The Strategic Impact of Information Technology on Managerial Work Final Report

CEO Publication
G 88-7 (120)

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CONTENTS

1. EXECUTIVE SUMMARY

Strategy, Managers and Information Technology

The purpose of the research project reported here was to examine the effect of information technology on that major strategic resource: managers and mid-level professionals. Are they more effective, less effective, or unaffected by the technological tidal wave, particularly computer technology? Here is what we found.

Who We Studied

We surveyed two main categories of middle-level employees: managers and professionals, 902 in all, from eight Fortune-500 companies. More than half the the respondents considered themselves to be both managers and professionals. The average manager was in his (only one-eighth of them were women) early forties, with about 17.5 years service with his company.

Key Results

1. Information technology can improve the effectiveness of middle managers and professionals.

(Chapters 4, 10.)

- But some combinations work better than others.
- There are six main groups of technologies (in terms of the similarity of their impacts on managers and professionals): **telephone**; **traditional internal communications** (face-to-face conversation, meetings, internal mail); **outside paper-based communications** (external mail, facsimile, overnight mail); **voice messaging** (answering machines, electronic paging, voice mail); **electronic conferencing** (electronic mail, telephone conferencing, slow-scan and full-motion video conferencing); and **computer technologies** (text processing, personal computing, specialized computer programs, spreadsheets, computer graphics and data management).

2. Information technology must not be considered in isolation.

(Chapters 2, 10.)

- It is part of a complex set of interrelationships including the organization in which it is used, the activities managers engage in, the roles they play and the tasks they perform. A change in any one of these can affect the others.

3. There are important differences between middle managers and professionals in the ways they use information.

(Chapters 3, 8, 9.)

- Professionals differ from managers on the importance of almost every managerial role.
- Professionals are better served by technology that aids them in processing information.
- Managers are more concerned with using information and communicating; here supporting technologies at present are less effective than are those that support professionals.
- Computer technology is less *generally* supportive of managerial roles than any of the other technologies we considered, yet it is the most supportive of key professional roles.
- Professionals who have become managers respond mostly like managers in their information technology uses.
- Managers have shorter time horizons than do professionals, hence their desire for rapid communications.
- Designers of current information technologies that support action need to be more attentive to the requirements of managers, and the designers of technologies that support diagnosis and thinking need to be more attentive to the demands of professionals.

4. Introducing new information technology is a personal matter.

(Chapters 4, 5.)

- There is no substitute for *Invented Here*. Information technology works best when the impetus for its introduction originates locally with the manager-user having a stake in the outcome; almost as good is motivation from the boss *provided that the users are involved in the implementation planning.*
- There is no substitute for jumping in. Those managers who were self learners, directly using the technology, were also those who perceived the success of the implementation to be the highest. Formal training sessions did not score high in the results.
- Gurus are vital. Although seminars are good for introduction to technologies, when users of new technologies get into trouble, the successful ones go immediately to the local expert. Local means easily available (even if over the phone line). Local means familiar with the content of the manager's job.
- The two key attributes of successful software packages are *conviviality* and *centrality to the user.*

5. Perceptual change is an important and demonstrable impact of information technology.

(Chapter 6.)

- For example, computers seem to increase managers' desires for better quality information, thereby decreasing their satisfaction with the current quality of their organization's information. The need for computers to be able to "talk" to each other boosts demand for more formalization.

6. Information technology enables structural change.

(Chapter 5.)

- For example, the *location* of work is becoming less important--there are more home telecommuting managers/professionals than expected; electronic conferencing materially increases the perceived importance of boundary spanning; traditional secretarial jobs, such as text processing, are being taken over by the secretaries' bosses; routine information jobs in general are being replaced by information technologies.

7. It is dangerous to generalize the impacts of all information technologies.

(Chapters 4, 10.)

- Each of the six technology groups has a distinct effect on its users. Telephone technology is the most difficult to assess. Telephone use is very important to both managers and professionals. Yet, the telephone seems to be almost invisible to its users in terms of identifiable correlations; possibly its use is so pervasive that it affects everything, without any specific impact focus. Traditional internal communications, on the other hand, act to increase managers' use of information and, to a smaller extent, their attention to critical tasks and their processing of information; the importance of acting autonomously and stretching their horizons is comparably reduced.
- Different information technologies have different structural effects on the manager's use and processing of information and the performance of their roles.
- For example, the use of computer technologies (PCs, spreadsheets, graphics) and inter-organizational paper-based technologies (fax, regular mail, overnight delivery) has significant and positive effects on the frequency with which middle managers were able to pay attention to critical tasks. Electronic conferencing had negative effects.
- Information technologies that help managers to do noncritical tasks (*efficiency* enhancers) do not necessarily help managers to identify and carry out critical tasks (*effectiveness* enhancers), and vice versa. There seems to be the implicit assumption in many companies that providing information technologies that enhance a manager's *efficiency* will free up time for critical tasks; our results indicate that this is not necessarily the case.

8. The nature of the effects of information technology is the same at all levels of implementation.

(Chapter 5.)

- Although our participating company groups showed a factor of two variation in their degree of implementation of information technologies, the nature of the impacts of the technologies was the same over the entire range.

9. Innovation and computer technology are positively related.

(Chapter 8.)

- Thus, computer technology can be used to spur management innovation in general.
- The mechanism for this may be that computer use increases managers' feelings of self empowerement/worth, which leads to greater willingness to try new things, which may result in new world views, which is the basis for innovation.

10. Computer phobia failed to materialize.

(Chapters 4, 9.)

- We failed to find respondents who were opposed to computer use. We also failed to find many "low tech" managers in these companies.
- Which does not mean they don't exist. This may be due to the fact that all of the organizations we surveyed were relatively "high tech."

Strategic Implications

What does this mean for the development of a corporate information technology strategy? We don't necessarily have to consider major revisions in existing information technology strategies. But there are some lessons here for *tuning* strategy to better meet organizational goals.

The first lesson is that **many of the impacts of information technology are straightforward. But they are not necessarily obvious Nor are they trivial.** As a consequence, a particular area of desirable impact (for example, increasing attention to critical tasks while also increasing decision making) may be enhanced by some technologies but degraded by others. The best technology for increasing use of information is electronic conferencing--a technology that also most degrades attention to critical tasks. Senior managers should be aware that these subtleties exist.

This leads to the conclusion that **one can develop customized mixes of information technologies to help achieve particular results in managerial performance.** The specific mix depends on the desired outcome and the present state of technology use and of the information infrastructure in the organization. Our questionnaire, the data analysis techniques, and the resultant mathematical model of the organization and its managers pro-

vide the means to formulate the result. Information system planners should evaluate the different outcomes of these technologies in their implementation planning.

The style of implementation of technology is important. Information technology must be personally accepted by it users to be most effective. It cannot successfully be imposed by fiat. Human resource managers should give serious thought to the mode of implementation of new technologies in their companies.

Another lesson is that the nature of managerial jobs changes in a technological environment. This can result in new and enhanced competences for the organization which, in turn, can affect its competitive position. It can also result in decreased competence if the technologies are used improperly. Therefore, it is important to develop strategies to take advantage of the enhanced human resources made possible by the technology and avoid the undesirable effects. Pressures for structural change are here now. Information technology can make the transition possible. Senior executives should think of information technology aids to their managers as one of their major strategic resources. And plan accordingly.

INTRODUCTION

This report summarizes the results of the project *The Strategic Impact of Information Technologies on Managerial Work*. The project was supported by several corporations, 902 of whose mid-level managerial and professional personnel participated in a survey that provided the raw data for the project. The purpose of this focal survey was to inquire into the effects of information technologies, particularly computers, on managers and professionals in large organizations. Emphasis was placed on examining the effects of the technologies *from the manager's point of view.*

The survey was conducted entirely by written questionnaire, a copy of which is included as Appendix A to this report. The questionnaire comprises seven modules: demography, information technology used by the respondents, technology implementation factors, the information infrastructure of the participant organizations, activities performed by the respondents, their managerial/professional roles, and the tasks they perform. Each of these modules is covered in a separate section of this report.

The intention of the survey was to get an integrated as well as a detailed view of the effects of information technology on middle managers and professional workers. Hence, the individual modules of the survey are viewed as successive building blocks in developing that picture, going from the basic backgrounds of the respondents to the "bottom line" implications on their job performance of their uses of technology in their particular organizational settings.

Hypotheses

Our research is designed to test some fundamental assumptions:

First, that the effects of information technology on managerial performance can be distinguished from other organizational/environmental factors.

Second, that the mode of implementation of a new technology and the information infrastructure of the organization mediate the effectiveness with which an information technology is used.

Third, that different mixes of information technology are appropriate for different types of jobs--and that a particular job can be associated with a particular combination of technologies.

Fourth, that the usefulness of a particular information technology depends strongly on its operational characteristics, especially the ease with which it can be adapted to user needs and with which it fits the style of the organization.

Fifth, that the main factors--the technologies, the information infrastructure, the activities performed by managers, the tasks they do, and the roles they play--can be explicitly interrelated; and that changes in any factor affect the others.

Alternative Ways of Examining the World

In this study, the impacts of information technology on the work of middle managers and professionals were determined by three methods:

1. By using a detailed explanatory model that takes into account the mediating effects of organizational and individual behaviors, and looks at the resulting change in work roles and task effectiveness. This model is able to get at the effects of various types of information technologies in detail.
2. By using direct task output measures that the managers attribute to information technology. No details of effects of various types of information technologies are possible from this set of measures.
3. By using direct technology-specific measures of how much the technology contributes to the manager's job in a general sense. While this measure is broken down by specific technology, it does not provide any details of the impacts; only the extent.

While the second and third way (above) provide some confirmatory evidence, the details can only be understood through the first way which comprises a detailed model with mediating effects.

A Model of the Interrelationships

The fifth hypothesis listed above forms the basis for the model of technology--manager relationships depicted in Figure INTRO-1. Technology directly affects managerial activities, the information infrastructure, and managerial roles and tasks. Technology indirectly affects managerial roles and tasks through its influence on activities and the infrastructure. Similarly, changes in each of the "technology affectees" can subsequently affect technology use, and so on.

In the model there is a direct effect of technology that is not dependent on information management, an effect directly caused by the appearance of a new tool. Second, there is an effect which is mediated by the information management characteristics of the organization (the effectiveness of the information management infrastructure) and individual information management characteristics (how often the managers engage in various forms of information management activities). In combination, these two components are hypothesized to also have an impact on managerial tasks and roles. The model structure has been determined through both theoretical considerations and the empirical results.

The following chapters of the report expand on these hypotheses and the model and explore the results of the survey.

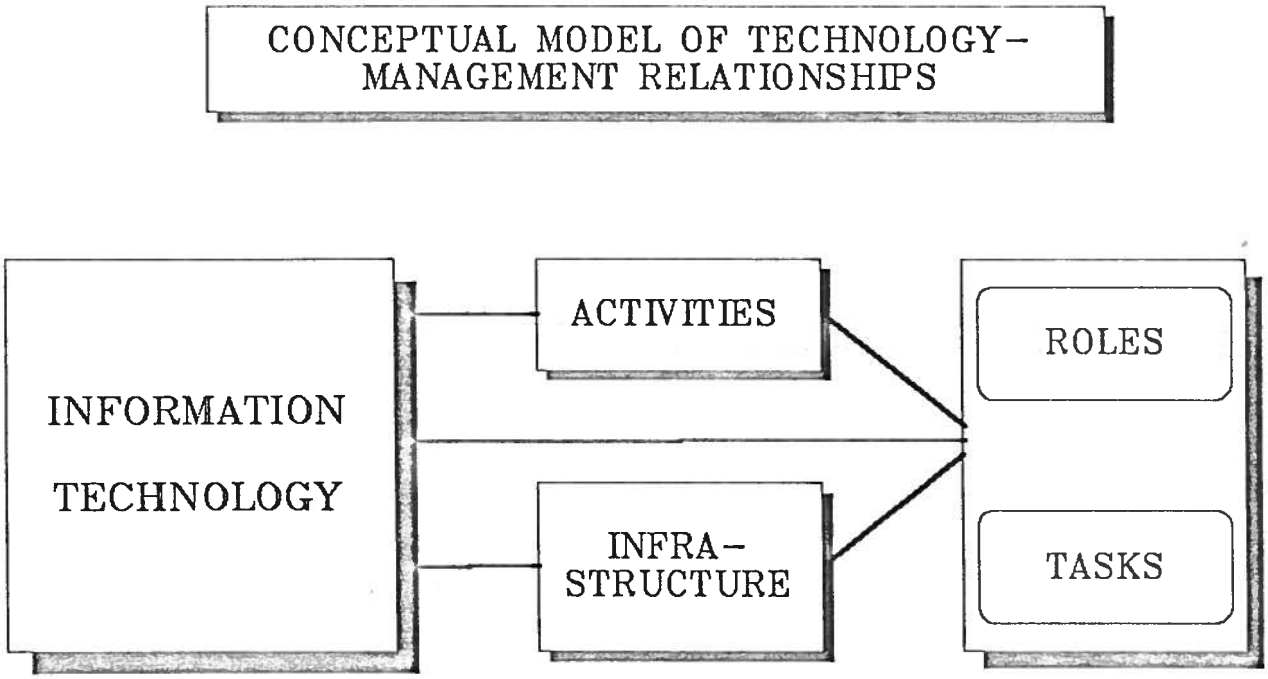

Figure INTRO-1: Relationships Between Technology and Management

DEMOGRAPHY

Rationale

Who ARE Middle Managers and Professionals?

