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8 New Organizational Media and Productivity

Organizations are rightfully concerned with the costs and productivity impacts of new organizational media. Before we can assess the impacts of new organizational information systems on office productivity, however, we need to establish a conceptual framework for identifying and locating such impacts. Information work is different from industrial work. Further, information and communication have attributes that may be productive at one organizational level but quite irrational or ineffective at another. Within a framework of information work behavior, this chapter considers the nature of and opportunities for productivity improvements from office automation in general and electronic messaging in particular.

This chapter begins by briefly noting the concept of productivity and how information work requires a new framework for analyzing productivity. That framework demands an understanding of effectiveness and

performance rather than efficiency and product. Further, it requires that communication activities be emphasized. The kinds of productivity benefits stemming from new office media are therefore outlined. A specific medium, electronic messaging, is described in light of such cost and benefit considerations. The general framework also demands an understanding of different levels of organizational performance, in order to specify what kinds of benefits are sought, and how communication activities play a role. The chapter ends with a brief summary of office automation study results with respect to information worker productivity.

UNDERSTANDING AND MEASURING PRODUCTIVITY

Even a summary discussion of the causes of productivity growth and decline—global and national economics, industrial strategies and markets, production engineering, personnel management, job satisfaction, job design, and augmentation of decision making—is well beyond the scope of this chapter (see, for example, Ruch and Ruch, 1982).

We do need to discuss the concept of productivity, however. There are numerous ways of conceptualizing and measuring productivity (see Rees et al., 1979; Siegel, 1980). A common approach is to divide output by input. Each may be "partial" or "total"—measuring one, several, or all known variables. Inputs and outputs are commonly physical in nature, or represented in monetary form or in combined form: the value of the outputs divided by a specific physical input. The cost of capital may be included in the resources used. The value-added component of the output may be measured in a simple way by subtracting the inputs from the value of the output. The value may include subjective pricing by a given market segment. Measures may shift from an emphasis on efficiency to a concern for effectiveness. Such productivity measures may include ratios of work units achieved versus those intended, achievements compared to objectives, or performance compared to resources. One long-run view of productivity assess how well the organization adjusts to changes in the environment while achieving its goals, or even its success in altering its goals in order to survive turbulent environments (see Downs and Hain, 1982; Packer, 1983).

There are problems with many of these classical productivity measures.

(a) They are not appropriate for custom or small-batch activities.

(b) They are not easily comparable between products varying in style or consumer tastes and in users' subjective perceptions.

(c) They tend to focus on outputs rather than outcomes and impacts.

(d) They do not involve sufficient tools for interpreting data, such as trade-offs between quality and cost or trends and cycles (Packer, 1983).

But for our purposes, the major difficulty is that they cannot be applied to knowledge workers.

INFORMATION WORK AND PRODUCTIVITY

We have entered the information economy, where more than half the GNP is allocated to handling information—an economy that is populated by information workers who represent more than half the labor force. Overall productivity (in 1972 dollars) in the private business economy declined during 1978-1980 and, indeed, has been declining since the mid-1960s (Packer, 1983; Tersine and Price, 1982). Yet productivity is far lower in white collar jobs than in blue collar jobs. The typical figures cited in the literature are that blue collar productivity grew 90% while white collar productivity grew only 4% during the 1960s (though those figures are over a decade old). To begin to improve office productivity, the activities performed and technologies used in organizations must be appropriate for information work. Notions of productivity and ways of measuring productivity need to be appropriate as well. Several authors have begun to outline how to go about this (Bair, 1978, 1980; Business Week, 1982; Culnan and Bair, 1983; Downs and Hain, 1982; Goldfield, 1983; National Bureau of Standards, 1980; Packer, 1983; Patrick, 1980; Strassman, 1976; Tuttle, 1982).

The reasons for this shift in conceptualizing productivity is that information work differs from material-based work (Giuliano, 1982; Paisley, 1980). Information does not itself behave like physical inputs or outputs. Constrained only by the physical markers used to transport its symbolic content, information can be diffused over time and space in ways that material products can never be. On the one hand, its utility may expand the more that it is used by more people; on the other, it may lose all worth when other people obtain it. The quality and timeliness of information may be critical to its use; yet quality may be largely subjective and determined separately by the producer and the user. Overabundance may sap the scarce resource of managerial attention (Simon, 1973). More *efficient* dissemination of information that is incorrect or unneeded will clearly harm the effectiveness of an organization. That is, the *effectiveness* or *outcome* of many information activities is more crucial than its *efficiency*.

As discussed in Chapter 3, use of information by managers may be heavily political and symbolic (Feldman and March, 1981), creating apparent inefficiencies and unjustified costs for the organization as a whole (such as mandating continual information searches or warehousing information for possible justifications) while increasing the status and survivability of a given department. Information use and obstacles may appear quite rational for an organization while appearing quite irrational for a client or customer (Singer, 1980). Organizations may die if they fail to reduce the amount of information that must be processed or fail to increase internal processing capability (Galbraith, 1977). Handling information—filtering, abstracting, storing, retrieving, evaluating it (especially in unstructured situations), deciding how and when to perform information processing tasks, avoiding overload—is a primary process of information workers, yet this means different things, and has different consequences, to different organizational members.

Interpersonal communication of this information is another important component of organizational activity. Communication effectiveness is related to organizational effectiveness. Communication is a fundamental activity in organizations. Studies have clearly shown that researchers' productivity is correlated with more communication within and between work teams and other groups (Allen, 1977; Kerr and Hiltz, 1982; O'Reilly, 1977; Paisley, 1980; Pelz and Andrews, 1976), although increased communication may also lead to information overload or divert work unit members from their tasks.[1]

Many aspects of organizational communication seem to be crucial to improved productivity, and are either essential components to office automation or are likely to be strongly affected by automation—or both. These communication aspects include: purpose of communication, the medium or channel used, timing, organizational communication structure and norms, group and organizational networks, supervisor-subordinate relations, the emphasis on task-related as opposed to more or less socioemotional content, and the like. "Ineffective communication is not the major cause of America's productivity crisis, but effective communication is a major requirement for implementing solutions" (Downs and Hain, 1982: 452). Indeed, of the top eighteen office activities (elicited from on-site interviews) that were perceived by managers as facilitating productivity improvement, eleven were specifically communication related (Culnan and Bair, 1983). The highest-rated need was providing remote information access and retrieval; the ninth was supporting composition; the eighteenth was reducing time for making written records of communication.

Finally, emphasizing a point now quite obvious in the literature on information work and the products of knowledge workers, the *outputs* of such work are often quite intangible. a "good" decision may involve weeks of reading, talking, thinking, near-random contacts, and blind alleys. In output form, it may not even appear in a report or on a memo. Yet it may save a company or motivate a group. On the other hand, countless thick, tangible aspects costing considerable time, energy, and money sit on shelves gathering dust.

