only 15 percent of their time on the joint design in the team, and they spent 85 percent of their time on their regular jobs. Thus, they constituted a virtual team because it was impractical to bring them to face-to-face meetings more than twice in the 10 months of the life of the project (once to start the project and be trained in the collaborative tools and once to celebrate the successful completion of the project). The team had 89 virtual meetings (2 or 3 meetings per week for the 41 weeks the project lasted). These meetings were supported by specially designed collaborative technology. Such support was necessary due to the need for an unusual solution from a virtual team whose members came from different organizations, with different experiences, in many disciplines, and who had never worked closely together.

Collaborative Technology Used

Custom software known as the *Internet Notebook* was developed in response to the wishes of the team. Team members could access the software securely from anywhere.

They could create, comment on, reference-link, search, and sort entries, which could consist of sketches, snapshots, hotlinks to desktop applications, text, or templates. They could also use an *electronic whiteboard* that allowed multiple team members near-instantaneous access to the same entry. In addition, a coordination protocol was used to facilitate the collaboration process.

A second software product, called *Project Vault*, allowed secured common file storage and transfer of these files on an as-needed basis. Thus, all members shared exactly the same data all the time.

The software tools were modified over the 10-month project period to allow flexibility. The protocol was also modified. For example, face-to-face meetings among two or more members, which were forbidden in the beginning, were later allowed, provided that their content was posted online for group sharing.

The major tools used to support the lengthy virtual meetings were teleconferencing and videoconferencing. Members in their offices used powerful desktop analysis software to analyze designs during the meeting, so results could be discussed in real-time (e.g., immediate feedback about proposed design ideas was provided in seconds). This allowed all those with the relevant skills and tools to participate in real-time virtual meetings. Hundreds of ideas were generated, leading to 20 conceptually distinct designs that were quickly evaluated using *electronic brainstorming*. The ability to analyze solutions from the desktop during the meetings greatly sped up the design process. All this encouraged knowledge sharing. Thus, decisions were made quickly and creatively, and frequent integration with all team members was easy and encouraged, leading to spontaneous and better decisions. The system allowed shared understanding of problems, possible solutions, analysis methods, constraints, and so on, as well as rapid creation (and discarding) of highly content-specific information. In addition to technology, it was necessary to formulate interorganizational strategy and structure a conducive work environment.

RESULTS

The team successfully designed a product made of 6 parts instead of the normal 1,200, at a cost of $0.5 million (versus $14 million) and a quality level of 9 sigma (instead of the normal 2–6 sigma, reducing defects to 1 projected failure in 10 billion). The team did all this in 10 months instead of 6 years, with production cost of $47,000 (instead of $4.5 million) and with more than a 5 percent reduction in total engineering hours. All these achievements are really amazing.

Sources: Compiled from A. Majchrzak; R. Carman, and V. Lott, "Radical Innovation Without Collocation: A Case Study at Boeing-Rocketdyne," *MIS Quarterly*, June 2001; and R. Carman, V. Lott, A. Malhotra, and A. Majchrzak, "Virtual Cross-Supply Chain Concept Development Collaborative Teams: Spurring Radical Innovations at Boeing-Rocketdyne," *Society for Information Management*, 2000, **simnet.org/Content/NavigationMenu/Resources/Library/Paper_Award_Winners/Download_Page2res/20001stPl.pdf** (accessed February 2006).

Questions for the Opening Vignette

1. Why was a group needed and why were the members in different locations?
2. Why did the project take so long? Why were so many meetings needed?
3. What computer support was provided? What type of software was used?
4. Comment on idea generation in this process.
5. Comment on sharing and collaboration in this process.

WHAT WE CAN LEARN FROM THIS VIGNETTE

The opening vignette illustrates how a temporary team that is properly supported by collaborative technologies and procedures can achieve incredible results. The team was virtual, meaning it met electronically, using telephone, videoconferencing, a document-sharing device, and other computer-based tools, some of which were customized for specific tasks. It shows the ability to make better and faster complex decisions with the support of computerized systems.

10.2 MAKING DECISIONS IN GROUPS: CHARACTERISTICS, PROCESS, BENEFITS, AND DYSFUNCTIONS

Managers and staff continuously make decisions, design and manufacture products, develop policies and strategies, design software, and so on. When people work in groups, they perform *groupwork*. **Groupwork** refers to work done by two or more people together.

CHARACTERISTICS OF GROUPWORK

The following are some of the functions and characteristics of groupwork:

- A group performs a task (sometimes decision making, sometimes not).
- Group members may be located in different places.
- Group members may work at different times.
- Group members may work for the same organization or for different organizations.
- A group can be permanent or temporary.
- A group can be at one managerial level or can span several levels.
- There can be synergy (leading to process and task gains) or conflict in groupwork.
- There can be gains and/or losses in productivity from groupwork.
- The task may have to be accomplished very quickly.
- It may be impossible or too expensive for all the team members to meet in one place, especially when the group is called for emergency purposes.
- Some of the needed data, information, or knowledge may be located in many sources, some of which may be external to the organization.
- The expertise of non-team members may be needed.
- Groups perform many tasks; however, groups of managers and analysts frequently concentrate on decision making.
- The decisions made by a group are easier to implement if supported by all (or at least most) members.

THE GROUP DECISION-MAKING PROCESS

Even in hierarchical organizations, decision making is usually a shared process. A group may be involved in a decision or in a decision-related task, such as creating a short list of acceptable alternatives or choosing criteria for evaluating alternatives and prioritizing them. The following activities and processes characterize *meetings*:

- The decision situation is important, so it is advisable to make it in a group in a meeting.
- A meeting is a joint activity engaged in by a group of people typically of equal or nearly equal status.

- The outcome of a meeting depends partly on the knowledge, opinions, and judgments of its participants and the support they give to the outcome.
- The outcome of a meeting depends on the composition of the group and on the decision making *process* the group uses.
- Differences in opinions are settled either by the ranking person present or, often, through negotiation or arbitration.
- The members of a group can be in one place, meeting face-to-face, or they can be a **virtual team**, in which case they are in different places while in a meeting.
- The process of group decision making can create benefits as well as dysfunctions.

THE BENEFITS AND LIMITATIONS OF GROUPWORK

Some people endure meetings as a necessity; others hate them. Groupwork may have both potential benefits and potential drawbacks.

Process gains are the benefits of working in groups. The unfortunate dysfunctions that may occur when people work in groups are called **process losses**. Examples of both are listed in Technology Insights 10.1.

TECHNOLOGY INSIGHTS 10.1

Benefits of Working in Groups and Dysfunctions of the Group Process

Benefits of Working in Groups (Process Gains)	Dysfunctions of the Group Process (Process Losses)
• It provides learning. Groups are better than individuals at understanding problems.	• Social pressures of conformity may result in **groupthink** (i.e., people begin to think alike and do not tolerate new ideas; they yield to *conformance pressure*).
• People readily take ownership of problems and their solutions. They take responsibility.	• It is a time-consuming, slow process (i.e., only one member can speak at a time).
• Group members have their egos embedded in the decision, so they are committed to the solution.	• There can be lack of coordination of the meeting and poor meeting planning.
• Groups are better than individuals at catching errors.	• Inappropriate influences (e.g., domination of time, topic, or opinion by one or few individuals; fear of contributing because of the possibility of *flaming*).
• A group has more *information* (i.e., knowledge) than any one member. Group members can combine their knowledge to create new knowledge. More and more creative alternatives for problem solving can be generated, and better solutions can be derived (e.g., through *stimulation*).	• There can be a tendency for group members to either dominate the agenda or rely on others to do most of the work (free-riding).
• A group may produce *synergy* during problem solving. The effectiveness and/or quality of groupwork can be greater than the sum of what is produced by independent individuals.	• Some members may be afraid to speak up.
• Working in a group may stimulate the creativity of the participants and the process.	• There can be a tendency to produce compromised solutions of poor quality.

(continued)

TECHNOLOGY INSIGHTS 10.1 (continued)

Benefits of Working in Groups (Process Gains)	Dysfunctions of the Group Process (Process Losses)
• A group may have better and more precise communication working together. • Risk propensity is balanced. Groups moderate high-risk takers and encourage conservatives.	• There is often nonproductive time (e.g., socializing, preparing, waiting for latecomers—*air-time fragmentation*). • There can be a tendency to repeat what was already said (because of failure to remember or process). • There is a high cost of meeting (e.g., travel, participation). • There can be incomplete or inappropriate use of information. • There can be too much information (i.e., information overload). • There can be incomplete or incorrect task analysis. • There can be inappropriate or incomplete representation in the group. • There can be attention blocking. • There can be concentration blocking.

IMPROVING THE MEETING PROCESS

Meetings can be very effective if the participants recognize what can go wrong there and try to improve the process of conducting a meeting.

Researchers have developed methods for improving the processes of groupwork; that is, increasing some of the benefits of meetings and eliminating or reducing some of the losses (see Duke Corporate Education, 2005). Some of these methods are known as *group dynamics*. Two representative methods are the **nominal group technique (NGT)**, which is a simple brainstorming process for non-electronic meetings, and the **Delphi method**, which is a qualitative forecasting methodology that uses anonymous questionnaires. These questionnaires are effective for technological forecasting and for forecasting involving sensitive issues. These methods were initially manual approaches to supporting groupwork. See Lindstone and Turroff (1975) for details. Also see Online File W10.1 for a description of seven things that do and do not work in meetings. Technography.com provides information, surveys, and tips about how to run more effective meetings.

The limited success of manual methods such as NGT and the Delphi method led to attempts to use information technology to support group meetings. (Today, both NGT and Delphi are supported by computers in some organizations.)

Section 10.2 Review Questions

1. Define *groupwork*.
2. List five characteristics of groupwork.
3. Describe the process of a group meeting for decision making.
4. Describe five potential gains of group meetings.
5. Describe five potential losses of group meetings.

10.3 SUPPORTING GROUPWORK WITH COMPUTERIZED SYSTEMS

When people work in teams, especially when the members are in different locations and may be working at different times, they need to communicate, collaborate, and access a diverse set of information sources in multiple formats. This makes meetings, especially virtual ones, complex, with a great chance for process losses. It is important to follow a certain process for conducting meetings. Computerized support may help, as was used at Boeing-Rocketdyne in the opening vignette. Other reasons for support are cost savings, expedited decision speed, the need to support virtual teams, the need for external experts (e.g., the Boeing-Rocketdyne case), and improving the decision-making process.

Almost all organizations, small and large, are using some computer-based communication and collaboration methods and tools to support people working in teams or groups. For example, Johnson Controls has cut production costs by $20 million with a collaboration portal that integrates supplier applications (see Hall, 2002). Lockheed Martin won a $19 billion contract on the basis of its collaboration capabilities (see Konicki, 2001). In Boeing-Rocketdyne's case, considerable support was provided to the temporary, virtual design group.

AN OVERVIEW OF GROUP SUPPORT SYSTEMS (GSS)

For groups to collaborate effectively, appropriate communication methods and technologies are needed. The Internet and its derivatives (i.e., intranets and extranets) are the infrastructures on which much communication for collaboration occurs. The Web supports intra- and interorganizational collaborative decision making through collaboration tools and access to data, information, and knowledge from inside and outside the organization.

Intraorganizational networked decision support can be effectively supported by an *intranet*. People within an organization can work with Internet tools and procedures through enterprise information portals (see Chapter 17, an online chapter). Specific applications can include important internal documents and procedures, corporate address lists, e-mail, tool access, and software distribution.

An *extranet* links people in different organizations. For example, several automobile manufacturers have involved their suppliers and dealers in extranets to help them to deal with inventories and customer complaints (see **covisint.com**). Other extranets are used to link teams together to design products when several different suppliers must collaborate on design and manufacturing techniques.

There are many Web-based collaborative configurations and tools, as described in the opening vignette. Other examples are Autodesk's Architectural Studio and CoCreate's OneSpace, which allow several designers to work together simultaneously. Most major auto manufacturers are moving toward using such tools to substantially reduce the cost and time of bringing new car models to market (see Application Case 10.2).

Computers have been used for several decades to facilitate groupwork and group decision making. Lately, collaborative tools have received even greater attention due to their increased capabilities and ability to save money (e.g., on travel cost) as well as their ability to expedite decision making. Such computerized tools are called *groupware*.

GROUPWARE

Many computerized tools have been developed to provide group support. These tools are called **groupware** because their primary objective is to support groupwork. Groupware tools can support decision making *directly* or *indirectly*, and they are

Application Case 10.2

How General Motors Is Collaborating Online

PROBLEM

Designing a car is a complex and lengthy process. Take, for example, just a small part of the process at General Motors (GM). Each model created needs to go through a frontal crash test. GM builds prototypes that cost about $1 million each and tests how they react to a frontal crash. GM crashes these cars, makes improvements, and then crashes them again. Even as late as the 1990s, GM crashed as many as 70 prototype versions of each new model.

The information regarding a new design collected from these crashes and other tests has to be shared among approximately 11,000 designers and engineers in hundreds of divisions and departments at 16 GM design labs, located all over the world. In addition, GM must communicate and collaborate with the design engineers of the more than 1,000 key suppliers. All this communication and collaboration slowed the design process and increased costs. It took over four years to get a new model to market, and the new car often looked stale on arrival because public tastes had changed during the course of development.

SOLUTION

GM, like its competitors, has been transforming itself into an e-business. This gradual transformation has been going on since the mid-1990s, when Internet bandwidth increased sufficiently. GM's first task was to examine more than 7,000 existing legacy IT systems and reduce that number to about 3,000 and make them Web-enabled. GM's new electronic commerce (EC) system is centered on a computer-aided design (CAD) program from EDS (**eds.com**). This system, known as Unigraphics, allows 3D design documents to be shared online by both the designers (internal and external) and engineers, all of whom are connected by the EDS software. In addition, collaborative and Web conferencing software tools, including Microsoft's NetMeeting and EDS's eVis, were added to enhance teamwork. In 2003, the company moved to eVis 4.0, which allows all the suppliers, from large companies to mom-and-pop operations, to communicate with GM. These tools have radically changed the vehicle-review process.

To understand how GM now collaborates with a supplier, let's take as an example a needed cost reduction in a new seat frame made by Johnson Controls. GM electronically sends its specifications for the seat to the vendor's product data system. Johnson Controls's collaboration system (eMatrix) is integrated with EDS's Unigraphics. This collaboration enables joint searching, designing, tooling, and testing of the seat frame in real-time, expediting the process and cutting costs by more than 10 percent. Finally, use of math-based modeling and a real-time, Web-based review process enable GM to electronically "crash" some of the cars during the design phases rather than doing it physically after each design change. GM supports this collaboration with its Advanced Design studio and Virtual Realty lab.