This project focuses on middle managers and professionals and on the effects of information technology on their work. Before we examine the effects of technology it is necessary to have some idea as to the nature of middle managers themselves. There was much discussion in the early stages of the project concerning definitions of *middle manager* and *professional.* For the purposes of this project we selected respondents from the participating companies who occupied positions in the middle of the corporate hierarchy. That is, middle managers and/or professionals were operationally defined as those who were neither senior (vice presidential level or higher) executives nor routine workers, but were somewhere in between.

To further categorize this group we asked the respondents to characterize themselves as either managers, professionals, or a combination of both, leaving the details of the definition up to the self perceptions of the respondents.

Our analyses of the survey data indicate that, for the most part, those who answered either *manager* or *both manager and professional* to the questionnaire also answered the rest of the questions the same way. The differences between *managers* and those who answered *both* indicate that the latter group are people who think of themselves primarily as professionals who have become managers, and who look on the world from a manager's point of view. Henceforth, we will call this group *manager/professionals.* In any case, those who identified themselves as *professionals* gave significantly different answers to some of the questions, as will be discussed later.

We also acquired a number of other facts about the individuals who participated in the survey, as summarized next.

Survey Results

Our first question was aimed at evaluating the diversity of job functional areas for the 902 participating middle managers and professionals. The breakdown is in Table DEMOG-1.

FUNCTION	Number	FUNCTION	Number
Marketing	25	Office Systems	3
Sales	6	Engineering	153
Operations	97	Product Development	48
Finance	49	Accounting	27
Research and Development	49	Legal	5
General Administration	45	Human Resources/Personnel	37
Production	58	Information Services	91
Customer Service	13	Program Management	33
Field Services	5	Planning	27
Office Services	15	Other	127

Table DEMOG-1: Distribution of Job Functional Areas

As to the central question concerning the perceived roles of the respondents, 36.5% said they were primarily managers, 9% answered that they were primarily professionals, 54.4% replied that they were both managers and professionals, and 1 person answered "other." Most of the participating companies had about half of their participants listing themselves as both managers and professionals. Also, in most companies the remainder tended to be either largely managers or largely professionals; i.e., there are only two main categories of mid-level employees per company.

The average age of all the respondents, 86.7% of whom are male, was in the early forties, although the average varied among the participating companies (from the early thirties to the late forties).

On average, the respondents had worked in their company for 17.4 years, in their present work units for 4.4 years, and in their current assignments for 2.2 years.

INFORMATION TECHNOLOGY

Key Conclusions

Most managers and professionals who responded to our survey were enthusiastic about their uses of information technology. We were surprised that so few (just 1%) were negative about technology. (It might be because the companies participating in the survey were fairly technology intensive already.)

Information technologies can be categorized and assessed in terms of their functional characteristics, rather than just by their technical specifications. Further, only a few of these functional characteristics are measured by the rating methods used in the trade and popular media. The other characteristics are more job- or situation-related.

The key characteristics of the most successful software packages have to do with how effectively individuals can match the packages' information processing power with their own goals and capabilities. In particular, two factors we call *conviviality* and *centrality to the user* seem to best differentiate between most favored and most rejected software.

Information technologies themselves can be grouped into a few generic classes, and these classes have different levels of utility for different aspects of managerial work. In particular, we can group the technologies into primarily "thinking" and primarily "doing" aids.

Rationale

Scope of Technology to be Examined

The term *information technology* covers a large territory, particularly as it is used in business. We started with the premise that information technology includes almost any method devised by humans to convey information. We then slightly restricted the scope of that definition to exclude mass media and related forms of broadcast (one to many) communication such as company newspapers, annual reports, and the like. Thus we concentrated on one-to-one or one-to-a-few communications and on the other technologies that aid managers and professionals in their daily tasks. Included in these technologies are the traditional ones that still form the mainstay of most office information activity: face-to-face conversations, meetings, mail and the telephone.

Emphasis on Computer Technology

But, because of its growing influence, we emphasized computer technology in our survey. Since our research emphasis is on the future impacts of information technology we felt it wise to concentrate on the technology with the highest potential impact. Further, we emphasize personal computing, whether carried out by a personal computer or via a link to a larger machine. Hence, we continue to focus on the technology directly used by managers and professionals themselves rather than those used elsewhere in the corporation.

Ties with Other Aspects of Survey

This focus is the central theme throughout the study. New technologies first succeed by offering better alternatives for the resolution of problems and needs already felt by their adopters. The breadth of success of a technology depends on the number of people who are better served by it. *Whether* they are better served depends on the attributes of

the technology, the needs and capacities of its users, the method of implementation, and the successes perceived as consequential to its use.

Key Issues

Predispositions Toward Technology

One of the keys to acceptance of a new technology is an attitudinal one, with the rate of diffusion of the technology presumably tied to the degree of positiveness of attitude of potential users. If people are biased against a technology it is less likely to be accepted soon--or at all. Are managers predisposed to accept, welcome or reject information technology, in particular, computers?

Technology Accessible to Users

Part of the answer as to what technology is most useful to which tasks depends on the accessibility of candidate technologies. There are two components of accessibility: availability of the technology to be used, and ability/need of the user to use it.

Personal Uses of Technology

The crux of the study is the technology that managers and professionals use personally. There are two components to this: hardware or systems and, for computer technology, software used personally.

Hardware

For the survey of managers and professionals we divided information technology into 24 categories, ranging from universally used, traditional "technologies" such as mail and face-to-face conversations to more recent introductions such as full-motion teleconferencing and cellular telephone. We asked each respondent to characterize the technologies in two respects: frequency of use and relative utility to the respondent in satisfying his/her job requirements. We also asked how long the respondent had been using each technology, if at all.

From these answers we derived a further measure, the *leverage* of the technology, proportional to the ratio of utility and frequency of use. Some technologies, though possibly infrequently used, have relatively high utility when compared with more frequently used technologies. This gives us a way of avoiding the dismissal of some infrequently used capabilities; when you need them you *need* them.

Software

Since software is the medium through which computer technology is used, we asked the respondents to list the software packages, if any, that they personally used in their work. We then asked what capabilities of this software were important to them, as well as the level of that importance.

Reasons for Use or Disuse

We also asked for computer users' opinions about the attributes of the software packages. Our questions were directed at both the operational qualities of the packages, such as utility, effectiveness and conviviality, and the perceived personal consequences of their use on the user's self esteem and status.

Survey Results

The following are capsule results of the survey.

Predispositions Toward Technology

Of the 85% of the respondents who answered the attitudes question, only 0.3% felt that information technology seriously impaired their work, 0.9% felt that it moderately impaired their work, 0.3% felt that it had no effect (for a neutral-to-very-negative total of 1.5%), 22.4% reported that it helped moderately and 76.2% felt that it greatly helped their work.

This illustrates an issue that we were unable to resolve in the survey; we could not seem to find many respondents who were anti-technology among our sample group. In fact, one of our participating companies, who were specifically asked to provide some "low-tech" and/or technology adverse respondents, felt that they could not do so. This could mean that there are few middle managers who are hostile toward information technology. More likely, it signifies that there are few technology-hostile middle managers in the Fortune 500 firms we studied. It is premature to generalize beyond this point with our present sample of the population.

Technology Available to Users

Table INFOTEK-1 shows the available technologies for the sample group.

RESPONSES TO INFORMATION TECHNOLOGY AVAILABILITY QUESTIONS

TECHNOLOGY	PERCENTAGE OF USE			
	None	Respondent Only	Others in Support	All of Unit
Typewriter	16.5	0.1	77.9	5.5
Dictating Machine	73.4	8.1	10.3	8.2
Copier	0.1	0.1	14.9	84.8
Calculator	2.3	6.1	5.4	86.2
Facsimile Machine	27.1	0.1	56.5	16.3
Answering Machine	57.7	1.6	27.9	12.7
Computer Device	0.4	1.3	21.8	76.4

Table INFOTEK-1a: Availability of Information Technology

THE COMPUTER DEVICE IS:

CONNECTED TO?		USED FOR? (Percent Response)	
Minicomputer	38.5	Personal Computing	49.7
Another Computer Device	17.5	Running Programs	56.0
Outside Database	16.3	Spreadsheet Analysis	54.7
Modem	40.4	Graphics	42.7
Local Area Network	51.1	Database Development	38.7
Other	21.1	Database Access	61.5
Don't Know	1.3	Electronic Mail	65.7
		Computer Conferencing	14.6
		Text Processing	66.6
		Other	14.0
		Don't Know	0.3

Table INFOTEK-1b: Computer Device Information

Personal Uses of Technology

In this section we address the other component of accessibility: the ability/desire of the user to take advantage of the technology's capabilities.

Hardware

The leaders of the most-used "technology" contest are what we call the traditional technologies (face-to-face conversation, telephone, paper-based mail, meetings) and the most popular computer-based technologies (text processing, electronic mail and some personal computer-based functions). Most of these are communications oriented.

To get an idea of the relative *importance* of each technology we devised a leverage factor, consisting of a weighted ratio of the usefulness of the technology to its frequency of use.[1] The resulting leverage factors are shown in Figure INFOTEK-1. Technologies with leverage greater than 1 might be considered to have greater usefulness than the average technology, while those with leverage less than one are perceived to be less useful than average.

Note that the less useful technologies are all relatively new, so that their relative disutility may be more the result of the respondents' inexperience with them than with any shortcomings of the technologies. The data do support the idea that there is a *learning curve* effect; frequency of use tends to go up as users gain more experience with the technology, until some normal-use level is reached. Beyond this level there is little growth in use over time. There also appear to be characteristic *competency times* (that is, the time it takes to go from novice to experienced user status) for each technology, measured in weeks for some and years for others. We do not have enough data to fix these times for all the technologies we considered.

We also found that we can group these technologies into six classes, as follows (in descending order of frequency of use):

1. **Telephone.** A class containing only this all-purpose member; cellular telephone may eventually end up here but there were too few members of our sample set to justify its inclusion at this time;
2. **Traditional Internal Communications.** Internal mail, meetings and face-to-face conversation constitute the oldest and most revered forms of communications; we called this Internal because most of such activity takes place within the organization;
3. **Outside Paper-Based Communications.** The external half of the traditional media are here, including both forms of external mail (regular and express) and the electronic form: facsimile.
4. **Computer Technology.** In this class are personal computing (on whatever size machine), text processing, specialized computer programs, spreadsheet analysis, graphics, and database development; outside database searching was not included for lack of respondents to this item;

[1]Specifically, the numerator is the sum of the usefulness results for the technology, from "not at all" to "immensely", each with an increasing integer multiplier (1 through 5), divided by a similar sum of the usage frequencies for the technology (provided it is available to the respondents). The ratios are normalized to the average usefulness/usage ratio of the 24 technologies.

5. **Electronic Conferencing.** Here we have telephone-, computer-, and slow-scan-conferencing and electronic mail; full motion teleconferencing was left out of this class simply because there weren't enough responses for this item to show up well in our factor analyses;

6. **Voice Messaging.** This class includes all the indirect, one-way voice technologies: call forwarding, answering machines, voice mail, and electronic paging;

Software

Next, we asked the respondents to list the software packages they *personally* used in their work, followed by a list of the capabilities of those packages that were most important to them. These capabilities group into the following 5 categories: Analyzing, Organizing, Communicating, CAD/CAM and, of course, Miscellaneous (including "other" and custom programs for the respondent's work unit tasks).

Reasons for Use or Disuse

The mean responses to our questions concerning the respondent's assessment of the attributes of the software packages they used most are listed in Table INFOTEK-2, grouped according to the categories in which they are included. Table INFOTEK-2 also gives the results for the software packages that the respondents use least. Note that, with the exception of the reliability item, the least used packages rate lower in all respects than the most used packages. The greatest differences, 27% and 19%, respectively, are in the "centrality to user" and "conviviality" categories.

