

The Impact of Office Automation on the Organization: Some Implications for Research and Practice

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Computer technology has recently been applied to the automation of office tasks and procedures. Much of the technology is aimed not at improving the efficiency of current office procedures, but at altering the nature of office work altogether. The development of automated office systems raises a number of issues for the organization. How will this technology be received by organization members? How will it affect the definition of traditional office work? What will be its impact on individuals, work groups, and the structure of the organization? This paper presents a descriptive model and propositions concerning the potential impacts of office automation on the organization and it stresses the need, when implementing automated office systems, to take a broad perspective of their potential positive and negative effects on the organization. The need for further research examining the potential effects of office automation is emphasized.

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Introduction

The term "office automation" is generally considered to refer to the use of integrated computer and communications systems to support administrative procedures in an office environment. Automated office systems represent structured methods of handling business text processing and communications through an integrated network that may include word processing for generating correspondence, electronic message systems for person-to-person communication, teleconferencing services, facsimile transmission, electronic filing systems, on-line calendar systems, and links to corporate files and outside services [6, 39]. In the automated office, not only will office work be performed more efficiently, but the concept of office work itself will be altered [9, 19, 39, 44, 49]. The greatest potential of office automation is not expected to be from the improvement of clerical and administrative tasks, but from the ability of managers to gain increased control over their operations [9, 39].

Two major factors motivate business organizations to consider automated office systems. The first is a critical need to improve the productivity of both clerical and managerial office employees. While office costs have doubled in the last ten years, office productivity has risen only four percent [48]. The size of the office work force is expected to double between 1975 and 1985 [51]. It has been estimated that up to 95 percent of a manager's time is spent in written and verbal communication [40], much of which could be affected by office automation.

The second reason for interest in office automation is the increasing complexity of organizational decision-making and information needs. The more traditional forms of communication such as telephone, mail, and person-to-person meetings may be ineffective for processing large volumes of information rapidly. In the future, this technology may be the only feasible way to deal with information processing in increasingly complex and rapidly changing organizational environments.

Components of Automated Office Systems

A broad definition of office automation may include all use of computer technology to support the "knowledge worker" [39, 51]; this definition includes computer-aided graphics and design tools, decision support systems, and any use of personal computers for work-related tasks. In this paper a more narrow view of office automation has been taken, concentrating on the administrative component of an organization's functioning. We are concerned with the collection and dissemination of information that prior to office automation was not supported by the organization's formal computer-based information systems [17]. A critical component of automated office systems under this focus is their communication functions; it has been suggested that communications technology is the most significant factor in

redesign of organizations through office automation [30]. The other major components to be considered here are text processing functions and personal applications supporting the administrative responsibilities of office workers.

In the restricted definition, automated office systems are generally based on interactive workstations connected to a communications network. The workstations have intelligence and storage capabilities managed either through a central computer or distributed to the workstation themselves. Workstation functions may be tailored to different roles, e.g., managerial, professional, secretarial, or even to individuals. Each workstation would have some degree of functionality of three components: communications, text processing, and personal applications.

Text processing capabilities of automated office systems are in common use today. The features that prepare, edit, and store text will in the future be augmented by the ability to file documents electronically with cross-reference indexes and keyword searching. Equipment for automatic facsimile transmission and automatic phototypesetting is also available.

Aids for interpersonal communication include any facilities for distribution of correspondence to an electronic "mailbox" of the recipient. The most common form of interpersonal communication is "electronic mail," where a user types a message at a workstation or computer terminal that sends it automatically to the mailbox. Upon transmission the message is immediately available to recipients. Store-and-forward message systems based on audio recording are also available. The significant feature of electronic mail and its audio counterparts is the asynchronous nature of communication. Both sender and recipient control the timing of their portion of the communication, thus eliminating the inefficiency of incomplete calls and minimizing the need for interruptions.

Personal applications include the capability for streamlining individual administrative tasks and are used by individuals at their own discretion. Examples of personal applications are on-line calendar and scheduling programs which can be used to keep a record of an individual's schedule and, if feasible, compare schedules of multiple individuals in order to select meeting times. Reminder systems can be used for follow-up on previous messages, for reminders of appointments based on the automatic calendar, and for tracking project schedules. Personal contacts may be electronically filed with multiple reference indexes for retrieval in order to generate personal correspondence or obtain such information as telephone numbers.

