Case Study

Group Work, "Groupware," and the Transformation of Information Resource Management

RICHARD M. KESNER

Abstract: This essay briefly considers the increasingly important role of computer-mediated tools in effective organizational communications: (1) electronic mail, offering one-to-one communication; (2) electronic conferencing, offering many-to-many communication; and (3) corporatewide information systems (CWIS), offering one-to-many communication. It then proceeds to explore in greater detail the role that a new generation of computer software, so-called groupware, is coming to play as an enabler and enhancer of these technologies, thus transforming information resource management (IRM) within the modern organization. The author illustrates his points through the use of three mini–case studies. The first and primary example considers the impact of groupware on the operations of Babson College. The Babson study is supplemented by two summary references to the use of similar products within a global accounting/consulting firm and within a large U.S. government agency.

This essay was prepared for the *American Archivist* in October 1992. Although some of the bibliographic notes have been superseded, the concepts and issues addressed in this paper are as relevant today as they were when originally written.

About the author: *Richard M. Kesner currently serves as a coordinator of Babson College's reengineering efforts as well as its chief information officer, where he is responsible for all aspects of the college's use of information technologies, including computer services, media services, voice and data communications, library services and resources, museums, and archives. He is also president and senior consultant for RMK Associates, Inc., a management, strategic planning, and management information services consulting firm, working with banks, insurance companies, professional and consulting organizations, and a wide range of public institutions.*

Prior to forming RMK Associates, Richard Kesner served as vice president of development and systems for the Parkman Companies, a diversified real estate development and management company, and prior to that as vice president of general services and MIS for Multibank Financial Corporation.

Kesner holds an M.A. and a Ph.D. from Stanford University, and an A.B. and M.B. from Oberlin College. He has completed postdoctoral training in finance and strategic planning at the Wharton School, University of Pennsylvania. He has spoken internationally before professional and business audiences, has published seven books and numerous articles, and is currently working on a practical guide to organizational change management called The Informated Enterprise.

CONSIDER SHARON STEIN, a typical busy executive. While simultaneously managing a number of complex assignments, she must also keep abreast of what is going on in the larger organization. She does not have the luxury of a research staff to assist her, but, fortunately, she does not require such services. Instead, she merely flicks on her desktop workstation, and within seconds the corporation's electronic information library pops onto her screen as a series of Lotus NOTES icons. These information resource applications connect her with work teams, data libraries, and presentation tools located throughout the organization—both in the United States and abroad. Thus, Stein always has the most current information at her fingertips and can share her own contributions with others automatically. As she travels from her home office to outlying sites, the system collects, stores, and forwards all the data in various formats that she will need when she arrives. To access these files, she needs only plug or dial into her organization's network, where she may then pick and choose with ease, addressing her immediate "need to know" and communicate. As a result, Stein stays well informed in an efficient and cost-effective manner and, in so doing, enhances her personal contribution to the team effort. Her use of information resources is fluid but focused on specific, time-dependent end products, defined and directed by the priorities of her work group.

As this scenario indicates, information is the life blood of the modern organization. Yet it is increasingly difficult to devise effective and efficient data delivery systems that reach the appropriate end users in a timely manner. Today's information resources manager must find ways to address this challenging part of his or her responsibilities. Increasingly, three of the key computer-mediated tools in this effort are

- Electronic mail, for the one-to-one exchange of ideas and documents;
- Electronic conferencing, for the electronic meeting and exchange of views by team players separated by distance and time;
- Corporatewide information systems (CWIS), for the corporatewide or communitywide sharing (i.e., one-to-many exchange) of information.

The implications and potential benefits of these services for corporate information resource management (IRM) are significant.[1] This essay considers the impact of these factors on the delivery of information services and the way groupware in particular is reshaping the IRM landscape. In addition, the essay focuses on the growing use of collaborative labor and learning in the workplace and what this means for those in information services.

Consider the nature of work today: it is highly dynamic, involving participants with varying responsibilities and skills. Indeed, collaboration is viewed as a strategy for leveraging the human and informational assets of the corporation.[2] Since the typical organization is also geographically dispersed, work teams do not always reside within the same facility or, for that matter, the same country. As collaboration extends even further—beyond the organization to corporate partners and institutional allies—still other levels of complexity are added. Even within the same organizational structure, work groups may overlap in terms of

[1]The use of the phrase *information resource management* (IRM) rather than *information systems* or *information technology* is meant to emphasize the importance of viewing information as a corporate asset to be managed, leveraged, and exploited for strategic advantage, just as other corporate assets are.

[2]Irene Grief, ed., *Computer-Supported Cooperative Work: A Book of Readings* (San Mateo, Calif.: Morgan Kaufmann Publishers, 1988); Robert Johansen, *Groupware: Computer Support for Business Teams* (New York: Free Press, 1988); Michael Schrage, *Shared Minds: The New Technologies of Collaboration* (New York: Random House, 1990).

the human and information resources they employ.[3]

These so-called groupwork efforts have become a characteristic of organizational life because they can quickly and efficiently bring together the capabilities required to address complex problems in a timely manner. However, the groupwork approach is not without its own overhead costs. Meetings must be scheduled, travel plans must be arranged, documents must be reproduced and distributed, team members must be polled for their comments, and so forth. All of these requirements in turn may severely impact other corporate resources. Furthermore, the end products of collaborative work, which often involve the creation of analytical models; the virtual representation of products, projects, and ideas; and the delivery of multimedia documents, tend to be more dynamic than traditional committee reports. To address these issues, and indeed to abet the entire groupwork process, a new set of electronic tools has emerged that fosters workgroup productivity.[4] Some of these, like electronic mail and voice and video conferencing, are in wide use and facilitate distance learning and communication. Others, including electronic conferencing and "groupware" products, are emerging technologies that offer new and exciting opportunities to work-team participants and the information resource managers who support them.

