MANAGERS AND OFFICE AUTOMATION- A FRAMEWORK FOR UNDERSTANDING USE

by
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A fairly widespread notion persists concerning office automation (OA) having a revolutionary impact on the work of managers. The new age will provide instant access to information, insightful consideration of numerous options, convincing graphics, and less time wasted in travel and administrative trivia. But how much of this ideal can be true? Given organizational and technological constraints, how much of it can be made true? How can practical consequences of OA be recognized and achieved? The answer to this question requires an appreciation of four issues: (a) the present status of OA use among managers; lb) practical expectations from OA, the nature of managerial work; (c) factors which limit managers' use of OA; and (d) the equilibrium between variables which promote and inhibit the use of OA.

MANAGERS' PRESENT USE OF OFFICE AUTOMATION

Managers recognize that a large percentage of their work can be made more productive through the use of OA (Poppel, 1982; Quillard et. al. 1983). Many studies indicate, however, that actual use of OA by managers is far from universal. In a study of computer use in 55 organizations, Bikson and Gutek (1983) reported the following percentages of use, broken down by job category: executive, 36%; managerial, 71%; professional, 79%; technical, 81%; secretarial, 64%; and clerical, 73%. A survey of approximately 200 middle managers and 100 executives in Fortune 500 companies by the Trinet Company showed that computers were used personally by 53% of the middle managers and 35% of the executives (Donath, 1985). Morell and Fleischer (in press) reported the following levels of computer use among 276 individuals working in a wide variety of organizations: worker staff, 72%; first-line supervisor, 71%; middle management, 49%; senior management, 41%; and executive, 35%. In a study of OA use among executives in 45 Fortune 500 companies, DeLong and Rockart (1986) found that 39 OA systems were distributed among 30 corporations such that "at least one executive, at either the corporate or divisional level, had a computer terminal on his or her desk."

Comparisons among these studies must be made cautiously because of important differences in sampling schemes, definitions of job level, and the way questions were asked. Still, these studies do convey an estimate of the likely upper and lower bounds of the extent of managerial use of OA. Within these boundaries of use, is OA having a pronounced affect on managers who are using the technology? Yes, but according to many studies, not to the profound extent that one might expect.

Two studies involving in-depth interviews with thirty seven OA users revealed evidence that some people do indeed use the technology in dramatic ways to benefit their organizations (Fleischer & Morell, 1985; Morell, 1987). For example, an officer took the initiative to have programs developed which allowed careful analysis of reasons for inappropriate overseas assignment of Naval personnel. Prior to this, such analyses could not be performed. Given the costs of moving personnel overseas and the associated costs of replacing overseas personnel before the end of a normal tour of duty, this use of office automation saved the Navy a large amount of money.

Many uses of office automation involved small changes for better planning or better use of information. These are changes which seemed advantageous, but which had no dramatic "bottom line" impacts on the

organization. Further, only one of the respondents reported that OA resulted in a profound change in the nature of his work.
In a questionnaire study of 168 managers in 15 large corporations, Fleischer and Morell (1988) asked respondents to rate, on a six point scale, how various applications affected their work lives. (1 = marked and profound change for the better, 6 = negative consequences have outweighed benefits.) Mean responses to this question were: word processing, 1.9; managing/manipulating data, 2.2; spreadsheets, 2.2; accessing data bases, 2.5; graphics, 3.0; electronic mail, 3.1; statistical analysis, 3.4; modeling/ forecasting, 3.5; training in work activities, 3.7; accounting, 3.8; and teleconferencing, 4.4.

The DeLong and Rockart study (1986) yielded the following ratings for information systems: high-3 cases, moderate-14 cases, low-6 cases, and don't know-16 cases. Studies by other researchers indicate that significant changes are being wrought in managerial life. Gutek, Bikson and Mankin (1984) report on a sample of managers who were "early adopters" of OA. Their respondents not only reported high levels of use, but also expressed strong interest in increasing the level of that use. Nutly (1984) reports several case studies of managers and executives who used personal computers to perform important analyses which they would not otherwise have done.

Evidence shows that some managers have had their work lives profoundly changed as a result of using OA and that many others have in some way been affected by the technology. But there has not been a ubiquitous, profound change in managerial practice. Moreover, there is considerable variability in the extent to which managers use OA. What explains this variability?