PRODUCTIVITY BENEFITS OF OFFICE AUTOMATION

This brief discussion of information and communication in organizational work readily generates a list of potential productivity benefits of office communication technologies or office automation. We can conceptualize these potential benefits in terms of five areas. (Needless to say, outcomes in any of these areas may not necessarily be productive; they represent areas for possible benefits).

The first two areas are crucial components of any cybernetic communication system, such as an organization.

(1) Control: requiring less information to perform a task, better planning, providing a more effective response.

(2) Timing: reduced waiting time for a meeting to commence or for another department to respond to an inquiry; reduced time spent in decision making, initiating action, or responding to the environment; increased flexibility of work schedule. Uhlig, Farber, and Bair (1979: Chap. 3) elaborate on the role of these components of a cybernetic communication system in improving productivity. The other three areas involve the form, transformation, and by-products of communication activities.

(3) Automation: the replacement or elimination of manual processes, such as constant revision of mailing lists, that do not contribute to increased effectiveness (because perhaps the material shouldn't be sent out to the mailing list in the first place).

(4) Media transformations: time, energy, and errors in transferring information from one medium to another may be reduced. For example, a company memo may pass through many media—oral, tape, typewritten, handwritten, revision, typewritten final, photocopies, and mail—before the content is entered into someone's calendar.

(5) Shadow functions: unforeseen, unpredictable, time-consuming activities that are associated with accomplishing any task, but do not contribute to productivity, include telephone tag and unsuccessful attempts to retrieve information from a personal file. For example, Table 8.1 suggests that the real costs of a successful telephone call are considerably greater than the actual telephone charges (Hirschberg, Bossaller, Kerns, Dugan, Sargent, Feltman, Wiseman, and Dutton, 1982, citing an International Resource Development report).

TABLE 8.1 Costs of Telephone Tag

Outcome	*Percentage of Calls*	*Length (minutes)*	*Labor $*	*Phone $*	*Total Cost 100 Calls*
No answer	5	1.0	.27	.00	1.35
Answering machine	2	1.5	.40	.65	2.10
Out	20	2.0	.51	.65	23.20
Lunch	18	1.5	.40	.65	18.90
Meeting	20	2.0	.51	.65	23.20
On phone	15	2.5	.62	.91	22.95
Not available	7	1.5	.40	.65	7.35
Put on hold	3	12.5	2.82	2.92	17.22
Reach party	10	10.0	2.27	2.37	46.10
Real cost of each successful call on average:				Phone cost = $8.97 Total cost = $16.24	

SOURCE: Hirschberg et al., 1982, adapted from International Resource Development report.

ORGANIZATIONAL USE OF ELECTRONIC MESSAGING: BENEFITS AND COSTS

This section considers the new organizational medium of electronic mail in light of the kinds of potential productivity benefits discussed above, provides an overview of the benefits of electronic mail in the context of similar and competing services, and summarizes some cost information for productivity assessment.

The use of the term "electronic mail" may be a bit misleading. That is, the term really encompasses far more than the sending and sharing of text files in computer-mediated communication systems. Consider that the first form of electronic mail was the telegraph, demonstrated in 1844, and still transmitting 45 million messages in 1979. However, nearly a quarter trillion telephone messages, 57 trillion first class mail messages, and 25 trillion intracompany letter mail messages were distributed in the same year (EMMS, 1979). Panko (1984) provides a comprehensive summary of the varieties of electronic mail, along with an estimated number of messages sent in the United States in 1979. (Figures from 1978 are available in EMMS [1979] for trend comparisons.)

Facsimile (350 million messages in 1979) is currently the most popular form of electronic mail and typically uses regular telephone lines. Several companies now offer private fax networks with store and forward capabilities. Recent developments in digital transmission will allow exchanges of photographic quality images in seconds, or remote copying, as well as integration of fax with video conferencing and teletext (Posa, 1983). Facsimile thus leads the way into "image processing."

TWX is in wide use in the United States and Canada, but European standards make *Telex* the dominant form outside North America. Telex is a point-to-point, dial-up telegraph service without "intelligence" in the system; i.e., it is primarily a transmission tool, although International Telephone and Telegraph's OMNI VI offers many processing capabilities. Their combined messages were 128 million. *Private teletypewriters* and networks distributed 100 million messages in 1979, and often are part of transaction-oriented data-processing systems, though they are typically limited to terminal-to-terminal transmission.

Teletex is a higher level of service than Telex, as the International Telecommunications Union adopted a standard in 1980 that includes a 2400 bits per second, message-switched store and forward service with broadcast (i.e., multiple recipient) capabilities. Teletex is a significant component of office automation plans in Germany, as it allows communication between office components and interorganizational networks.

The U.S. Postal Service, (USPS) is slowly moving into the area of electronic mail, with *Mailgram* (40 million messages), a joint venture with Western Union, which uses Telex to transmit messages to selected post offices that print and mail messages. *ECOM* (electronic computer-originated mail) takes advantage of batch electronic input from companies, although there are severe format restrictions (still, over 172 thousand ECOM messages were sent in one week in July 1982 [Office of Technology Assessment, 1982]). The USPS's new Electronic Message Service System (*EMSS*) is much more flexible, and is creating some concern in the private industry.

Communicating word processors sent over 200 million messages in 1979, typically via Telex lines. The more advanced systems, some using centralized message controllers, take care of all aspects of addressing, communicating, and delivery once the file destination is given. *Voice mail* (one million messages) provides editing, indexing, store and forward, and distribution facilities for handling aural/oral content. This recent medium may develop into the messaging service of choice within organizations, particularly for managers who typically prefer talking over writing.

Electronic Messaging: Benefits

Computer-mediated exchange of text—in which computer capabilities are involved in processing the message rather than just transmitting it—constituted 66 million messages on commercial systems in 1979. Hewlett-Packard's private electronic messaging service generated 25 million messages a year worldwide (Panko, 1984). Projections by the Yankee Group call for a rise in the number of service "mailboxes" (formal accounts on commercial services using electronic messaging) from 49,000 in 1981 to 392,000 in 1983 and 882,000 in 1984 (Burstyn, 1983). Comparable figures for private mailboxes (corporate systems) are 80,000, 225,000, and 680,000, indicating a shift to greater use in a service environment after 1983. These figures do not include the rapidly growing use of personal messaging on The Source, CompuServe, or microcomputer networks (estimated number of mailboxes: 77,000 [Sandler, 1983]).