These personal impact factors are pretty much the same for different job types (manager, both manager and professional, and professional), with two exceptions. Professionals differ from the other two categories in that they are much less concerned about use of software by support personnel and slightly more concerned about centrality to themselves. All of the job types indicate positive effects of the software they use in all respects.

STATEMENT: this package: Value=1	Value=5 Mean Response:	Amount of Use Most	Least
EFFICIENCY			
Wastes Time	Saves Time	4.59	4.06
Wastes Effort	Saves Effort	4.55	4.04
Wastes Money	Saves Money	4.41	3.88
Lengthens turn-around time	Shortens turn-around time	4.54	4.09
Decreases the amount of work accomplished	Increases the amount of work accomplished	4.36	3.97
EFFECTIVENESS			
Increases workload	Decreases workload	3.85	3.59
Decreases quality of work	Increases quality of work	4.36	4.12
Restricts the variety of tasks I can do	Expands the variety of tasks I can do	4.14	3.92
Makes the tasks harder	Makes the tasks easier	4.31	3.91
STATUS ALTERATION			
Decreases my status	Increases my status	3.54	3.44
Decreases my influence	Increases my influence	3.72	3.46
Undermines my image	Enhances my image	3.63	3.46
INTELLECTUAL CAPITAL			
Makes a lot of my previous knowledge and skills obsolete	Allows me to better use my previous knowledge and skills	3.98	3.68
Has decreased my work skills	Has expanded my work skills	4.09	3.74
CONVIVIALITY			
Hard to learn	Easy to learn	3.91	3.24
Requires lots of effort to use	Requires very little effort to use	3.91	3.26
Hard to retain, must continually refer to manual	Easy to retain, never refer to manual	3.84	3.13
Does not fit my style of thinking and doing	Fits into my style of thinking and doing very well	4.10	3.64
Poor accessibility; takes very special knowledge to use	Great accessibility; takes no special knowledge to use	3.74	3.15
GENERAL PERFORMANCE			
Slow speed	Fast speed	3.95	3.57
Too few command options	Great variety of command options	3.91	3.67
Unreliable, frequently bombs	Very reliable, never bombs	3.98	4.03
Capacity only handles my small tasks	Capacity can handle my biggest tasks	3.95	3.74
Unable to interface with other packages	Easily interfaces with other packages	2.90	2.71
CENTRALITY TO USER			
I personally do not use this package at all	I personally use this package a lot	4.22	3.09
I have no expertise with this package	I have a lot of expertise with this package	3.63	3.08
This package is not important to my work	This package is very important to my work	4.25	3.37
SUPPORT USE			
Others do not use these packages in support of my work	Others use these packages a lot in support of my work	4.10	3.30

Table INFOTEK-2: Attributes of Software

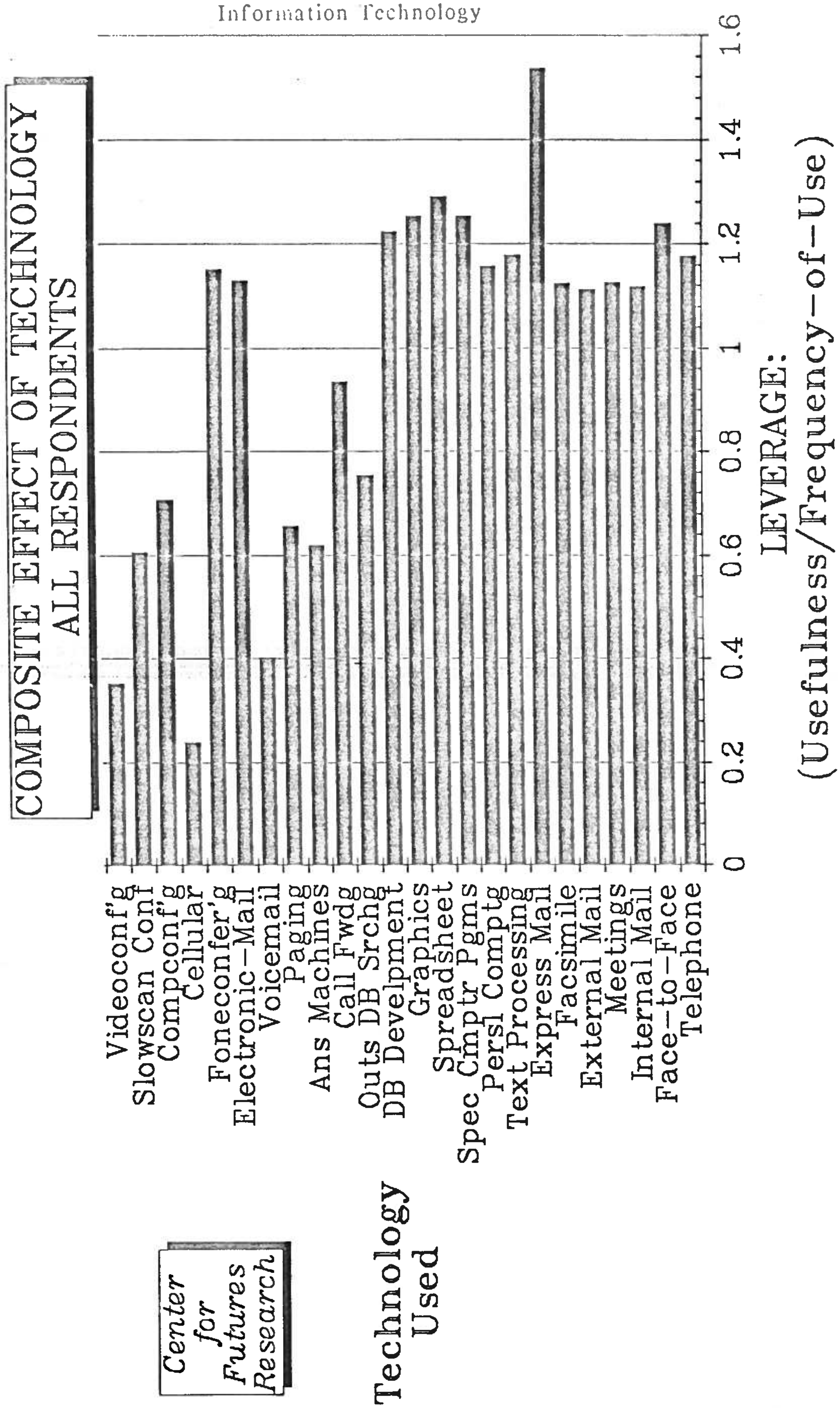

Figure INFOTEK-1: Perceived Leverage of Various Technologies

5. IMPLEMENTATION

Key Conclusions

We can quantify the degree of implementation of information technology in an organization with a single, multi-dimensional variable derived from our survey data.. It combines: 1) level of implementation; 2) degree of integration of the information technologies into work; and 3) the extent of success of the implementation process. We can use this to differentiate between "more high tech" and "less high tech" organizations.

The components of the scale are based on managers' relative assessments of success of the technologies rather than on some absolute scale (like number of reports produced or the number of computers on desks). Thus, the scale is self-adjusting over time (when used in future years) as managers' expectations of the degree of implementation change.

Specifically, the implementation measure is based on actual technology use and incorporates a measure of how well integrated the information technology is into work as well as the perceived success of the implementation from the manager's viewpoint.

Rationale

The term *implementation* refers to the level and methods of deployment of information technologies in an organization. Implementation involves the introduction, diffusion, evaluation, and support of information technology-based applications for the support and enhancement of work. Consistent with the orientation of the study, we examined the implementation variables from the middle manager's point of view.

Two multi-dimensional variables come out of our analysis. The first is the Degree of Implementation. The second is the Style of Implementation. The former is the one which is used as a measure of the technology intensiveness of an organization, while the latter is used to develop strategies for implementing new technologies.

Degree of Implementation

This is an organizational-level variable which characterizes the impacts of information technologies on managerial work. It is a critical variable in the study. It also serves to distinguish among the more "high tech" and less "high tech" organizations.

These are the major components of the degree of implementation, as seen by middle managers:-

- Direct assessment of the level of the implementation of information technology in the work unit;
- Extent of load shift in information processing functions from a centralized operation to work unit and vice versa;
- Extent of use of information technologies away from the office;
- Workstation density in work unit;
- Degree of integration of information technology into job and dependence on it;

  Whether the use of the information technology was discretionary or non-discretionary; and
- Overall success of implementation of information technologies .

Style of Implementation

A popular hypothesis is that style of implementation influences the success of implementation of information technologies. Style of implementation comprises the following:-

- Methods of introduction and diffusion of information technologies;
- Methods for learning to use the information technologies;
- Methods of support during use of information technologies; and
- Methods of evaluating information technologies.

Survey Results

Empirical Assessment of the Degree of Implementation Scales

Over 80% of our respondents pegged the level of implementation of information technologies in their organizations at past the start- up phase. About 50% thought there was widespread use of information technologies in their work unit. Only about 6% of the sample were in work units that had not yet even started the use of information technologies. It looks very much like a "high tech" world.

	Percentage	Cumulative Percentage
None	2.4 %	2.4 %
Being discussed	2.2 %	4.5 %
Being planned	1.3 %	5.8 %
Just started	12.0 %	17.8 %
Catching on	30.6 %	48.4 %
Widespread use	51.4 %	99.8 %
Falling into disuse	0.2 %	100.0 %

Table IMPL-1: Level of Implementation of Information Technologies In the Work Unit (N=902)

Degree of Implementation of Information Technologies Into Work

Three sets of data are used to assess the degree of integration of information technologies into work.

Percentage of Tasks that the Manager Uses Information Technology to Do. The results indicate that 30% of the sample still only use information technologies to do at most 15% of their tasks.

How Well/Easily They Could Do Their Present Job Without the Technology. The results indicate that 88% of all sampled felt they could not do their jobs as well without the technology, and 93% of all sampled responded that they could not do their jobs as easily without the technology. It is clear from these results that the information technology is well integrated into their jobs, and there are aspects of their job in which they could not do without it.

	Percentage	Cumulative Percentage
Much worse	41.3 %	41.3 %
Somewhat worse	46.4 %	87.7 %
As well as I do now	11.1 %	98.8 %
Somewhat better	1.0 %	99.9 %
Much better	0.1 %	100.0 %

Table IMPL-2: How WELL Managers Could Do Their Present Job Without the Technology

	Percentage	Cumulative Percentage
With much more difficulty	48.6 %	48.6 %
With somewhat more difficulty	44.6%	93.2 %
As easily as I do now	5.9 %	99.1 %
Somewhat more easily	0.7 %	99.8 %
Much more easily	0.2 %	100.0 %

Table IMPL-3: How EASILY Managers Could Do Their Present Job Without the Technology

Success of Implementation

Over 72% of the respondents thought that the implementation of information technology was at least mostly successful, and 25% of the respondents thought that it was extremely successful. This is not a surprising result given the degree of integration reported above. It is however surprisingly high given the usual griping and implementation failures reported in general.

	Percentage	Cumulative Percentage
Not at all successful	1.4 %	1.4 %
Slightly successful	6.8 %	8.2 %
Moderately successful	19.3 %	27.6 %
Mostly successful	47.4 %	74.9 %
Extremely successful	25.1 %	100.0 %

Table IMPL-4: Success of the Implementation

Extent of Working Away from the Office

Half the respondents indicated that they had a terminal or personal computer available to use for work away from the office. Slightly less than half (46.7%) used it to do work away from the office *in addition to* the work done at the office (graveyard teleworking), while 17.7% used it to work at home or away from the office *instead of* the office (orthodox teleworking). 13% of the respondents used the technology away from the office for at least 8 hours per week in addition to use at the office. And 3.1% of the respondents used the technology away from the office for at least 8 hours per week instead of the office.

These data represent the start of what appears, from other sources, to be a growing trend (for example, see *The Wall Street Journal*, 19 February, 1986, p. 33). Although the number of day-per-week home telecommuters among our survey respondents is only 3%, it was almost 0% two years ago. The 3% figure is six times our forecast value for 1985 for

home telecommuting information workers in general. Another project at the Center is investigating the possible growth of this work mode for managers and professionals.

Demographic Aspects of the Degree of Implementation

Professionals rated the degree of implementation significantly higher than did managers, suggesting that they were in situations in which information technologies were better integrated into their work, and their work unit generally enjoyed a higher level of implementation.