The answers to this question begin with an understanding of what managers do. The capabilities of OA are secondary; first, because few end-users push the limits of their software, and more importantly, because many managers' tasks are not amenable to direct help from computer technology. As an example, computers will not help a manager motivate employees to work more effectively in their work groups. So for us, the critical question is whether some of the capacities of information technology might help managers with some of their work.

MANAGERS' WORK

No matter how large an organization, any given manager is likely to have a unique set of responsibilities related to the coordination and oversight of a particular set of personnel, resources, and organizational activities. To carry out these responsibilities, managers spend their work lives reading reports and memos , talking with others by phone and in person, preparing presentations, and attending meetings (Mintzberg, 1973). The object of all this activity is to balance the often competing demands of being a good supervisor, meeting the demands of superiors, helping the company and advancing one's career. Some of these activities are in pursuit of long-range, or at least consistent goals. But much other work is short term or peripheral to truly important activities. Throughout, there is an emphasis on interpersonal influence, bargaining, and coalition building. Little of this activity is quiet, uninterrupted, or contemplative. Sproull's (1984) review of empirical research on managerial work concluded that managerial attention is "choppy, mostly unscheduled, oral, and as much other-directed as self-directed" (p. 16). Within this hectic work style, managers are continually engaged in assimilating information and making decisions.

What is the nature of that information search/decision making process? On an organizational level, it is an open process, continually subject to revision in light of new circumstances or new information. It is a non-linear process that is sensitive to new information, and rich with feedback loops. Revision and recommitment is continual. (Mintzberg, Raisinghani and Theoret (1976) describe this process in detail.) The continuous nature of organizational decision making is also manifest in the way people seek and use

information. Weiss (1980) has characterized information use and decision making as a process of "knowledge creep and decision accretion." Her view is that managers continually make small decisions on a day-today basis, and that each decision shapes and constrains options for the future. Available information continually affects this process on a day-to-day basis.

Bullen and Bennett (1983) demonstrate that managers will use computers in different ways because of differences in the extent to which they engage in fixed tasks with well-defined information requirements. Fleischer and Morell (1988) asked about the impact of various OA applications on helping to solve three different types of problems they had encountered: structured, semi-structured, and unstructured. With the exception of communications applications, the managers reported significantly greater impact from OA on the structured and semi-structured problems.

Because OA can quickly generate unique information, transmit messages, and produce varied documents, it can help managers provide an extremely valuable service, a service for which organizations have an almost insatiable demand-coordination. (In fact, Osterman (1986) argues that computers may increase the demand for managerial work by decreasing the cost of that important service.) If the technology is so ideally suited to help managers and their organizations, why is OA not being used more extensively? These questions will be discussed in the following section.

FACTORS INFLUENCING MANAGERS' USE OF OFFICE AUTOMATION

One aid to understanding factors which affect managers' use of OA is to take an "open systems" approach to the manager's computer system. In this approach one is concerned with inputs (how information gets into the system from the environment); throughputs (how the system processes that information); outputs (how the processed information gets out of the system and into the environment); and the environment the system is in. Environment includes two broad categories-the organization the system is in and the information environment in which the OA is operating. It is also important to be concerned with the specific attributes of the managers making use of the OA and the hardware and software involved.

Factors Affecting Inputs

Ideally, managers should be able to obtain information easily-either because a small group of experts maintain a database that meets everyone's needs; or because there is a rich linkage among individual workstations, thus allowing many parties to take advantage of data developed others. At the opposite extreme is a profusion of "private" databases which were developed exclusively within a single work group, and readily available only to that group.

There is good reason to strive for the most integrated information transfer system possible, because such connectivity has a noteworthy positive impact on managerial use of OA (Lauden, 1986). Unfortunately, many efforts to set up effective computer linkages prove to be far more difficult and less successful than planners expect (Ferris, 1983). The results of these difficulties are reflected in three sources of data which point to only sparse use of OA-based telecommunications by managers. Only 56% of the respondents in Fleischer and Morell's (1988) survey reported using a modem (defined as "any telephone access to a computer") for any reason in the prior month. For those who reported using a modem, the average response to a question about "frequency of use" was "about once per week."