The general notion of computer-mediated communication (CMC) was described in Chapter 6. Electronic messaging allows the creation, editing, sending, receiving, storage, forwarding, and printing of text—all facilitated by the computer. Integration with the computer-file system, command recognition and spelling correction, the ability to request a return receipt, and a reliable computer system, along with a screen-based editor, variable levels of sophistication, general simplicity, good documentation, and related nonmail options, such as calendar or tickler files, have been listed as important or desirable by users (McQuillan and Walden, 1980).

Because of the processing capabilities of the computers, and the interconnections facilitated by telecommunications networks, many commercial messaging systems are marketed (and used) in integrated ways. Computer Corporation of America's COMET integrates with word processing; General Electric's Quik-Comm integrates with data processing; Dialcom's service is viewed as part of an integrated management system; The Source's Sourcemail provides access to diverse information sources. Special features possible include security programming, voice and text integration, spelling checks, automatic report generation, interconnection with other media and networks, managerial calendars, auto dial-out, delayed mailing, prioritizing and filtering of messages, graphics genera-

tion, file purging, cancellation of previously sent messages, and even general delivery service (such as MCI's new MCIMAIL).

A particularly innovative application is "Intelligent Electronic Communications," whereby electronic messaging is integrated with relational data bases and executable computer programs. Messages can be sent to a software *function*, which, upon receipt of a message with proper formatting, processes the message as a command with *variables*. Thus, a field report update could automatically generate payroll, inventory, billing, and scheduling processes while entering a progress report maintained as a data base.

It should be apparent by now that electronic messaging has many potential benefits (and some disadvantages) for information work, many of which are listed below.

- permanent, searchable record
- no simultaneous activity necessary
- less meeting scheduling—or meetings
- control over timing and preparation of response
- freedom from geographical constraints—including time zones
- no interruptions
- fast delivery (if recipient logs on)
- automatic headers and message information
- easy reply, further distribution ("carbon copies")
- increased contacts (although possible overload)
- rapid responses (with possible misunderstandings)
- more upward and diagonal organizational communication (possibly by passing approved channels)
- substitution for some other media, under some conditions
- potential for reduction in travel (though possibly generating more travel)
- medium for creation, transmission, and receipt are the same
- fewer nonverbal constraints (though possibility of disinhibition)
- one action (possibly automatic) for multiple distribution (though perhaps before content is ready, and perhaps lacking relevant context for all receivers)
- information search not limited by *known* contacts
- communication can develop around timely or common interests (perhaps reducing chances of "new" topics)

Electronic Messaging: Costs

These potential—or even actual—benefits of electronic messaging must be placed in a multidimensional context before they can be converted into claims of increased productivity. First, for interorganizational messaging, standards must be established and regulatory issues must be negotiated (particularly for international communication). These standards include designs and formats for usage, addressing and delivery, the message itself, and the transmitting networks (Panko, 1981a). Second, the benefits must contribute not only to individual users, but also to the goals of the organization, as discussed below. Third, the costs of such services must be justifiable.

The third point is no less difficult than the preceding two. Many factors are involved: operators and maintenance, transmission and storage, terminals, training, users' time spent in composing and sending, receiving and reading, costs of the software or service or licensing. For example, the National Archives and Record Service (1981) found that one of the five systems they studied generated $1960/month in computer storage costs for electronic mail files. The report concluded that, in addition to a lack of baseline comparative data or even a sufficient conceptualization of the need for and use of office automation in federal agencies, "it appears that current office automation efforts have often led to increased costs with limited tangible benefits"(p.5).

King and Kraemer (1981) postulate that information technologies generate both organizational and social costs far beyond what is commonly estimated and that the decentralizing influences the new telecommunications technologies are likely to have on the world of information use and management will exacerbate what is already nearly uncontrolled growth in costs from these technologies. For example, according to the authors, the costs of computing are typically 20% higher than they are usually estimated to be.

Several attempts have been made to specify electronic messaging costs. Montgomery and Benbasat (1983), assuming $150/month for subscription to COMET, $60/month for service, and $90/month for terminal rental, concluded that for a $50,000/year managerial salary (plus 30% overhead), only 12.5 minutes/day needed to be saved in order to cost-justify the service. Crawford (1982) analyzed a variety of cost components for organizational communication, including labor, shadow costs, materials, communications facilities, system use, peripherals, and access. Total cost for a phone call was $4.31; for an electronic message entered and sent by the originator, $4.70; for an electronic message entered and sent by support staff for the originator, $6.70; and for an interoffice memo, $7.60.

Panko's (1981b) cost analysis is the most thorough to date. He suggests that there are cost opportunities in *handling* messages—at $30/hour, the cost of managerial time spent writing is nearly $60 (see Table 8.3 below)—and *transmitting* messages—the sending and receiving costs of a business letter are about $15. Based on actual costs in 1977 of two systems, with adjustments for up-to-date hardware, continuing reductions in communications costs, and operator and transmission costs, Panko suggests that the cost per message (assuming three per day) for two extant systems would drop from $1.34-$6.72 in 1977 to $.07-$.27 in 1985. Adding in terminal costs, the costs per message in 1985 (assuming five per day) would range from $.17 to $.27. Panko offers $.25 to $.50 in a later

paper (1983). These figures do not include software, training or local communication costs.

Table 8.2 summarizes costs of the major commercial electronic messaging services (Hirschberg et al., 1982).[2] Not included in these cost figures are hardware, labor, or operator support; these are all assumed to be sunk costs and in place before the service is implemented. Investigation of the table shows that some services are more cost-effective for certain kinds of messaging activity. For example, Quik-Comm is more cost-effective for single copies and short messages; Dialcom and Sourcemail have declining unit storage costs; and Infoplex puts all cost burdens on the message.

Comparing electronic messaging to the more traditional services, it can be shown that Telex is not as cost-efficient for multiple messages; Fax has lower message unit costs at higher transmission rates, but this requires the more expensive "Group Two" and "Group Three" machines; telephone costs are distance-sensitive and of course provide no written record; the USPS is weight-sensitive and has long delivery time; further, most traditional "mail" services cannot provide processing capabilities—only transmission.

The implication of these analyses is that productivity benefits—in terms of quality, effectiveness, and value-added output—provide the rationales for using messaging systems, as strict cost comparisons show relatively similar orders of magnitude among media at this time.

LOCATING PRODUCTIVITY IMPACTS: A MODEL OF ORGANIZATIONAL COMMUNICATION PERFORMANCE

So far we have emphasized that the welter of productivity conceptualization and measures are, as yet, not sufficient for understanding the potential productivity impacts of office automation. We have noted some aspects of two components of organizational information work: information and communication. Using the example of electronic mail, we have briefly mentioned some of the potential benefits of office automation for information work, and located five areas for communication benefits. The cost benefits for electronic messaging are not, as yet, overwhelming, unless criteria more relevant to knowledge work are also considered.