RESULTS

It now takes less than 18 months to bring a new car to market, and the design cost is now much lower than it used to be. For example, during the design phases, 60 cars are now "crashed" electronically, and only 10 prototype cars are crashed physically. The change has produced enormous savings. In addition, the shorter cycle time enables GM to bring out more new car models more quickly, providing the company with a competitive edge.

These changes have translated into profit. Despite the economic slowdown, GM's revenues increased more than 6 percent in 2002, and its earnings in the second quarter of 2002 doubled those of the same period in 2001. By 2004, assembly-line defects dropped by 25 percent, cutting inventory costs by 20 percent.

Sources: Compiled from M. Sullivan, "GM Moves Into the Passing Lane," *Forbes* (*Best of the Web supplement*), October 7, 2002; G. Rifkin, "GM's Internet Overhaul," *MIT Technology Review,* October 2002; and S. Ulfelder, "GM Gears Up with Collaboration Based on Web Services," *NetworkWorldFusion,* May 6, 2003, **nwfusion.com/research/2003/0526gm.html?page=1** (accessed March 2006).

described in the remainder of this chapter. For example, generating creative solutions to problems is a direct support. Some e-mail programs, chat rooms, instant messaging (IM), and teleconferencing provide indirect support.

Groupware provides a mechanism for team members to share opinions, data, information, knowledge, and other resources. Different computing technologies support groupwork in different ways, depending on the purpose of the group, the task, and the time/place category in which the work occurs.

TIME/PLACE FRAMEWORK

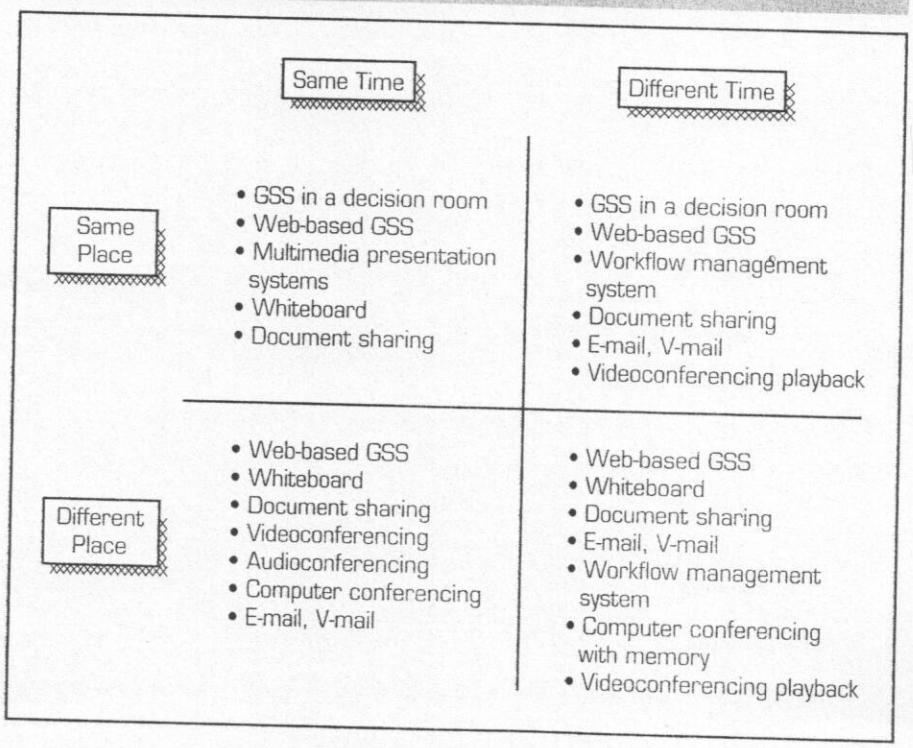
The effectiveness of a collaborative computing technology depends on the location of the group members and on the time that shared information is sent and received. DeSanctis and Gallupe (1987) proposed a framework for classifying IT communication support technologies. In this framework, communication is divided into four cells, which are shown together with representative computerized support technologies in Figure 10.1. The four cells are organized along the two dimensions *time* and *place*.

When information is sent and received almost simultaneously, the communication is **synchronous (real-time)**. Telephones, IM, and face-to-face meetings are examples of synchronous communication. **Asynchronous** communication occurs when the receiver gets the information at a different time than it was sent, such as in e-mail. The senders and the receivers can be in the same room or in different places.

As shown in Figure 10.1, time and place combination can be viewed as a four-cell matrix or framework. The four cells of the framework are as follows:

- *Same time/same place.* Participants meet face-to-face in one place at the same time, as in a traditional meeting or decision room. This is still an important way to meet, even when Web-based support is used, because it is sometimes critical for participants to leave the office to eliminate distractions.
- *Same time/different place.* Participants are in different places, but they communicate at the same time (e.g., with videoconferencing).
- *Different time/same place.* People work in shifts. One shift leaves information for the next shift.
- *Different time/different place (any time, any place).* Participants are in different places, and they also send and receive information at different times. This occurs when team members are traveling, have conflicting schedules, or work in different time zones.

FIGURE 10.1 Time/Place Communication Framework and Some Collaborative Computer-Supported Technologies



Groups and groupwork (also known as *teams* and *teamwork*) in organizations are proliferating. Consequently, groupware continues to evolve to support effective groupwork, mostly for communication and collaboration.

WHAT COMPUTERS CAN AND CANNOT DO

Modern Web-based information technologies provide an inexpensive, fast, capable, and reliable means of supporting communications. But computers cannot support all communication areas. (See Technology Insights 10.3 for some unsupported aspects of communication.) Networked computer systems, such as the Internet, intranets, extranets, and proprietary private networks, are the enabling platforms that support communication.

TECHNOLOGY INSIGHTS 10.3

Unsupported Aspects of Communication

Communication can be problematic in general because computerized communication methods do not transmit most of our nonverbal cues, which are important in establishing the richer meaning of a message by adding context. A large part of what we mean (perhaps exceeding 50 percent) is conveyed via nonverbal cues. Facial expressions, body language, voice tone, expression, inflection, touching, and distance are but a few. (For example, it is possible to fairly accurately determine who will win a U.S. presidential election by measuring the average rate of each candidate's eye blinking. The one who blinks the least has won every election from the Kennedy–Nixon contest in 1960 through 2000. Jay Aronson used this method in analyzing the third debate of the 2000 U.S. presidential election to predict the winner correctly.) Cross-cultural aspects and language subtleties are not easily transmitted through computer-mediated communication channels.

Emoticons were a first attempt to include nonverbal cues in text-based e-mail. For example, in the emoticon system, the characters :) are a happy face called a "smiley," and writing your message in all capital letters means you are SHOUTING! These have been updated into icons in IM software.

Some aspects of communication, such as the frequency of touching and the interpersonal distance between participants, are difficult to capture through technology. However, video technology can show facial expressions and some body language. Researchers are attempting to develop collaborative systems that capture more of this imprecise nature of human communication that makes the meaning of the message received more precise. They are also developing output devices (e.g., robot faces that can reflect mood) to do the same. Other devices are being developed to interpret facial cues, voice changes, and body movement.

Sources: D. Ferber, "The Man Who Mistook His Girlfriend for a Robot," *Popular Science*, September 2003, **popsci.com/popsci/science/ c0c80b4511b84010vgnvcm1000004eecbccdrcrd.html** (accessed August 2006); and D. Rosenbergm and J.A.A. Sillince, "Verbal and Nonverbal Communication in Computer Mediated Settings," *International Journal of Artificial Intelligence in Education*, 2000, Vol. 11.

Next, we examine representative tools that support decision making indirectly.

Section 10.3 Review Questions

1. Why do we use computers to support groupwork?
2. Define *groupware*.
3. Describe the components of the time/place framework.
4. What can computers not do in terms of supporting groupwork?

10.4 TOOLS FOR INDIRECT SUPPORT OF DECISION MAKING

A large number of tools and methodologies are available to facilitate e-collaboration, communication, and decision support. The following sections present the major tools that support decision making indirectly.

GROUPWARE TOOLS

Groupware products provide a way for groups to share resources and opinions. Groupware implies the use of networks to connect people, even if they are in the same room. Many groupware products are available on the Internet or an intranet to enhance the collaboration of a large number of people worldwide (e.g., see Henrie, 2004). Also, groupware tools are available in Microsoft Windows and Office 2007.

Groupware products and features that support collaboration and conferencing are listed in Table 10.1.

Synchronous Versus Asynchronous Products

Notice that the features in Table 10.1 may be *synchronous*, meaning that communication and collaboration are done in real-time, or *asynchronous*, meaning that communication and collaboration are done by the participants at different times. Web conferencing and IM as well as Voice over IP (VoIP) are associated with synchronous mode. Associated with asynchronous modes are e-mail, wikilogs, and *online workspaces*, where participants can collaborate, for example, on joint designs or projects, but work at different times. Vignette, Inc. (**vignette.com**), and Groove Networks (**groove.net**) allow users to set up online workspaces for sharing and storing documents. According to Henrie (2004), many of the tools offered by vendors are converging. This is occurring thanks to new technologies such as VoIP.

Groupware products are either standalone products that support one task (such as e-mail) or integrated kits that include several tools. In general, groupware technology products are fairly inexpensive and can easily be incorporated into existing information systems.

Virtual Meeting Systems

The advancement of Web-based systems opens the door for improved, electronically supported **virtual meetings**, where members are in different locations and even in different countries. For example, online meetings and presentation tools are provided by **webex.com** and **gotomeeting.com.**

The events of September 11 and the economic slowdown of 2001 through 2003 helped to make virtual meetings more popular (e.g., see Bray, 2004; and Powell et al., 2004). It is difficult for companies to ignore reported cost savings, such as the $4 million per month that IBM reported it saved just from cutting travel-related meeting expenses (Callaghan, 2002). In addition, improvements in supporting technology, reductions in the price of the technology, and the acceptance of virtual meetings as a respected way of doing business are fueling their growth.

Virtual meetings are supported by a variety of groupware tools, as discussed in the remainder of this section. We begin our discussion with the support provided by real-time support tools.

REAL-TIME COLLABORATION TOOLS

The Internet, intranets, and extranets offer tremendous potential for real-time and synchronous interaction for people working in groups. *Real-time collaboration (RTC)* tools

TABLE 10.1 Groupware Products and Features

General (can be either synchronous or asynchronous)

- Built-in e-mail, messaging system
- Browser interface
- Joint Web-page creation
- Sharing of active hyperlinks
- File sharing (graphics, video, audio, or other)
- Built-in search functions (by topic or keyword)
- Workflow tools
- Use of corporate portals for communication, collaboration, and search
- Shared screens
- Electronic decision rooms
- Peer-to-peer networks

Synchronous (same-time)

- Instant messaging (IM)
- Videoconferencing, multimedia conferencing
- Audio conferencing
- Shared whiteboard, smart whiteboard
- Instant video
- Brainstorming
- Polling (voting), and other decision support (consensus builder, scheduler)

Asynchronous (different times)

- Workspaces
- Threaded discussions
- Users can receive/send e-mail, SMS
- Users can receive activity notification alerts, via e-mail or SMS
- Users can collapse/expand discussion threads
- Users can sort messages (by date, author, or read/unread)
- Auto responder
- Chat session logs
- Bulletin boards, discussion groups
- Use of blogs, wikis, and wikilogs
- Collaborative planning and/or design tools
- Use of bulletin boards

help companies bridge time and space to make decisions and collaborate on projects. RTC tools support synchronous communication of graphical and text-based information. These tools are also being used in distance training, product demonstrations, customer support, e-commerce, and sales applications.

RTC tools can be purchased as standalone tools or used on a subscription basis (as offered by several vendors). One such vendor is WebEx (described later in this chapter).

Electronic Teleconferencing

Teleconferencing is the use of electronic communication to allow two or more people at different locations to have a simultaneous conference. It is the simplest infrastructure for supporting a virtual meeting. Several types of teleconferencing are possible.

The oldest and simplest is a *telephone conference call*, wherein several people talk to each other from three or more locations. The biggest disadvantage of this method is that it does not allow for face-to-face communication. Also, participants in one location cannot see graphs, charts, and pictures at other locations. Although the latter disadvantage can be overcome by using faxes, this is a time-consuming, expensive, and frequently poor-quality process. One solution is *video teleconferencing*, in which participants can see each other as well as documents.

Video Teleconferencing In **video teleconferencing (videoconferencing)**, participants in one location can see participants at other locations. Dynamic pictures of the participants can appear on a large screen and/or on a desktop computer. Originally, videoconferencing was the transmission of live, compressed TV sessions between two or more points. Today, videoconferencing is a digital technology capable of linking various types of computers across networks. When conferences are digitized and transmitted over networks, they become computer applications.

With videoconferencing, participants can share data, voice, pictures, graphics, and animation. Data can also be sent along with voice and video. Such **data conferencing** makes it possible to work on documents and to exchange computer files during videoconferences. This allows several geographically dispersed groups to work on the same project and to communicate by video simultaneously.

Videoconferencing offers various benefits. For example, it improves employee productivity, cuts travel costs, conserves the time and energy of key employees, and increases the speed of business processes (e.g., product development, contract negotiation, customer service). It also improves the efficiency and frequency of communications and saves an electronic record of a meeting, enabling specific parts of a meeting to be reconstructed for future purposes. It can also be used to improve customer service (see Application Case 10.4). Videoconferencing also makes it possible to hold classes at different locations. Finally, videoconferencing can be used to conduct meetings with business partners as well as to interview candidates for employment.

Web Conferencing *Web conferencing* is conducted on the Internet for as few as two and for as many as thousands of people. It allows users to simultaneously view something on their computer screens, such as a sales presentation in Microsoft PowerPoint or a product drawing; interaction takes place via messaging or a simultaneous phone teleconference. Web conferencing is much less expensive than videoconferencing because it runs over the Internet. An example of an application of Web conferencing is banks in Alaska that use video kiosks in sparsely populated areas instead of building branches that would be underutilized. A video kiosk operates on a bank's intranet and provides videoconferencing equipment for face-to-face interactions. A variety of other communication tools, such as online polls, whiteboards, and question-and-answer boards may also be used. Such innovations can be used to educate staff members about a new product line or technology, to amplify a meeting with investors, or to walk a prospective client though an introductory presentation. People can use Web conferencing to view presentations, seminars, and lectures and to collaborate on documents.

Web conferencing is becoming very popular. Almost all Web conferencing products provide whiteboarding and polling features and allow users to give presentations and demos and share applications. Popular Web conferencing products are Centra EMeeting, Genesys Meeting Center, PlaceWare, Go To Meeting, and WebEx Meeting Center.