An important feature of automated office systems under this definition is easy accessibility. At a minimum, terminals or other access facilities should be readily available to "principals" (primarily, managers and professionals) and support staff. With the decreasing cost of electronic equipment, centralized office support facil-

ities, which were motivated by economies of scale for equipment, should give way to an acceptance of the need for convenient access.

Automated Office Systems in the Organization

While the potential for office automation to improve office productivity appears compelling, such improvements will not accrue automatically. What is the appropriate strategy for implementing such systems? Designers emphasize clear objectives, proper planning, choosing an appropriate site for a prototype, eliciting the support and involvement of affected parties, etc. [7, 9].

Given that automated office systems are successfully implemented in the organization, are productivity improvements assured? Even more important, *how* will the new systems affect patterns of work, individual and group interactions, and organizational structure? How will the organization of the future look given the new technology?

Although there have been a number of major evaluations of the effects of automated office systems on office activities and communication patterns [8, 13, 16, 18, 27, 33, 42], little attention has been paid to its long-term effects on organizational functioning. The purpose of this paper is to consider some potential long-term organizational implications of office automation in order to (1) call attention to the need for research to increase our understanding of the potential effects of the technology and (2) alert practitioners to take a broad perspective when implementing these systems.

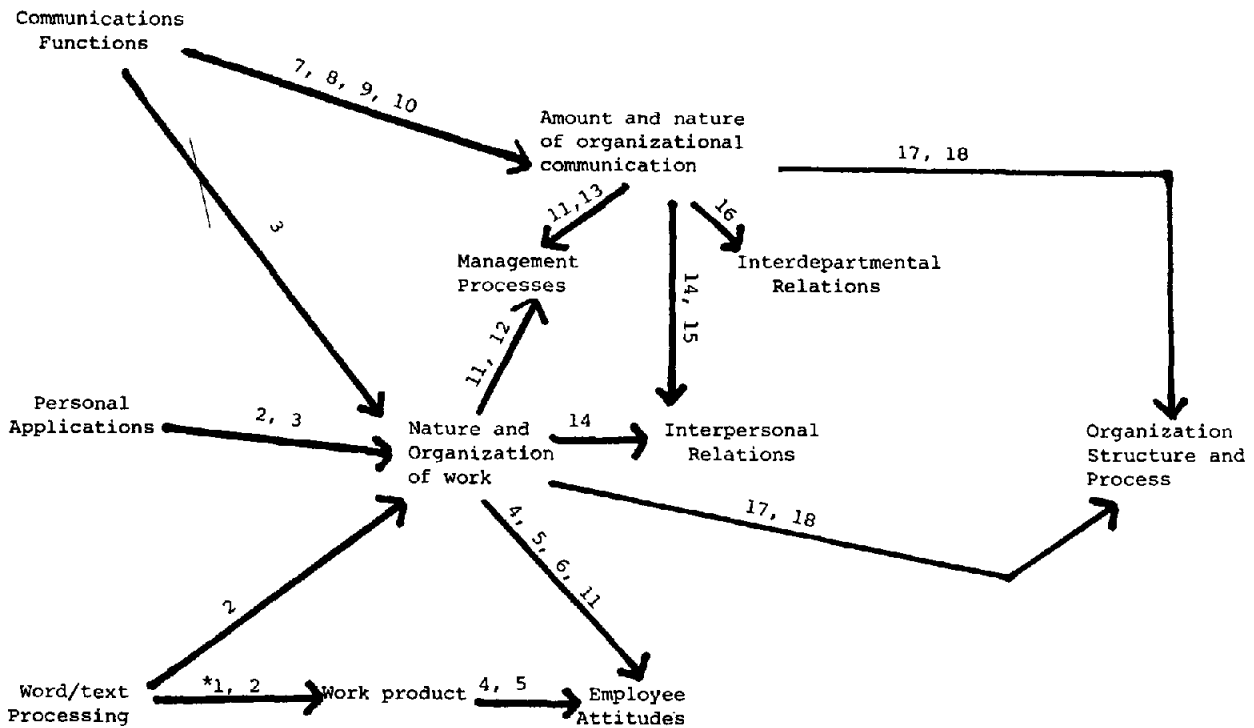
Some possible effects of office automation components on the organization and its members are illustrated in Fig. 1. The figure represents organizational characteristics affected by the successful implementation and integration of system components. The figure suggests that employee attitudes, management processes, interpersonal relations, interdepartmental relations, and organizational structure will be altered by automated office systems through intervening changes in the locational and temporal definition of work, shifts in the mode and timing of communication, and changes in the work product itself.