The term *groupware* can refer to any electronic or telecommunications tool designed to facilitate the collaboration of work teams.[5] However, most products that earn the "groupware" accolade provide more rigorously defined capabilities, including the ability to operate over a diverse set of computer platforms, a graphical user interface (e.g., Microsoft's Windows, Apple's System 7, or IBM's OS/2), a shared database, electronic mail and conferencing subsystems, automatic scheduling, some type of project management or reporting tool, and a comprehensive security system.[6] To use groupware, the work team must be connected to a common local-area or wide-area network (LAN/WAN) that can handle compound documents. Such documents could include text, graphics, tables, and, possibly, scanned and audiovisual images.

To appreciate fully the robust capabilities of groupware products and their meaning to information resource managers one must consider how work processes themselves are facilitated through networked electronic information delivery systems in general and through groupware in particular.

[3]Bernard DeKoven, *Connected Executives: A Strategic Communications Plan* (Palo Alto, Calif.: Institute for Better Meetings, 1990); Lee Sproull and Sara Kiesler, *Connections: New Ways of Working in the Networked World* (Cambridge, Mass.: MIT Press, 1991); Shoshana Zuboff, *In the Age of the Smart Machine: The Future of Work and Power* (New York: Basic Books, 1988).

[4]David D. Coleman, *GroupWare '92* (San Mateo, Calif.: Morgan Kaufmann Publishers, 1992); Mehdi Khosrowpour and Gayle Yaverbaum, eds., *Information Technology Resources Utilization and Management: Issues and Trends* (Harrisburg, Pa.: Idea Group, 1990); Susanna Opper and Henry Fersko-Weiss, *Technology for Teams* (New York: Van Nostrand Reinhold, 1992); Andrew Targowski, *The Architecture and Planning of Enterprise-Wide Information Management Systems* (Harrisburg, Pa.: Idea Group, 1990).

[5]"Groupware: The Team Approach," *PC Week* 8 (Supplement, 14 October 1992): S3. See also "Groupware," *BYTE* 13 (1988), special edition on groupware.

[6]The clear industry leader for the time being is Lotus Corporation with its NOTES product. However, NOTES is just the beginning of a new wave of software written for client-server–based information processing environments and high-powered desktop workstations. See, for example, David DeJean and Sally Blanning DeJean, *Lotus Notes at Work* (New York: Lotus Books, 1991) and "Groupware: The Team Approach," *PC Week* 8.

The Modern Organization, IRM, and the Knowledge Worker

The modern organization is less bureaucratic, more complex, and more global than its counterpart of a decade ago. Increasingly, its management structure is flatter, with senior executives playing a larger role in the direct management of people, processes, and resources, including information resources. Typically, these senior players map out the strategic programs for their organization, often employing external alliances, resource sharing, outsourcing, and new information technologies to enhance overall corporate performance.

Correspondingly, the middle management layer is growing thinner. Many of its occupants now serve primarily as technical specialists who develop policies, procedures, and applications for hands-on workers. The vast majority of remaining middle managers directly contribute to value creation for the organization's ultimate customers. In this more fluid, less hierarchical environment, most if not all employees will have both IRM and production responsibilities.[7]

The information services arm of the organization acts as the information technology (I/T) standards watchdog, the keeper of networks and operating environments (i.e., the I/T infrastructure), the provider of access to external information utilities (e.g., bibliographic utilities and extracorporate electronic mail networks), and the developer and supporter of new I/T capabilities. These IRM processes encompass economical and efficient management, servicing, and support of all information that is of value to the organization in all formats. The value-added component of IRM is the information utility's ability to deliver accurate and specific information to the end user in a timely manner. As such, the twenty-first century information utility will require the services of cross-trained, highly integrated staffs of I/T professionals to act as facilitators, catalysts for change, standards monitors, and resource managers for information delivery systems that are increasingly complex and user- and user-team–driven and controlled.[8]

We often think of "information" in terms of documents, records, and files, but these are merely formalized vehicles for the delivery of data to an end user. Historically, these information products have been self-supporting and generally sufficient in terms of satisfying the needs of the end user. With recent developments in I/T, "information" alone is not satisfactory—primarily because there is too much of it and the "products" in question are insufficiently focused and unadaptable. Instead, users seek knowledge: a higher level of information, at times in multimedia formats, tailored and processed to address a specific requirement. Correspondingly, knowledge tools, such as artificial intelligence systems, relational databases, and groupware products, facilitate the manipulation of information to meet end-user needs.