Application Case 10.4

Videoconferencing Is Ready for Prime Time

Videoconferencing technology can cut travel expenses and increase a company's productivity. Dan Denardo, manager of global videoconferencing at Dow Chemical Company, says that videoconferencing vastly improves customer service and helps Dow deliver products to the market faster. "We know it can decrease cycle time, since we can hold more meetings in the same amount of time," Denardo says. Dow has about 160 video cameras at its headquarters in Midland, Michigan, and it has achieved an estimated annual travel cost savings of more than $7 million. At Dow, the technology is advancing from in-house conference rooms to customer sites. "It is fairly cheap hardware, the customers really like it and it sets us apart," Denardo commented.

Quantum Corporation (**quantum.com**), a large storage vendor, saves about $500,000 per month in travel expenses, lost-time avoidance, and productivity increase, according to Albert Villarde, a network analyst. Quantum has more than 20 video-equipped conference rooms around the globe. The primary business advantage of this is the speed-up in information sharing.

Estimates vary, but Pat Conway, product marketing manager at videoconferencing vendor VTEL Corporation, estimates that videoconferencing could reduce a firm's travel budget by about 15 percent. The most significant savings come from the increased speed of information delivery because more frequent, impromptu meetings occur.

Technology varies from PC desktop video to standalone conference rooms. Most companies use DSL, cable television Internet connections, or ISDN lines because of their higher bandwidth. Videoconferencing is an economical way to cut travel costs and boost productivity. Since September 11, 2001, these technologies have become critical because air travel is not as convenient as it previously was.

Lately, Dow implemented an IP-based communication system network that includes individual conference rooms with collaborative tools.

Sources: Compiled from L. Wood, "Videoconferencing Shows It's Ready for Prime Time," *InternetWeek*, July 12, 1999, p. 26; and SPL Integrated Solutions, "The Dow Chemical Company, Implementing IP Global Communication Network." **splis.com/VideoConferencingSolutions/ dow_ams.html** (no longer available online).

Interactive Whiteboards

Whiteboards are a type of groupware. Computer-based whiteboards work like real-world whiteboards with markers and erasers, except for one big difference: Instead of one person standing in front of a meeting room drawing on the whiteboard, all participants can join in. Throughout a meeting, each user can view and draw on a single document that is "pasted" onto the electronic whiteboard on a computer screen. Users can save digital whiteboarding sessions for future use. Some whiteboarding products let users insert graphics files that the group can annotate. For further information, see Online File W10.2.

Screen Sharing

In collaborative work, team members are frequently in different locations. By using **screen sharing** software, group members can work on the same document, which is shown on the PC screen of each participant. For example, two authors can work on a single manuscript. One may suggest a correction and execute it so that the other author can view the change. Collaborators can work together on the same spreadsheet or on the resultant graphics. Changes can be made by using the keyboard or by touching the screen. This capability can expedite the design of products, the preparation of reports and bids, and the resolution of conflicts.

Groove Networks (**groove.net**) offers a special screen-sharing capability. Its product enables the joint creation and editing of documents on a PC. (See the discussion of Groove later in this chapter.)

Instant Video

The spread of IM and Internet telephony has naturally led to the idea of linking people via both voice and audio. Called *instant video*, the idea is a kind of video chat room. Instant video allows users to chat in real-time and see the person(s) with whom they are meeting. A simple way to do this is to add video cameras to the participants' computers. A more sophisticated and better-quality approach is to integrate an existing online videoconferencing service with IM software, creating a service that offers the online equivalent of a videophone.

This idea is still in the early stages. One instant video pioneer is CUworld (**cuworld.com**). Here is how its CUworld software works: Users gets free CUworld software that can compress and decompress video signals sent over an online connection. To start a conference, a user sends a request to an online buddy via IM. The CUworld software goes to the directory of the IM service to determine the Internet addresses of the users' connections, and, using the Web addresses, the computers of the video participants are linked directly via the Internet. A videoconference can then begin.

Instant video sounds like a good product, but no one knows for sure how commercially viable it will be.

SUPPORT OF ASYNCHRONOUS COMMUNICATION

Asynchronous communication is supported mainly by e-mail and short message service (SMS) wireless messages. In the past few years, we have seen an increase in other tools that are not subject to spam. The two major tools, blogs and wikis, are discussed in Section 10.8. Other tools not discussed here are online bulletin (discussion) groups, auto responders, and workflow and interactive portals (see Chapter 17, an online chapter).

A major new asynchronous tool is the online workspace (see Henrie, 2004).

Online Workspaces

Online (electronic) workspaces are online screens that allow people to share documents, files, project plans, calendars, and so on in the same online place, though not necessarily at the same time. An online workspace is an extension of screen sharing, which was developed mainly for synchronous collaboration. An example is Intraspect from Vignette Corp., which allows users to set up workspaces for sharing and storing documents and other unstructured data. Another example is Microsoft's SharePoint, which allows employees to create Web sites, invite co-workers to join discussions, and post documents. Groove Networks sells an online workspace especially suited to users who are frequently outside a company's firewalls. Finally, CollabNet, Inc., offers an online workspace specifically to support collaboration of software developers.

Section 10.4 Review Questions

1. List the major groupware tools and divide them into synchronous and asynchronous types.
2. Describe the various types of electronic teleconferencing, including Web-based conferencing.
3. Describe whiteboards and screen sharing.
4. Describe instant video.
5. Describe the online workspace.

10.5 INTEGRATED GROUPWARE SUITES

Because groupware technologies are computer based and have the objective of supporting groupwork, it makes sense to integrate them among themselves and/or with other computer-based technologies. A *software suite* is created when several products are integrated into one system. Integrating several technologies can save time and money for users. For example, Polycom, Inc. (**polycom.com**), in an alliance with software developer Lotus, developed an integrated desktop videoteleconferencing product that uses Lotus Notes. Using this integrated system, publisher *Reader's Digest* has built several applications that have videoconferencing capabilities. *Groupware suites* provide seamless integration.

Groupware typically contains capabilities for at least one of the following: **electronic brainstorming** (i.e., brainstorming supported by computers), electronic conferencing or meetings, scheduling of meetings, calendaring, planning, conflict resolution, model building, videoconferencing, electronic document sharing (e.g., screen sharing, whiteboards, liveboards), voting, and organizational memory. Some groupware—such as Lotus Notes/Domino (**lotus.com**), Microsoft NetMeeting (**microsoft.com**), Groove (**groove.net**), WebEx (**webex.com**), and GroupSystems OnLine (**groupsystems.com**)—supports a fairly comprehensive range of activities. These products are known as *suites* and are described next.

LOTUS NOTES/DOMINO AND LOTUSPHERE

Lotus Notes/Domino (**ibm.com/software/lotus**) was the first widely used groupware (see Langley, 2004). Lotus Notes/Domino enables collaboration by letting users access and create shared information through specially programmed Notes documents. Notes provides online collaboration capabilities through Web conferencing on demand, work group e-mail, distributed databases, bulletin whiteboards, text editing, (electronic) document management, workflow capabilities, consensus building, voting, ranking, and various application-development tools, all integrated into one environment with a graphical menu-based user interface. Notes fosters a virtual corporation and creates interorganizational alliances. Notes broadens personal information management (PIM) data to supported mobile or wireless devices, including PDAs, pagers, and mobile phones, and makes available online access to critical business information using mobile devices. It also supports a variety of Web browsers on Linux as well as Microsoft Windows, while providing security features to help protect business-critical information. The software integrates presence awareness and IM to assist in collaboration with colleagues without launching a separate application and gives mobile workers the convenience of working while disconnected from the network.

Although increased competition is cutting into its market share, there are millions of Notes users in thousands of organizations. Many applications have been programmed directly in Lotus Notes (e.g., Learning Space, a courseware package that supports distance learning). Lotusphere is IBM's conferencing software with its Workplace platform, which is integrated with Domino. Workplace Builder allows nontechnical business users to create applications based on templates. For companies that have fewer than 1,000 employees, IBM offers Lotus Domino Express. For examples, see success stories at IBM (2006).

MICROSOFT NETMEETING AND LIVE MEETING

Microsoft NetMeeting is a real-time collaboration package that includes whiteboarding (i.e., support of relatively free-form graphics to which all participants can contribute

simultaneously), application sharing (of any Microsoft Windows application document), remote desktop sharing, file transfer, text chat, data conferencing, and desktop audio- and videoconferencing. This application sharing is a vast improvement over what was called *whiteboarding* in the early 1990s. The NetMeeting client is included in the Windows operating system. See Application Case 10.5 for an example of a successful use of NetMeeting. Also see the "NetMeeting in Action" stories at **microsoft.com**. Live Meeting is a hosted Web conferencing tool (see *eWEEK* Reviews, 2005, for software evaluation).

Application Case 10.5

NetMeeting Provides a Real-Time Advantage

Jack O'Donnell is CEO of O'Donnell & Partners, a corporate interior contracting firm in Manhattan with branch offices in Chicago, London, and Milan. Until recently, O'Donnell felt the need to be on-site when any project was in its crucial stages. "Phone calls weren't enough, nor was e-mail—especially when you're dealing with a team of architects, designers, and contractors who speak different languages and all have their own professional jargon," he says. "Add to that the need for working on plans, sketches, and blueprints together at meetings, and my partners and I found we were spending most of our time at airports."

Microsoft NetMeeting provides collaborative computing support for groupwork, including application sharing through its Remote Desktop Sharing feature. It also provides real-time video. Now O'Donnell and his team members meet online. "Everyone can prepare a presentation that shows and doesn't just tell the progress of their part of the project," says O'Donnell. "We can work on files together, as if we were sitting across from each other at a conference table. And we can see each other's expressions, so it feels more like a real meeting."

O'Donnell estimates that Web conferencing saved his company at least a $0.5 million in travel costs in 1999. And that did not include the benefit of having fewer people out sick with whatever virus they picked up on their last plane trip. By 2000, the company started using VoIP to enhance collaboration using NetMeeting.

Sources: Compiled from M. Delio, "Power Meetings in Cyberspace," *Knowledge Management*, Vol. 2, No. 12, December 1999, pp. 77–78; and B. Stamler, "Making Face-to-Face Time Possible on the PC," *New York Times on the Web*, October 25, 2000. **partners.nytimes.com/library/tech/00/10/biztech/technology/25stam.html** (accessed August 2006).

Microsoft also offers a hosted Web conferencing product for Web conferencing called Live Meeting.

GROOVE NETWORKS

Groove Virtual Office is a product from Groove (**groove.net**; a Microsoft's company). It is an end-user application for secure discussions, file sharing, projects, and meetings. The software supports seamless shared project documents, allows work between project team members inside and outside an organization, and enables communication about project status and such, live virtual meetings, allocation and tracking of action items and tasks, and access to the latest project information (online or offline).

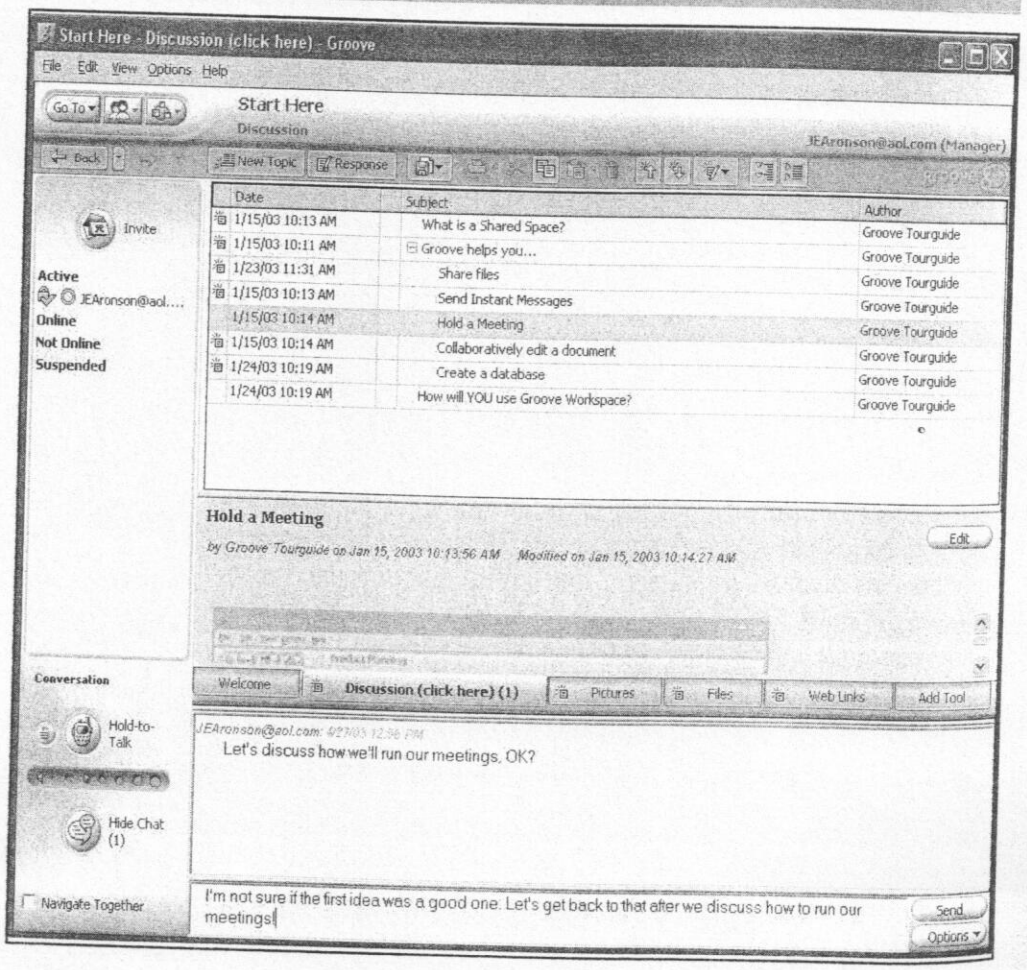
Used alone or with Groove Enterprise Servers and Hosted Services, Groove Workspace enables spontaneous, online–offline collaboration that reduces project costs and speeds time-to-market for products and services. The Groove Outliner tool is an open-ended brainstorming tool that allows shared space members to build structured hierarchical lists of videos and concepts. Groove's Sketchpad enhances collaboration on drawings and designs. The Groove peer-collaboration platform works across corporate firewalls and requires no special configuration or IT administration.

A very functional demo version (with no videoconferencing, however) is available for download. Although it takes a while to structure a first meeting and download all files to users, it is definitely an inexpensive, useful peer-to-peer package. A screenshot of a Groove Outliner session is shown in Figure 10.2.