The descriptive model in Fig. 1 assumes that a certain level of system implementation and utilization has been achieved. The level of maturity of an automated office system may be considered to be a function of

- the number of individuals with access to the system
- the number of organizational subgroups connected to the network
- the percentage of work accomplished through the system

A large number of individuals need to utilize the communications component of the system before the system will affect organizational communications pat-

Fig. 1. The Impact of Office Automation.



* The numbers refer to propositions in the text.

terns [20, 49]. For instance, if one member of the target group of a communication does not have access to the system, other procedures need to be instituted to accommodate the exception. This reduces the overall effectiveness of communications substantially.

An organizationally mature system is utilized across major organizational subgroups. For instance, the authors utilize an electronic mail system in a university for intradepartmental communications only. Although it is used extensively, under this definition it will not be a "mature" system until it is implemented in other academic departments and the Dean's Office. In general, several subgroups that are central to the organization's major workflow need to utilize the system before this criterion is met.

The third determinant of system maturity is a minimum percentage of use by each organizational member on the system. Although an arbitrary definition in terms of time spent at a workstation, etc. is not very helpful, casual use for an occasional inquiry or demonstration clearly does not meet the criterion. Instead, it is assumed that after a period of utilization an individual will become more dependent on the automated office system. If access to the system is denied, the individual would be seriously hampered in performing his or her duties.

The descriptive model shows classes of interacting effects of mature automated office systems. Although research to date has focused on the individual productivity of secretaries and clerical workers [4, 18, 53], little has been said about potential changes in role definitions or in quality of work life. Impacts on managerial workers are more difficult to determine, primarily because the

work a manager does is itself not well understood. Changes in communications may affect both the formal aspects of intragroup relations (such as managerial span of control) and informal social interaction among individuals. The locational and temporal definition of work may be altered, requiring that managers monitor and control employees remotely. Enhanced availability of communications paths across departmental boundaries may have significant impacts on interdepartmental relations. Ultimately, the goal of any intraorganizational change or intervention is improved organizational effectiveness; increased organizational flexibility in structure and processes are expected to contribute to this goal.

This paper assumes what can best be termed a "socio-technical" perspective of organizations, that is, social and technical-economic elements of the organization as a system interact to produce outcomes such as those predicted here. It is more representative of the views of "structural" and "human relations" perspectives of organizations, as described in [32], than a "class politics" view. A word should be said, however, about this latter perspective. The political view assumes that automation (in this case, of the office) implies a division of labor that leads to decreases in skill, knowledge, and worker control over activities [32, 54]. In this view, "The question for management is... not simply one of saving money through reducing the payroll, but clearly one of securing the maximum control over the labour process in pursuit of maximum profitability" [15, p. 286].

The political view is not totally ignored. We recognize that the way in which an automated office system is implemented may lead to such outcomes; however, au-

tomation itself does not necessarily reduce individual skills or control over work. The socio-technical perspective assumes that the tools of automation are neutral; the social, task, and structural factors combine with technical factors to influence the nature of the work activity.

Some Research Propositions

The descriptive model suggests numerous propositions regarding impacts of mature automated office systems on the organization. In this section some specific research propositions are discussed. Where research in other disciplines can be applied, the implications for predicting the impacts of automated office systems are discussed. The propositions are stated in very general terms; the goal is to suggest important issues that need to be investigated further. The underlying premise is that behavioral and organizational implications of these systems are not well understood. Research that examines the propositions presented here will greatly enhance our understanding of those critical factors that will help automated office systems improve organizational productivity and effectiveness.