The second data source is a survey by Morell and Fleischer (in press), which provides an even lower estimate of the number of people with electronic access to a centralized data base. In that study, 92

people were asked a variety of open-ended questions about the use of computers by themselves, by their immediate superior, and by someone they supervise. These questions yielded 365 instances of OA, only 12% of which use fell into the category of "information transfer."

The authors conducted approximately 50 interviews with managers who use OA. Of these, no more than ten have had the ability to electronically access centralized data and download (or otherwise manipulate) selected files in unique ways.

There are many legitimate reasons why data access through telecommunications is limited. Providing such access poses problems of increased needs for communication equipment and greater input/output capacity for centralized computers. Easy data access also makes it harder to maintain security, and it puts pressure on information system personnel to service a greater number of users.

Further, the idiosyncratic nature of managers' problems means that even the best data access environments may not meet their needs. The problem is that managers often require specific data at particular levels of aggregation, delivered at precisely the right time. Multiplied across all the problems of all the managers in an organization, this results in an extraordinarily complex data environment. It is not reasonable to expect a single centralized data service to meet all these needs.

The solution? Create, input, and maintain the data oneself. Here lies an inevitable tension between the nature of managerial work and the resources needed to exploit OA technology. The better a manager, the more he or she will creatively approach a variety of issues, each of which may well have unique data requirements. The more numerous those attempts, the greater the need to invest time and other resources in developing and maintaining specialized data. At some point an equilibrium will be reached, a limit beyond which the exploitation of information technology for problem solving will require greater resources than can be justified.

Factors Affecting Throughput

Evidence suggests that technological limitations on hardware and software are not major impediments to managers' use of OA. Zippo (1984) reports on a survey conducted by the Honeywell Corporation, which collected data from approximately 1,200 secretaries and 900 managers. In response to questions about suggestions for improving productivity, fewer than 10% of the respondents mentioned possibilities such as "more equipment, better/improved equipment, or rearranging access to present equipment." This finding is reflected in the authors' own research, where it was discovered that the most severe constraint on managers' effective use of OA is the amount of expertise they have available, e.g. knowing how to use available technology, or having someone close at hand who does.

Although organizations vary widely in the way they distribute computer expertise, all distribution patterns can be seen as a compromise between two basic models. One model is a single center of knowledgeable people who have wide-ranging expertise in the use of OA. The other model involves the distribution of computer expertise throughout a company, with "local experts" in different departments or work groups.

From the end-user's point of view, the distributed model has distinct advantages. The closer OA experts are to a manager's direct control, the more likely they are to devote time and expertise to that manager's unique needs. Computer experts who work closely with managers are also more likely to understand unique data and analysis needs, and thus be able to quickly develop workable and appropriate systems.

A centralized pool of experts also has its advantages, primarily because it requires a smaller number of total support staff. Aside from possible economic advantages, small numbers make it practical to staff a support group with true experts, who, by working closely together, can draw on each others' knowledge. Moreover, such a group's collective knowledge of organizational computing activity may allow them to serve a networking function. Another advantage is the potential to mitigate the problem of preserving the integrity of electronic files. In a study of 33 end-users, Sumner (1986, p. 44) reports that: "Fewer than 20% of the users surveyed had developed control, backup and recovery, and data security procedures for their applications."

Unfortunately, a small pool of experts may not have the time to answer questions, or at least, the ability to answer questions within a manager's time frame. This lack of assistance can be particularly troublesome if the "question" involves intense support for developing a database or a custom program. There is little question that end-users believe that such a problem exists. Approximately 61% of Sumner's respondents reported (p. 44) that their MIS organization would not have supported their applications because ". . . of their low priority and their departmental scope. Other respondents noted that MIS would have taken too much time and money to develop the same applications."

Many costs operate to inhibit the development of the "local expert" model. As local experts proliferate, so will the total labor costs invested in such experts. Efforts to incorporate local experts will also put a strain on work groups because those groups will have to find ways to do their regular work and also maintain a "private" information system support capacity. As the diversity of data systems increases, so too will threats to the integrity and security of data. Finally, the greater the balkanization of expertise, the harder it will be for computer knowledge to be shared throughout the company. Counterbalancing these costs is the fact that managers have access to competent support, and are thus well prepared to creatively solve problems and capitalize on opportunities.

No matter how great the advantages of local expertise for creative problem solving, few organizations can maintain decentralized systems that provide in-depth support throughout the organization. But the greater a manager's use of OA, the greater the likelihood that he or she may need custom support. Why? Because the more one appreciates the power of OA, the greater the likelihood of wanting data not readily available in centralized data archives, or of having a need for custom programming.