There were definitely company effects detected which were operationally significant. The degree of implementation for the company with the highest magnitude was rated as approximately double that of the company with the lowest magnitude, giving us a sizable spectrum from the "more high tech" to the "less high tech" companies. So, although we are moving rapidly towards a "high tech" world, there are still sizable differences along that spectrum.

Technology Attributes and Degree of Implementation

Our analysis of technological implementation deals mostly with relatively advanced technologies such as personal computing, local area networks, and word processors. It does not include typewriters or telephones. Bivariate correlations between the attributes of managerial use and the degree of implementation are shown below.

There are positive and significant correlations between the degree of implementation in the company and the importance of the various software capabilities (analyzing, organizing, CAD/CAM, communications, and custom programs) except for communication capabilities. Thus, managers who perceived the general degree of implementation in their organization to be higher also valued the software capabilities more, which is not a surprising result. The higher correlation with custom programs is not surprising either, given that they are customized to the manager's requirements.

What is surprising is the very low correlation of 0.05 with communications capabilities (text processing and electronic messaging), especially since these were rated the highest in terms of importance as compared to the other capabilities. One possible explanation for this is that these applications are fairly well-developed in many organizations and successfully implemented, irrespective of the degree of implementation of information technologies in general. [That is, everybody and his brother can make word processing successful and integrated into work.] In fact, word processing is in many cases one of the first applications of information technology to be implemented. Thus, like the telephone, the technology has become so intimately integrated as to be invisible to its users. Another explanation might be that other, nontechnological forms of communication dominate, making the technology unimportant.

IMPORTANCE OF SOFTWARE CAPABILITIES	
Custom Programs	0.30
Analyzing	0.17
CAD/CAM	0.14
Organizing	0.13
Communications	0.05

	MOST FREQUENTLY USED SOFTWARE PACKAGE	LESS USED SOFTWARE PACKAGE
Centrality	0.39	0.09
Efficiency	0.20	0.07
Effectiveness	0.19	-0.02
Conviviality	0.18	0.00
General Performance	0.18	0.00
Intellectual Capital	0.16	0.03
Support Use	0.14	0.01
Status Alteration	0.12	-0.02

Table IMPL-5: Correlates of the Degree of Implementation with the Attributes of Managerial Use of Information Technologies

The correlation table also shows that the degree of implementation correlates positively and significantly with the attributes of managerial use of information technologies that they most frequently use. Thus managers who rate the degree of implementation of information technologies in their organization to be high, seem to be guided very much by the software packages that they use most. In contrast, as we look at the near-to-zero correlation of less used software packages, it appears that the attributes of less used software packages do not influence the managers' perceptions of the degree of implementation. In other words, **the degree of implementation is judged mainly by successes, rather than by failures.**

Style of Implementation

Is it important *how* information technology is introduced into an organization? Our analysis points to some key rules for future implementation plans.

There is no substitute for *Invented Here.* Every technique for introducing information technology (various introducers and teachers of the technology) had its best results when the manager's own work unit was perceived to be the source of inspiration for the change.

Well... Almost none. When the inspiration came from above the results were not quite as good but were better than if it came from other units at the same or lower levels. It is particularly important for good top-down results to have the ultimate users of the technology involved in the planning process.

There is no substitute for jumping in. Those managers who were self learners, directly using the technology, were also those who perceived the success of the implementation to be the highest. Formal training sessions did not score nearly as high in the results.

Gurus are vital. When users of new technologies get into trouble, the successful ones go immediately to the local expert. Local means easily available (even if over the phone line). Local means familiar with the content of the manager's job. This makes it clear that the newly evolving function of local expert is a vital one and should be recognized (and appropriately rewarded) by higher management.

INFORMATION MANAGEMENT INFRASTRUCTURE

Key Conclusions

The information infrastructure of an organization--the sociotechnical system of information communication and control--can be characterized in terms of effectiveness. Although both the physical details of the infrastructure--information technology, information communication policies and practices--and the infrastructure's effectiveness may vary widely between organizations, its relative success can be characterized by 13 parameters. These parameters are independent of the level of implementation of information technologies in an organization.

Furthermore, the effects on infrastructure effectiveness differ among information technologies. For example, a particular group of technologies, such as computers, may have positive effects on half the infrastructure elements and negative effects on the other half. Computers and electronic conferencing have the greatest, and telephone the least, effect in altering the information infrastructure. Interestingly, computers tend to alter the effectiveness of the infrastructure generally in the opposite direction from electronic conferencing. We interpret this as an indication that managers' and professionals' *perceptions* of the infrastructure change as a result of their uses of new technology.

As in other aspects of this study, we found that professionals reacted differently from managers to several aspects of the infrastructure.

Rationale

Organizational structure, culture, norms, administrative procedures, technology, all in combination provide an infrastructure through which information management occurs. That is what we call the information management infrastructure.

The information management infrastructure itself is difficult to characterize in either an abbreviated way or in a way that makes it comparable across organizations. One easily gets lost in the details of the infrastructure elements. However, our concern is with the *effectiveness* of the information management infrastructure rather than with the *description* of the infrastructure. We hypothesize that infrastructure effectiveness *can* be assessed without recourse to the details of how it got that way, just as an automobile's performance can be measured without regard to the details of its construction.

The relevant effectiveness dimensions are the dimensions of the organizational environment that influence the manager's ability to use information. We used two central guidelines in defining these dimensions, in order to make them as general as possible. First, we have characterized them in a task-independent way. Second, we have characterized them from an information management perspective.

Dimensions of Effectiveness of the Information Management Infrastructure

We have identified thirteen effectiveness dimensions. For facility in exposition, the dimensions will be referred to simply as "infrastructure" dimensions in the rest of this Chapter.

1. Coordination of Information Among Groups

This characterizes the degree of uniformity among different groups concerning: 1) methods of providing information, 2) frequency of updating information, 3) procedures for handling information, and 4) the coordination of information between groups.

2. Expediency of Access

This covers: 1) the speed with which a manager can deliver a message, 2) the speed with which the manager can have a face to face meeting, 3) the speed with which the manager can get back a response to a message, 4) the speed with which members of *ad hoc* teams or task forces can share information, and 5) the speed with which internal communications systems (e.g., mail, telephones) can respond to changes in the organization (such as physical relocations, reorganizations).

3. Formalization of Information

This dimension includes: 1) the number of rules and procedures governing how the manager handles information, 2) the number of rules and procedures governing how the manager communicates with others, and 3) the extent of use of standard formats.

4. Information Quality

This refers to the accuracy and the completeness of information that reaches the manager.

5. Ease of Communication with Others

This is the ease of communication with others in the organization when the manager is in the office, and when the manager is away from the office.

6. Information Capacity

This dimension comprises the extent of backlog in unprocessed or unfinished paperwork, and the amount of extra work-load that can be absorbed at peak times.

7. Fragmentation

Fragmentation refers to the extent to which the work flow breaks down if one of the involved individuals or subunits has a major problem, and the extent to which individuals or subunits operate independently of each other.

8. Tempo

This dimension focuses on the amount of time the manager has to get most of the information he/she needs.

9. Amount of Information

An easy one: how much information are you getting?

10. Restrictions on Access

This concerns the extent of restrictions on access to information.

11. Proximity

This refers to the extent of physical proximity between interacting groups.

12. Amount of Redundant Information

How much redundant information are managers getting?

13. Deadline Tolerance

Finally, how tolerant is the organization, from the manager's point of view, for missed deadlines.

All of these dimensions are characterized in relative terms--not enough, just right, too much--rather than in bean counting numbers. This is because the quantities themselves, such as tolerance in days or hours for missed deadlines, change meanings between organi-

zations, or even between groups in the same organization. More important is the the manager's view of the dimensions in terms of their appropriateness for his/her particular job.

Survey Results

Description of Infrastructure Profiles

For the whole sample of 902 managers, the bar chart profile in Figure INFRA-1 shows the means for the thirteen dimensions of infrastructure. The less the deviation from the "about right" center line, the more effective the infrastructure.

The dimensions about which managers were most negative seemed to be the lack of coordination among groups, and the amount of redundant information being too much. At the same time, but on a somewhat lesser degree, they complained that the quality of information was less than it should be, access to others was not fast enough, ease of communication was less than it should be, the organization's capacity was less than it should be. They also complained that the amount of information they were getting was less than it should be, which is somewhat surprising in a world of information overload; but combining this result with their complaint about too much redundant information, suggests that they were not getting the information they wanted or thought they needed.

Demographic Effects

There were marked differences between the information infrastructure dimensions for professionals. Figure INFRA-2 portrays the means of the thirteen dimensions for the three groups (managers, professionals, both). Professionals seemed to portray in general a more effective information infrastructure (or one better tuned to their needs). Several dimensions were significantly different. The professionals reported less difficulty with communicating with others, complained less about the company's information capacity and the distance between groups. Several dimensions switched from one side of the "about right" to the other as compared to middle managers: professionals reported less formalization of information than there should be, less redundancy of information than there should be, and more deadline tolerance than there should be. The information management structure that professionals portrayed seemed to be less harried, more informal, and less organized (as evidenced by their sense that redundant information was less than it should be). All of these are consonant with the differences between the demands of managers' and professionals' jobs.

Each company had a different infrastructural effectiveness profile, and there were significant differences between companies.

Interactions Between Dimensions of Infrastructure and Information Technology

Most of the correlations between the dimensions of infrastructure with the importance of various software capabilities were nearly zero, except for a few exceptions which we report (we only report correlations > 0.1).

The *proximity* dimension correlated positively at 0.1 with *organizing* software capabilities (time management, outlining, project management). The possible explanation is that when interacting groups are proximal, there is more interaction and consequently more need to organize frequent activities. The *proximity* dimension also correlated negatively at -0.11 with *communicating* software capabilities, which is expected: the closer the groups are, the less need there is for software to communicate between them.

Several dimensions correlated with the importance of capabilities in *custom* software packages. The *custom* variable correlated negatively at -0.1 with *formalization of information*, positively with *information capacity* at 0.11, positively at 0.23 with *fragmentation*, and positively at 0.15 with the *amount of redundant information.* What these correlations

suggest in combination is that where customized software packages are used there is less standardization and formalization of information, and there is much looser coupling between sub-units.

Of the six categories of technology, the more traditional ones (telephone, traditional internal communications, outside, paper-based communication and voice messaging) had little effect on the infrastructure. There were some exceptions: traditional internal communications produce a slight excess in redundancy and outside, paper-based communications result in a higher-than-necessary quality of information, according to the managers.

Increases in computer technology usage result in impressions that that there is too little formalization and fragmentation, that the level of information quality is too low, and that both ease of communication and the capacity of the organization to handle information are too high. Electronic conferencing usage results in the opposite impressions, with the additional complaint of too little coordination--and the exception that both technologies lead to a poorer impression of information quality in the organization.

This suggests that the old, familiar parts of the information infrastructure have become "invisible" to managers and professionals and that the newer technologies produce perceptual change--a new view of the environment in which they operate. For example, as computers (and, to a lesser extent, electronic conferencing) show the ability to deliver higher quality information, the manager's perception of what constitutes high quality change and dissatisfaction with the status quo increases. It is not that the quality of information has become worse somehow, but that the manager's standards of quality have risen.

This change in perceptions of the information environment, we believe, prepares the way for some of the other changes discussed in the following chapters.

Interactions Between Dimensions of Infrastructure and Degree of Implementation

There was very close to zero bivariate correlation between the degree of implementation and any of the thirteen dimensions of the information management infrastructure. There was no theoretical reason to expect any significant correlations. In fact, it confirms that our concept of those two sets of organizational variables was correct, and that they are independent of each other. For purposes of our larger model, this is a very important result.