We have, thus, introduced some of the concepts and variables needed to understand and measure information productivity. Finally, we need a model to provide the context of organizational information work: what goes on in information work. Paisley (1980) provides a comprehensive review and analysis of the more cognitive aspects of information work; we here provide a model of behavioral communication performance. This model will aid in using the concepts above to locate behaviors—organizational performance—that may be appropriate contexts for analyses of information work and changes in its productivity. Finally, a review of office automation productivity benefits will be structured according to this model.

TABLE 8.2 Cost Analysis Matrix (EM Systems)

	SYSTEMS								
Costs	*CCA's COMET*	*GFISCO's Quik-Comm*	*Dialcom*	*Telenet's Telemail*	*Compuserve's Infoplex*	*Ontyme*	*BBN's Infomail*	*Source*	*Notice*
Initial account charge		$500		$100	$500 (includes training)		DEC or VAX/ UMS: $30,000	$100.00	(SRU=44¢ fee standard user, or 30¢ on discounted volume rate)
Software/ License fee	DEC: 40,000 (includes installation, documentation & 1 user-training class) IBM: 60,000 (includes installation, documentation, class)					$80-100,000	IBM VM/CHS: $50-70,000		
Documentation	(included above)	$30.00		(included in initial acct.)					
User training	(included above)	$100-200							
Maintenance	DEC soft. fees:450/month IBM soft. fees: 750/month							$1.00/acct.	

(Continued)

Table 8.2 Continued

Costs	SYSTEMS								
	CCA's COMET	*GFISCO's Quik-Comm*	*Dialcom*	*Telenet's Telemail*	*Compuserve's Infoplex*	*Ontyme*	*BBN's Infomail*	*Source*	*Notice*
Monthly fee for standard usage	$100/organ. +60/indiv. user (includes 9 hrs connect time & 500 stored messages)			None	None	$200			
Minimum monthly fee	None		$100	None	$2,000 (or 2.500 w/filing system after 4 month period)	$500		$9/Acct./ Month	$250/subscriber organization
Common carrier (phone) lines included?	Not included	Not included	No	Not included	Not included (but 50% discount on all rates if use GTE WATS line)				
Connect time	$7/ hour	0 (costs based on activities or functions performed) $.10/hr.(prime time) $.05/hr. (non-prime time)	$6-$8.00/hr. (prime time) $4.00/hr.(non-prime time)	$14/hr. (business hrs.) $7/ hr. (non-peak hrs.) $4/hr (night hrs.)		$3.40/hr. high density areas $6.00/hr. low density areas		$20.75 (prime) $300 baud $25.75 (prime) 1200 baud $7.75 (weekends, evenings, holidays) 300 baud $10.75 (weekends, evenings, holidays)	$16.50/hr. (average (prime time) $.05/hr. (non prime time)
								1200 baud $5.75 (non prime) 300 baud $8.75 (non prime) 1200 baud	
Log on fee Log off fee	None	$.50 to log on						2 SRU's	
Composing fee		$.09/line		None	.40/600 chars.	None			1 SRU ½ SRU per line (CL) .25 (1/10 Sru)
Cost for multiple copies		Basic .40 + .02 per line		No charge for first					
Forward/send					.20(+ .15 per 600 chars.)	.04/1000 chars.			
Editing fee					.40/600 chars.				
Use file for further processing		No charge			.40/600 chars.				
Transfer charge to storage				.05/message	.05/message	.10-.15/message (.03/1000 chars.)			
Storage charge	.02 per message per month (after standard 500 messages)	2.00 per month per user acct.	0-2500 units = .40 over 10,000 units = .10 (unit = 2048 chars.) (so, cheaper with more use)	.01/day per 2000 chars. (No charge 1st 3 days)	.02 per 600 chars. (after 3 days)	.03 per 1000 chars. (14 days free)		1-10 blks-.50/ mo. per blk 11-99 blks.-.20/ mo per blk. 100-999 blks.-15/mo. per blk. 1000-9999 blks.- 10/mo. per blk. 10,000-99,999 blks.- .05/mo. per blk.	

(Continued)

Table 8.2 Continued

Costs	SYSTEMS								
	CCA's COMET	*GFISCO's Quik-Comm*	*Dialcom*	*Telenet's Telemail*	*Compuserve's Infoplex*	*Ontyme*	*BBN's Infomail*	*Source*	*Notice*
Store/ Confidential					.25+ .25/600 chars.				
Store/ Priority					.25+ .25/600 chars.				
Printing			.05 per page						
Discount available w/volume	Yes. Over 25 mailboxes. pay 1 fee based on # of boxes. Then, monthly costs $20 per box per month		Yes. 0-15,000 fees no discount 15-20,000 fees 5% dis. Over 20,000 fees 10% dis.	Yes	Yes. $10,000/ mo.=10% 25,000/ mo=15% dis. 40,000/mo & over=20% discount	Yes		No	
Pilot program offered			Yes, but no discount		Yes				
File					.40 per text file (or .20 per 600 chars.)				
Display					.15 per text file (or 600 chars.)				
Delete/Cancel messages		5.00/ message			$3.00 per text file				
Check status of messages		.03/line							
Scan messages		.03/line			.10/text file				2.3 SRUs ($^1/_{10}$ SRU per line)
Retrieve messages					No charge	.03/1000 chars.			
Broadcast delivery				.05/ addressee					
Define a group		5.00/group							2 SRUs
Add/delete user (Admin. functions)		10.00/first time 2.50/ after			40.00/connect hr.				

SOURCE: Hirschberg et al. (1982).

The model of organizational communication performance is one level of a four-level model of information work performance.

(1) Equipment performance—includes error rate, percent of manufacturer's specifications, reliability, response time, overload threshold, features, cost per unit, and the like.

(2) Throughput performance—includes the interaction of operators and equipment, such as how individual worker differences are facilitated or constrained by the equipment (and vice versa), work flow, learning rates, effects of variances in input and output, cost per unit processed, resources required for maintaining man-machine interaction maintenance communication.

(3) Organizational performance—discussed below.

(4) Institutional performance—includes organizational-environment interactions such as economic conditions, labor costs, competitions, resource inputs and dependencies, total productivity, seasonal variations, vendor resources.