WEBEX MEETING CENTER AND PLACEWARE CONFERENCE CENTER

WebEx Meeting Center (**webex.com**) is pay-per-use groupware. It provides a low-cost, simplified way to hold electronic meetings over the Web. WebEx contains all the features you need to run a meeting. WebEx Meeting Center integrates data, voice, and video within a standard Web browser for real-time meetings over the Internet from any desktop, laptop, or wireless handheld device. WebEx delivers active and interactive presentations, allows real-time collaboration with remote co-workers and partners, enhances demonstration of products and services, and assists in document management by allowing viewing, annotation, and editing of documents in real-time. Spontaneous Q&A sessions can be held, and closer relationships are built through interactive meetings with customers and partners from an individual's desktop. WebEx contains all the tools needed to share documents or opinions. WebEx Meeting Center is a fully hosted solution, enabling the initiation of online meetings that require no IT staff involvement, and it has very low startup costs. The WebEx MediaTone Network also provides fast communication for videoconferencing. For an interesting case with a

FIGURE 10.2 Example of Electronic Brainstorming in the Groove Workspace



savings of $6 million, see Smith (2004). Finally, MeetMeNow is designed specifically for the support of data with integrated audio.

The PlaceWare Conference Center (main.placeware.com/services/pw_conference_ctr.cfm), now a subsidiary of Microsoft, provides Live Meeting and is capable of supporting multiple presenters and concurrent meetings with up to 2,500 participants per session. It is used to conduct product launches, sales demonstrations, training sessions, and more. Live Meeting is easily integrated with existing productivity tools (e.g., sessions can be scheduled quickly through a Microsoft Outlook calendar). The collaborative experience is enhanced through added features such as live polling, audience feedback, and mood indicators. PlaceWare also offers a virtual classroom, a distance-learning environment for training and seminars (**main.placeware.com/services/virtual_corp_training_orgs.cfm**).

GROUPSYSTEMS AND OTHER VENDORS

GroupSystems (**groupsystems.com**) MeetingRoom was one of the first comprehensive same time/same place electronic meeting packages. GroupSystems OnLine offers similar capabilities, and it runs in asynchronous mode (anytime/anyplace) over the Web (MeetingRoom runs over a local area network [LAN]). GroupSystems products are used in many academic studies to establish needed tools and teach how they should operate. We discuss these systems in Section 10.8.

Another specialized product is eRoom (now owned by EMC/Documentum at **software.emc.com**). This is a comprehensive Web-based suite of tools that can support a variety of collaboration scenarios. Yet another product is Team Expert Choice (EC11), which is an add-on product for Expert Choice (**expertchoice.com**). It has limited decision support capabilities, mainly supporting one-room meetings. Finally, the Zimbra Collaboration Suite is available at **zimbra.com**.

CONCLUSIONS ABOUT GROUPWARE SUITES

Successful **enterprise-wide collaboration systems** such as Lotus Notes/Domino can be expensive to develop and operate. To obtain the full benefits of such groupware, a well-trained, full-time support staff is required to develop applications and operate the system. On the other hand, Groove is relatively inexpensive and provides easy-to-use and easy-to-set-up collaboration for an organization.

Industry reports estimate that all forms of groupware (e.g., audioconferencing, videoconferencing, data conferencing, Web-based conferencing) have become a more established part of the corporate decision-making process. The total collaboration software market is growing rapidly. This growth is driven by time and money savings due to reduced travel and by organizational decentralization and globalization.

Electronic meeting services such as WebEx Meeting Center (**webex.com**), PlaceWare Conference Center (**main.placeware.com/services/pw_conference_ctr.cfm**), and Verizon Conferencing (**e-meetings.mci.com**) enable anyone to hold a meeting for a fee per rental.

Section 10.5 Review Questions

1. Define *integrated collaboration suite.*
2. Describe Lotus/Domino and its major capabilities.
3. Describe Microsoft's collaboration products.
4. What is unique about Groove?
5. Describe the process of renting a place for a virtual meeting, using companies such as WebEx.

10.6 DIRECT COMPUTERIZED SUPPORT FOR DECISION MAKING: FROM GROUP DECISION SUPPORT SYSTEMS TO GROUP SUPPORT SYSTEMS

Decisions are made at many meetings, some of which are called in order to make one specific decision. For example, the federal government meets periodically to decide on the short-term interest rate. Directors may be elected at shareholder meetings, organizations allocate budgets in meetings, a company decides on which candidate to hire, and so on. Some of these decisions are lengthy, as in the Boeing-Rocketdyne case. Others can be controversial, as in resource allocation by a city government. Process gains and dysfunctions can be very large in such meetings, and, therefore, computerized improvements have been attempted by researchers from different disciplines (see Duke Corporate Education, 2005; and Powell et al., 2004). These appeared under different names, such as *GDSS, computer-supported collaborative work (CSCW)*, and *electronic meeting systems (EMS)*, and they are the subject of this section.

GROUP DECISION SUPPORT SYSTEMS (GDSS)

During the 1980s, researchers realized that computerized support to managerial decision making needed to be expanded to groups because major organizational decisions are made by groups such as executive committees, special task forces, and departments. The result was the creation of *group decision support systems* (see Powell et al., 2004).

A **group decision support system (GDSS)** is an interactive computer-based system that facilitates the solution of semistructured and unstructured problems by a group of decision makers. The goal of GDSS is to improve the productivity of decision-making meetings, either by speeding up the decision-making process, by improving the quality of the resulting decisions, or both.

The following are the major characteristics of a GDSS:

- Its goal is to support the *process* of group decision makers by providing automation of subprocesses, using information technology tools.
- It is a specially designed information system, not merely a configuration of already-existing system components. It can be designed to address one type of problem or a variety of group-level organizational decisions.
- It encourages generation of ideas, resolution of conflicts, and freedom of expression. It contains built-in mechanisms that discourage development of negative group behaviors, such as destructive conflict miscommunication and groupthink.

The first generation of GDSS was designed to support face-to-face meetings in a *decision room*. Today, support is provided mostly over the Web to virtual groups (e.g., the Boeing-Rocketdyne case in the opening vignette). The group can meet at the same time or at different times by using e-mail, sending documents, and reading transaction logs. GDSS is especially useful when controversial decisions have to be made (e.g., resource allocation, determining which individuals to lay off). GDSS applications require a facilitator when done in one room or a coordinator or leader when done using virtual meetings.

GDSS can improve the decision-making process in various ways. For one, GDSS generally provides structure to the planning process, which keeps the group on track, although some applications permit the group to use unstructured techniques and methods for idea generation. In addition, GDSS offer rapid and easy access to external and stored information needed for decision making. GDSS also support parallel processing of information and idea generation by participants and allow asynchronous

computer discussion. They make possible larger meetings that would otherwise be unmanageable; having a larger group means that more complete information, knowledge, and skills will be represented in the meeting. Finally, voting can be anonymous, with instant results, and all information that passes through the system can be recorded for future analysis (producing *organizational memory*).

GDSS initially was confined to face-to-face meetings. To provide the necessary technology, a special facility (i.e., room) was created. Also, the groups usually had a clearly defined, narrow task, such as allocation of scarce resources or prioritization of goals in a long-range plan.

Over time, it became clear that the support teams need is broader than that provided by GDSS. For example, as indicated in the opening vignette, the task is not a single decision but rather a broad challenge that includes several goals and many decisions, some of which are unknown at the initiation of the project. Furthermore, it became clear that what is really needed is support for virtual teams, both in different place/same time (as in Boeing-Rocketdyne's case) and different place/different time situations. Also, it became clear that teams need indirect support in most decision-making cases (e.g., help in searching information or collaboration) rather than direct support for the decision making. While GDSS expanded to virtual team support, it was unable to meet all the other needs. Thus, a broader term, GSS, was created. We use the terms interchangeably in this book.

GROUP SUPPORT SYSTEMS

A **group support system (GSS)** is any combination of hardware and software that enhances groupwork either in direct or indirect support of decision making. *GSS* is a generic term that includes all forms of collaborative computing. GSS evolved after information technology researchers recognized that technology could be developed to support the many activities normally occurring at face-to-face meetings (e.g., idea generation, consensus building, anonymous ranking).

A complete GSS is still considered a specially designed information system (e.g., the Boeing-Rocketdyne case), but since the mid-1990s, many of the special capabilities of GSS have been embedded in standard productivity tools. For example, Microsoft NetMeeting Client is part of Windows. Most GSS are easy to use because they have a Windows graphical user interface (GUI) or a Web browser interface. Most GSS are fairly general and provide support for activities such as idea generation, conflict resolution, and voting. Also, many commercial products have been developed to support only one or two aspects of teamwork (e.g., videoconferencing, idea generation, screen sharing, wikis).

An **electronic meeting system (EMS)** is a form of GSS that supports anytime/anyplace meetings. Group tasks include, but are not limited to, communication, planning of a meeting, idea generation, problem solving, issue discussion, negotiation, conflict resolution, and collaborative group activities, such as document preparation and sharing. EMS may include desktop videoconferencing, whereas in the past, GSS did not. However, there is a blurring between these two concepts, so today they should be considered synonymous.

GSS settings range from a group meeting at a single location for solving a specific problem to virtual meetings conducted in multiple locations and held via telecommunication channels for the purpose of considering a variety of problems (e.g., see the Boeing-Rocketdyne case in the opening vignette). Using effective new collaboration methods and tools that continue to evolve, GSS can operate effectively in asynchronous mode.

GSS can be considered in terms of the common group activities that can benefit from computer-based support: *information retrieval*, including access of data values from an existing database and retrieval of information from other group members; *information sharing*, the display of data for the whole group on a common screen or at group members' workstations for viewing; and *information use*, the application of software technology (e.g., modeling packages, specific application programs), procedures, and group problem-solving techniques for reaching a group decision (e.g., see Technology Insights 10.6). In addition, creativity in problem solving (discussed in Section 10.10) can be enhanced via GSS.

TECHNOLOGY INSIGHTS 10.6

Modeling in Group Decision Making: EC11 for Groups

Based on the analytic hierarchy process (AHP) decision-making methodology implemented as Expert Choice (see Chapter 4), EC11 for Groups helps group members define objectives, goals, criteria, and alternatives and then organize them into a hierarchical structure. Using PCs, participants compare and prioritize the relative importance of the decision variables. EC11 for Groups then synthesizes the group's judgments to arrive at a conclusion and allows individuals to examine how changing the weighting of their criteria affects the outcome.

EC11 for groups imitates the way people naturally make decisions: gathering information, structuring the decision, weighing the variables and alternatives, and reaching a conclusion. It supports the decision process. The group structures an AHP decision hierarchy for the problem as members perceive it; members provide the judgments, and members make the decision. A decision portal provides team members with models they can use to evaluate objectives and alternatives from their desktops.

Source: Partly adapted from Expert Choice Inc., **expertchoice.com** (accessed March 2006); and *Expert Choice Unveils Latest Enterprise Portfolio Analysis Solutions*, July 12, 2004, **dssresources.com/news/80.php** (accessed April 2006).

How GDSS (or GSS) Improves Groupwork

The goal of GSS is to provide support to meeting participants to improve the productivity and effectiveness of meetings by streamlining and speeding up the decision-making process (i.e., efficiency) or by improving the quality of the results (i.e., effectiveness). GSS attempts to increase process and task gains and decrease process and task losses. Overall, GSS has been successful in doing just that (see Holt, 2002); however, some process and task gains may decrease, and some process and task losses may increase. Improvement is achieved by providing support to group members for the generation and exchange of ideas, opinions, and preferences. Specific features such as **parallelism** (i.e., the ability of participants in a group to work simultaneously on a task, such as brainstorming or voting) and anonymity produce this improvement. The following are some specific GDSS support activities:

- GDSS supports parallel processing of information and idea generation (parallelism).
- GDSS enables the participation of larger groups with more complete information, knowledge, and skills.
- GDSS permits the group to use structured or unstructured techniques and methods.
- GDSS offers rapid, easy access to external information.
- GDSS allows parallel computer discussions.

- GDSS helps participants frame the big picture.
- Anonymity allows shy people to contribute to the meeting (i.e., get up and do what needs to be done).
- Anonymity helps prevent aggressive individuals from driving a meeting.
- GDSS provides for multiple ways to participate in instant, anonymous voting.
- GDSS provides structure for the planning process to keep the group on track.
- GDSS enables several users to interact simultaneously (i.e., conferencing).
- GDSS records all information presented at a meeting (i.e., organizational memory).

(For GSS success stories, see vendors' Web sites. In many of these cases, collaborative computing led to dramatic speed-ups in process and cost savings, as shown in the opening vignette.)

Note that the electronic generation of a large number of ideas does not necessarily mean that electronic brainstorming is better than verbal brainstorming. As a matter of fact, Dennis and Reinicke (2004) proved that the opposite may be true. More research is needed.

FACILITIES FOR GDSS

There are three options for deploying GDSS/GSS technology: (1) in a special-purpose decision room, (2) using a multiple-use facility, and (3) as Internet or intranet-based groupware, with clients running wherever the group members are.

Decision Rooms

The earliest GDSS were installed in expensive, customized, special-purpose facilities called **decision rooms** (or electronic meeting rooms) with PCs and large public screens at the front of each room. The original idea was that only executives and high-level managers would use the facility. The software in a special-purpose electronic meeting room usually runs over a LAN, and these rooms are fairly plush in their furnishings. Electronic meeting rooms can be constructed in different shapes and sizes. A common design includes a room equipped with 12 to 30 networked PCs, usually recessed into the desktop (for better participant viewing). A server PC is attached to a large-screen projection system and connected to the network to display the work at individual workstations and aggregated information from the facilitator's workstation. Adjacent to the decision room are sometimes breakout rooms equipped with PCs connected to the server, where small subgroups can consult. The output from the subgroups can also be displayed on the large public screen.

Some organizations (e.g., universities, large companies, government agencies) still use electronic decision rooms, and these rooms support same time/same place meetings. One Ohio school district even built a portable facility in a bus (the driver's seat turns around to become the facilitator's seat). However, there is still a need and a desire for groups to meet face-to-face. A facility like this can conveniently provide videoconferencing for communication with outsiders or team members who cannot attend the meeting, can provide other groupware, and may also function as a fairly expensive computer lab. Decision rooms have been found especially useful when the decision topic is controversial (e.g., resource allocation or long-range planning) and the decision support can provide excellent results. For an example, see Application Case 10.7 and customer success stories at **groupsystems.com.**

Application Case 10.7

Eastman Chemical Boosts Creative Processes and Saves $500,000 with Groupware

PROBLEM

Eastman Chemical Co. (**eastman.com**) wanted to use creative problem-solving sessions to process ideas. Team members would present problems in a face-to-face meeting using flip charts and sticky notes to come up with better solutions, but organizing and studying the notes took far too long. The company needed more ideas and better methods to meet customers' needs. Traditional methods were not effective. The process was extremely unproductive and time-consuming.

SOLUTION

Eastman Chemical chose GroupSystems to support its problem-solving process meetings. Here's how the meetings work now. First, participants define the problem and frame it. Then participants brainstorm ideas to develop potential solutions to the problem, trying for "outside-the-box" thinking using creativity techniques. Recently, some 400 ideas were generated by nine people in a two-hour session through parallelism. After categorizing similar items, the team establishes common decision criteria to choose the top three ideas, using the Alternative Analysis tool. Results are then copied into an Excel spreadsheet to develop an action plan.