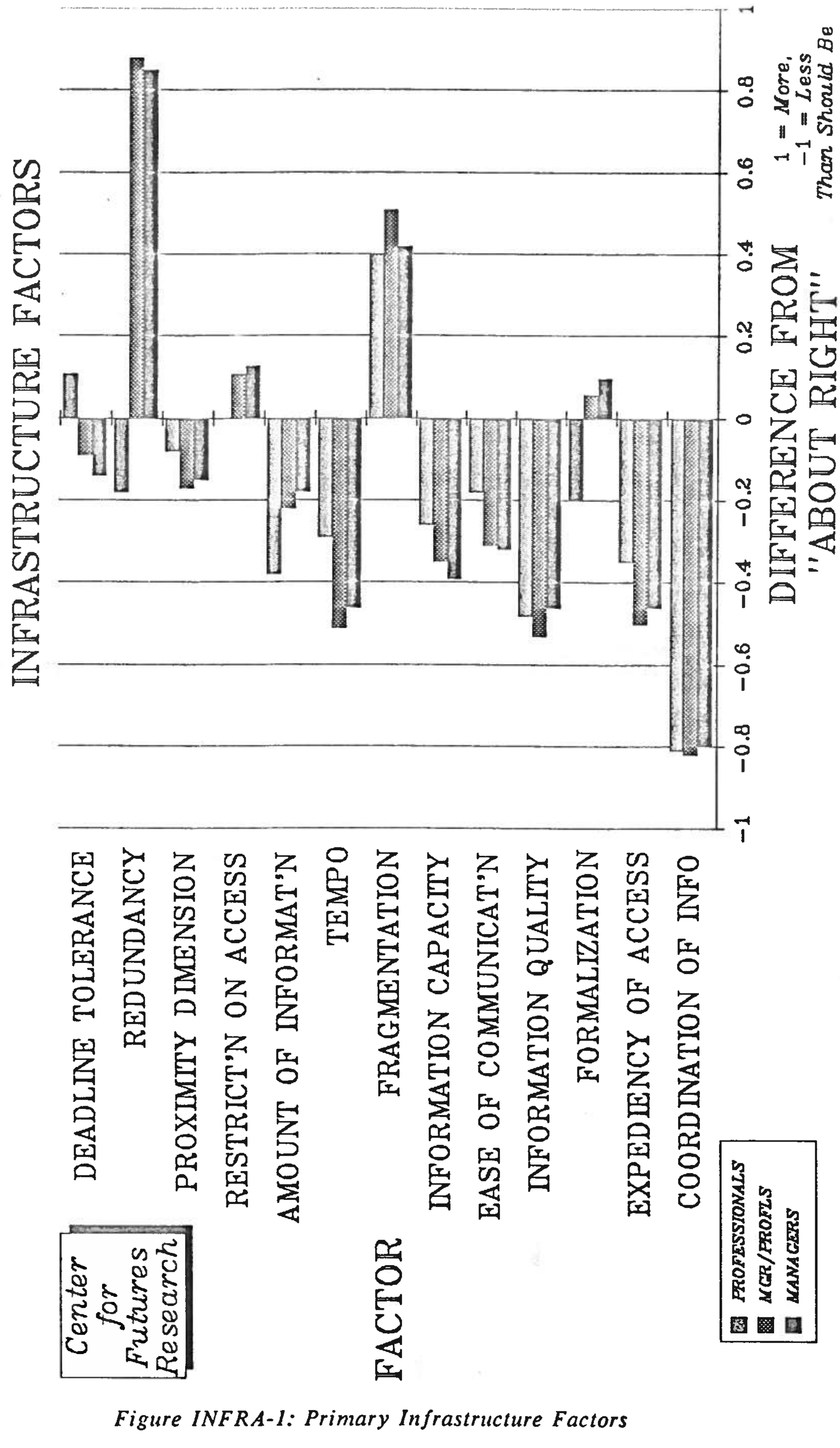

Figure INFRA-1: Primary Infrastructure Factors

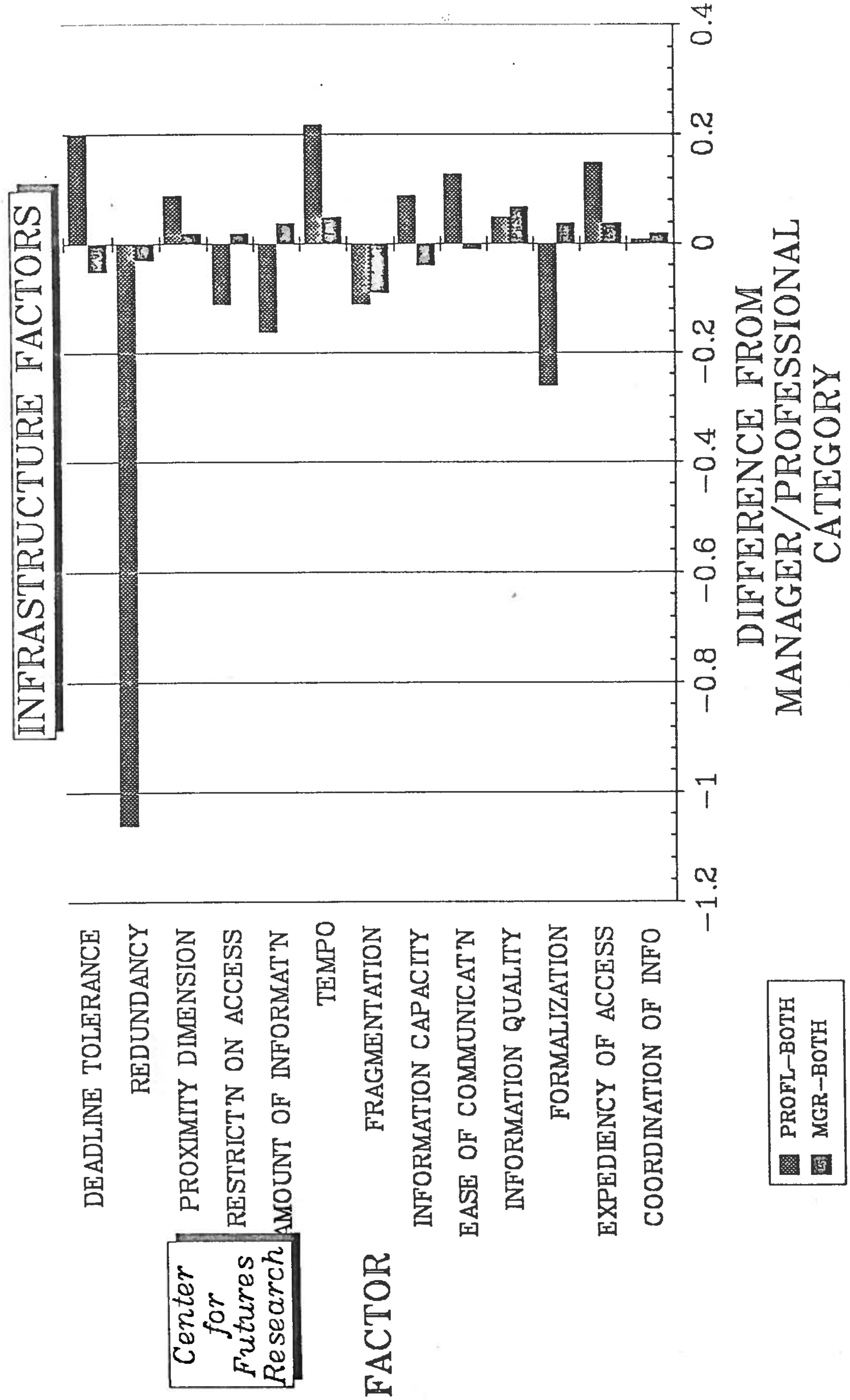

Figure INFRA-2: Infrastructure Differences - Managers & Professionals

ACTIVITIES

Preamble: Activities, Roles and Tasks

The above areas of our study (demography, technology, implementation, and infrastructure) all deal with the *context* of the manager's work the surroundings, technological and organizational, in which the manager must perform. This and the next two chapters deal with the *content* of the manager's work.

Naturally, every manager has a unique job he or she performs. In this sense it is nearly impossible to express the content of managerial work in specific detail. We must look for general dimensions that can be applied to all managers. These are necessarily abstractions of the actual things managers do.

Figure ACTIV-1 shows how the conceptual abstractions that we use in this study relate to the things that managers actually do.

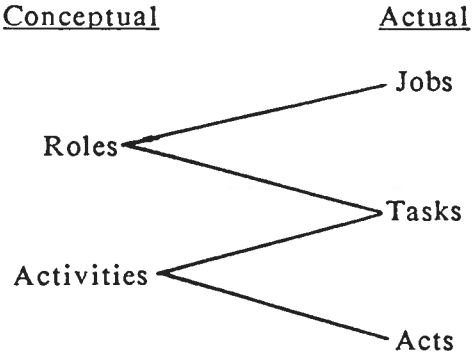

Figure ACTIV-1: What Managers and Professionals Do

The right hand column of the figure refers to a hierarchy of things actually done by managers and professionals. At the most specific level are the *acts* that people perform. Here we refer to striking keys on a keyboard, reading words, saying words, pressing buttons, etc.

At the next higher level these acts are combined together to perform *tasks*. By tasks we mean such things as writing a report, conducting a meeting, planning a stream of work, etc.

The final level combines the tasks people do into *jobs*, groups of tasks that fit together. These jobs, in turn, fit with other jobs to form organized units (not represented on figure ACTIV-1).

It is possible to express acts, tasks, and jobs in organizations. In fact it is necessary if employees are to be able to perform properly. But the more we focus on the details of actual acts, tasks, and jobs that people perform the less we will be able to compare across different jobs because everything will be expressed uniquely.

The left column of figure ACTIV-1 contains the concepts we use to generalize across jobs. Coincidentally the notions of activities and roles are what we use to conceptually tie together the different levels of actuality.

Activities are the concepts that we use to conceptually bundle together acts to form tasks.

Roles are the concepts that help us bundle tasks together to form jobs.

Key Conclusions

Activities managers and professionals engage in can be classed into two main categories: processing information (thinking), and using (or acting on) information.

Managers tend to use information in action oriented activities much more than professionals. Managers lag only slightly behind professionals in their need to process information.

Conferencing technologies contribute to both processing and using information. Computing technologies without conferencing capabilities contribute only to processing information. Therefore managers will need to have both competing and conferencing technologies. Professionals will not be as deprived in their ability to carry and activities as managers are by the lack of conferencing technologies.

In terms of software, managers especially need communicating software to support conferencing. But it is also the case that computer based software that helps planning and organizing is also important to activities that use information. Analyzing software only seem to support information processing activities.

People tend to adopt a software package for both using and processing information based on the package's impact on their efficiency and its centrality to the users job. When users have a need to use information then they will pick packages that other's will use to support them. When users have needs to process information they will pick packages that increase their status, increase their skills and knowledge and increase their effectiveness.

At present the more completely implemented technologies support primarily information processing activities. This means that presently implemented technologies support the major portion of professional information activities and only the minor portion of managerial information activities.

Different organizational settings create different informational infrastructures. These in turn create different informational activity needs. Therefore organizational settings indirectly affect the kinds of technology that contribute to these activities.

Rationale

Consider Figure ACTIV-2. In it we have added a third column that deals with information technology. In their jobs people only make direct contact with the technology in terms of the acts they perform. Human acts are performed only on technological elements, such as: striking keys, reading screens, and dialing and speaking into phones. Beyond this, people conceptually group their acts into tasks and jobs and connect the technological elements into technological systems.

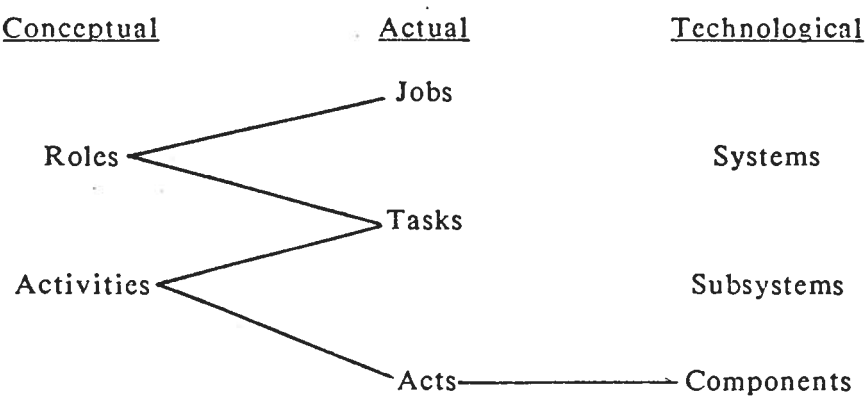

Figure ACTIV-2: Relationships Between Jobs and Technology

Activities are therefore the closest conceptual categories to the technology as it enters into the acts people perform. We have broken activities down into nine basic categories: scanning, inferring/interpreting, storing/retaining, transforming/altering, evaluating, acting, communicating, transacting, and interacting.

Survey Results

The survey data show that these nine activities can be further clumped into two strong categories. The first category includes: Scanning, Inferring, Storing/Retaining, Transforming, and Evaluating. We call this *processing information.* The second category comprises acting, communicating, transacting and interacting. We call that *using information.* This is often interpersonal in nature.

Managers vs. Professionals

Professionals tend to need to do the information processing activities more often than do managers, although overall the differences are not strong. On the other hand managers (including manager/professionals) tend to use information in an action oriented and interpersonal way significantly more than do professionals. Both managers and professionals need to do any of these activities moderately often to very often.