Knowledge workers are end users who employ a wide range of information technologies to draw on diverse information resources to address their immediate needs through sophisticated sifting, search, and reassembly of data into highly usable formats. These are complex processes. They often require a global perspective of both the problem at hand and the information

[7]Stan Davis and Bill Davidson, *2020 Vision* (New York: Simon & Schuster, 1991); Charles R. Morris, *The Coming Global Boom* (New York: Bantam Books, 1990); John Naisbitt and Patricia Aburdene, *Megatrends 2000* (New York: William Morrow, 1990); Tom Peters, *Thriving on Chaos* (New York: Knopf, 1987).

[8]Peter F. Drucker, *The New Realities* (New York: Harper & Row, 1989); Susanna Opper and Henry Fersko-Weiss, *Technology for Teams* (New York: Van Nostrand Reinhold, 1992); Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York: Doubleday, 1990).

resources required to address it. Teams of knowledge workers, rather than individuals, are best suited to these efforts. In general, such teams develop virtual views of the organization's information resources to address short-term operational or long-term strategic needs. The documents they create may be static, but these products increasingly are based on information resources that are dynamic. This means that a document's metadata constructs may remain fairly stable over time, but the "knowledge" that this document conveys will change as the data that feed it changes.

Individuals and teams working in this context must have access to a complex array of information resources, including printed publications of all kinds, information systems documentation, bibliographic and other information utilities, proprietary and public databases, and the thoughts and voices of colleagues. But access alone is not enough. To be empowered and, indeed, to add value to the information at hand, the knowledge worker requires independent data processing capabilities, including a personal computer workstation with local- and wide-area network connectivity; a multimedia receipt and transmission capacity; and even artificial-intelligence–based IRM applications. Given these tools, workers can more readily address their self-managed assignments, efficiently and effectively interact with colleagues, and enhance the knowledge base of the organization through data sharing and groupwork.[9]

The knowledge-worker scenario described here reflects a growing desire within the modern organization to enhance the productivity and corporate contribution of each employee. To achieve this end, information services must be tailored to the specific needs of the worker and readily accessible at the desktop. Furthermore, since work is increasingly a group effort, calling for information systems that not only integrate diverse data resources but also bring workers together electronically, groupware affords a particularly promising avenue for exploration.

Groupware: An IRM Strategy and Its Implications

Most organizations are buried in information, much of it communicated via paper even though it may exist simultaneously in an electronic format. Document distribution tends to be costly and dysfunctional. Thus, knowledge workers do not get what they need when they need it. Furthermore, data often come to the end user in a static form that can be altered only after a process of wasteful rekeying. To avoid these pitfalls, many information resource managers, especially those in geographically dispersed organizations, have turned to electronic delivery systems.[10]

The most familiar of these approaches is electronic mail. E-mail has repeatedly demonstrated its worth as a means of shipping messages and documents throughout an organization. It is expressly designed to afford electronic communication between a given individual "sender" and one or more recipients. Although e-mail systems are often used to broadcast messages within a large group, they are not always suited for the transmission of large, complex documents on an as-needed basis. Nor do

[9]"Workgroup Technology: Tying Technology to Business Objectives," *International Data Corporation White Paper* (Framingham, Mass.: IDC, 1992); James S. Henry, *The Impact of Lotus Notes on Productivity* (Cambridge, Mass.: Lotus Development Corporation, 1992); Edward Szewczak et al., eds., *Management Impacts of Information Technology: Perspectives on Organizational Change and Growth* (Harrisburg, Pa.: Idea Group, 1991).

[10]James C. Emery, *The Strategic Imperative* (Oxford: Oxford University Press, 1987); Shailendra Palvia et al., eds., *The Global Issues of Information Technology Management* (Harrisburg, Pa.: Idea Group, 1991); Charles Wiseman, *Strategic Information Systems* (Homewood, Ill.: Irwin, 1988).

most e-mail systems lend themselves to interactive exchanges.

To address this type of information-sharing requirement, many organizations are now turning to electronic conferencing or videoconferencing, which enables a select group of users to interact, reviewing and commenting both on data and on the remarks of their fellow team members. This type of "many-to-many" communication works well within well-defined groups of knowledge workers. However, like electronic mail, videoconferencing and electronic conferencing systems are not designed for organizationwide information sharing, nor are they the easiest and most economical ways of promoting groupwork. Furthermore, videoconferencing products place time and financial constraints on their users and, typically, fail to deliver information on demand. Older electronic conferencing products usually lack easy-to-use interfaces and associated services that would make them attractive to nontechnical users.[11]

In their search for a satisfactory alternative, many organizations are now investing in electronic libraries and bulletin boards for information dissemination. These vehicles store both time-sensitive data, such as events and schedules, and voluminous documents, such as policy and procedure manuals, in machine-readable formats. Employing a limited number of keystrokes or a mouse, end users access these files through a simple menu- or icon-driven interface. In busy public-access areas, touch-tone screens may replace more conventional mechanisms to encourage widespread use of the service.

Such systems typically provide access to information that is in demand. Data that also change regularly, are time-sensitive, and need to reach a broad cross-section of the organization probably belong in these so-called corporatewide information systems (CWIS). On the customer side of the equation, ready access to on-line, timely, and accurate information will prove irresistible even among hitherto nonusers of the network. Indeed, using a CWIS is a sure way an organization can create a more sympathetic view of electronic data exchange among its employees and managers who formerly resisted information technology.