Eastman ran 100 research and development managers through collaborative sessions to determine top strategies. They defined 8 opportunities, with an action plan for the top 3—after generating 2,200 ideas!

RESULTS

Henry Gonzales, manager of the polymer technology core competency group at Eastman, stated, "We found that with GroupSystems, we had more unusual ideas, a richer pool to choose from, and we got to the point a lot faster. I did a study and calculated that the software saved 50 percent of people's time, and projected a cost savings of over $500,000 for the 12 people during a year's time." Consequently, Eastman Chemical bought a second site license and upgraded to another facility so that more people could use the groupware.

Sources: Adapted from *Eastman Chemical—Creativity and Team Center*, **groupsystems.com/resource-center/customersandcases/CorporateCaseStudies/Eastman-Case-Study** (accessed August 2006); and **eastman.com** (accessed February 2006).

Multiuse Facilities

A *multiuse facility* can also be constructed for GSS. This is sometimes a general-purpose computer lab or computer classroom that is also a less elegant but equally useful GDSS or GSS room. For example, at the Terry College of Business of The University of Georgia, Sanford Hall has a 48-seat lab/computer classroom with GroupSystems MeetingRoom installed. This room "triples" as a distance-learning classroom because it contains the latest academic videoconferencing software and hardware. Because a decision room is rarely used 100 percent of the time for groupwork, making such a room a multiuse room is an effective way to lower or share costs.

Internet/Intranet-Based Systems

Since the late 1990s, the most common approach to GSS facilities has been to use *Web-based* or *intranet-based groupware* that allows group members to work from any location at any time (e.g., Lotus Notes, Groove, WebEx, PlaceWare, GroupSystems, NetMeeting). This groupware often includes audioconferencing and videoconferencing. The availability of relatively inexpensive groupware (for purchase or for rent) combined with the power and low cost of capable PCs, makes this type of system very attractive. Some groupware vendors, notably Groove, run in peer-to-peer mode, where each person works on a copy of the entire conference so that only differences among the files need to be transmitted. This capability makes this approach even more attractive.

Which GSS Facility to Use?

For the first and second options, a trained facilitator is necessary to coordinate and facilitate the meetings. The group leader works with the facilitator to structure the meeting. The success of a GSS session depends largely on the quality, activities, and support of the facilitator. For the third option, a coordinator is needed, but the required facilitating skills are much lower.

The high cost of constructing a facility and finding an experienced facilitator, and the need to have participants connect from other locations at any time, have reduced the need for the first two approaches. Therefore, the third option is most frequently used today. However, time deadlines are generally needed for each phase of an any-time/anyplace meeting. (The deadlines are set to allow for time zones and travel.) A problem for non-face-to-face meetings is that participants want to see the people with whom they are working. Some systems have access to still pictures, and others use

TABLE 10.2 Collaborative Computing/GSS and Web Impacts

Collaborative Computing/GSS	***Web Impacts***	***Impacts on the Web***
Collaboration	• Provides a consistent, friendly graphical user interface (GUI) for client units • Provides convenient, fast access to team members • Provides improved collaboration tools • Enables access to data/information/knowledge on servers • Enables document sharing • Enables anytime/anywhere collaboration • Enables collaboration between companies, customers, and vendors	• Enables improvements in management, hardware, software, and infrastructure, due mainly to collaboration in (Web-based) CASE and other systems analysis and design tools • Enables improvements in site design and development methods • Allows simultaneous Web surfing (e.g., Groove)
Communication	• Provides improved, fast communication among group members and links to data/information/knowledge sources • Makes audio- and videoconferencing a reality, especially for individuals not using a local area network (LAN)	Same as above
Decision room	• Provides a consistent, friendly GUI for clients • Supports communication • Provides access to Web-based tools • Enables room design teams to collaborate to provide dramatic improvements in facilities	Same as above
Mixed-mode facility	Same as above	Same as above
Colocated team facility (members in different locations)	• Provides fast connections to enable real-time collaboration	Same as above

videoconferencing to enhance some meeting aspects by showing the faces of the participants and sometimes their body language.

In Table 10.2, we provide a list of collaborative computing/GSS and Web impacts. Next, we describe some of the features and structure of a comprehensive GSS, using GroupSystems as an example.

Section 10.6 Review Questions

1. Define *GDSS* and list the limitations of the initial GDSS software.
2. Define *GSS* and list its benefits.
3. Define *EMS*.
4. List process gain improvements made by GSS.
5. Define *decision room*.
6. Describe a GSS multiuse facility.
7. Describe Web-based GSS.
8. Why is the third option for a GDSS facility the most popular?

10.7 PRODUCTS AND TOOLS FOR GDSS/GSS AND SUCCESSFUL IMPLEMENTATION

Products and tools designed specifically to support meetings that deal with decisior support may appear in groupware products or in special suites, such as that o GroupSystems. GroupSystems offers two products: MeetingRoom (for face-to-face meetings) and OnLine (for supporting virtual teams). Before we describe the products let's take a look at how to get ready to use them.

ORGANIZING A GSS SESSION

Face-to-face, same time/same place electronic meetings generally follow a commor progression. First, the group leader meets with the facilitator to plan the meeting (thi is critically important), select the software tools, and develop an agenda. Second, the participants meet in the decision room, and the leader poses a question or problem t the group. Third, the participants type their ideas or comments (i.e., brainstorm), an the results are displayed publicly. Because the participants can see on their own moni tors what others are typing, they can provide comments or generate new ideas. Fourth the facilitator, using idea organization software, searches for common themes, topics and ideas and organizes them into rough categories (i.e., key ideas) with appropriat comments; new research is attempting to automate this part of the electronic meeting The results are publicly displayed. Fifth, the leader starts a discussion, either verbal o electronic. The participants next prioritize the ideas. Sixth, the top 5 or 10 topics ar sent to idea-generation software following a discussion. The process (idea generation idea organization, prioritization) can be repeated, or a final vote can be taken.

The major activities of a typical GDSS session are listed in Technology Insight 10.8. For examples of GSS use in practice, see **groupsystems.com**.

It is important to remind participants of where they are in the group meetin process and to keep them focused on long-term tasks. Other issues include security (t protect valuable information from theft), universal access (i.e., from home or othe sites), folder invitations and information (i.e., participants must be invited to partici pate in meeting segments), information about the participants (i.e., on virtual busines

TECHNOLOGY INSIGHTS 10.8

The Standard GSS Process

Here are the major steps in the GSS process:

Idea generation. This exploratory step looks at the problem and attempts to develop creative ideas about its important features (or alternative solutions in a problem-solving session). The ideas can have anything to do with the problem; they can be potential solutions, criteria, or mitigating factors. An electronic brainstorming tool is appropriate; its output is a list of ideas. Typical time for this step is 30 to 45 minutes.

Idea organization. An idea-organizing tool groups the many ideas generated (possibly hundreds) into a list of key issues. The output of this stage is a list of a few key ideas (about 1 for every 20 original ideas) with the supporting details. Typical time for this step is 45 to 90 minutes.

Prioritization. At this stage, the key ideas are prioritized. A voting tool can be appropriate (see Online File W10.3); its output is a prioritized list of ideas and details. Typical time for this step is 10 to 20 minutes.

Additional idea generation. New ideas are generated based on the prioritization of the key ideas. A brainstorming tool that provides structure, such as a topic commentator tool, is appropriate here. The ideas generated are typically focused on solutions. This stage's output may consist of up to 20 ideas for each of the original key ideas.

This process continues in iterations until a final idea is selected as a solution to the problem that prompted the meeting or a few solutions are identified to be investigated in more depth. Some meetings are oriented toward decision making. Others are exploratory in nature and are focused on generating ideas to pursue in follow-up meetings or individual work. Often, a GDSS meeting takes longer than an unsupported meeting, but participants are generally more thorough in their brainstorming and analysis, and they feel that they have made a better decision by using the system.

cards), indication of who is on the system (to alleviate feelings of loneliness), and facilitator controls (i.e., to start and stop sessions, to restrict access to activities).

Planning the session is one of the most critical issues. Facilitators must provide incentives and develop investment in the outcome, communicate often and explicitly, assign roles and tasks with accountability, and be explicit in goal and activity communication. To illustrate this process, let's look at GroupSystems and its products.

GROUPSYSTEMS PRODUCTS: MEETINGROOM AND ONLINE

GroupSystems MeetingRoom and OnLine are comprehensive groupware products that support a wide variety of group processes and are designed specifically to support group decision-making processes. MeetingRoom is the LAN version, designed for one-room meetings, and OnLine is the Web-enabled version, for participants in different locations. The two products provide the same set of capabilities. We refer to this software simply as *GroupSystems*. An overview of the tools and their relationship to the major GSS activities is shown in Figure 10.3. Agenda is the control panel for scheduling and running GroupSystems activities; it is the meeting manager.

The tools in GroupSystems are divided into standard tools and advanced tools, and they are listed in Online File W10.4.

GSS SUCCESS FACTORS

The success of a GSS depends mostly on its results. A system succeeds if it cuts costs (especially travel costs), supports participants in making better decisions, and/or increases productivity substantially. In order to succeed, a GSS needs many of the usual information system success factors: organizational commitment, an executive

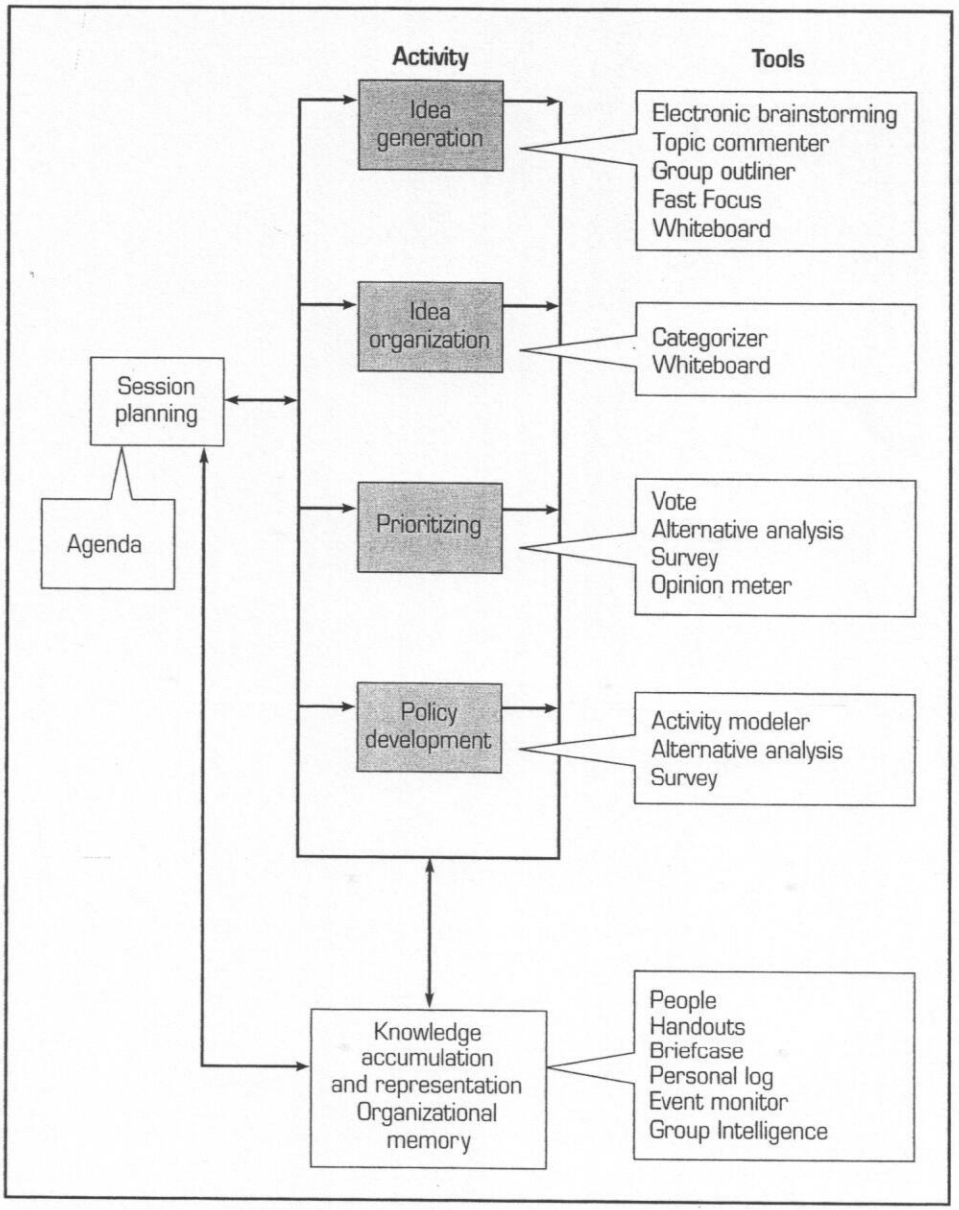


FIGURE 10.3 Structure of GroupSystems for Windows

sponsor, an operating sponsor, user involvement and training, a user-seductive interface, and so on. If the organizational culture does not readily support face-to-face collaboration, then it must be changed to do so before a GSS is introduced. Otherwise, the system will not be used, and it will be deemed a failure. This is also a critical issue in knowledge management (see Chapter 11), which involves collaboration at the enterprise level. Having a dedicated, well-trained, personable facilitator is also critical. The GSS must have the correct tools to support the organization's groupwork and must include parallelism and anonymity to provide process and task gains. Good planning is also a key to running successful meetings, including electronic meetings. If anything, bad planning might make a group believe that the GSS is to blame for its poor performance. Finally, GSS must demonstrate cost savings, either through a more effective and efficient meeting process or through reduced travel costs. Tangible results are necessary, but not sufficient; a collaborative culture is necessary.

Crafting a Collaborative Culture

Collaboration is about people; however, a collaboration tool will not change their attitudes. Technology provides support to the solution. It is also important to motivate the users to really use the new system. The managers must create a work environment that supports collaboration. According to Agrew (2000), this involves three simple steps:

1. *Know what you want.* Get team members to articulate their definition of success (or performance). This is part of the team-building process. For example, at Boeing-Rocketdyne, the team created a formal contract indicating goals and how the team would function.
2. *Determine resource constraints.* These include everything from the geographic distribution of team members to reporting relationships to motivations. Each constraint limits the possible tools the team can use.
3. *Determine what technologies can be used to overcome resource constraints.* It is important to keep in mind business needs rather than fun, new, or convenient technologies. For example, videoconferencing and detailed product and code design work require high-bandwidth connections.