The discussion of the research propositions also emphasizes that potential effects are often complex, with both positive and negative connotations. Where possible, the discussion includes some speculation on design strategies that encourage positive organizational changes and minimize negative impacts.

Effects of Office Automation on the Nature of Work

It has already been pointed out that office automation is expected to increase organizational productivity through redefinition of office work rather than increased efficiency of current office functions. Several potential changes in the nature of work are proposed.

Proposition 1: Automated office systems, especially text processing functions, can improve the quality of written documents produced (e.g., reports).

A number of specific office activities can be "streamlined" through automation even without a major reorganization of office functions. Activities associated with the preparation of correspondence—addressing, copying, formatting, distributing, etc. can be handled more efficiently, especially if word processing is integrated into a communications network. The resultant output should also be attractive physically. In addition, the number of media transformations required to compose and distribute correspondence will be reduced [5]. Media transformations occur between speaking and writing, handwriting and typing, computer file and hard copy, etc. Since errors can be introduced at each transformation, the fewer the media transformations, the more accurate the final product. Automated office systems should therefore improve the appearance and accuracy of output.

The quality of work produced should improve even where time savings cannot be demonstrated. Word processing should permit text to be easily corrected and modified, making it possible to improve document quality within given time constraints.

Proposition 2: Automated office systems, especially text processing functions, can permit increased specialization of skills to support administrative and clerical tasks.

The potential exists to reorganize office tasks for increased specialization. The effect of this specialization is highly dependent on the management philosophy underlying the organization of the new systems. On the one hand, the acquisition of word processing skills may be represented as skill enhancement and enrichment of current clerical work. The role of "information specialist" may emerge. Moreover, the decentralized "one-on-one" clerical work force may be replaced by an administrative hierarchy that permits acquisition of new skills and increased opportunities for advancement.

A more negative picture is drawn by the political view of increased specialization. The potential exists for automation to permit an increased division of labor and increased "de-skilling" or routinization of office tasks. In this view the "... office of the future is a recreation of the factory of the past" [54]. The authors, as stated earlier, feel that a management philosophy stressing careful design will prevent these negative outcomes. The potential effects of specialization on individual stress, status, and job satisfaction are discussed in later propositions.

Proposition 3: Automated office systems, especially communications functions, can alter the physical and temporal boundaries of work.

The asynchronous nature of communications with automated office systems has already been discussed. Since physical proximity is not required for many communications and since responses can be asynchronous, the opportunity exists to increase the flexibility of work hours and work location. For instance, if employees were permitted to work part-time at home, there would be potential savings for the organization in terms of office space. Individuals could enjoy increased flexibility and savings in commute time and costs. Several companies are now experimenting with "remote work" options, motivated by the need to attract and retain qualified personnel [43]. Particularly in densely populated urban areas, allowing flexibility in work hours and work location can help to attract qualified individuals who cannot or will not tolerate a long commute to work nine-to-five. Such options provide significant opportunities for the elderly, the severely handicapped, and those with other personal or family responsibilities that constrain their freedom of movement and limit their current work options.

The communications component of automated office systems provides the potential to move entire work units

into "satellite work centers," small organizational units located in areas closer to employees' homes. Organizations are considering such options because of the potential savings in costly urban office space and because of the benefits to employees in terms of reduced commuting. Both the satellite work center and work-at-home options invite significant questions about how to manage employees remotely and how work location affects the employee's own job satisfaction; these questions are contained in subsequent research propositions. The important point here is that current technology permits changes in the physical and temporal nature of work that were not feasible previously.

Effects of Office Automation on Individuals

Where the first three propositions focused on the nature of work itself, the propositions in this section are concerned with how automated office systems, influenced by changes in the nature of work, affect individuals' attitudes toward their work.

Proposition 4: Automated office systems can affect the role identification and stress of office workers, especially secretarial and clerical workers.