Information Technology and Activities

Telephone technologies are used and contribute to the job in direct proportion to the frequency with which the respondent needs to use information.

Various telephone related technologies such as call forwarding, answering machines, etc. do not show any relationship to either using or processing information. The exception is electronic paging which shows an inverse relationship with processing information. The more electronic paging is used the less often the individual tends to perform information processing activities and vice versa.

Similarly mail and facsimile do not correlate with either activity.

The traditional communication technologies of meetings and face to face conversations are strongly related to both kinds of activities. Internal mail (memo traffic) is related to using information.

The use and contribution of electronic versions of these traditional technologies--telephone conferencing, electronic mail, and other electronic conferencing techniques--also relate, by and large, to the need to perform both activities.

Technologies that are based on the computer are used and contribute only to the extent that the respondent needs to perform information processing activities.

In summary, we can say that interactive conferencing, whether based on traditional or electronic technologies, contributes consistently both to processing and to using information (particularly to the latter). Computer based noncommunication technologies contribute primarily to processing information but not to using it. We earlier showed that both managers and professionals process information, but that managers more than professionals use information. Therefore managers will get only partial use from computer based technologies until these are linked together in interactive conferencing networks. Professionals on the other hand will not feel the need for conferencing technologies as strongly and will derive substantial benefit from dedicated computing capability only.

The Importance of Software in Activities

Communicating software (including text processing and electronic messaging) is associated most strongly with using information while analyzing software (spreadsheets, databases, etc.) is associated almost entirely with processing information. Organizing software (project planners, schedulers, etc.) is also important to information using activities.

In summary, managers most benefit to the extent they have organizing and communicating software as well as analyzing software. Professionals can still function well if they only have analyzing software. Or one might conjecture, since organizing and communicating software promote the use of information, their presence for professionals may subtly influence professionals to behave in a proactive, self management mode.

Software Attributes and Activities

Neither the perceived conviviality nor the general performance of computer software is associated with the information activities. The degree to which the software is central to one's work is related more to the user's need to process information but is also related (to a lesser extent) to the need to use information.

Similarly, users use a technology because it efficiently helps them both process and use information. Efficiency, like centrality, is more important to information processing. Users use a technology that can be supportively used by others because it helps them use, not to process, information.

Finally, people use technologies that increase their status, that enhance their knowledge and skills, and that increase their effectiveness. These attributes are related to information processing activities.

In summary, people tend to use software to the extent it supports one or the other of their information activities. Most vital generally are the degree to which the package is efficient and central to the job the user has to do. Most critical to helping the person use information is the degree to which the package can be used in his or her support by others. Associated with the person's need to process information are the technology's impact on the status of the user, its impact on the skills and abilities of the user, and its impact on the effectiveness of the user. Conviviality (user friendliness) and the general performance of the technology (i.e., speed, reliability) do not relate to the activities that users need to perform.

Degree of Implementation and Activities

The only significant correlation between the two general information activities and degree of implementation is between processing information and degree of implementation. This says that the most deeply imbedded information technologies primarily support information processing. Therefore, at present, professionals are reaping the most benefit

from deeply implemented technologies while managers are supported only on the less frequently needed activities they perform.

Infrastructure and Activities

Four dimensions of the information infrastructure relate to both managerial information activities. Expediency of access, work capacity, and (especially) quality of information all related negatively with both activities. This means that the less expediently people can access information, the less work capacity the organization has, and the less the quality of the information in the organization, then the more frequently people feel the need to engage in processing and using information. Similarly the more redundant people think information is the more frequently they will need to process it and use it.

Three infrastructure dimensions relate only to information processing. The easier the communication, the more time people have to gather information (tempo), and the more tolerance there is for deadlines, then the less frequently people need to process information.

Several infrastructure dimensions (fragmentation, coordination of information, amount of information, restrictions on access to information, and physical proximity) are not related at all to the informational activities.

The overall significance of these findings is that there is a connection between the informational surroundings of a person and the frequency with which he or she feels the need to perform informational activities. Coupling this with our finding in earlier sections we conclude that different infrastructural environments can create different informational activity needs. These, in turn, can be met by appropriate information technologies.

MANAGERIAL ROLES

Key Conclusions

The roles managers play in performing their jobs can be broken into 13 categories. In addition there are seven type of demands that these roles put on the managers.

Managers and manager/professionals are nearly equivalent in the roles they play. Manager/professionals see networking and the role of technical expert to be more important than do managers. The predominant managerial roles are goal directing in nature followed by human relations roles, boundary spanning roles and finally coordinating roles. Being expert and working with others rank lowest.

Professionals differ from managers and manager/professionals on the importance of almost every role. In general, managers and professionals tend to feel helped, not hindered, in performing these roles. Managers and professionals tend to feel similar levels of demands. In general professionals tend to feel that their job situation helps them meet role demands more than do managers.

The most important roles of managers, producing and directing, are primarily associated with internal mail and fact to face meetings. They are secondarily associated with telephone technologies and electronic conferencing. The next most important roles, mentoring and managing conflict, are supported consistently by the same three technology bundles. Innovating is associated primarily with the newer computer based and electronic conferencing technologies as well as face to face meetings. Boundary Spanning is associated primarily with the two forms of conferencing, traditional and electronic. Coordinating is associated positively with mail and negatively with computer-based technologies. Allocating resources is associated with traditional and electronic conferencing and telephone technologies. Knowing the Work Unit is somewhat associated with mail of all types and the telephone. Being technically expert is associated primarily with computer based technologies. Being administratively expert is associated with the traditional technologies. Networking is associated with the mail and the telephone. Assisting is associated with the mail, internal and external.

Rationale

We have chosen a model of roles that is based on different conceptions of effectiveness. This model has three dimensions by which organizational effectiveness can be measured. These three dimensions seem to exhaust all prominent approaches to organizational effectiveness. Effectiveness depends on value judgments, so the model focuses on the different criteria that people value when they judge the effectiveness of organizational units. Figure ROLES-1 portrays these dimensions.

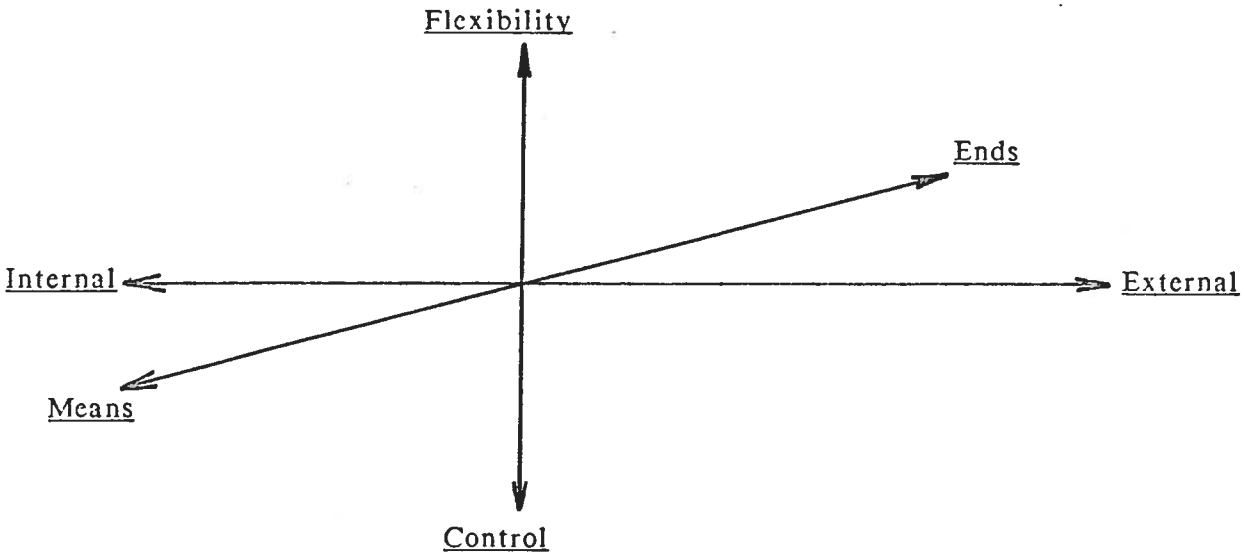

Figure ROLES-1: Dimensions of Effectiveness

The vertical dimension is the flexibility-control continuum. It portrays two competing values by which effectiveness is judged. People sometimes tend to judge organizations as effective to the extent they are flexible and can adjust to different situations. On the other hand we often judge organizations to be effective because they are able to strongly control the endeavors they are engaged in. Although it is possible to conceive of an organization as being both flexible and highly controlled, in practice these two general values tend to compete with each other and organizations will stress one over the other, or they will experience tension if both values are stressed simultaneously.

Another dimension of competing values is expressed on the horizontal axis of Figure ROLES-1. Here the competing values of effectiveness are internal and external focuses. When we have an internal focus we tend to judge organizations as effective based on the degree to which their internal activities and people are well developed and coordinated with one another. When we have an external focus we tend to judge organizations as effective in terms of the impact that the organization has on its environment. Again, it is generally true that organizations will find it difficult to stress both ends of this continuum simultaneously.

The final dimension refers to whether organizations tend to judge effectiveness in terms of the means they use to accomplish their tasks or the ends they achieve. Goal attainment, for instance, would be an example of an ends-oriented definition of effectiveness. Particular behavior patterns might be examples of means that are effective in achieving those ends.

When these dimensions are combined the results are eight quadrants that each denote a different strategic combination of organizational effectiveness values. Each of these eight strategic approaches to effectiveness has matching managerial roles that are implied by it. Figure ROLES-2 presents eight such managerial roles.

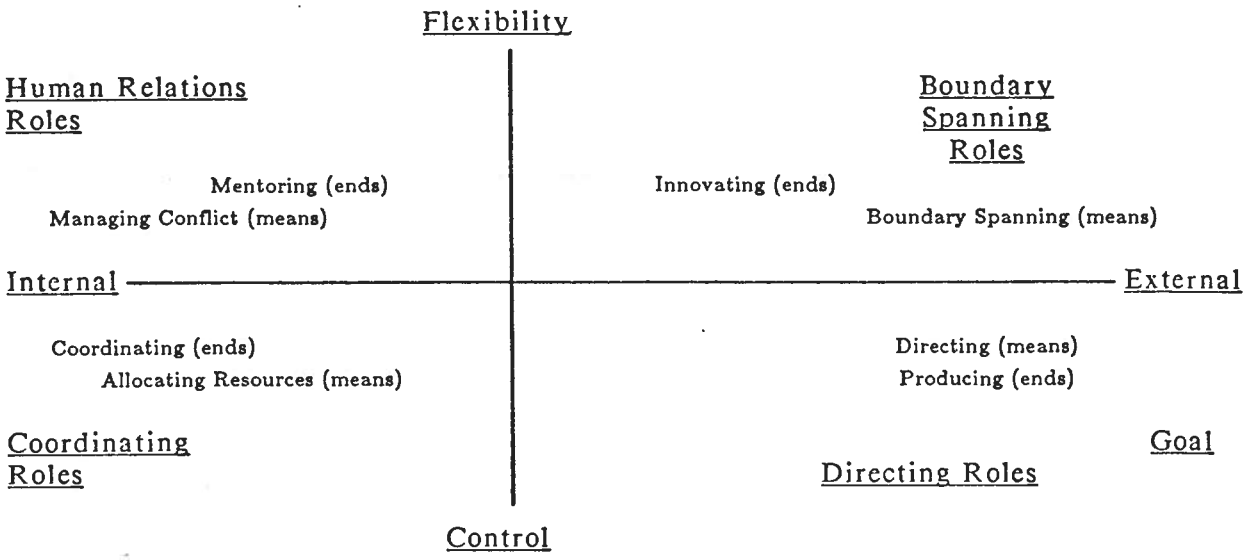

Figure ROLES-2: Eight Managerial Roles

Two roles appear in each of the four quadrants. One role is focused on means, the other on ends. The primary divisions are the four quadrants depicted. In the upper left quadrant the implied strategy for effectiveness is an internal focus on creating a flexible organization. Since human resources are the organization's most obvious internal source of flexibility the appropriate managerial roles are those that focus on their growth and management. We have chosen Mentoring and Managing Conflicts as representative of these human relations roles.

The upper right quadrant depicts a strategy that defines effectiveness as flexibility stemming from a focus on the external environment. The appropriate roles to achieve this strategy would stress spanning the units boundary so that change can be imported from outside and that the organization can keep up with changes in its environment. We have chosen the Innovating and Boundary Spanning roles as representative of this quadrant.