Restricted distribution of expertise can inhibit the development of useful "local" information systems. A good example of the need for local expertise is the previously mentioned case of inappropriate overseas personnel assignments (Morell 1987). An officer took the initiative to analyze this problem, and by so doing saved the Navy a great deal of money. His analysis, however, required some specialized programming. Normal centers of computer support could not devote programmer time to a customized system with so few users. By good fortune (and clever planning) this officer had in his work group an expert in the database software which contained the necessary information. It was this "local expert" who wrote the programs that have successfully identified many unnecessary early returns, and have thus saved a large sum of money.

The inappropriate distribution of expertise can also inhibit the use of an already developed system. Who will actually run the machines that produce information for a manager's use? In the world of personal computing, the answer is either the manager or a person working in the manager's work group. The operation of computers-no matter how user-friendly they are-requires time and expertise. Worse, the drain on time and expertise will be greatest for obtaining the most valuable information. This is because

the more useful the information, the more likely it will derive from a custom database, or involve specialized analyses. It is those analyses that will help a manager gain recognition as being able to uniquely contribute to his or her company. But as more intense efforts are applied to these issues, a work group's ability to do other work will be lessened. At some point the work group will face the inevitable choice of shirking routine assignments or working on special problems.

Factors Affecting Outputs

The kinds of output that are of greatest concern to managers are so-called "hard copy"-printed outputs used for routine reports, special projects, memos, and audiovisual aids for presentations. Many of these documents are tools that relate directly to a manager's reward system. For example, an effort to build a coalition in support of a special project may require high quality slides at presentations and many memos which cite relevant data, are cogently reasoned, and must be tailored for a variety of specific audiences. An important aid to such an effort would clearly be a good OA system, with its ability to access specific information, transfer sections of text among documents, and provide opportunities to preview any number of text and diagram layouts.

The main problems here are hidden constraints on support for outputs. One type of constraint involves limitations on human resources, as manifest in the ratio of time needed to produce a basic draft to the time needed to "pretty it up" and make it acceptable for distribution. To the best of the authors' knowledge, there are no empirical studies which attempt to calculate this ratio, but personal experience-and that of many others-is that the ratio is far less favorable than most people anticipate. To make matters worse, the more documents are produced, the greater the need for help in getting those documents ready for distribution.

A second type of output constraint centers on available hardware. Consider the situation with laser printers. While a minimal laser printer costs about $2,000, a reasonably good dot matrix printer can be had for less than $500. Any desire for colored output will raise costs even more. Thus, OA users have word processing software that can generate excellent text layout, and graphics packages that can insert wonderful illustrations into that text. But they do not have ready access to printers which can do justice to the final product.

Limitations on both human and material resources result in a situation where it is much easier to generate information for reports and presentations than it is to put that information in a form acceptable for important presentations. As a result, the ability to produce documents is self-limiting; the more that are produced, the greater the strain on available capacity to put those documents in usable form.

ENVIRONMENT OF OA USE

For convenience, environmental factors can be divided into four categories: organization, technology (hardware and software), information environment, and attributes of managers. Factors in each category affect some combination of input, throughput, or output.

As an example of the influence of organizational factors in explaining OA use, one should consider the range of policies an organization may adopt to govern the acquisition and use of microcomputer technology. In some cases, a centralized authority may place severe constraints on what technology can be obtained or where programming expertise can be located. In other cases, centralized direction may

be minimal, insuring only bare standards for file and telecommunication compatibility. In stark contrast to the former case, managers' use of OA in the latter case is constrained mostly by the value they place on that use. Once a decision is made about the value of OA, managers can use available resources to obtain whatever technology or assistance they need to develop and operate local systems (input and throughput), or to produce hard copy (output).

Technology obviously has a major influence on all aspects of the model presented here. Networked workstations are likely to provide more data (input) than would free-standing workstations. Available software limits throughput by constraining how data can be analyzed. For example, user-friendly linear programming packages have only recently become widely available. Prior to the availability of this technology, many types of optimization analyses were beyond the scope of most users of office automation. Output, as shown earlier, is dependent on the number and type of printers that are available. System reliability is also an important consideration; unreliable hardware will severely limit a manager's confidence that he or she can use the system well.