A recent report [55] cites numerous studies of office workers showing that stress is a major problem in this work group. In particular, the report concludes that machine pacing of work, monotonous, repetitive work, and service work (responsibility for people rather than "things") are major sources of stress. Turner and Karasek [50] identify four characteristics of task environments that affect operator performance and physical health for tasks requiring computer interaction: operator autonomy over control of the work, uncertainty about the system, changed task interdependencies, and overall workload. These characteristics have been identified as stress-related in white-collar jobs [14, 29, 37]. Factors of the task environment specific to automated office systems might be the increased speed of communications with superiors and increased workload through having a greater number of principals to serve per secretary.

As discussed under Proposition 3, the degree to which stress-related conditions are enhanced is highly dependent on the organization of the work activities to be supported by automated tools. Turner and Karasek [50] present a number of suggestions for design of systems to decrease stress and improve performance, many of which pertain directly to office automation.

It is expected that there will be little or no increase in role overload or stress for professionals or managers as a result of automated office systems. For managerial workers, one can expect greater time pressures to respond to electronic memoranda that previously would have been typed and transmitted by mail. However, to the extent that electronic mail replaces phone messages, the manager has the opportunity to think and respond to a message without having to react immediately on the telephone. Thus, the advantage of the greater transmis-

sion speed combined with the ability to defer reading as well as answering messages should result in greater control over daily interaction when electronic systems substitute for some face-to-face communications [5].

Proposition 5: Automated office systems can affect the perceived status and job satisfaction of office workers, especially secretarial and clerical workers.

Evidence from research on job satisfaction shows that greater satisfaction and higher perceived status can result from increasing the task variety, skill requirements, and direct feedback of a job [23, 25, 47]. If the task environment is organized appropriately, the training involved in the use of automated office systems can represent an upgrading of skills, increased status, and job enrichment for clerical and secretarial workers. Those jobs such as filing that are typically considered the most boring and repetitive can be incorporated into other jobs and eventually disappear altogether.

In the long run, the function of "information specialist" can provide not only an upgrading of skills, but greater opportunity for advancement and increased responsibility. It is conceivable that administrative work will be a significant organizational function with a hierarchy of authority and career paths that do not exist for the typical administrative worker today.

The potential for a negative impact on the status and job satisfaction of clerical and secretarial workers also exists, especially if poor work designs accompany the new systems. Examples exist of centralized word processing systems where secretaries who had previously gained status and satisfaction from support of a particular manager were reduced to membership in glorified "typing pools" and experienced decreases in status and satisfaction with the work [54].

Automated office systems can be designed to either enhance or decrease the perceived status and job satisfaction of affected employees. The automated systems are themselves basically neutral; their implementation provides the opportunity to consider perceived status and job satisfaction in the redesign of the tasks they are to support.

Proposition 6: Changes in the physical and temporal nature of work supported by automated office systems can affect the worker's feelings of identity with organizational goals and criteria for promotability, especially for professional and managerial workers.

The majority of tasks performed by professionals in an organization are project-oriented with relatively long-term deadlines. Many professional functions are supported by computer and communications technology. This proposition is based on the premise that given the nature of their work, many professionals can work in relative isolation from the organizational environment for at least some period of time. While it may be very attractive to a professional to work at home several days a week in relative "peace and quiet," for instance, it is

conceivable that such work patterns could discourage organizational commitment and encourage professional autonomy. Such a shift could be very dysfunctional to the organization overall and may also be dysfunctional to individuals; lack of visibility, for instance, may negatively affect their chances of promotion [41].

Effects of Office Automation on Organizational Communications

The next four propositions are concerned with the quality of most forms of communication of a work-related nature.

Proposition 7: Automated office systems, especially communications functions, can lead to improved efficiency of communication for all office employees.

It is expected that use of communications functions, primarily electronic mail, will increase the efficiency of communication through the substitution of electronic memos for telephone communications and written memos. Electronic messages are fast and accurate; they require fewer media transformations than written memos. One effect of electronic mail substituting for telephone communications is reduced "shadow functions" [5], the unpredictable, time-consuming, but "unproductive" activities associated with a telephone call such as a busy signal, the called party being out of the office, or a bad connection. Another mechanism for improving the efficiency of managerial time is "message queuing" [5]. A telephone call often interrupts something else that a manager is doing, causing "wait" and "recycle" time before the original activity is resumed. Electronic mail messages, unlike telephone calls, can be "queued" until the recipient finds the appropriate time to handle them.