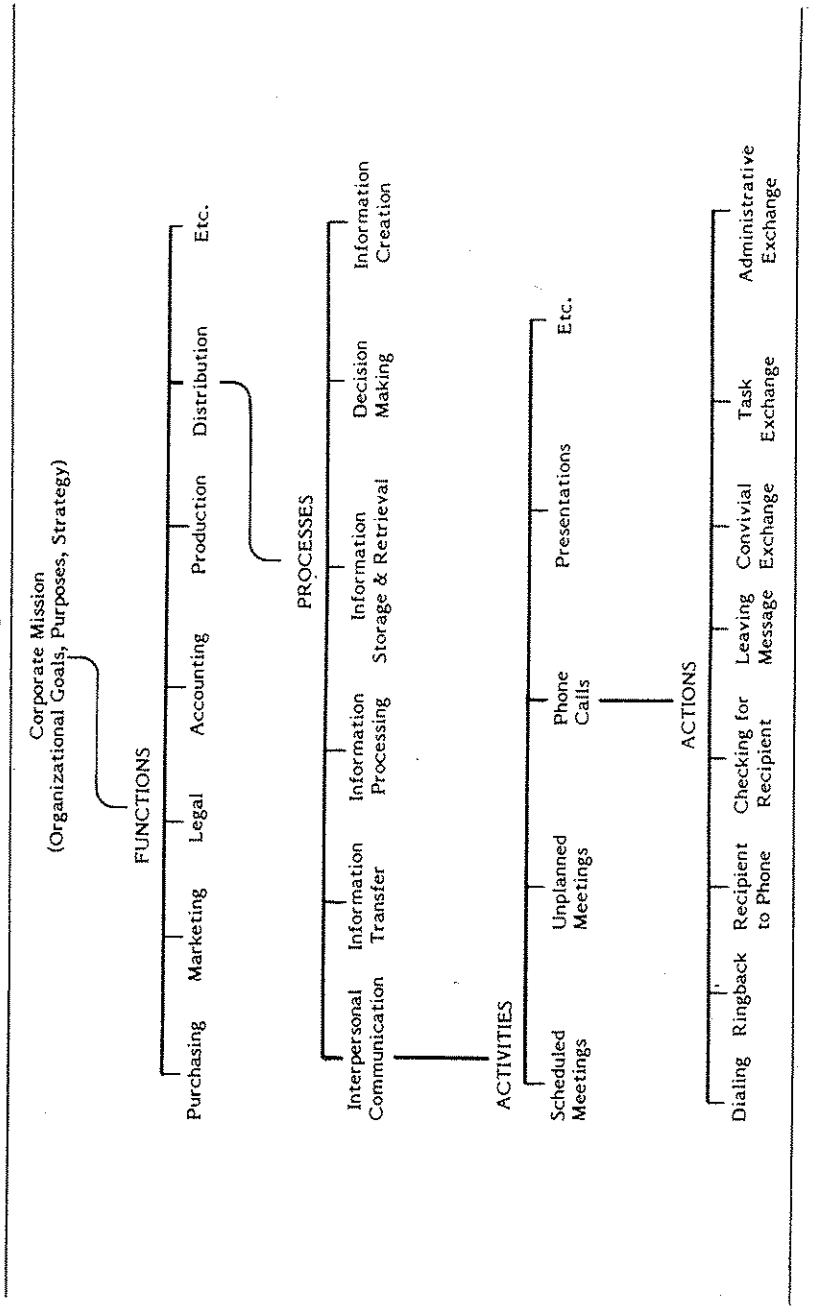
Any measurement of information work productivity and the impacts of office automation would naturally consider all four levels of performance. Further, an in-depth analysis would have to consider the interactions among the levels. For example, if regulatory changes allow more vendors to offer equipment with incompatible standards, an organization's ability to network information work internally may be reduced, or the organization may be less competitive with respect to multinational organizations that own their own private networks. The remainder of this chapter concentrates on level 3—organizational communication performance.

A Hierarchy of Organizational Communication Performance

We suggest that organizational performance occurs, and may be measured, at six levels: mission, purpose, function, process, activity, and action. This hierarchy provides a tentative framework for making sense of the difficult concept of knowledge worker productivity, by identifying possible interactions among variables and across performance levels. Figure 8.1 summarizes these levels.

(1) The *mission* of the organization is what organizational members perceive as "the business" of the organization. This is not straightforward. For stockholders, the mission may be to increase dividends; for a clerical worker, it may be unknown. In terms of criteria for beneficial impacts of office automation, corporate stockholders may emphasize short-term return on investment, perhaps through labor reduction or better dissemination of research results, while the marketing department may emphasize how new technology mirrors the innovative culture of the organization. If corporate policy maintains a narrow and industrial definition of productivity, the "mission" of the organization may appear to be in conflict with the introduction of office automation.

FIGURE 8.1 Model of Organization Performance Identifying Communication Behaviors



(2) Organizational *purpose* represents decisions to focus corporate resources, and includes what are commonly known as organizational goals—strategic targets for accomplishment of mission. Figure 8.1 shows purpose subsumed under mission, as they are often difficult to separate operationally. An example of an organizational purpose is to reduce operating expenses and overhead; an inventory control system providing instant updating and ordering (such as at Sears) can have impacts deemed beneficial for this goal. The goal of reducing customer turnover through improved quality of service may be obtained by the same information system, but the impacts would be measured in very different and longer-term ways.

(3) *Functions* include the traditional division of labor within an organization (such as accounting, purchasing, and planning). Within an organizational function, the information that is processed and communicated may be relatively homogeneous and sequential. Quick, isolated, and cryptic electronic messages may improve the productivity of this function. However, organizational structure may be redesigned around products instead of functions. For example, a matrix organization may pull together persons with complementary skills into a temporary organizational structure. Particularly in consulting or research organizations, coordination of information and communication is crucial in this organizational form. Separate computer conferences for ongoing projects would allow group members to stay updated, but would require attention only from participants, who could retrieve information for performance assessment by project code or time period. Without a formally instituted documentation process, as might exist in a function, a product group might maintain online, ongoing documentation as a by-product of the work.

(4) *Processes* define the form of organizational behavior, while the higher levels describe the content of organizational behavior. Processes are the means for achieving the missions, purposes, and functions of an organization. Differences across organizations affect the nature of processes and, thus, the media used. For example, some companies (perhaps due to their environment, corporate philosophies, or nature of their business) are more oriented toward meetings, and others to telephones. Different organizations foster different norms for information sharing, leading to variations in media use (Dewhirst, 1971).

Information work processes include information creation, processing, storage, retrieval, and transfer; decision making and problem solving; interpersonal communication, and the like. Processes tend to be dynamic, ongoing behaviors, yet may be quite structured, depending on the organization. Some processes may be repetitious, while others have a "life cycle." For example, a report, from its inception to final use, has a life cycle involving many people, revisions, and media. Office automation may facilitate the process, perhaps by removing some of the repetitive steps. Other processes occur in the form of human communication networks. The recurring patterns of relations provide a structure through which information dynamically flows.

(5) *Activities* are the observable behaviors that comprise each process. For example, the process of interpersonal communication may include activities such as unplanned meetings, using various media for communication interactions, presentations, negotiating, interviewing, supervising, and relaying orders. These activities are specific, measurable behaviors. For example, the time and money spent in attending regional meetings may be directly compared with the same for teleconferences. Other important components of attending meeting—such as satisfaction, quality of decision, increased contacts, and the like—can also be measured, although perhaps more subjectively.