Information environment factors are also important. Consider several variables which may affect the ease of managers' obtaining relevant data: content; level of aggregation and logical structures of central data archives; frequency of updating of those archives; input/output capacity that affects the availability of data in a timely manner; and the number of experts available to help end-users. The more limited any of these factors, the greater will be managers' desires for a "private data base" (an input issue), and local expertise (a throughput issue).

The attributes of managers must be considered. On a personal level, managers differ on factors that have a direct bearing on OA use. Creative managers with high achievement motivation may make heavy use of OA in order to solve problems and take advantage of opportunities. Further, much of that use is likely to involve non-routine applications of their equipment, thus putting a strain on input and throughput capacity. Other important factors to consider are a manager's ability to define the mission of his or her group, to garner organizational resources, to use computers to lighten routine work loads, and to get assignments passed on to others. Each of these factors will have an influence on resources available to input or process information, or on the technology available to a manager to generate output.

Beyond a manager's personal attributes, the nature of his or her job is also important. Managers on the "technical" end of the "professional manager" spectrum are likely to have specialized information needs concerned with a relatively narrow range of information. The more diverse a manager's job, the lower the likelihood that a centralized data archive can provide needed information, thus influencing the need for specialized data bases (input) and for a "local" capacity to deal with that information (throughput).

Two brief examples from the authors' research will illustrate how the aforementioned factors affect managers use of OA in actual work-world settings.

Case #1: In order to be more responsive to customer needs, an insurance company made a decision to give branch office heads more autonomy in taking on new business. An important step in implementing that policy was the establishment of an information system that served two functions. First, it provided the branches with data they needed to m4e decisions about new business. Second, it allowed central office personnel to carefully monitor new business, even under a condition of reduced decision making authority concerning that new business.

Case #2. One of the insurance company's managers wished to track business for the "line" (i.e., automobile, residential, etc.) for which he was responsible. The company's central data archives did not have the data he needed in the precise form that would allow him to make specific decisions for his area of responsibility. The archives could, however, produce information from which he could derive the data he wanted. This he did, and then set up and maintained his own database on a personal computer. For the most part, he personally did the work necessary to keep the database functional.

Consider the implications of these examples for the constraints on OA presented earlier. In Case #1 there was a strong commitment from top management to provide OA. From a technical point of view, this meant that hardware, software and data elements were chosen to meet a wide variety of local needs. These technical considerations have distinct implications for human resources. Managers have less of an impetus to develop private databases and localized expertise, thus minimizing the diversion of personnel to talks concerning system development or maintenance. Individuals can obtain the information they need without substantially altering their own work tasks, or those of their subordinates. Because the hardware and software were designed to meet local needs, there is great potential that sources of expert assistance can also be centralized without limiting people's ability to use the system. On the other hand, none of the system's end-users took a personal risk in making a commitment to OA, and thus may not feel impelled to produce creative outputs to prove the value of the system.

Case #2 illustrates a very different situation within the same insurance company. Here, the special needs of a small part of the company required a "local" commitment to OA, and hence, a risk on the part of an individual manager. The manager had to use his own resources to maintain his system, thus changing the goals of his work group and the activities engaged in by his subordinates. He had to have strong personal convictions that the outputs obtainable from his system would pay off for himself and for his department. He certainly had ample motivation to prove that point.

CONCLUSIONS

Given what managers do and the way they serve their organizations, managerial use of OA can make an important contribution to organizational effectiveness. In order to maximize that contribution, the process of managerial use of OA must itself be managed. Managerial use of OA must be guided by three principles. First, any given manager's needs for OA are likely to be quite specialized, at least in some respects. Second, if those very specialized needs are not met, the value of OA to the manager will decrease dramatically. Third, meeting those specialized needs requires close integration between OA and a hectic, often unpredictable work pace.

The difficulty in achieving integration can be understood in terms of problems with the inputs, throughputs, and outputs of OA systems. In each category, there is tension between factors driving up the demand for OA, and factors which inhibit the unbounded use of the technology. A first step in resolving the tension is to make a decision about the level of managerial use of OA that is desired. Then, for that specific setting, the most salient problems involving input, throughput and output must be identified. By following this problem identification process, it becomes possible to devise effective strategies for the productive use of OA by managers.

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