In terms of cost, a CWIS is highly affordable, assuming of course that the organization already has a network in place. Like e-mail, a CWIS system is merely a delivery shell with various rules for the storage and retrieval of electronic files. Most of the older CWIS products, like Digital Equipment Corporation's VideoTex, have a somewhat friendly menu-driven interface for user access, but they require professional support and are difficult to tailor to specific IRM requirements.

Unlike e-mail, however, a CWIS system stores all of its information centrally. The user calls into the system, selects items of interest, views them, and then signs off (with the option of printing portions of CWIS files or whole files off-line). An e-mail system would need to ship individual copies of each file to all end users to have something approximating the same result. Data delivery would not be driven by customer requirements and would clutter the electronic mailboxes of all network users, regardless of their interests and needs. Clearly, CWIS uses fewer data processing resources and is at the same time more responsive to user requirements. Postimplementation system maintenance of standardized offerings by I/T personnel is minimal because information resource file maintenance is the responsibility of the organization's information providers ("own-

[11]ACRL, "The Use of Electronic Mail in Research Libraries,"*ACRL Spec Kit 149* (November–December, 1988); Caroline Arms, ed., *Campus Networking Strategies* (Maynard, Mass., Digital Press, 1988); Gregory A. Finnegan, "Wiring Information to a College Campus: A Port for Every Pillow," *Online* 14 (March 1990): 37–40.

ers''), e.g., the registrar is the owner for student academic records, and the controller for accounting data.

Unfortunately, many earlier implementations of CWIS fail to satisfy the needs of knowledge workers. Groupware products, like the industry leader Lotus NOTES, have the potential to change all of that, for several reasons. First, a quality groupware system provides an integrated electronic work environment in which team members share access both to a common set of office productivity tools, such as word processing, spreadsheet, and graphics presentation software, and to the files created by these products. Team members can revise draft documents interactively, and the system records each change and its author as it happens. Thus, the system retains both the final information product and all its previous iterations.[12] In addition, groupware tools can link knowledge workers with information providers, such as electronic journal publishers, database providers, news and stock quote services, and so forth. To avoid an information overload, the user may activate a filter that will screen out unwanted information and highlight highly desirable data.

At a second level, groupware facilitates the communication of work and the navigation of both team and nonteam members through bodies of focused information. To achieve this end, groupware integrates electronic mail and replication capabilities. As a member of a work team, an end user automatically receives all documents and electronic discussions generated by other members of the team. Each entry is time stamped, and some systems, like NOTES, track access, indicating whether an information entry is new or previously reviewed. Thus, work-team members, or those who interact or overlap with them, are always in the information loop. Furthermore, this arrangement transcends location and time. As long as end users have access to the network, they can reach the team and its output in a timely and efficient manner.

But groupware goes even further. It provides true information navigation by means of document management. For example, by providing tools for managing and creating database documents, groupware can integrate information resources, including text, graphics, images, and sound into a compound document that, from the user's perspective, will appear to be a single entity. Groupware software draws from a wide range of information resources to deliver that predetermined single view of the data, which will change as each data element is independently updated within its own source application. To function successfully, network information architecture and desktop platform must be aligned to deliver on the potential of groupware.[13] Not surprisingly, many organizations are currently reengineering their I/T services and acquiring new information resources to avail themselves of this functionality.

The growing use of groupware should be viewed as a blessing. Today, most organizations—no matter their size or their focus—are in a real muddle when it comes to IRM. There is an excess of data, and the data reside in too many unrelated formats across too many unrelated technology platforms. Those who need to know remain largely uninformed, and the very integrity of corporate knowledge is called into question as workers dig their way through mountains of paper and electronic rec-

[12]DeJean and DeJean, *Lotus Notes at Work,* 5–40.

[13]In the case of Babson College, for example, the institution has implemented a campuswide client-server–based network, a new information architecture, a graphical user interface at the desktop, and of course groupware. All of these changes also called for a reorganization of the college's information services unit. See Richard M. Kesner, ''Integrating the Library into the Information Utility,'' *Library Trends* 42 (Winter 1994): 373–93.

ords.[14] Although groupware in and of itself does not address this set of challenges, it is playing an increasingly important role as a catalyst to the constructive realignment of organizational IRM.

In the first instance, groupware forces both end users and the information service professionals who support them to examine their IRM resources in light of operational requirements. This analysis typically includes an assessment of the existing I/T infrastructure, the capabilities of the desktop platform, and the needs of external customers or clients. During this process, teams identify redundant information resources and usually eliminate paper and nonstandard electronic duplicates. If compound documents, which integrate some combination of text, scanned images, numerical data, graphics, and even full-motion video, are important to the organization's users, these requirements will shape decisions on what items will be kept in storage and the format in which they will be maintained. Ease of access and integratability as well as the integrity and timeliness of the data are primary concerns. From this effort will emerge a fresh approach to the corporation's information architecture and the IRM tools available to access and manipulate data in that environment. Thus, in moving to groupware, many organizations review and rationalize their information resources and services in line with their greater business objectives.