This example also highlights an important aspect of this model: Different activities may accomplish the same process (just as different processes may support the same function, and different functions may support the same purpose and mission). Thus, office automation impacts may show up in reduced media transformations, more control, fewer interruptions, when a set of activities is transferred to or integrated in, one information system. Such potential benefits, of course, are subject to constraints such as advantages of some activities over others (there are personal benefits to travel), attributes of different activities (such as easy accessibility of and familiarity with the telephone compared to a terminal down the hall), and differences in activities across organizational roles and levels.

(5A) Intraorganizational communication activities. Such differences in activities across organizational roles and levels are, we believe, a crucial element in assessing the appropriateness, and likelihood of productivity improvements, of CMC systems. There are several reasons for this belief.

The first reason is due to the nature of managerial processes and activities. These tend to be less structured, more informal, more diverse, and higher in uncertainty for upper management than for staff managers and specialists. Intuition and politics, as well as a reliance on nonverbal affect cues, are important in managerial communication along with negotiating, getting to know contacts, creating a corporate image, and discussing confidential information (Downs and Hain, 1982; Kotter, 1982; Newman, 1981; Rice and Case, 1983). "Middle management . . . calls for the ability to shape and utilize the person-to-person channel of communication, to influence, persuade, facilitate" (Volard and Davies, 1982). One study of organizational communication training needs showed that the primary communication difficulty reported by supervisors involved the crucial task of listening. Computer-mediated communication systems are less likely to be appropriate for these kinds of tasks than are more traditional channels (see Chapter 3).

The second reason is that managers differ among themselves according to activity styles: some are emissaries, writers, discussers, troubleshooters, committee persons (Stewart, 1976). So, while CMC systems may aid some, they are not likely to aid all managers even in the bulk of their activities. Therefore, office automation may have greater productivity benefits for the more clerical and transactional processes (or for interorganizational information exchange) and less so for more managerial processes. This

different potentiality for application must be weighed against the fact that a single manager costs the organization more than a single clerical worker, so a greater payoff in terms of an organizational purpose of decreased labor costs is likely to come from increased augmentation of managerial information work (Bair, 1979).

The third reason follows from descriptions of how managers actually do allocate their time, particularly with respect to communication activities. Table 8.3 summarizes many of the studies of managerial time allocation.

The gross conclusion from these studies is that, indeed, managers spend most of their time communicating (about 75%-80%) and most of that time in oral communication (about 60% face-to-face within dyadic discussions or in meetings, or via the telephone). Another conclusion—not surprising—is that secretarial and clerical workers spend considerably less time communicating, and the bulk of that in reading and writing. Scientific and technical workers fall somewhere in between.

(5B) Interorganizational communication activities. An analysis of communication activities should also include cross-organizational media use, because CMC systems may play a role in improving productivity involving interorganizational relations. Picot, Klingenberg, and Kranzle (1982) studied four German suborganizations in two large companies involving 30 locations with 640 principals and 150 secretaries. The authors found that as the direction of communication went from intra- to inter- to extraorganizational, the percentage of communications spent in phone usage varied (22%, 53%, 46%), face-to-face usage decreased (73%, 28%, 11%), mail increased (5%, 15%, 32%), and Telex also increased (0%, 3%, 10%). Another European study (Dormois, Fioux, and Gensollen, 1978) aggregated data over 60 organizations to find 47% of interorganization communication by mail, 46% by telephone, 7% face-to-face, and 1% by Telex. Of particular interest, respondents claimed that over one-third of the calls required a written follow-up, while over two-thirds of the letters and Telex were sent to authenticate a telephone call. That is, uses of some media have attributes that lead to additional use of other media. Steinfield's (1983) analysis of 220 CMC users and 176 nonusers, found 55% of their average monthly communications with members of other companies was by telephone, 12% by memo, and 15% by face-to-face.

Thiessen's (1978) study of 26 Kansas organizations summarizes the usage of 11 different media (including closed circuit TV and WATS lines) by five types of organizations, and describes the kinds of difficulties experienced with each medium. For example, written media may require additional drafts because of lack of initial clarity, or may duplicate other information; difficulties with oral media include the unavailability of the individual called, and the marring of instructions by bad telephone connections or verbal ambiguities. Other research shows that private connections or verbal ambiguities. Other research shows that private organizations tend to use more face-to-face and technical literature than do public organizations (Volard and Davies, 1982), and that different academic departments may rank their usage of media very differently (COST, 1980).

TABLE 8.3 Percentage Allocation of Managers' and Professionals' Working Day to Communication Activities

Source and Sample Notes	*COMMUNICATION CHANNEL*			
	Oral		*Written*	
	FTF[a]	*Phone*	*Reading*	*Writing*[b]
Advanced Systems (1981) N = 30	42	36	—22—	
Booz et al., cited in Panko and Sprague (1982); Poppel (1982) N=300; 90,000 time samples	26	20	8	13
Burns (1954) N=76 managers	—52—		—24—	
Brewer and Tomlinson (1964) N=6 Managers	meetings=37 discussion=14	6	13	17
Carter (1980)[c]	meetings=27 discussion=29	11	8	15
Case Institute (1958) N=1500 Chemists			mail=9	
Conrath (1973b) N=115 Managers 4086 events	—40— 66	13	—29— —21—	

(Continued)

Table 8.3 Continued

Source and Sample Notes	COMMUNICATION CHANNEL: Oral — FTF[a]	Oral — Phone	Written — Reading	Written — Writing[b]
Coulter and Hayo (1978)	51.6	18	—6.8—	
Croston and Goulding (1967) N=6 Managers	56	7	—18—	
Dubin and Spray (1964) N=8 Managers	55	6	—5—	
Ganz and Peacock (1981) managers and professionals	—23—		—47—	
Goetzinger and Valentine (1962) N=40 faculty and staff	40	37	11	12
Hinrichs (1964)				
N=58 supervisors	49	8	10	14
N=20 technical	27	6	11	16
Horne and Lupton(1965) N=66 managers	54	9	10	14
Klemmer and Snyder (1972)				
N=3132 observed events	35	7	12	14[d]
N=2626 reported events scientists and engineers	20	8	20	22[d]

Source and Sample Notes	R	R&W[c]	W	T
Lowenstein (1978); Engel et al. (1980)				
N=396 managers[g]	11	18	11	—
N=1066 managers[g]	11	18	12	—
N=1074 managers	7	21	16	4
N=297 managers[h]	10	19	11	10
N=363 secretaries[i]	4	40	3	29