Proposition 8: Automated office systems, especially communications functions, can lead to a decrease in the amount of face-to-face contact between a manager and secretary, between colleagues, and between superiors and subordinates.

It is relatively clear that a communications function such as electronic mail can provide a direct substitute for some forms of face-to-face communication. What is less obvious is the effect of removing verbal or face-to-face contact on the quality of a communication. At least one study [11] has shown that the average time required to solve structured logic problems requiring direct communication was less with voice communication than with any other mode (handwriting, typewriter, video) or combination of modes without voice. There was no significant difference between full face-to-face communication and audio-only. On the other hand, studies of the mechanics of interaction in problem-solving have consistently failed to show a significant difference in the quality of the solution with variations in communication mode [10, 46].

The effects of altering the mode of communication on task performance need to be examined in each context

before major changes are instituted. While the quality of solution may not decrease, other factors such as the time to reach a solution, the social reinforcement provided by face-to-face contact, and pressure to conform or change one's attitudes may be important in given situations. In general, it is expected that the effects of altering the mode of communication will be more pronounced as one moves on a continuum from structured, task-oriented messages to bargaining or negotiation-type problems, where the messages contain highly subjective material (see Table I).

Proposition 9: Automated office systems, especially communications functions, can lead to an increase in the total volume of communications by organization members.

It is expected that while the total volume of communications may increase because of the ease of transmitting messages, automated office systems will alter the mode and circumstances under which this communication takes place. At least two studies [7, 56] have shown a net increase in volume of communications as a result of automated office systems. Another study [28] showed an increase in the volume of communications among researchers in dispersed locations as a result of the use of computerized conferencing.

Proposition 10: Automated office systems, especially communications functions, can affect the total volume of communications between departments.

Although the amount of interdepartmental communications depends on the structure of the organization, interdepartmental relations, and the nature of task activities, the existence of an electronic mail system or similar communications functions should facilitate communications among departments. However, during the interim period before all organizational units utilize the system or if some units resist using it, there may be decreased efficiency of operations related to that unit due to lack of complete information.

Effects of Office Automation on Management Processes

There are a number of ways that office automation technology can affect superior-subordinate relation-

Table I. Classification of Messages.

| Characteristic | Type of Message |
|--|--|
| Rational, thinking | Scheduling, coordinating, facts Perform tasks, i.e., bring a paper or book Reminder Write or respond to memo Make an expected request Make request beyond call of duty Negotiate |
| Feeling, interpersonal skill and competence required | Value oriented feedback on performance, etc. Creative discussion, model building, theory building |

ships. Some are direct effects of the technology itself, others are indirect effects mediated by changes in the physical and temporal nature of work.

Proposition 11: Automated office systems, especially communications functions and personal applications, can affect managers' perceptions of the degree of rationality, flexibility, and free space of their work.

Argyris [3] has predicted that information systems and operations research tend to increase the rationality of the manager's job. Automated office systems have the capability to contribute to increased rationality. Following the arguments of Argyris, automated office systems could result in fewer private information systems and less individual discretion in accepting information. Also, one would expect less intentional withholding of information because of the ease of communications. Messages can be transmitted accurately through many individuals and many levels, resulting in less filtering and less distortion of information received by higher management levels. This effect could be personally threatening or disadvantageous for subordinates in situations where they find it desirable to distort or block upward communications [2, 45]. The number of options open to managers for coping with excessive rationality in the organization or for defending themselves against perceived threats from others could be reduced.

Proposition 12: Automated office systems, through their effect on the physical and temporal nature of work, can affect methods for monitoring and controlling work.

A question frequently raised regarding remote work is: how does a manager monitor and control work that is performed out of sight? The answer to this question is highly dependent on the nature of the work being performed. For clerical tasks that can be defined in terms of output, there may be a return to the concept of "piece rates." Much professional work has objectives and milestones defined in terms of "deliverables"; the challenge is to define equitable deliverables within a realistic time frame. Jobs whose controls are defined in terms of process rather than output may simply not be good candidates for remote work. Perhaps a more significant problem is the adjustment in personal management style that would be required to manage remote work. Many managers do not feel comfortable supervising employees they cannot see; regardless of the employee's personal preference or the nature of the task, a job is probably not a good candidate for remote work if the manager does not feel comfortable with the arrangement.