On a less lofty level, the use of groupware promotes more systematic creation and documentation of compound documents. Indeed, groupware lays bare the metadata behind electronic virtual documents, time stamping changes and codifying the links between the final product and the information resource from which it is drawn. These capabilities initially assist the user in creating the document and subsequently aid the information services professional in maintaining that document as part of an archives. Furthermore, if one is to understand the dynamics of the enterprise and the groupwork that undergirds its activities, one will benefit from the view of this functionality afforded through groupware. Three brief case studies will illustrate these points.

Case 1: Babson College

Babson College's experience demonstrates both the power of groupware as an IRM tool and the degree to which it will transform information dissemination and actual work processes. Babson College faces the challenge of continuously adapting and adopting leading-edge real-world management practices for the classroom. Since effective information resource management is key to the college's success, Babson's Information Technology and Services Division (ITSD), which is responsible for I/T on campus, recognized the need to inventory and update the college's communications infrastructure as soon as possible. The campus already employs highly successful voice-mail and electronic-mail systems. To supplement face-to-face meetings, ITSD also installed an electronic conferencing product (VAXNotes) with only minimal success.[15] However, most mass communications still go out in paper formats. Although the institution attempted periodically to reach the college community through voice and electronic mail these applications proved inefficient. Broadcast messages of even the shortest

[14]Jerry Kanter and Richard M. Kesner, "The CIO/GIO as Catalyst and Facilitator: Building the Information Utility to Meet Global Challenges," in Palvia et al., eds., *The Global Issues of Information Technology Management,* 465–83.

[15]VAXNotes is an electronic conferencing product with little documentation to assist those programming VAXNotes for particular end-user applications. After an initial investment of time and effort in the VAXNotes product, Babson College found that it was not adaptable to the institution's groupware requirements.

length annoyed some end users, cluttered both voice- and e-mail boxes with unwanted information, and consumed computer disk space needed to store more important data. In addition, the broadcast messages never reached some recipients because they were not regular users of electronic mail.

After considering its options, ITSD identified an opportunity to automate much of this information exchange through a CWIS, employing a groupware user interface (namely NOTES) on the World Wide Web (WWW). Initially, Babson's CWIS will provide ready electronic access to a broad range of shared information resources, including campuswide calendars and schedules of events, college policies and procedures manuals and handbooks, internal telephone directories, and, eventually, such information services as stock quotes, news and weather reports, and train schedules, among others.

As prototype implementations, ITSD currently employs NOTES to manage the development and installation of its campuswide client-server network, GlobeNet, and to address all of the policy and process issues emerging from these activities. In the former instance, an ITSD work group developed a detailed work plan for GlobeNet, encompassing nearly one hundred subprojects. Each subproject team leader maintains the status reports for his or her activities, replicating them after they have been updated to the project database. All team members can thereafter view these reports, or anyone else's, at any time by clicking on the appropriate NOTES icon. In the second instance, any project member may raise a discussion issue via the NOTES discussion database created for that purpose. Issues are typically resolved through electronic discussions in which everyone has an opportunity to contribute to, or at least to review, the comments of others. In both instances, the only documentation retained of these communications and decisions is in the NOTES databases themselves. Although an official GlobeNet policy or procedure may be published over e-mail to the college community, the derivation of that policy or procedure resides in NOTES.

In the near future, Babson College will employ NOTES or some other groupware product to assist students, faculty, and staff to navigate more effectively through the institution's information resources. For example, Babson will issue its course catalogs to network users online. By selecting appropriate icons and menu options, an individual may view catalog contents from the perspective of a particular discipline, set of graduation requirements, or subject preference. Course prerequisites will be listed and a degree audit system will run in tandem with these catalog views. Eventually syllabi, student course evaluations, and even actual faculty videos will be integrated into the system.

The resulting application will allow students to make informed decisions about course selections, will qualify them for registration in a particular course, and will register them in a specific course section—all without the creation of a single paper record. What is more, a student need not be on campus or have access to a wide range of other documents and files to take action. Similarly, a student and his or her faculty adviser will be able to view the same information, replicated via an electronic conference link, before making a final commitment. All of the logic and necessary hooks to other information resources for this application are encompassed in the groupware program. Once these and similar network offerings are fully operational, Babson College may consider providing individual alumni and possibly corporate sponsors access to CWIS on a limited basis.

The implications of this design for records management and archival processes are profound. The college's information

systems themselves will retain the logical views of the data and the interfaces between diverse information resources. These same systems will retain all of the knowledge-driven transactions and their associated virtual documents as created by end users. In this scenario, records management and archiving are system defined and system maintained. The professional input of archivists and records managers will be required as system architects develop the metadata structures and rules governing system performance. Thereafter, the processes of records disposition, retention, and retrieval will occur more or less automatically. The declining cost and rapidly expanding capacity of optical and electronic storage technologies provide the means to ensure that whatever a knowledge worker creates and wishes to retain will be retained.

Case 2: Price Waterhouse

Another illustration of how groupware can benefit an organization occurred at Price Waterhouse, a global accounting/management consulting firm, which installed groupware on its wide-area network to leverage the expertise of its work force. According to Sheldon J. Laube, the firm's director of information and technology, "A firm like Price Waterhouse has two principle assets—smart people and their thoughts."[16] In applying groupware, the firm enabled work teams to assemble as needed, according to their skills and experience and regardless of the geographic location and current mobility. The product provides for a secure exchange of confidential information and a prompt and focused response to customer assignments. For busy team members, the system also affords greater flexibility when coping with crowded schedules.