When all this is determined, it is necessary to set up group sessions with good facilitation to guide and train the participants in the tools used. For more on cultural aspects and international perspectives, see de Vreede and Ackermann (2005).

IMPLEMENTATION ISSUES FOR ONLINE COLLABORATION

This chapter has presented numerous online collaboration issues of different sorts. In addition, a few implementation issues must be addressed when planning online collaboration. First, to connect business partners, an organization needs an effective collaborative environment. Such an environment is provided by groupware suites such as Lotus Notes/Domino or Cybozu Share360 (**cybozu.com**). Another issue is the need to connect collaborative tools with file management products on an organization's intranet. Two products that offer such connection capabilities are the WiredRed server and client (**wiredred.com**) and the eRoom server (**software.emc.com**).

Another important issue in collaboration is automatic language translation. This is required for global teams in which not all the participants speak the same language. For discussion on this, see Chapter 13 and Transclick.com.

In addition, to create a truly collaborative environment, protocols are needed for easy integration of different applications and to standardize communication. One such protocol, which is relatively new, is WebDAV (Web Distributed Authoring and Versioning protocol; see **webdav.org**).

An example of a tool that facilitates collaboration administration is Vignette Collaboration 7.0. For administrators, the tool supports clustering and eases administration of user access policies through improved mapping to corporate directories. The tool also enables the display, storage, and search of any Unicode-supported language. Also available is integration with Microsoft's Live Communications Server for presence awareness and IM.

Finally, note that online collaboration is not a panacea for all occasions or all situations. Many times, a face-to-face meeting is a must. People sometimes need the facial cues and the physical closeness that no computer system can currently provide. (A technology called *pervasive computing* attempts to remove some of these limitations by interpreting facial cues.)

Section 10.7 Review Questions

1. List the steps of organizing a GDSS session.
2. List GroupSystems's major products.
3. List some success factors of GDSS/GSS.
4. How can a company create a collaborative culture?
5. List three implementation issues of GDSS/GSS.

10.8 EMERGING COLLABORATION TOOLS: FROM VOIP TO WIKIS

A large number of new collaborative tools have appeared on the market in the past few years. Representative examples are presented here.

VOICE OVER IP

Voice over IP (VoIP) refers to communication systems that transmit voice calls over Internet Protocol (IP)–based networks. Corporations are moving their phone systems to Internet standards to cut costs and boost efficiency. VoIP is also known as **Internet telephony**. Free Internet telephony software is available from **pc-telephone.com**. Most browsers provide for VoIP capabilities. The browsers enable you to receive telephone calls initiated on the Internet (with a microphone and special VoIP software, which may be provided with the sender's browser). VoIP is helping educational institutions, as discussed in Technology Insights 10.9.

TECHNOLOGY INSIGHTS 10.9

VoIP Systems Help Increase Productivity and Enhance Learning Experiences at the State University of New York (SUNY)

The Cortland campus of SUNY was one of two winners recognized at the EDUCAUSE 2003 annual conference. The award honors innovative programs or practices that improve network infrastructure and architecture, integration, and quality of service on a campus or within an educational system and that positively affect a campus community or significant subcommunity.

The Cisco IP Communications system replaced a traditional private branch exchange (PBX)–based voice network and a shared 10-megabit-per-second Ethernet data network. The new converged network includes 700 Cisco IP phones that work with 3,000 existing analog phones connected via Cisco VG-248 IP gateways.

Daniel Sidebottom, director or Administrative Computing Services at SUNY, stated that the return-on-investment (ROI) analysis for the IP communications system anticipated a return on the technology investment in less than one year.

The new system helps university faculty, staff, and students communicate more effectively and provides applications to enhance the academic experience. For example, university faculty and students are able to use streaming video, file sharing, and other high-bandwidth applications, adding considerable value to the curricula as well as driving operational effectiveness. The combined voice and data network features a single call center system to support the admissions and financial aid offices to better serve students, parents, and others who need information and assistance. The solution delivers streamlined voice, data communications, and video to the entire campus and strengthens SUNY Cortland's mission to provide students with the opportunity to develop and use technology in their studies.

Sources: Compiled from T. Spangler, "Cisco to Replace VoIP Tools," *Baseline*, October 1, 2005; and J.A. Pirani, *Implementing an IP-Based Voice, Data and Video an SUNY Cortland*, 2005, **educause.edu/LibraryDetailPage/666?ID=ECS0503** (accessed March 2006).

The Benefits of VoIP

According to a Siemens Communication (**communications.USA.Siemens.com**) special advertisement, the following are the benefits of VoIP communications:

For the business:

- Allows chief information officers to explore different deployment options for company's communications needs
- Lowers total cost of ownership through voice/data convergence
- Lowers operational costs through use of integrated applications
- Reduces hardware requirements on the server side for certain applications (e.g., VoIP)
- Provides a holistic approach to security, enhanced by encryption and identity management
- Helps streamline workflows by empowering companies to communications-enable different business processes
- Enables optimized conferencing tools to replace business travel

For the user:

- Eliminates unwanted interruptions and unproductive actions by intelligently filtering communications
- Provides access to real-time presence information, which helps decisions get made faster
- Initiates ad hoc conferencing/collaboration sessions without the need to prearrange separate audio- or videoconferencing bridges
- Enables participation in conferencing sessions quickly and easily via a variety of mobile devices

COLLABORATIVE WORKFLOW

Collaborative workflow refers to software products that address project-oriented and collaborative types of processes. They are administered centrally yet are capable of being accessed and used by workers from different departments and even from different physical locations. The goal of collaborative workflow tools is to empower knowledge workers. The focus of an enterprise solution for collaborative workflow is on allowing workers to communicate, negotiate, and collaborate within an integrated environment. Some leading vendors of collaborative workflow applications are Lotus, EpicData, FileNet, and Action Technologies.

WIKIS

A **wiki** is a piece of server software available in a Web site that allows users to freely create and edit Web page content, using any Web browser. A wiki supports hyperlinks and has a simple text syntax for creating new pages and cross-links between internal pages on-the-fly. It is especially suited for collaborative writing.

Wikis are unusual among group communication mechanisms in that they allow the organization of contributions to be edited in addition to the content itself. (The term *wiki* means "quick" or "to hasten" in the Hawaiian language; e.g., "Wiki Wiki" is the name of the shuttle bus in Honolulu International Airport.) The term *wiki* also refers to the collaborative software that facilitates the operation of a wiki Web site.

A wiki enables documents to be written collectively in a very simple markup, using a Web browser. A single page in a wiki is referred to as a "wiki page," and the entire body of pages, which are usually highly interconnected via hyperlinks, is "the wiki"; in effect, it is a very simple, easier-to-use database. For further details, see **en.wikipedia.org/wiki/Wiki** and **wiki.org.**

Wikis come in many shapes and formats, one of which is a wikilog.

Wikilog

A wikilog (or wikiblog) is an extension of a blog, which is usually created by an individual (or maybe a small group) and may have a discussion board. A **wikilog** is essentially a blog that allows everyone to participate as a peer (a combination of wikis and blogs, also known as a *bliki*). Anyone may add, delete, or change content. It is like a loose-leaf notebook with a pencil and eraser left in a public place. Anyone can read it, scrawl notes, tear out a page, and so on. Creating a wikilog is a collaborative process. Any information being collected in a wiki can be changed or deleted by anyone (though many wikis preserve previous copies of posted contributions in the background). Unlike protected Web pages, articles added to a wiki are at the editorial mercy of the wiki's other participants. For further details, see **usemod.com/cgi-bin/mb.pl?WikiLog.**

Commercial Aspects of Wikis and Their Derivatives

Because wikis are a relatively new technology, it is difficult to assess their commercial potential. However, the research firm Gartner Group predicts that wikis will become mainstream collaboration tools in at least 50 percent of companies by 2009 (see WikiThat.com, 2005). In addition to being used for collaboration, wikis can replace e-mail because wikis are open source, spam-free communication tools. The benefits of the technology are demonstrated in the DrKW application case at the end of this chapter. A major vendor of wiki commercialization is Socialtext (**socialtext.com**).

COLLABORATION HUBS

One of the most popular forms of B2B e-commerce is the **collaboration hub**, which is used by the members of a supply chain to help improve effectiveness between manufacturing companies, their suppliers, and contract producers by reducing inventory, improving flexibility, and increasing supply-chain transparency through the Internet. For details, see Turban et al. (2006).

COLLABORATIVE NETWORKS

Traditionally, collaboration took place among supply-chain members, frequently those that were close to each other (e.g., a manufacturer and its distributor, a distributor and a retailer). Even if more partners were involved, the focus was on the optimization of information and product flow between existing nodes in the traditional supply chain. Advanced approaches, such as collaborative planning, forecasting, and replenishment (CPFR; see Section 10.9), do not change this basic structure.

Traditional collaboration results in a vertically integrated supply chain. However, Web technologies can fundamentally change the shape of the supply chain, the number of players in it, and their individual roles. In a *collaborative network*, partners at any point in the network can interact with each other, bypassing traditional partners. Interaction may occur among several manufacturers or distributors, as well as with new players, such as software agents that act as aggregators, business-to-business (B2B) exchanges, or logistics providers. For discussion and examples, see Turban et al. (2006) and **logility.com**

CORPORATE (ENTERPRISE) PORTALS

A **corporate (enterprise) portal** is a gateway to a corporate Web site that enables communication, collaboration, and access to company information. A corporate portal is a personalized, single point of access through a Web browser to critical business information located inside and outside an organization. In contrast with commercial portals such as Yahoo! and MSN, which are gateways to general information on the Internet, corporate portals provide a single point of access to information and applications available on the Internet, intranets, and extranets of a specific organization. Several types of corporate portals facilitate communication and collaboration. For details, see Chapter 17 (an online chapter).

Section 10.8 Review Questions

1. Describe VoIP and its advantages.
2. Define *collaborative workflow*.
3. Define *wiki* and *wikilog*.
4. Define *collaborative hub*.
5. Define *corporate (enterprise) portal*.

10.9 COLLABORATIVE EFFORTS IN DESIGN, PLANNING, AND PROJECT MANAGEMENT

Three major collaborative efforts are in the areas of joint design, collaborative planning, and project management.

COLLABORATIVE DESIGN AND PRODUCT DEVELOPMENT

The opening vignette in this chapter illustrates the potential benefits of computer-supported design and new product development.

Collaborative product development involves the use of product design and development techniques across multiple companies to improve product launch success and reduce cost and time to market. During product development, engineering and design drawings can be shared over a secure network among the contract firm, testing facility, marketing firm, and downstream manufacturing and service companies. Other techniques include sharing specifications, test results, design changes, and using online prototyping to obtain customer feedback. Development costs can be reduced by tightly integrating and streamlining communication channels.

Example: Reduction of Product Development Time: Caterpillar, Inc.

Caterpillar, Inc. (**caterpillar.com**), is a multinational heavy-machinery manufacturer. In the traditional mode of operation, cycle time along the supply chain was long because the process involved paper-document transfers among managers, salespeople, and technical staff. To solve the problem, Caterpillar connected its engineering and manufacturing divisions with its active suppliers, distributors, overseas factories, and customers through an extranet-based global collaboration system. By means of the collaboration system, a request for a customized tractor component, for example, can be transmitted from a customer to a Caterpillar dealer and on to designers and suppliers, all in a very short time. Customers can use the extranet to retrieve and modify detailed order information while the vehicle is still on the assembly line. Remote

collaboration capabilities between the customer and product developers have decreased cycle time delays caused by rework time. Suppliers are also connected to the system, so they can deliver materials or parts directly to Caterpillar's repair shops or directly to the customer, if appropriate. The system is also used for expediting maintenance and repairs.

For comprehensive coverage of collaborative virtual design environments, see Manninen (2004). For an example of how General Motors collaborates on designing its new models using its Advanced Design Studio to support collaboration of its design engineers with design engineers of more than 1,000 key suppliers, refer to Application Case 10.2.

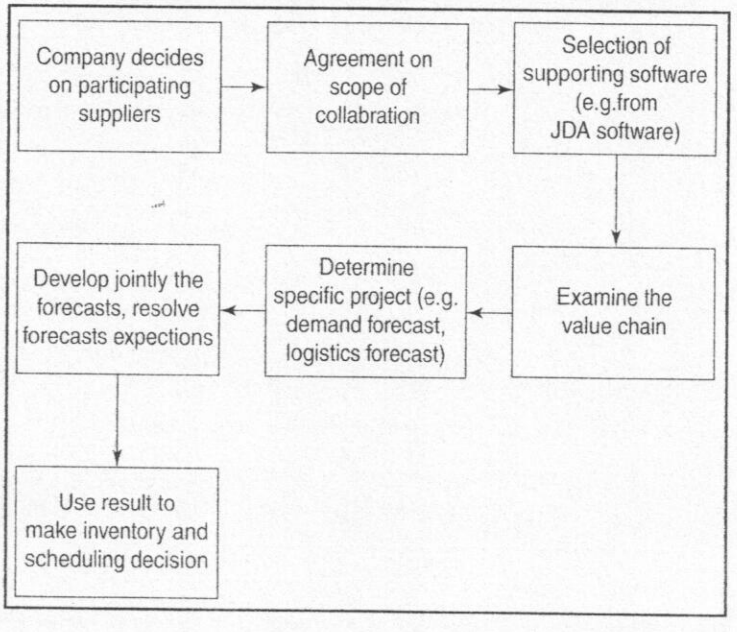
COLLABORATIVE PLANNING ALONG THE SUPPLY CHAIN

Collaborative planning is designed to synchronize production and distribution plans and product flows, optimize resource utilization over an expanded capacity base, increase customer responsiveness, and reduce inventories. In *collaborative planning*, business partners—manufacturers, suppliers, distribution partners, and others—create the initial demand (or sales) forecasts, provide changes as necessary, and share information (e.g., actual sales, their own forecasts). Thus, all parties work according to a unified schedule aligned to a common view and all have access to order and forecast performance that is globally visible through electronic links. Schedule, order, and product changes trigger immediate adjustments to all parties' schedules. There is an industry project in this area known as CPFR.

The CPFR Project

Collaborative planning, forecasting, and replenishment (CPFR) is an industry-wide project in which suppliers and retailers collaborate in planning and demand forecasting in order to ensure that members of the supply chain will have the right amount of raw materials and finished goods when they need them. When implementing a CPRF project, the collaborators agree on a standard process, shown in Figure 10.4. The process ends with an order forecast. CPFR provides a standard framework for collaborative planning. Retailers and vendors determine the "rules of engagement," such as how often and at what level information will be provided. Typically, they share greater

FIGURE 10.4 The CPFR Process



amounts of more detailed information, such as promotion schedules and item point-of-sale history, and use store-level expectations as the basis for all forecasts.