Proposition 13: Automated office systems can be utilized to help increase the span of control of managers.

Increasing efficiency of communications and other office functions should result in greater free time for a manager. Although it can be argued that a manager can make use of that time to make "higher quality decisions," this benefit is difficult to quantify. On the other hand,

increasing the number of subordinates reporting to a manager has the distinct advantage of being quantifiable in terms of a reduction in the total number of managers required. Because of this advantage, some companies have cited increasing span of control as a direct goal of implementation of their automated office systems [7]. If a reorganization occurs parallel to the implementation of automated office systems, the increased load on the manager can provide an incentive to utilize the new technology to improve efficiency.

Effects of Office Automation on Interpersonal Relations

The existence of automated office systems is expected to affect the nature of interpersonal relationships within the organization both directly and indirectly.

Proposition 14: Automated office systems, especially communications functions and personal applications, can reduce the quantity and quality of social interaction and social reinforcement in the office.

It is clear from the preceding discussion that automated office systems have the potential to reduce face-to-face interaction through the direct substitution of electronic communication and the indirect effect of alterations in the physical location of work. Social needs play an important part in the motivation of individual workers [36, 38]; however, it is not clearly understood whether that motivation derives from peer group support, especially for professionals, or is purely social. One reason that satellite work centers are favored over, for instance, more extreme remote work options such as work at home is because of the social interaction provided.

Proposition 15: Automated office systems, especially communications functions, can affect the number of "sociometric"¹ links within an organization, the volume of communications among existing links, and the volume of communications upward in the hierarchy.

The availability of a fast and simple communications link should increase the amount of communications flowing along existing paths. This impact can be positive if the communications are satisfactory. If conflict exists or if inappropriate messages are sent, the impact of systems on communications and sociometric patterns could be negative. Another danger is that the increase in upward communication can cause information overload at higher management levels and lack of ability to differentiate significant information. New communications links and sociometric patterns should result from the increased ease of communications. Because communications are easier and faster, the addition of individuals to sociometric groups should be facilitated.

It has been predicted [6] that automated office systems will provide upward accessibility for employees at

¹ Sociometric refers to the number of other individuals with whom each individual interacts.

lower levels in the organization. For instance, with electronic mail employees can easily duplicate electronic messages and send copies to their superiors. It has been shown that upwardly mobile individuals will take advantage of improved communications facilities, possibly as a form of substitute upward locomotion [1, 31, 45].

Effects of Office Automation on Interdepartmental Relations

Proposition 16: Automated office systems, especially communications functions, can affect the degree of interdepartmental conflict, the degree of perceived interdependence among departments, and the definition of departmental boundaries.

The work of Walton and Dutton [52] suggests that withholding of information and other communications obstacles provide a major source of conflict between departments. To the extent that obstacles are mechanical rather than political or emotional, automated office systems provide the potential to reduce barriers to communication across departments and to reduce distortion of task-oriented exchanges, thus effectively reducing interdepartmental conflict.

Departments evolve from the need to specialize organizational activities [22]. High levels of interdependence among departments can lead to one department acquiring high levels of power over another [21, 26]. Conditions of high interdependence can also lead to interdepartmental conflict [52]. Automated office systems should facilitate information flow and exchange which should in turn ease interdepartmental coordination and reduce interdependence. As a result of the impacts expected between groups in the organization, departmental boundaries should also become less rigid [24].

Effects of Office Automation on Organizational Structure and Processes

Given a mature, integrated, organization-wide automated office system, what will be the long-term effects on organizational structure and processes?

Proposition 17: Automated office systems can facilitate changes in the definition of physical organizational boundaries.