Source and Sample Notes	FTF[a]	Phone	Reading	Writing[b]
Mintzberg (1973) N=5 managers	64	6	—20—	
Olson (1982) N=6 d.p. managers	48	9	—?—	
Palmer and Beishon (1970) N=1 manager	54	6	—15—	
Ruchinskas (1982) N=795 exempt employees	27	15	17	
Steinfield (1981) N=357 supervisors				
receiving	78	3	—6—	
transmitting	59	4	—14—	
Steinfield (1983) N=220 CMC users	19[j]	7	15	manual=6 computer = 20[k]
N=176 nonusers	19	14	13	CMC=10 manual = 16 computer=9
Stewart (1967) N=160 managers	44	6	—36—	

(Continued)

Table 8.3 Continued

Source and Sample Notes	COMMUNICATION CHANNEL: Oral: FTF[a]	Oral: Phone	Written: Reading	Written: Writing[b]
Talbott et al. (1982)				
N=20 managers	meetings=34			
observation	other[c]=25	7	4	8
questionnaire	meetings=28			
	other[c]=13	5	9	16
Volard and Davies (1982)	61	6	—21—	
Wofford et al. (1977) averaged 10 studies	—72—		—?—	
Xerox[m] Panko and Sprague (1982) N=17,000	18	5	—47—	

NOTE: Data were collected by a variety of means (observations, self-report questionnaires, event-driven diaries, time-sampling diaries, etc.) for different durations (one time, up to two months) and therefore are not conceptually similar across studies. However, most studies using multiple data collection methods report good correspondences between observational data and self-report data on *overall* time spent communicating (Goetzinger and Valentine, 1962; Hinrichs, 1964; Klemmer and Snyder, 1972; Roberts and O'Reilly, 1974). However, several studies found that allocations to specific *channels* showed discrepancies. Typically these involved overestimates of time spent writing or phoning and underestimation of time spent in face-to-face contact (Dahl and Lewis, 1975; Hinrichs, 1964, 1976; Kay and Meyer, 1962; Klemmer and Snyder, 1972). The most comprehensive analysis of such comparisons, based upon an average of 603 observations of each of 36 office workers, as well as task identifications, task sorting, and time estimation, concluded that subjects can reliably identify which tasks they perform, only moderately well rank each task according to the time spent in each task, and are not reliably able to estimate specific amounts of time allocated to each task (Hartley, Brecht, Pagerey, Weeks, Chapanis, and Hoecker, 1977).

a. Primarily meetings; also informal discussions, conferring with working partners, etc.
b. Includes general document preparation.
c. Carter's figures are weighted averages of figures from Brewer and Tomlinson, 1964; Burns, 1954; Carlson, 1951; Copeman, Luijk and de P. Hanika, 1963; Dubin and Spray, 1964; Horne and Lupton, 1965; Lawler, Porter, and Tennenbaum, 1968; Sproull, 1977; Stewart, 1967; and Stogdill and Shartle, 1955.
d. Data analysis and programming included.
e. That is, searching, filing, dictating, proofing, copying, record-keeping, and mail handling.
f. Use of terminal, or typing.
g. Organization was meeting-oriented.
h. Used interactive computing.
i. From same organization as N=1066 managers; other three secretarial samples included in sources.
j. Management=28%.
k. Management=12%.
l. Supervising, training, consulting, coordinating, information-gathering.
m. Same organization as reported in Steinfield (1983); note similarly low FTF figures.

The implication of these interorganizational media usage studies is that there is considerable potential for the use of CMC systems *between* organizations. This potential is due to two reasons. First, more of cross-organizational communication is transmitted by text or telephone, rather than face-to-face. The kinds of content and communication exchanged by text or sound are more easily transmitted by CMC systems than are face-to-face communication contents. Second, interorganizational communications seem to require (or generate) the use of complementary media for successful exchanges. CMC systems may provide the marginal capabilities needed to satisfy such needs.

(6) *Actions* constitute the sequential stages in performing activities. For example, making phone calls involves finding the number, dialing, encountering busy signals or wrong numbers, having the target person called to the phone (or giving a short message and verifying its content), exchanging social or task communication, recording, and following-up the conversation. Many actions are shadow functions, which have cost. As shown in Table 8.1 these shadow costs may be estimated and averaged over a managerial day, just as the costs of preparing letters can be, in order to compare with as opposed to sending costs for alternate media, such as electronic messaging.

It is at this stage that strict labor-saving benefits (in the sense of reducing time spent in performing activities) of office automation can easily be understood. Because of the ease with which system usage may be monitored (see Chapter 4) and because of the explicit nature of such productivity comparisons, much office automation planning concentrates on this level. For example, as described in the preceding chapter, the primary rationale for most organizations in adopting word processing is to reduce repetitive typing. This is laudable and, depending on the organization's productivity criteria, may justify word processing. However, this emphasis limits the scope of office automation application and may in fact solidify ineffective activities and processes; they may even inhibit the performance of organizational purposes and missions.

Such justifications may prevent the organization from using software that automates or reduces actions involved in the creation, revision, and organization of text (such as the UNIX system's Writer's Workbench; See Cherry, Fox, Frase, Gingrich, Keenan, and Macdonald, 1983). As the beginning of the chapter noted, it is necessary to avoid focusing solely on improvement in efficiency. However, if avoiding inefficient communication activities than frees organization members to apply their time and skills to more effective activities, then such improvements are crucial.

SUMMARY OF OFFICE AUTOMATION BENEFITS WITH RESPECT TO COMMUNICATION BEHAVIORS

This section summarizes the primary results from available field studies on office automation impacts, specifically those results concerning productivity and communication behaviors. Table 8.4 lists the studies and their

key impacts; only the primary or key cost benefits explicitly cited by each study are noted, although there often were other explicit benefits and may have been other implicit, qualitative, or long-term benefits. Computer conferencing studies are not included, as they are considered in Chapter 6.

The following major positive findings are highlighted as a summary of those benefits that were common across many of the studies:

(1) Electronic mail capabilities increased asynchronous communication activity within functional groups and in superior-subordinate relations.

(2) Remote communications enabled executives to work outside the office during nontraditional work hours.

(3) Word processing reduced document preparation turnaround time.

(4) Office automation systems produced a daily time savings by reducing the number of clerical tasks per activity and reducing the number of clerical tasks per activity and reducing wasteful shadow functions.

(5) Users perceived a qualitative improvement of their work frequently in the form of greater control, improved communications, and greater access to information.

Some of the studies have sufficiently detailed information that their impacts can be categorized according to classes of communication activities and benefits.

(1) Reduced shadow functions—telephone calls (Bair, 1974; Bullen, Bennett, and Carlson, 1982; Edwards, 1978; Gardner, 1981; Rice and Case, 1983; Steinfield, 1983; Tapscott, 1982; Uhlig, Farber, and Bair, 1979).