As a value-added service, Price Waterhouse has now extended groupware to its customers. In so doing, the firm brings the customer right into the work team, providing immediate access to the status and content of project work. The arrangement has won broad customer approval and, in the view of the firm, has improved Price Waterhouse's overall performance. It is no surprise that businesses of all kinds are linking their customers and suppliers to their internal operations through groupware. This strategy has reduced the flow of paper and operating costs while improving response time and project quality. It has also altered the nature and extent to which Price Waterhouse documents its billable activities for its clients.

Case 3: Minnesota State Department of Revenue

The Minnesota State Department of Revenue has also turned to groupware to improve its customer service. After reorganizing its I/T infrastructure, the department issued laptop computers with NOTES to its field personnel. The agency's objective was to create a "virtual consultancy within the organization."[17] As tax codes change, as court rulings interpret tax laws, or as the department alters its policies and procedures, field personnel's files are immediately updated. Field agent training and development are also delivered through groupware. Similarly, in servicing taxpayers, the department now processes paperwork more efficiently and with a higher degree of accuracy through groupware-empowered applications. Overall, paperwork and turnaround time are being reduced. As a next step, the agency may employ groupware to link its major customers (i.e., cor-

[16] "Leveraging the Corporate Information Bank Using NOTES Group Collaboration Software," *Lotus Notes Application Profile* (Cambridge, Mass.: Lotus Development Corporation, 1991), 1.

[17] "Groupware: The Team Approach," S28.

porate taxpayers) to its information resources and electronic help-desk services. Such an undertaking will revolutionize its processes as well as the nature and extent of its paper documentation.

Future Trends and Conclusions

In each of these three examples CWIS and groupware employed in tandem effectively address major IRM issues for the organization. This accomplishment did not come without some effort and investment, but the benefits clearly outweigh the costs. One must, however, recognize that the associated business transformation did not come without the pain and anxiety of rethinking established practices, retraining personnel, and departing from organizational traditions. Nevertheless, these technologies play an important and useful part in IRM strategies for the future. Many organizations are now in the process of shifting their IRM paradigms. Previously, they created and established information systems along functional lines, but as end-user and work-group empowerment have become more of an issue, this "stove-pipe" approach to IRM has proven inadequate. In response, these organizations are investing in information architecture redesigns, relational databases that tie disparate older information systems together, and a tool-rich desktop for end-user manipulation of information resources.

These developments will have a dramatic impact on the evolution of corporatewide information systems. First, all corporate information resources of any consequence will reside in an electronic format, rendering the concept of a CWIS all the more viable. Second, corporate information architectures will overtly connect or build linkages between these resources, making them more accessible. Third, to abet these developments, organizations will invest in such information utilities as client-server–based networks, powerful relational-database tools, versatile desktop platforms, and groupware software. Fourth, the costs associated with PC-based videoconferencing and multimedia information transmissions are plummeting. Multimedia CWIS capabilities will surely follow.

As corporate information architecture plans grow to fruition, they will establish the necessary environment to encourage an investment in groupware. Robust and easy-to-use networks are a clear prerequisite to successful groupware deployment. Without such connections, electronic collaboration among end users cannot take place. Similarly, a desktop that possesses both the necessary processing power and a graphical user interface is essential if the organization is to run groupware. Bear in mind also that products like NOTES are powerful facilitators for collaborative work but they do not by themselves accomplish this end. They merely provide hooks into the organization's data resources. If the corporation's information structures are built upon older database technologies and not upon a relational, SQL-based architecture, integrating groupware with existing information resources may prove difficult.

These infrastructural requirements become even more important when one moves beyond generic groupware applications, such as electronic conferencing, and toward the dissemination of complex applications employing multimedia documents. Information resources must be made available to the chosen integrative tool (e.g., NOTES) in a manner that allows a rich array of information resources to be combined. For example, HOOVER, an application that runs under NOTES, links end users to various external information sources, such as the electronic files of widely read magazines and newspapers. HOOVER stores criteria for the selection of information from these media and, if it finds a match between an article and an end user's requirements, replicates that article

to the appropriate NOTES folder. Other applications combine audio, scanned images, and electronic text information for the user of automobile insurance adjusters. Each of these examples assumes that a uniform I/T context exists within which groupware tools and applications may function. These information products would run on top of this environment to provide services to the end user.

The potential afforded by groupware in the leveraging of corporate information assets will most certainly outweigh these related investments. For that matter, in light of recent developments in I/T and IRM, there are other—equally important—reasons for organizations to realign their information architectures. Even so, the worth of groupware as a facilitator of worker empowerment and corporate communications suggests that it will rapidly become a strategic feature of corporate I/T planning. For those who would take up this opportunity, here are some concluding observations:

1. **Groupware must be viewed as an extension of the team work process and should therefore be employed as an integral part of the organization's delivery of IRM services.** If technologists market groupware as a new toy, it will receive a cool reception from end users. Instead, the IRM team should develop a thorough understanding of how their customers currently collaborate and then help them to understand how groupware might help them expand and enhance these activities.
2. **An IRM team implementing groupware applications for the first time should build support for the product through the introduction of highly visible, heavily used, and yet simple applications.** For example, a groupware product that allows one to navigate through corporate phone directories and policy manuals might be a good place to start.
3. **One need not have a corporate-wide information architecture and integrated electronic network to deploy groupware locally, but groupware's greatest utility will come from its broad-based use within the organization and between the organization and its customers and suppliers.** The true cost benefit of groupware will come from widespread use, and as indicated earlier, this requires a network. Many successful users of the technology have linked both customers and suppliers through groupware, keeping all parties in the business value chain informed of developments, performance requirements, project status reports, and so forth.
4. **Groupware applications should be user driven, and they can be user developed if the organization will invest in the associated training and support.** Like most products that have a friendly user front end, groupware requires added support from the corporate technologists who will be called on to develop customized applications. NOTES may not be difficult to master in and of itself, but it does add yet another layer of complexity to the network and desktop. Organizations must invest in the training and development both of information systems support personnel and of end users in order to take full advantage of the capabilities of groupware.
5. **IRM professionals must take it upon themselves to learn about the implications of groupware and understand how this new generation of application software will transform the workplace, work processes, and future document man-**

agement. As I/T specialists, these IRM professionals may not have the best sense of how to proceed. They therefore need to work in close association with end users to reengineer work and to achieve better alignment of information resource delivery and collaborative effort through groupware.

6. **The widespread use of groupware will change the way knowledge workers and IRM professionals envision and employ document-based information.** The virtual record will become the standard for the conveyance of knowledge.
7. **The emerging CWIS/groupware environment affords an opportunity for the archivist and records manager to participate more directly in the reshaping of the enterprise.** However, this can come about only if information services professionals involve themselves in the processes of metadata definition, system architecture design, database administration, and IRM security and contingency planning. (This latter area addresses the protection and retention of the system's digital media.)

These simple observations are based on my practical, hands-on experience. There is nothing magical in these recommendations. Rather, their intent is to serve as a checklist for information service professionals who are about to embark on the establishment of a CWIS or groupware capability within their own organizations. In each instance, the reader's own institutional culture and context will necessitate the tailoring of this personal view. However, one key to success remains: listening to the customer and building one's corporatewide information systems on the foundation of those information resources and services in greatest demand.

Groupware Bibliography

Monographs and Anthologies

ACRL. "The Use of Electronic Mail in Research Libraries." *ACRL Spec Kit 149* (November–December 1988). This set of working papers and examples illustrates the ways that institutions of higher education are putting e-mail to use as a groupware tool.

Arms, Caroline, ed. *Campus Networking Strategies.* Maynard, Mass.: Digital Press, 1988. As an EDUCOM-generated anthology of campus-network case studies, this volume identifies the critical success factors in establishing an information technology environment for groupware.

Coleman, David D. *GroupWare '92.* San Mateo, Calif.: Morgan Kaufmann Publishers, 1992. This volume brings together the papers of the second annual "GroupWare" conference. Most of the papers are conceptual rather than product-oriented.

Davis, Stan, and Davidson, Bill. *2020 Vision.* New York: Simon & Schuster, 1991. Davis and Davidson provide a view of the "informated" future of human society.

DeJean, David, and DeJean, Sally Blanning. *Lotus Notes at Work.* New York: Lotus Books, 1991. Here is a practical book about working with and getting the most out of Lotus NOTES.

DeKoven, Bernard. *Connected Executives: A Strategic Communications Plan.* Palo Alto, Calif.: Institute for Better Meetings, 1990. The primary themes of this book are group work, distance learning, voice and data communications, telecommuting, and, of course, groupware as they relate to the changing workplace.

Drucker, Peter F. *The New Realities.* New York: Harper & Row, 1989. In his own insightful manner, Drucker presents a view of the evolving workplace.

Emery, James C. *The Strategic Imperative.* Oxford: Oxford University Press, 1987. Emery concentrates his analysis on the strategic importance of information resource management in the modern organization.

Finnegan, Gregory A. "Wiring Information to a College Campus: A Port for Every Pillow," *Online* 14 (March 1990): 37–40. This article provides an update on the growth of campus networks in student residence halls.

Grief, Irene, ed. *Computer-Supported Cooperative Work: A Book of Readings.* San Mateo, Calif.: Morgan Kaufmann Publishers, 1988. This anthology provides a wide range of views concerning group work and groupware.

"Groupware," *BYTE* 13 (1988). This special edition considers the emergence of groupware and what it will mean for the computer industry and information technology users.

"Groupware: The Team Approach." *PC Week* 8 (Supplement, 14 October 1992). This *PC Week* supplement provides an excellent survey of groupware products and brief case-study application scenarios.

Hawkins, Brian L. "Campus-Wide Networking at Brown University." *Academic Computing* 3 (January 1989): 32–33, 36–39, 44, 46–49. Hawkins reviews networking developments at Brown University.

———, ed. *Organizing and Managing Information Resources on Campus.* McKinney, Tex.: Academic Computing Publications, 1989. As an EDUCOM-generated anthology of campuswide IRM case studies, this volume identifies the critical success factors in establishing IRM strategies and systems.

Henry, James S. *The Impact of Lotus Notes on Productivity.* Cambridge, Mass.: Lotus Development Corporation, 1992. Henry is paid to promote NOTES, and yet this book has much to offer in the way of more general guidance and advice.