The lower right quadrant refers to a strategy of effectiveness that seeks to maximize the achievement of the organization's environmental output by controlling the direction the organization takes and the goals it seeks. We have chosen the managerial roles of directing and producing as representative of this quadrant.

Finally, the lower left quadrant depicts a strategy that defines effectiveness in terms of controlling the internal processes of the organization. We use the coordinating and resource allocating roles as indicative of this quadrant.

We also use five other roles that do not appear on Figure ROLES-2. Three of these stress various kinds of expert roles that managers might play. These are:

- Knowing the Work Unit
- Being Technically Expert
- Being Administratively Expert

The final two roles we added to pick up some of the other possible ways that managers might chose to relate to the people with whom they work. These are:

- Networking
- Assisting

Some of these additional roles were added to help assure that we would pick up some of the roles that professionals might also play. (Being Technically expert and Assisting, for instance.)

Role Demands

In addition to the roles that managers and professionals play, we measured some of the demands that roles frequently put on people that perform them. These can be thought of as aspects or requirements of the roles people play. They are:

- Completing Tasks
- Being Interdependent
- Stretching One's Skills
- Acting Autonomously
- Getting Feedback
- Coping With Variety
- Covering Demands

It is important to get at these qualities of the person's roles. We might expect that as managers play several roles and have increasing demands put on them that the new information technologies might help to alleviate some of these demands. On the other hand it is possible that the new technologies may actually exacerbate these role demands

These role demands also relate to job enrichment. Things like getting feedback, stretching one's skills etc. have been associated with jobs that are motivating in and of themselves. It has been sometimes claimed that information technologies will lead to a new organizational world of increased interdependence, feedback, variety, autonomy, etc. with the opportunity to develop and use new skills. The flip side of this is that these new conditions might also bring with them stressful demands on the people playing out their organizational roles. We want to keep track of the dual nature of role demands: they can be both enriching and stressful. We also want to know how much the technologies contribute to and help cope with these demands.

Measurement

We measure two aspects of roles and role demands. First, we ask the importance of the role or role demand to the respondent in his or her job. Second we ask the degree to which the respondent's job situation helps or hinder the respondent in performing the role or meeting the role demand.

Survey Results: Managers vs. Professionals

Role Importances

The survey results indicate that "goal directing" (producing and directing) is the most important set of effectiveness roles. This is followed by the set of human relations roles (mentoring and managing conflict). As we have seen these two role strategies stress opposing values in defining effectiveness. The fact that they are both stressed highly in our sample may indicate an attempt to balance opposing but necessary value systems. The boundary spanning set (boundary spanning and innovating) is ranked next highest followed by the coordinating set (coordinating and allocating resources). The bundle of expert roles (knowing the work unit, being technically expert and being administratively expert) ranks about as high as the coordinating roles. The final set of roles, having to do

with working with others (networking and assisting), is quite a bit lower in importance than the others.

In most cases the importance of a given role to the professionals was significantly lower than it was to the managers. The most glaring exception is the role of being technically expert which professionals understandably rated significantly higher than did managers.

The managers and the manager/professionals were not significantly different in how they rated the importance of the majority of the roles. This indicates, once again, that manager/professionals, for whatever reasons they perceive themselves to be both, are really almost identical to managers in their perceptions and in the roles they play. The two roles that manager/professionals do rate as more important than managers do are being technically expert and networking. On the basis of these two roles one might describe manager/professionals as needing to be more technically expert than managers and as playing a consulting role more than managers.

The professionals differed from the manager groups on the importance of only one role demand: being interdependent was more important to managers than professionals.

Role Aids

We asked the respondents to what degree they were hindered or helped in the roles they play. Most of the roles for all three groups were seen either as being slightly helped or neither helped nor hindered in their job situations. Both manager groups were significantly more helped in the mentoring role than were professionals. Professionals were significantly more helped in being technically expert and in innovating roles than were the manager groups. Roughly speaking, the more important roles are the more helped roles.

Professionals differed from managers in the degree to which three role demands were helped in the job situation. Professionals felt more help than managers in completing tasks, being interdependent, and acting autonomously.

Most role demands were only slightly helped. One role demand, covering demands, the least important, was felt to be slightly hindered.

Information Technology and Role Importance

We are interested in roles not for their own value but in terms of how they relate to information technologies.

The use and usefulness of telephone and telephone based technologies are more consistently correlated with the human relations roles (mentoring and managing conflicts) than any others. Their usefulness is also consistently correlated with the allocating resources roles. Several other roles are related to the use of the telephone and call forwarding as a pair.

The external paper-based traditional technologies, mail and facsimile, relate mostly to the importance of the least important roles, networking and assisting, as well as coordinating and being administratively expert. The traditional internal technologies, memos, meetings and face to face, are most consistently related to the more important roles, and continue their historical dominance as the technologies of choice.

The electronic conferencing technologies relate most consistently with the flexibility oriented roles (see Figure ROLES-2) and sporadically with several others. In other words, electronic conferencing, in general, contributes to the job and is more frequently used in correlation with the importance of several roles; most prominent among them are innovating, boundary spanning, mentoring and managing conflict. The specific technologies that support these roles most strongly are telephone conferencing, electronic mail and slow

scan conferencing. This bundle of conferencing technologies has a pattern of role support most similar to that of traditional internal technologies.

. The final bundle of technologies are all computer based. More frequently than any other bundle they correlate negatively with some roles. (The most notable instance of negative correlation otherwise was between the coordinating role and another computer based technology, computer conferencing.) **Computer technology has a very consistent pattern of support for two roles: Innovating and being technically expert.** Both these roles are mentioned earlier as ones that professionals find important as much or more than managers. On the other hand, computer based technologies are the least generally supportive of manager roles of the technology bundles we have considered, traditional and new.

Information Technology and Role Help.

We also examined the correlations between the use of the technology and the degree to which the respondents felt their job situations hindered/helped them in performing the various roles. As before, two measures of technology use were used. The first measure was of how useful the technology was to the respondent in doing his or her job. The second was of how frequently the respondent used the technology. The correlations indicate the connection between how much job situations help (or hinder) people to play different roles and the use of the technology in their job. The presence of the technology is part of the job situation so that the use and usefulness of the technology should have some connection with how helpful the job situation is.

Only one technology bundle correlates with a job situation that helps every role. Meetings is the main component of this technology bundle. On the other hand, computer conferencing usefulness and use show correlations with the helpfulness of the job situation that are negative and directly opposite the correlations for meetings.

The remainder of the technologies show only sporadic connections between their use and usefulness and the helpfulness of the job situation. These connections are mixed in direction also. Some correlations are negative, some are positive.

Being an Administrative Expert is the role showing the largest number of connections between technology's usefulness and use and the helpfulness of the job situation. This role tended to be helped by the usefulness of the traditional technologies and hindered by the usefulness and use of electronic technologies, with the exception of the data-base technologies.

TASKS

Key Conclusions

Managerial effectiveness can be assessed in terms of managers' ability to identify and do critical tasks, do appropriate but noncritical tasks efficiently, and avoid doing tasks that are inappropriate for their job.

Information technologies that help managers to do noncritical tasks (efficiency enhancers) do not necessarily help managers to identify and carry out critical tasks (effectiveness enhancers), and vice versa.

The use of computer technologies (PCs, spreadsheets, graphics) and inter-organizational paper-based technologies (fax, regular mail, overnight delivery) has significant and positive effects on the frequency with which middle managers were able to pay attention to critical tasks. Electronic conferencing had negative effects.

Designers of current information technologies that support action need to be more attentive to the requirements of managers, and the designers of technologies that support diagnosis and thinking need to be more attentive to the demands of professionals.

The degree of implementation of information technologies in the organization in general had no effects on the outcomes.

The use of telephones and computers helps middle managers *stay away* from the unnecessary tasks which did not have high payoff. That is, these technologies increase the managers' efficiency.

"Speeding up" organizations, increasing the perceived tempo of work, is beneficial to both managerial effectiveness and efficiency.

There is a short time span mentality and a bias for action among the managers who participated in the survey, which has a heavy influence as to what is regarded as critical.

Rationale

Why Tasks?

A managerial job can be described as a collection of tasks. The tasks that managers do as part of their jobs are observable, and are things such as developing plans, supervising employees, attending meetings, preparing reports, and writing memos and letters. Tasks are descriptors of work that are tangible to managers, and are not conceptual constructions. They therefore provide a way of describing a manager's job in terms relevant to managers.

Furthermore, one of the objectives of this study was to discover the impacts of information technologies on managerial effectiveness. By describing effectiveness in terms that are linked to tasks, we have a much greater chance of providing operational prescriptions for increasing managerial effectiveness by the use of information technologies. We provide a managerially attractive way of cutting up the "managerial attention pie" into a set of tasks.

Tasks are related to both information management activities (any task is made up of various information management activities), and to roles (any role involves carrying out a variety of tasks).

Linking Tasks with Managerial Effectiveness

We distinguish between the *selective* aspects of attention (how much time is allocated to a task) and the *intensive* aspects of attention (what importance is given to a task). At the managerial level, managing the intensive aspects of attention is what is ultimately related to organizational effectiveness.

The extent to which managerial attention is currently being leveraged is discovered by assessing how effectively critical tasks are identified and done.

Survey Results

Identifying and Doing Tasks

An analysis of five items related to the frequency of identifying and carrying out tasks yielded two orthogonal dimensions. These two dimensions characterize how the managers identified and carried out tasks:

Attention to Critical Tasks

This includes being able to identify critical tasks, being able to distinguish between critical and non-critical tasks, and giving critical tasks the attention that they deserve. This dimension has both selective attention and intensive attention components.

Managers: The results show that the use of computer technologies (PCs, spreadsheets, graphics) and inter-organizational paper-based technologies (fax, regular mail, overnight delivery) have significant and positive effects on the frequency they were able to pay attention to critical tasks. Electronic conferencing had negative effects, which we infer as resulting largely from use of electronic mail; composed of an increasing flow of electronic "junk mail" that is less easily destroyed before reading, and possibly to an increase in electronic mail "junkies" who are diverted from their critical tasks by browsing through the mail.

Information management activities that contributed to the *use* of information had negative effects, and those that contributed to the *processing* of information had no effect. Thus it appears that at the individual level, the "technological charisma" effect was what influenced the positive effects on attention to critical tasks.

The infrastructure had mediating effects which were in the expected directions.

The degree of implementation of information technologies in the organization in general had no effects on the outcomes, which is very surprising.

Professionals: It is interesting that most of the effects that professionals report as significant are negative. In other words, they perceive the dimensions that restrict their attention to critical tasks. In terms of technologies, only voice mail seems to have that restricting effect. As in the case of the managers, the degree of implementation does not have any effect.

Doing Noncritical Tasks

This includes doing tasks that are inappropriate for their job, and doing tasks that are appropriate but not critical to their job.

The regression results show that both the use of telephones and computer technology had significant and negative effects on the frequency with which the managers did tasks which were inappropriate for their job, or which were appropriate but not critical. In other words, the use of telephones and computers helped them *stay away* from the unnecessary tasks which did not have high payoff. That is, these technologies increased the managers' efficiency.

Here, too, the degree of implementation of information technologies did not have any direct effects on that outcome. Neither did any of the information management activities.

However, the organizational infrastructure did have mediating effects. The infrastructural dimensions that had negative effects on this variable (i.e., stopped effort on low payoff tasks) were increased organizational tempo, physical proximity, and expediency of access. These three dimensions also had positive effects on paying attention to critical tasks. While the expediency of access and the proximity dimension are obvious, the tempo dimension is more subtle. What it suggests is that "speeding up" organizations is beneficial to both managerial effectiveness and efficiency.

From the above results on attention to tasks, we can conclude that both managerial effectiveness and efficiency are increased by computer technologies (PCs, spreadsheets, graphics). The use of telephones surprisingly is associated with efficiency, rather than effectiveness. Also, it appears that electronic conferencing currently has negative effects on managerial effectiveness

This analysis has some important implications for the impacts of information technology on managerial work. It suggests that information technology can help enhance identifying and carrying out tasks by these two ways, but that these two dimensions are not on a linear continuum. That means that information technologies that help managers to do noncritical tasks (efficiency enhancers) do not necessarily help managers to identify and carry out critical tasks (effectiveness enhancers), and vice versa. There seems to be the implicit assumption in many companies that providing information technologies that enhance a manager's efficiency will free up time for critical tasks; our results indicate that this is not necessarily the case.

Their were no significant differences between middle managers and professionals, or between companies.