(2) Reduced media transformations—handwritten to computer (Melton, 1981; National Archives and Records, 1981).

(3) Reduced tasks per job—retyping (Cramer and Fast, 1982; Crawford, 1982; Dahl, 1981; Dunlop et al., 1980; Edwards, 1978; EIU Informatics, 1982).

(4) Eliminating manual tasks—handling mail (Edwards, 1978; EIU Informatics, 1982; Tapscott, 1982).

(5) Increased speed of information creation and turnaround—composing documents (Bamford, 1978, 1979; Dahl 1981; Dunlop et al., 1980; Edwards, 1978; EIU Informatics, 1982; Gardner, 1981; Talbott, Savage, and Borko, 1982).

(6) Increased information control—reduced information float (EIU Informatics, 1982; Gardner, 1981; Mertes, 1981; Melton, 1981; Steinfield, 1983).

(7) Decreased time to process information—responding to requests (National Archives and Records, 1981).

(8) Decreased time to manage information—managing personal information (Gardner, 1981; Talbott et al., 1982).

(9) Increase in outputs—quantity of documents (majority of studies).

(10) Decreased cost per unit output—typesetting (Dahl, 1981; Dunlop et al., 1980; EIU Informatics, 1982).

TABLE 8.4 Key Productivity Impacts of Office Automation

Study Reference	*Key Impact*
Bair (1974)	Changes in communication patterns: decreased face-to-face contact and increased vertical communication
Bair (1980)	Reduction of telephone shadow costs
Bamford (1978,1979)	Decreased document turnaround time and increased document output
Bullen et al. (1982)	Improved work flow with time saved
Canning (1978)	Increased volume of communications
Conrath and Bair (1974)	Reduction in telephone and face-to-face; increased upward communication flows
Cramer and Fast (1982)	Considerable secretarial time saved
Crawford (1982)	Decline in menial, clerical tasks
Curley and Pyburn (1982)	Greater organizational productivity when seen as more than a way to increase secretarial output
Dahl (1981)	Annual cost savings and 8% increase in knowledge worker time
Dunlop et al. (1980)	Striking productivity gains from 50-100+ percent in document preparation
Edwards (1978)	Change in working mode based on ability to work at home
EIU Informatics (1982)	
Rank Xerox	Large reductions in telephone use, 1 hour/day labor saved for attorneys
German Computer Services	Joint information sharing and editing
British Dept. of Education and Science	50-100% productivity gains in word processing after 6 months
England—various organizations	Many sites did *not* reach cost-justifying wp productivity levels
British travel agents	Booking rose significantly
Scotland	WP output rose 150%
Engel et al. (1979)	5-25% knowledge worker and 15-35% secretarial time saved
Gardner (1981)	Decreased turnaround time in document preparation and scheduling
Gutek (1982)	More creative, challenging, complex, organized work

TABLE 8.4 Continued

Study Reference	*Key Impact*
Helmreich and Wimmer (1982)	High user acceptance
Leduc (1979)	Changes in communication patterns: ability to work at home and increased vertical communication
Lippitt et al. (1980) Miller and Nichols (1981)	Reduction in memos and phone calls
Melton (1981)	Improved communication and decreased information float
Mertes (1981)	Cost and time savings via central library
National Archives and Records (1981)	Concept, scope, and potential of office automation ill-defined in government
case-processing	Reduced backlogs, more timely and accurate reports
electronic messaging	Too few terminals—no benefits identified
optical character scanning	More cost-beneficial than word processing
Panko and Panko (1981)	Many perceived benefits—more for managers and professionals using system directly than for secretaries; highest benefit for long-distance communications
Rice and Case (1983)	Reduction in paper and telephone traffic; increased work quantity and quality; but depends on "media style"
Steinfield (1983)	More timely and accurate information, increased coordination
Steward (1983)	13% daily time saving; 35% increased document output
Talbot et al. (1982)	Less time in communication activities
Tapscott (1982)	Changes in communication patterns: decreased telephone usage and meetings
Tucker (1982)	Implementation failure primarily due to shortened initial analyses phase
Uhlig et al. (1979)	Reduction of telephone shadow costs

SUMMARY

In discussing the various levels of organizational performance, we emphasized that a specific concept of productivity benefits at one level of

organizational performance may detract from performance at another level. This is crucial, for increases in office worker effectiveness and efficiency are possible, but not guaranteed, either within a level or as a cumulative effect across levels. Office automation represents *opportunities* for management and workers to improve task productivity, worker satisfaction, and organizational viability. Most managers spend most of their time in communication, but most of that time involves oral communication. So the opportunities for improved organizational productivity by managers lie in specific and appropriate augmentation of oral communications (preparation, some substitution for phone, documentation), improving or replacing the remaining mediated communication (memos, meeting notices, reviewing documents, some conferencing), and in facilitating support staff in aiding managerial communication. Developments in integrated multimedia systems may have greater significance for improved managerial communication, because they will facilitate the kinds of communication to which most managers allocate most of their time. Interorganizational communication, which must overcome obstacles such as distance, technological incompatibilities, and noisy or inappropriate media, may be a productive area in which to apply computer-mediated systems.

Organizational managers of these systems should remember that media are only one component of the organization. They are part of the *total information system* used by people of varying roles for tasks within and across organizations.

A suggestion made a decade ago might be relevant here. Mason and Mitroff (1973) wrote,

> What is information for one type (of person) will definitely not be information for another. Thus, as designers of MIS, our job is not to get (or force) all types to conform to one, but to give each type the kind of information he is psychologically attuned to and will use most effectively.

If we change "information" to "an appropriate medium" and change "MIS" to "computer-mediated communication systems," this good advice is brought up to date. Management can implement and use office automation in ways that will achieve missions and purposes through more appropriate functions, more responsive processes, and more effective activities and actions. We must be careful to avoid measuring the wrong thing well, but we also must be responsive to opportunities to improve performance through the use of new organizational communication media.

NOTES

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1. Researchers are not representative of typical organizational information workers. However, communication is central to both kinds of workers. The relationships between communication and effectiveness found in studies of the former provide useful foundations for analyzing media use of the latter.

2. Other major systems not listed include Electronic Mail Information System by Medical Information Technology, Inc.; Mailbox by I. P. Sharp Associates, Ltd.; APL Plus Message Processing System by STSC, Inc.; Mailcall by Telecomputing Corporation of America (offered through The Source); Mailbox by United Computing Services; and MCIMAIL by MCI. (MCIMAIL already has over 80,000 subscribers, according to Communications Week [1984].) The Survey of Electronic Mail Systems, Edition II, 1982, by Hannigan and Associates lists over 70 commercial electronic messaging systems and services. Most major information utilities—including specialized services such as library networks—will soon offer electronic mail.