The idea of CPFR is to improve demand forecasting for all the partners in the supply chain and then communicate forecasts, using information-sharing applications (already developed by technology companies such as Manugistics, Oracle, and i2). For the retailer, collaborative forecasting means fewer out-of-stocks and resultant lost sales and less stored inventory. For the manufacturer, collaborative forecasting means fewer expedited shipments, optimal inventory levels, and optimally sized production runs.

Besides working together to develop production plans and forecasts for stock replenishment, suppliers and retailers also coordinate the related logistics activities (such as shipment or warehousing), using a common language standard and new information methodologies.

A 2002 survey (see Bradley, 2002) found that 67 percent of 43 large food, beverage, and consumer products companies were researching, piloting, or implementing CPFR. About half of the respondents who were looking at CPFR said they planned to go ahead with their initiatives. However, CPFR is not the answer for all trading partners or all types of stock-keeping units (SKUs). According to Tim Paydos, a vice president of marketing at Syncra Systems, CPFR has generated the highest payback with either highly promoted or seasonal goods, whose inventories historically have often been misaligned with demand. "If I'm going to make the investment in CPFR," noted Paydos, "I want to do it with the products with the greatest return" (Bradley, 2002).

The CPFR strategy has been driven by Wal-Mart and various benchmarking partners. After a successful pilot between Wal-Mart and Warner-Lambert involving Listerine products, a Voluntary Interindustry Commerce Standards (VICS) subcommittee was established to develop the proposed CPFR standard for the participating retailing industries (i.e., Wal-Mart's suppliers).

Ace Hardware Corp. and Sears have had interesting applications of CPFR as discussed in Application Case 10.10.

CPFR can be used with a company-centric B2B, sell-side, or buy-side marketplaces. For more on the benefits of CPFR, see **vics.org/committees/cpfr**.

Vendor-Managed Inventory

With **vendor-managed inventory (VMI)**, retailers make their suppliers responsible for determining when to order and how much to order. The retailer provides the supplier with real-time information (e.g., point-of-sale data), inventory levels, and a threshold below which orders are to be replenished. The reorder quantities also are predetermined and usually recommended by the supplier. By using this approach, the retailer is no longer burdened with inventory management, demand forecasting becomes easier, the supplier can see the potential need for an item before the item is ordered, there are no purchase orders, inventories are kept low, and stockouts occur infrequently. This method was initiated by Wal-Mart in the 1980s and was supported by an electronic data interchange (EDI). Today, it can be supported by CFPR and special software. VMI software solutions are provided by Sockeye Solutions, Cactus Communications, and JDA Software. For details, see Bury (2004).

For other innovative collaborative solutions to supply-chain problems, see **logility.com**.

PROJECT MANAGEMENT

Developing large-scale projects requires collaboration of a large number of units and individuals inside and outside an organization. Effective and efficient communication and collaboration is a must. Here is an example of how one company is doing it effectively:

Application Case 10.10

CPFR Initiatives at Ace Hardware and Sears

Ace Hardware Corp. (**acehardware.com**), based in Oak Brook, Illinois, is a chain of 5,100 independently owned stores that sell everything from 10-penny nails to toasters. In 1999, Ace implemented a CPFR process, using its buy-side private exchange, to achieve more intelligent relationships with its suppliers. This platform creates and executes a single, shared demand forecast, allowing Ace to increase revenue while reducing costs.

Ace began using CPFR with a single supplier, Henkel Consumer Adhesives, a manufacturer of duct tape, adhesives, and other do-it-yourself home and office products. During the first year of implementation, the two companies improved forecast accuracy by 10 percent, lowered distribution costs by 28 percent, lowered freight costs by 18 percent, increased annual sales by 9 percent, and increased employee productivity by more than 20 percent.

Since then, Ace has implemented CPFR initiatives with several dozen suppliers, including Black & Decker, Rust-Oleum, Master Lock, and Sherwin-Williams. More accurate forecasts and seasonal profiles ensure that products are available when consumers want to buy them. Improved service levels, increased sales, and decreased supply-chain costs have combined to make Ace Hardware more competitive.

To improve efficiency and effectiveness of inventory management with its major suppliers, Sears (**sears.com**) is using CPFR software from GNX (**gnx.com**). The system enables total supply-chain visibility. The first experiment was with all major tire vendors (e.g., Michelin, Goodyear, Sumitomo). Using this software, all partners collaborated weekly about optimal replenishment and inventory plans to minimize stock, maximize customer service level, and optimize transport. Each week's actual and forecast sales information were refreshed for more than 500 SKUs related to tires. The initial results of the pilot project were so successful that Sears is implementing the program with all its strategic partners.

Sources: Compiled from D. Buss, "CPFR Initiative Allows Ace to Boost Revenue While Cutting Costs," *Stores*, September 2002; and H.L. Richardson, "The Ins & Outs of VMI," *Logistics Today*, Vol. 45, No. 3, 2004.

Example: Pfizer's Computer-Aided Document Management and Collaborative System

The process of bringing a new drug to market may take 6 to 10 years, and fewer than 10 percent of drugs actually make it. Food and Drug Administration (FDA) approval, which is the final step, takes 18 to 24 months. The U.S. government is putting pressure on drug manufacturers to collaborate with the FDA to cut this step to 12 months. To do so, Pfizer developed a special system called Electronic Submission Navigator (ESUB) that has the following capabilities:

- Provides a global view of the status of a trial or application process.
- Enhances Pfizer's competitive advantage by linking drug researchers around the world; ESUB has attracted business partners, including other drug manufacturers seeking to forge strategic alliances with Pfizer to help market and distribute their drugs.
- Enables Pfizer to penetrate world markets much more quickly by filing concurrent submissions in different countries.
- Gives the company the ability to deliver five new drugs every 12 months—the fastest rate in the industry.
- Allows portable review with a full-featured system, which is important because the FDA frequently uses outside consultants.

For details, see M. Blodgett, "Prescription Strength," *CIO*, February 1, 2000, and **pfizer.com** (accessed April 2006).

For an example of project management at Safeway, see Online File W10.5.

Section 10.9 Review Questions

1. Define *CPFR* and describe its process.
2. Define *VMI*.
3. Describe the benefits of collaboration to project management.

10.10 CREATIVITY, IDEA GENERATION, AND COMPUTERIZED SUPPORT

A major task in the decision-making/problem-solving process is generation of alternative courses of actions. Knowledge and experience can help in this task, but we frequently need new and innovative ideas. These can be achieved via creativity and idea generation.

CREATIVITY

Creativity is the human trait that leads to the production of acts, items, and instances of novelty and the achievement of creative products. *Creativity* is complex. Personality-related creativity traits include inventiveness, independence, individuality, enthusiasm, and flexibility, and these traits have been assessed through the widely-used Torrance Tests of Creative Thinking (TTCT; e.g., Cramond, 1995). However, researchers have established that creativity can be learned and improved and is not as strongly dependent on individual traits as originally thought. Innovative companies recognize that creativity may not necessarily be the result of having traits (i.e., being a genius) as much as the result of being in an idea-nurturing work environment (e.g., see Gatignon et al., 2002).

After a problem is formulated, potential criteria and alternatives must be identified. Creative ideas generally lead to better solutions. In brainstorming, there are some specific creativity measures: the quantitative (number of ideas) and qualitative (quality of ideas) components. Both can be positively affected by the use of software that concentrates on idea generation and evaluation of creative solutions to problems.

When creativity is unleashed, it can dramatically enhance productivity and profitability in the long run. Creativity is important in problem solving (see Handzic and Cule, 2002), and thus it is critical to develop computerized support systems for it.

Creativity and innovation can be stimulated also by a number of environmental factors. An environment that meets the "serious play" criterion is part of the process. Stimulation by other creative people in the environment can push a group forward. How? Some stimulation can come directly from exciting ideas developed as a consequence of association (i.e., synergy) among creative people (e.g., during brainstorming). This can be done, for example, by presenting a person with a string of related (even distantly related) concepts. Some stimulation may even come from friction among employees. Some research suggests that some dissatisfaction and discomfort is a must to spark innovation. A manager should not hire people like himself or herself because their differences cause stimulation; for example, in brainstorming, they broaden the viewpoints (see Sutton, 2001). These differences were capitalized at Boeing-Rocketdyne in using a GSS, as Malhotra et al. (2001) described, "Innovation, most often, comes from the collaboration of individuals from a cross-section of disciplines, inside and outside of an organization."

A number of association methods have been proposed and empirically proven to be effective in stimulating creativity. And viewing ideas in a different frame (e.g., outside the box, from different angles) can stimulate creativity (see von Oech, 2002; and Creative Think, at **creativethink.com**). Next, we discuss creativity and innovation in the context of idea generation and electronic brainstorming.

IDEA GENERATION THROUGH ELECTRONIC BRAINSTORMING

Idea generation methods and techniques have been adopted to enhance the creativity of both individuals and groups. **Idea generation** software (e.g., *electronic brainstorming*) helps to stimulate the free flow of turbulent creative thinking: ideas, words, pictures, and

concepts set loose with fearless enthusiasm, based on the principle of synergy (i.e., association). Some packages are designed to enhance the creative thought process of the human mind and can be used to create new product ideas, marketing strategies, promotional campaigns, names, titles, slogans, or stories, or they can be used just for brainstorming.

Bombarding the user with many ideas is a key feature of idea-generating GDSS software. This is critical because it helps the user move away from an analytic mode and into a creative mode. Psychological research indicates that people tend to anchor their thoughts early on, using their first ideas as springboards for other ideas. Therefore, subsequent ideas may not be significantly new but simply minor variations of the original idea. Because brainstorming software is free of human subjectivity, it can help broaden the thinking platform and encourage truly unique ideas to emerge.

By definition, idea generation in GDSS is a collaborative effort. One person's idea triggers another's ideas, which trigger even more ideas (in *idea chains* developed by association). With collaborative computing-support tools (e.g., GDSS), the individuals do all the thinking, and the software system encourages them to proceed. The technology is an anonymous, safe way to encourage participants to voice opinions that they might be reluctant to express in a more conventional setting. By building on each other's ideas, people can obtain creative insights they did not have before, based on associations with existing ideas and with their memories. There is a percolation effect as ideas work their way through the process. Associations trigger memories that can activate creativity. The exchange of information (i.e., learning) can lead to increases in output and creativity (see Rees and Koehler, 1999). There are many relatively inexpensive idea-generation packages on the market. Under the right electronic brainstorming conditions, more ideas and ideas that are more creative overall can be generated. A number of different conditions have been explored.

Generally, if the right approach is used in electronic brainstorming, more ideas and more creative ideas are generated. But a word of caution is in order: Sometimes a group may experience a process gain in the number of ideas and the number of creative ideas but also experience a process loss resulting from information overload or lack of group well-being and member support (see Dennis and Reinicke, 2004). The results of each idea-generation session can be stored in the organizational memory so that results can be carried over from one meeting to another to enhance the creativity of more people.

What if an individual needs to brainstorm alone? There are methods for enhancing individual brainstorming. Satzinger et al. (1999) developed a simulated brainstorming package to help individuals trigger more creative responses when brainstorming alone. They compared the impact of a simulator that randomly generates ideas to an individual decision maker with an individual decision maker not using a simulator in brainstorming. The participants using the simulator generated more ideas and more creative ideas than the others.

Loosely related to brainstorming, *cognitive maps* (e.g., Banxia's Decision Explorer) can help an individual or a group understand a messy problem, develop a common frame, and enhance creativity. A cognitive map shows how concepts relate to each other, thus helping users organize their thoughts and ideas. In this way, they can visualize the problem they are trying to solve (**banxia.com**).

CREATIVITY-ENHANCING SOFTWARE

Although electronic brainstorming enhances creativity, it is primarily human beings who produce the results. In the next two subsections, we describe software and methods (other than brainstorming) that enhance human creativity by actually performing some of the creative tasks of a human being. Some of these systems actually exhibit creative behavior.

Computer Programs That Exhibit Creative Behavior

For several decades, people have attempted to write computer programs that exhibit intelligent behavior. A major characteristic of intelligent behavior is creativity. Can computers be creative?

Intelligent agents (i.e., smartbots) can function as facilitators in GDSS. Chen et al. (1995) described an experiment in which an intelligent agent assisted in idea convergence. The agent's performance was comparable to that of a human facilitator in identifying important meeting concepts, but it was inferior in generating precise and relevant concepts. However, the agent was able to complete its task faster than its human counterparts. This concept is in its infancy but has potential for supporting Web-based GDSS, where the facilitator cannot be available on a 24/7 basis.

Rasmus (1995) described three creativity tools. The first one is called Copycat, a program that seeks analogies in patterns of letters. Identifying patterns is the essence of intelligence. Copycat, consisting of several intelligent agents, can find analogies to strings of letters (e.g., find an analogy for transforming *aabc* to *aabd*). This ability can be generalized to other problems that require conceptual understanding and the manipulation of objects. The capability of the program to anticipate the meaning of the transformation and find analogous fits provides evidence that computers can mimic a human being's ability to create analogies. The second system, Tabletop, is also capable of finding analogies. A third system, AARON, is a sophisticated art drawing program that has resulted from 15 years of research. Its developer, Harold Cohen, created a comprehensive knowledge base to support AARON. Similar computer programs have been developed to write poems and music and create works in other media. The increased knowledge base, processing speed, and storage now available enable such programs to create artwork of good quality.

Electronic Idea Generation for Problem Solving

Goldfire (from Invention Machine Corp., **invention-machine.com**) is an intelligent partner that accelerates technical innovation. Goldfire's semantic processing technology reads, understands, and extracts key concepts from company databases, intranets, and the Internet. The software reads content, creates a problem solution tree (i.e., knowledge index), and delivers an abstract listing of the technical content in relevant documents. Goldfire uses scientific and engineering knowledge as the foundation for its semantic algorithms to accelerate new product and process design innovations.

Goldfire is based on the theory of inventive problem solving (TRIZ—a Russian acronym). TRIZ was first developed by Genrich Altshuller and his colleagues in Russia in 1946 (Altshuller Institute for TRIZ Studies, 2006). More than 2 million patents were examined, classified by level of inventiveness, and analyzed to look for the following innovation principles:

- Problems and solutions are repeated across industries and sciences.
- Patterns of technical evolution are repeated across industries and sciences.
- Innovations may successfully use scientific effects outside the field where they were developed.

The TRIZ creative process is described on the Web sites of *The TRIZ Journal* (**triz-journal.com**) and Ideation International (**ideationtriz.com**).

Software That Facilitates Human Creativity

Several software packages can help stimulate creativity. Some have very specific functions, and others use word associations or questions to prompt users to take new, unexplored directions in their thought patterns. This activity can help users break cyclic

thinking patterns, get past mental blocks, or overcome procrastination. Such software can use several different approaches to release the user's flow of ideas. Creative WhackPack is an example of this type of software.