The Index Group. *Critical Issues of Information Systems Management for 1993.* Boston: The Index Group, 1993. The Index Group publishes this volume for its customers each year. The data represent the views of more than 300 chief information officers from global organizations.

Johansen, Robert. *Groupware: Computer Support for Business Teams.* New York: Free Press, 1988. Johansen provides an excellent conceptual framework for the consideration of group work and groupware.

Kanter, Jerry, and Kesner, Richard M. "The CIO/GIO as Catalyst and Facilitator: Building the Information Utility to Meet Global Challenges." In *The Global Issues of Information Technology Management*, edited by Shailendra Palvia et al., 465–83. Harrisburg, Pa.: Idea Group, 1991. Kanter and Kesner develop a case for the training and education of information management professionals who face the global-IRM challenges of today's marketplace.

Kesner, Richard M. *Automation for Archivists and Records Managers,* 12–31. Chicago: American Library Association, 1984. Though eleven years old, this volume provides a sound approach for the development and implementation of IRM programs in archives and records centers.

———. *Microcomputer Applications in Libraries*, 49–80. Westport, Conn.: Greenwood Press, 1984. Though dated, Kesner's views on distributed information processing in libraries still apply, especially in the context of groupware tools.

———. "Integrating the Library into the Information Utility." *Library Trends* 42 (Winter 1994): 373–93. This article describes the new organizational structures

that complement the move to corporatewide IRM.

Khosrowpour, Mehdi, and Yaverbaum, Gayle, eds. *Information Technology Resources Utilization and Management: Issues and Trends.* Harrisburg, Pa.: Idea Group, 1990. This volume includes academic papers on IRM.

Morris, Charles R. *The Coming Global Boom.* New York: Bantam Books, 1990. Morris describes the global economy and its IRM and information technology underpinnings.

Naisbitt, John, and Aburdene, Patricia. *Megatrends 2000.* New York: William Morrow, 1990. Naisbitt and Aburdene describe the coming of the information age.

Opper, Susanna, and Fersko-Weiss, Henry. *Technology for Teams.* New York: Van Nostrand Reinhold, 1992. This book is one of the best available works on group work and groupware.

Palvia, Shailendra, et al., eds. *The Global Issues of Information Technology Management.* Harrisburg, Pa: Idea Group, 1991. This anthology explores the many sides of global IRM.

Peters, Tom. *Thriving on Chaos.* New York: Knopf, 1987. For those coping with radical change and global competition, Peters is a "must read."

Schrage, Michael. *Shared Minds: The New Technologies of Collaboration.* New York: Random House, 1990. Schrage presents a broad conceptual framework for group work through technological enablement and revolutionized ways of communicating, collaborating, and creating value.

Senge, Peter M. *The Fifth Discipline: The Art and Practice of the Learning Organization.* New York: Doubleday, 1990. In line with the recent interest in total quality management and IRM, Senge explores the need for organizational cultures to be devoted to the continuous development of employees.

Sproull, Lee, and Kiesler, Sara. *Connections: New Ways of Working in the Networked World.* Cambridge, Mass.: The MIT Press, 1991. Sproull and Kiesler, authors who appreciate library and information services, look at the human side of group work and groupware.

Szewczak, Edward, et al., eds. *Management Impacts of Information Technology: Perspectives on Organizational Change and Growth.* Harrisburg, Pa.: Idea Group, 1991. This volume brings together academic and practitioner views of trends in IRM.

Targowski, Andrew, ed. *The Architecture and Planning of Enterprise-Wide Information Management Systems.* Harrisburg, Pa: Idea Group, 1990. This volume brings together academic and practitioner views of trends in network, voice and data communications, and groupware technologies.

Tom, Paul L. *Managing Information as a Corporate Resource.* 2d ed. New York: Harper Collins, 1991. Tom provides a well-argued case for IRM for strategic advantage.

United Nations. *Advisory Committee for Coordination of Information Systems, Management of Electronic Records: Issues and Guidelines.* New York: United Nations, 1990. This report provides a standard for examining archival IRM issues.

Whitaker, Becki. "Electronic Mail in the Library: A Perspective." *Library Trends* 37 (Winter 1989): 357–65. The author provides an update on e-mail applications in libraries.

Wiseman, Charles. *Strategic Information Systems.* Homewood, Ill.: Irwin, 1988. Wiseman provides a comprehensive view of strategic IRM.

Woodsworth, Anne. *Managing Information Technology on Campus.* Chicago: American Library Association, 1991. Woodsworth explores the role of the

CIO and the information utility on college and university campuses.

"Workgroup Technology: Tying Technology to Business Objectives." *International Data Corporation White Paper.* Framingham, Mass.: IDC, 1992. IDC prepares industry studies like this one on a wide range of information-technology–related subjects. This particular article explores the business justifications behind groupware.

Zuboff, Shoshana. *In the Age of the Smart Machine: The Future of Work and Power.* New York: Basic Books, 1988. Zuboff's volume is a landmark study in the society-transforming role of information technology.

Periodicals that Address Groupware Topics

Communications Week
Computerworld
InfoWorld
LAN Times
Network World
PC Week
PC World