The long-term effects of the changing nature of communications may be that individuals can productively contribute to organizational functioning regardless of their physical location. It is conceivable that without the requirement of physical proximity of employees, organizations would have no central physical location but would be composed of many smaller physical entities connected by a telecommunications network. Although this is a rather extreme and futuristic view, organizations are already beginning to take advantage of the lack of physical constraints, primarily through increasing regionalization and the satellite work center concept.

Proposition 18: Automated office systems can help improve the ability of the organization to accommodate structural changes.

This is a logical extension of the previous proposition. Galbraith [22] suggests that increasing information processing capabilities is crucial for coping with organizational uncertainty. Provision of vertical information systems and lateral relations are two organization design mechanisms that facilitate information processing; both of these can be achieved through automated office systems, as suggested by previous propositions. Physical limitations to changing organizational structures should be less critical since the communications capabilities become relatively independent of physical location.

Implications for Research on Office Automation

The descriptive model and research propositions discussed here are meant to provide a meaningful basis for research into the behavioral and organizational impacts of office automation. The propositions have not yet been tested with data. They are meant only to suggest the potentially widespread impact of the new technology. The overall implication is that, unlike many new technological developments which improve organizational efficiency, automated office systems have the potential to bring about profound changes in the nature of organizations.

The authors feel strongly that research focusing on the issues suggested here is urgently needed. Researchers should examine long-term, widespread organizational changes rather than narrowly defined changes in productivity or demonstrable efficiency increases. The authors recognize that such research is difficult, involving longitudinal, detailed examinations of organizations. In addition, the propositions in this paper differ considerably in the effort required to conduct research to assess their validity. For example, it would be very hard to design a study to examine Proposition 18 on structural changes in the organization arising from the implementation of automated office systems.

Research attempts to date have been admirable in the precision with which they attempt to measure or define activities [see, for instance, 4, 12, 13, 16, 33]. However, this research has not attempted to capture more indirect effects of new systems on the nature of work. Studies comparing the effects of different work designs and different implementation strategies are also critical.

Implications for the Design and Implementation of Automated Office Systems

The authors recognize that implementation of automated office systems in organizations will continue and probably increase as productivity improvements are

demonstrated. The best strategy implied by the descriptive model of system effects is for implementors to take a broad view of consequences of the new systems.

The systems themselves are not, generally, the "cause" of the types of changes suggested. Rather, the technology is mediated by the design of the work it supports and by the nature of the implementation process. Neither the long-term effects of altering the definition of "work" in space and time nor the consequences of new technologies at work are well understood. It is suggested that some potential problems can be solved by treating the introduction of automated office systems as a problem in work design. Task structures and role definitions can be designed to meet organizational objectives and the technology can be configured to support those work designs. For instance, a work design objective may be to increase specialization of administrative and clerical skills and to create a managerial hierarchy to support administrative tasks; a likely strategy would be to centralize word processing and utilize a reduced staff for other managerial support. On the other hand, increased skill variety and task significance for all support personnel may be a work design goal which would result in decentralization of text processing equipment and training of more personnel. Methods of monitoring and controlling work, especially remote work, can be explicitly considered in the introduction of each new automated office system.

Because the technology is relatively new, many organizations will begin with a prototype office automation project. In order to be as successful as possible with the first applications (which are highly visible), the authors suggest the following characteristics of a high potential prototype application:

1. A high volume of task-oriented communications among users.
2. A significant requirement for coordination of activities within and between departments.
3. High familiarity and good working relationships among those involved with the system.
4. Low levels of conflict among the departments involved in using the system.

The suggestions made here to consider work design alternatives and to pay attention to the implementation process are based on knowledge of computer systems implementation [34, 35]. The authors feel that to provide guidelines for enhancing or minimizing the proposed effects of office automation is premature. It is hoped that research along the lines suggested here can help lead to a set of prescriptions for practitioners that capture the broad scope of impact of this new set of technologies.

Conclusion

Automated office systems can provide a powerful mechanism for increasing productivity and improving

the quality of work life by changing the fundamental nature of organizational information processing. The propositions discussed here are meant to provide a starting point for research on the impact of automated office systems. Research should help provide more precise and adequate recommendations for the design of automated office systems so that these systems can be implemented *successfully* and contribute to improvements in organizational effectiveness.

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