Creative Think (**creativethink.com**) provides the Creative WhackPack, a deck of 64 cards that "whack" you out of habitual thought patterns and let you look at your problem in a new way. The cards ("a physical package") are designed to stimulate the imagination. Fortunately, all 64 illustrated cards are up and running on the Web site (as software); you can click the Give Me Another Creative Whack button to select one at random.

Section 10.10 Review Questions

1. Define *creativity*.
2. Relate creativity to collaboration and problem solving.
3. List software categories of creativity enhancement.
4. Describe software programs that exhibit intelligent behavior.

Chapter Highlights

- People collaborate in their work (called groupwork). Groupware (i.e., collaborative computing software) supports groupwork.
- Group members may be in the same organization or may span organizations; they may be in the same location or in different locations; they may work at the same time or at different times.
- The time/place framework is a convenient way to describe the communication and collaboration patterns of groupwork. Different technologies can support different time/place settings.
- Working in groups may result in many benefits, including improved decision making.
- Meetings have some limitations and dysfunctions. Computerized support can help.
- When people work in teams, especially when the members are in different locations and may be working at different times, they need to communicate, collaborate, and access a diverse set of information sources in multiple formats.
- Communication can be synchronous (i.e., same time), or asynchronous (i.e., sent and received in different times).
- Groupware refers to software products that provide collaborative support to groups (including conducting meetings).
- Groupware can support decision making/problem solving directly or can provide indirect support by improving communication between team members.
- Collaborative computing is known by a number of terms, including groupware, GSS, GDSS, and CSCW.
- Groups and groupwork (i.e., teams and teamwork) in organizations are proliferating. Consequently, groupware continues to evolve to support effective groupwork.
- The Internet (Web), intranets, and extranets support decision making through collaboration tools and access to data, information, and knowledge.
- An extranet links a work group from several different organizations. A common situation is to use the extranet and groupware in managing a supply chain involving several collaborative organizations.
- People may work together and communicate and collaborate at the same time or at different times and in the same place or in different places.
- Groupware for direct support such as GDSS typically contains capabilities for electronic brainstorming, electronic conferencing or meeting, group scheduling, calendaring, planning, conflict resolution, model building, videoconferencing, electronic document sharing, stakeholder identification, topic commentator, voting, policy formulation, and enterprise analysis.
- Groupware can support anytime/anyplace groupwork.
- A GSS is any combination of hardware and software that facilitates meetings. Its predecessor is known as GDSS, which provided direct support to decision meetings, usually in a face-to-face setting.
- GDSS attempts to increase process and task gains and reduce process and task losses of groupwork.
- Parallelism and anonymity provide several GDSS gains.

- GDSS
  group a
  sharing
- GDSS
  room e
  or over
- Web-ba
  place cc
- GDSS i
  follow t
  (3) brai
  sion an
  generat
- Interne
  cations
  collabor

Key Term

- asynchron
- collaborat
- collaborat
  forecastin
  (CPFR)
- corporate
- data confe
- decision r
- Delphi me
- electronic
- electronic
- enterprise
  system

Question

1. How do
2. What is
   is impor
   method
   nonverb
   computi
3. Explain
   terms of
4. Describ
   provide
5. Explain
   the Web.
6. Compar
   sion mak
7. Explain
   this, expl

- GDSS may be assessed in terms of the common group activities of information retrieval, information sharing, and information use.
- GDSS can be deployed in an electronic decision room environment, in a multipurpose computer lab, or over the Web.
- Web-based groupware is the norm for anytime/anyplace collaboration.
- GDSS for same time/same place meetings generally follow these steps: (1) planning, (2) question posing, (3) brainstorming, (4) idea organization, (5) discussion and idea prioritization, and (6) more idea generation.
- Internet telephony, or VoIP, is an efficient communications media with many applications that facilitate collaboration.
- Creativity is a complex concept that is used to generate alternative courses of actions in decision making.
- Creativity can be learned and fostered with good managerial techniques and a supportive environment.
- Idea generation (i.e., electronic brainstorming) allows participants to generate and share ideas simultaneously and anonymously.
- Human creativity can be supported with idea generation (i.e., electronic brainstorming) systems.
- Creativity software programs use association and "thinking outside the box" to trigger new concepts.

Key Terms

- asynchronous
- collaboration hub
- collaborative planning, forecasting, and replenishment (CPFR)
- corporate (enterprise) portal
- data conferencing
- decision room
- Delphi method
- electronic brainstorming
- electronic meeting system (EMS)
- enterprise-wide collaboration system
- group decision support system (GDSS)
- group support system (GSS)
- groupthink
- groupware
- groupwork
- idea generation
- Internet telephony
- nominal group technique (NGT)
- online (electronic) workspace
- parallelism
- process gain
- process loss
- screen sharing
- synchronous (real-time)
- teleconferencing
- vendor-managed inventory (VMI)
- video teleconferencing (videoconferencing)
- virtual meeting
- virtual team
- Voice over IP (VoIP)
- wiki
- wikilog

Questions for Discussion

1. How does groupware attain its primary objective?
2. What is nonverbal communication? Explain why it is important in human-to-human interaction. What methods are currently being used to incorporate nonverbal communication into collaborative computing?
3. Explain why it is useful to describe groupwork in terms of the time/place framework.
4. Describe the kinds of support that groupware can provide to decision makers.
5. Explain why most groupware is deployed today over the Web.
6. Compare GDSS and noncomputerized group decision making.
7. Explain why meetings can be so inefficient. Given this, explain how effective meetings can be run.
8. Discuss the details of process gains (i.e., benefits) of groupwork.
9. Discuss the details of process losses (i.e., dysfunctions) of groupwork.
10. Explain how GDSS can increase some of the benefits of collaboration and decision making in groups and eliminate or reduce some of the losses.
11. The original term for group support system (GSS) was group decision support system (GDSS). Why was the word *decision* dropped? Does this make sense? Why or why not?
12. Discuss how parallelism and anonymity can produce improvements in group processes.
13. Describe the three technologies through which GSS is deployed. What are the advantages and disadvantages of each?

14. Explain in detail what creativity is and how it relates to decision support.
15. Explain how GSS can support creativity.
16. Explain how idea generation (i.e., electronic brainstorming) works.
17. Can computers be creative? Why or why not? Discuss.
18. Discuss the benefits of CPFR to retailers and suppliers.
19. Discuss the improvements to supply-chain management that result from using CPFR and VMI.
20. Explain the potential benefits of wikis to a director of marketing.
21. Discuss the benefits of VoIP as a facilitator of communication.
22. Discuss the benefits of collaborative design.
23. Discuss the benefits of CPFR and relate it to decision support.

Exercises

Teradata University and Other Hands-on Exercises

1. Make a list of all the communications methods (both work and personal) you use during your day. Which are the most effective? Which are the least effective? What kind of work or activity does each communications method enable?
2. Investigate the impact of turning off every communication system in a firm (i.e., telephone, fax, television, radio, all comter systems). How effective and efficient would the following types of firms be: airline, bank, insurance company, travel agency, department store, grocery store? What would happen? Do customers expect 100 percent uptime? (When was the last time a major airline's reservation system was down?) How long would it be before each type of firm would not be functioning at all? Investigate what organizations are doing to prevent this situation from occurring.
3. Read Application Case 10.10 ("CPFR Initiatives at Ace Hardware and Sears") and answer the following questions:
   a. What motivated Ace to try CPFR?
   b. Describe how Ace deployed its CPFR system.
   c. Can you guess the common characteristics of the suppliers Ace used first?
   d. Why did Sears start using CPFR with tires?
   e. What are the benefits of CPFR to Sears and to its suppliers?
4. Investigate how researchers are trying to develop collaborative computer systems that portray or display nonverbal communication factors.
5. For each of the following software packages, check the trade literature and the Web for details and explain how computerized collaborative support system capabilities are included: Groove, GroupSystems OnLine, NetMeeting, and WebEx.
6. From your own experience or from the vendor's information, list all the major capabilities of Lotus Notes and explain how they can be used to support decision making.
7. Compare Simon's four-phase decision-making model (see Chapters 1 and 3) to the steps in using GDSS.

Exercises

Team Assignments and Role-Playing

1. Access **groove.net.** Download the demo software to each group member's computer and use it to brainstorm and vote on a specific problem or issue. When brainstorming, think broadly. Did you feel comfortable with the software? Why or why not?
2. Access the Web site of a for-lease Web-based groupware service (e.g., Meetmenow at WebEx). Describe what features it offers and how they could help the members of a group work together. If the site offers a free trial, have your group try it out and report your experience to the class.
3. Some GDSS researchers are concerned with the cross-cultural effects of computer system use. This is especially important in GDSS where opinions are usually entered and synthesized by meeting participants at different places around the globe. Examine the literature and write a report on the major issues of how GDSS provides either process gains or processes losses in a multicultural electronic meeting setting.
4. Access a demo version of a GSS (e.g., Groove, WebEx, NetMeeting) on the Web. Use the system for a meeting of your group to solve another group assignment for any of your courses (check with your instructor). Explain why you did or did not feel comfortable with the software.

5. Prepare a study of all the major Web conferencing software—Centra EMeeting, Genesys Meeting Center, GoToMeeting.com, WebEx Meeting Center, Microsoft Live Meeting, and Oracle.
6. Go to **ifip-dss.org** and find recent material on GSS. At this site, also look at the June 2006 conference proceedings on creativity and innovation in decision support. Prepare a report on your findings.
7. A major claim in favor of wikis is that they can replace e-mail, eliminating its disadvantages (e.g., spam). Go to **socialtext.com** and review such claims. Find other supporters of switching to wikis. Then find counter arguments and conduct a debate on the topic.
8. Go to **ibm.com/software** and find information on the Workplace family of products. Identify all the products that facilitate collaboration and list their major capabilities. Make sure to check Lotusphere and Lotus Domino Express.

Exercises

Internet Exercises

1. Search the Internet to identify sites that describe methods for improving meetings. Investigate ways that meetings can be made more effective and efficient.
2. Go to **groupsystems.com** and identify its current GSS products. List the major capabilities of those products.
3. Go to the Expert Choice, Inc., Web site (**expertchoice.com**) and find information about the company's group support products and capabilities. Team Expert Choice is related to the concept of the AHP described in Chapter 4. Evaluate this product in terms of decision support. Do you think that keypad use provides process gains or process losses? How and why? Also prepare a list of the product analytical capabilities. Examine the free trial. How can it support groupwork?
4. Identify five real-world GSS success stories at vendor Web sites (using at least three different vendors). Describe them. How did GSS software and methods contribute to the successes? What common features do they share? What different features do individual successes have?
5. Go to **creativethink.com** with a problem in mind that you are trying to solve (e.g., selecting a graduate school or a job). Click the Give Me Another Whack button to enhance your thinking. Try a few whacks to see if they can help you. Do they?
6. For one of the creativity software packages described in the text, go to the company's Web site, download and try out a demo, and describe your experience in a report. Include what you liked and didn't like and what you found useful and didn't find useful.
7. Go to **groove.net**, **collabnet.com**, and other companies that provide workspace products. Summarize the capabilities of each product.
8. Go to **logility.com**. Review collaborative products that optimize supply chains.
9. Go to **software.emc.com/products/software_az/eroom_enterprise.htm?hlnav=T** and find the product's capabilities. Write a report.

End of Chapter Application Case

Dresdner Kleinwort Wasserstein Uses Wiki for Collaboration

Dresdner Kleinwort Wasserstein (DrKW) is the international investment banking arm of Dresdner Bank. Based in Europe, DrKW provides a range of capital markets and advisory services, and it employs approximately 6,000 people worldwide.

Because of the large number employees, their geographic distribution, and the diversity of cultures, it became necessary to provide a range of collaborative tools, from blogs and wikis to IM, chat and audio/video-conferencing in order to allow people to move between modes, depending on which was most appropriate at the time. DrKW installed a primitive open source wiki in 1997. The company reviewed Socialtext products in March 2004 and ran a small pilot on the hosted service in July

2004. Based on the pilot, DrKW decided to upgrade to Socialtext Enterprise, which was installed in the third quarter of 2004.

DrKW chose Socialtext because the company was willing to work with DrKW on better authentication, permissioning, and sharing of information and communication among silos as well as the vendor, and it understood the necessity for information to flow across multiple forms of communications. Because DrKW is highly regulated, everything must be recordable, archivable, searchable, and retrievable.

USAGE AND BENEFITS

The Information Strategy team was the first group to use Socialtext on a hosted service. Because its work needed structure, skills were geographically dispersed, and publication and collaboration at an individual level gained many capabilities through the Socialtext workspace. The team uses it as a communications tool, a collective discussion tool, and as a storehouse for documents and information.

The user-centered design (UCD) team incorporates usability into external-facing applications used across all business lines. The wiki allows all team members to upload information more easily, which encourages collaboration and transparency by making the sharing of e-mail conversations and other ideas uncomplicated. UCD also uses the wiki to help explain what user-centered design is and why it is important to a wider DrKW community as well as to share presentations, documents, and reports.

One of the most important roles of the wiki is to track project development so that the team and management know what progress is being made, regardless of individual geographical locations and to raise the team's awareness about what each person is doing, the status of each project, and what actions should follow.

In 2004, the Equity Delta1 equity financing team was one of the largest users of the wiki. This unit deals with loans, equity swaps, and so on. It began using the wiki workspace to eliminate the cumbersome number of e-mails, to view the development of business plans, and to store commonly used information. The team also creates an open forum where anyone can post views, comments, and questions on given subjects, publish and share white papers and bulletins, coordinate sales and marketing activities, and organize important team tasks.

The E-Capital London Team develops back-end applications for the Digital Markets business line and supports a number of legacy systems. It uses Socialtext to share and develop new system specifications and product overviews and to help with documentation. The wiki provides an instantly editable collaboration platform that simplifies the publication process. The version history function is useful for product specs, where it is important to retain a complete audit trail.

Socialtext also enables individuals to edit the intranet quickly and easily. For example, it is helping build an internal glossary that defines company jargon through employees doing similar jobs. The Wikipedia-style usage cuts down the training time and costs of new hires because it helps them understand internal and external jargon more quickly and easily. It also simplifies the roles of people writing in other locations and languages. Eventually, the wiki will be used for informal training, which will encourage its use.

Sources: SocialText, Dresdner Kleinwort Wasserstein (DrKW), 2004, **socialtext.com/customers/customerdrkw/** (accessed February 2006); and "E-mail Is So Five Minutes Ago," *BusinessWeek Online*, November, 28, 2005, **businessweek.com/magazine/content/05_48/b3961120.htm** (accessed August 2006).

QUESTIONS FOR THE CASE

1. What capabilities of a wiki are not available in e-mail?
2. Describe the applications of wikis in finance and operations.
3. How does DrKW's wiki increase employee productivity?
4. How does DrKW's wiki help with foreign languages and training?

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