The Characteristics of Critical Tasks

There are four dimensions characterizing critical tasks:

1. *Importance*: High urgency and high impact;
2. *Costs*: High cost of performance, high risk, high effort, and stressful;
3. *Benefits*: high probability of payoff, high probability that they can do it, and satisfying;
4. *Distance*: mostly performed away from the office, and delayed payoff.

There were no significant differences between middle managers and professionals among these dimensions, except on the reported magnitudes of the distance dimension where professionals had responses which indicated their view of critical tasks allowed for more distance in both time and space, which is not surprising. For the entire sample, the data suggest that there is a short time span mentality and a bias for action which has a heavy influence as to what is regarded as critical.

Task Support Provided by Information Technology

There are two main dimensions that characterize managers' views of the support given them in their tasks by information technology:

1. *Support for Action*: this includes doing critical tasks, performing those tasks that free their time for doing the critical tasks, and performing tasks that are critical to the mission of the organizational unit;

2. *Support for Task Diagnosis*: this includes identifying the tasks that are appropriate for the job, deciding which are the critical tasks for the job, identifying tasks that free their time for doing the appropriate or critical tasks, identifying tasks appropriate for the mission of the organizational unit, and deciding which are the critical tasks for that mission.

In general the support that the information technology provided was higher for action (moderately well), than for task diagnosis (closer to slightly well than moderately well). In both dimensions, there is much room for improvement. It is interesting to note that this is the only set of dimensions along which the responses differed depending on whether the respondent was a middle manager, a professional or both. The professionals reported higher levels of support for action than the other two groups, and reported lesser levels of support for task diagnosis than the other two groups. This suggests that designers of current information technologies that support action need to be more attentive to the requirements of managers, and the designers of technologies that support diagnosis and thinking need to be more attentive to the demands of professionals.

While the managers were able to view their managerial tasks "strategically," they viewed the support that information technology provided for their tasks "operationally." It seems that there might be lost opportunity here in terms of increasing the leverage that information technology can provide for increasing managerial effectiveness.

How Much Better or Worse Are Managers Able to Do Their Jobs Because of the Use of Information Technology?

The question asked the respondents was in the context of the upper limits of their job that the information technology provided. The majority (59.6%) reported that it allowed them to do their job better, and a further 28.9% reported that it allowed them to do their job much better. For 11.2% of the respondents there had been no difference in their ability to do the job, and a very small minority of 0.27% (2 people) reported they were worse off. The general conclusion from these data is that information technology helped the managers perform their job better, which is not surprising.

MODELING THE IMPACTS

All of the previous chapters have been concerned with developing and validating a conceptual model of the relationships among information technology, aspects of the organization in which the technology is used, the context of managerial/professional work, and the content of that work (in effectiveness terms). In this final chapter we describe a simple computer-based model that can be used for estimating the effects of changes in any one of those components.

The Central Concept

The model is based on the results of the linear regression analyses of the survey data, showing the interactions among the dimensions of technology, infrastructure, activities, roles and tasks. The regression parameters are fractional multipliers that indicate how one variable is affected by changes in another, all other factors being held constant. That is, one regression parameter might show how a change in computer technology affects ease of communication (an infrastructure factor). A different parameter might show the reverse relationship. In short, the regression parameters make explicit the two-way relationships, if any, between all of the pairs of dimensions discussed earlier. They establish the linkages connecting the boxes of Figure INTRO-1.

Many of these relationships are null. Computer, technology, for example, has no effect (according to the survey data) on the importance of being a technical expert although it does have a positive impact (4.5%) on the extent to which a manager feels helped in fulfilling that role. Taken all together, the parameters will fill an array (69X75) that characterizes the average or expected effects of changes in any one of the factors. This array forms the database for a set of linear equations that sum up the effects on any one factor of changes in all the other factors.

The important point about this approach is that it includes all the feedback paths in the impact process. The indirect as well as the direct effects of technology on role importance, say, are included as are the effects of role importances on technology use and usefulness.

The Model

The specific version of this model that we have developed includes the regression parameter array and a pair of display segments, one for input of proposed changes, the other for display of the consequences of the changes. Figure MODEL-1 shows a sample of these two screens for the case of a 10% change in the frequency of use of computer technology.

The model is currently set up as a Lotus 1-2-3 Version 1A (tm) spreadsheet and will run on any personal computer that can run Lotus. However, it could also be set up on any other machine with relative ease.

The database included in the model contains the regression parameters for the total sample of 902 respondents. Thus, it is a mixture of managers, manager/professionals, and professionals. Restricting the database to parameters for professionals only, for example, merely requires changing some of the regression parameters. Similarly, a company-specific version of the model would use only the survey data from that company. In any case, a change in the situation only requires a change in the database.

Applying the Model

As Figure MODEL-1 shows, the model can be used to estimate the consequences of a change in any one of the technology, infrastructure, activities, roles or tasks factors on all of the others. It can also be used to estimate the combination of changes needed to produce a desired result. This is important because some combinations may produce complementary effects on some of the factors, and counteractive effects on others. The usefulness of the model comes in its ability to point up some of these interactions that might not be intuitively obvious beforehand.

Several other examples of the model are shown in Figures MODEL-2 through MODEL-7. These explore changes in the individual technology groups and in some of the non-technological factors.

The reader is urged to develop a version of the model that uses the regression data for his/her own organization, rather than the generalized data in the distribution version of the model. That step, of course, requires that a survey be performed of the managers/professionals in the organization using the current version of the questionnaire developed during this project.

Caveats

This model does not predict exactly what will happen when something changes in an organization. Rather, it shows the average impact to be expected from a change in organizations very similar to the ones we studied. Individual managers or professionals may react differently from the modeled outcomes. Other organizations may have different values for some or all of the variables we measured. Hence, this particular set of data for the model should be used only as a general impact estimator.

Secondly, because we were not able to adequately separate the temporal effects, the model shows only equilibrium conditions. It does not show how long it may take from the time of introduction of a change to the time when the estimated consequences all occur. This is possibly why the degree of implementation does not appear as a factor in the model; the degree of implementation has more to do with how long it takes to get a result than with what the result is.

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THE STRATEGIC IMPACT OF INFORMATION TECHNOLOGY ON MANAGERIAL WORK -- REGRESSION MODEL          * Telephone Impact *
****************************************************************************************************************
    These changes in     ...and these
    technology:          changes in:
(%) FREQUENCY of USE      (%)     INFRASTRUCTURE        (%)  ACTIVITIES             (%)  ROLE'S IMPORTANCE          (%)  HELPED IN DOING ROLE
 10 Telephone                   0 Coordination               0 Process'g Info            0 Producing                     0 Producing
  0 Trad'l Internal             0 Expediency                 0 Using Info                0 Directing                     0 Directing
  0 Outs PaperBased             0 Formalization                                          0 Mentoring                     0 Mentoring
  0 Computer Tech               0 Info Quality                 TASKS                     0 Mng Conflict                  0 Mng Conflict
  0 Voice Messaging             0 Ease of Communictn         0 Att'n to Crit             0 Innovating                    0 Innovating
  0 Elec Confernc'g             0 Capacity                   0 Doing Noncritical         0 Spanning                      0 Spanning
                                0 Fragmentation              0 Importance                0 Coordinating                  0 Coordinating
                                0 Tempo                      0 Costs                     0 Allocating                    0 Allocating
                                0 Amount of Info             0 Benefits                  0 Knowing Unit                  0 Knowing Unit
                                0 Accessibility              0 Distance                  0 Tech Expert                   0 Tech Expert
                                0 Proximity                  0 Prioritizing              0 Administrating                0 Administrating
                                0 Redundancy                 0 Doing Tasks               0 Networking                    0 Networking
                                0 Tolerance                                              0 Assisting                     0 Assisting
                                                                                         0 Completing Tasks              0 Completing Tasks
                                                                                         0 Copg Interdependence          0 Copg Interdependence
                                                                                         0 Stretching                    0 Stretching
                                                                                         0 Acting Auton                  0 Acting Autonomously
                                                                                         0 Getg Feedback                 0 Getg Feedback
                                                                                         0 Copg Variety                  0 Copg Variety
                                                                                         0 Covrg Demand                  0 Covrg Demand
****************************************************************************************************************

                                                                                                   09-Jun-86
****************************************************************************************************************
PRODUCE These changes in     ...and these
        technology:          changes in:
(%)     FREQUENCY of USE       (%)   INFRASTRUCTURE        (%)  ACTIVITIES            (%)  ROLE'S IMPORTANCE          (%)  HELPED IN DOING ROLE
  10.00 Telephone               0.00 Coordination            0.00 Process'g Info        0.00 Producing                  0.00 Producing
   0.00 Trad'l Internal         0.00 Expediency              0.00 Using Info            0.00 Directing                  0.00 Directing
   0.00 Outs PaperBased         0.00 Formalization                                      0.00 Mentoring                  0.00 Mentoring
   0.10 Computer Tech           0.00 Info Quality                 TASKS                 0.00 Mng Conflict               0.00 Mng Conflict
   0.00 Voice Messaging         0.00 Ease of Communictn      0.00 Att'n to Crit         0.00 Innovating                -1.30 Innovating
   0.01 Elec Confernc'g         0.00 Capacity                0.00 Doing Noncritical     0.00 Spanning                   0.00 Spanning
                                0.00 Fragmentation           0.00 Importance            0.00 Coordinating               0.00 Coordinating
(%)     USEFULNESS              0.00 Tempo                   0.00 Costs                 0.00 Allocating                 0.00 Allocating
  10.00 Telephone               0.00 Amount of Info          0.00 Benefits              0.00 Knowing Unit               0.00 Knowing Unit
   0.00 Trad'l Internal         0.00 Accessibility           0.00 Distance              0.00 Tech Expert                0.00 Tech Expert
  -0.21 Outs PaperBased         0.00 Proximity               0.00 Prioritizing          0.00 Administrating             0.00 Administrating
   0.00 Computer Tech           0.09 Redundancy              0.00 Doing Tasks          -0.82 Networking                 0.00 Networking
   0.00 Voice Messaging        -0.10 Tolerance                                          0.00 Assisting                  0.00 Assisting
   0.00 Elec Confernc'g                                                                 0.00 Completing Tasks           0.00 Completing Tasks
                                                                                        0.00 Copg Interdependence       0.00 Copg Interdependence
                                                                                        0.00 Stretching                 0.00 Stretching
                                                                                        0.00 Acting Auton               0.00 Acting Autonomously
                                                                                        0.00 Getg Feedback              0.00 Getg Feedback
                                                                                        0.00 Copg Variety               0.00 Copg Variety
                                                                                        0.00 Covrg Demand               0.00 Covrg Demand
****************************************************************************************************************
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Figure MODEL-1: Effect of a 10% Change in Telephone Usage

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THE STRATEGIC IMPACT OF INFORMATION TECHNOLOGY ON MANAGERIAL WORK -- REGRESSION MODEL          * Traditional Internal Communications *
*************************************************************************************************************************************
    These changes in       ...and these
    technology:            changes in:
(%) FREQUENCY of USE         (%)   INFRASTRUCTURE      (%)   ACTIVITIES            (%)  ROLE'S IMPORTANCE        (%)  HELPED IN DOING ROLE   *
  0 Telephone                    0 Coordination          0 Process'g Info           0 Producing                   0 Producing              *
 10 Trad'l Internal              0 Expediency            0 Using Info               0 Directing                   0 Directing              *
  0 Outs PaperBased              0 Formalization                                    0 Mentoring                   0 Mentoring              *
  0 Computer Tech                0 Info Quality            TASKS                    0 Mng Conflict                0 Mng Conflict           *
  0 Voice Messaging              0 Ease of Communictn    0 Att'n to Crit            0 Innovating                  0 Innovating             *
  0 Elec Confernc'g              0 Capacity              0 Doing Noncritical        0 Spanning                    0 Spanning               *
                                 0 Fragmentation         0 Importance               0 Coordinating                0 Coordinating           *
                                 0 Tempo                 0 Costs                    0 Allocating                  0 Allocating             *
                                 0 Amount of Info        0 Benefits                 0 Knowing Unit                0 Knowing Unit           *
                                 0 Accessibility         0 Distance                 0 Tech Expert                 0 Tech Expert            *
                                 0 Proximity             0 Prioritizing             0 Administrating              0 Administrating         *
                                 0 Redundancy            0 Doing Tasks              0 Networking                  0 Networking             *
                                 0 Tolerance                                        0 Assisting                   0 Assisting              *
                                                                                    0 Completing Tasks            0 Completing Tasks       *
                                                                                    0 Copg Interdependence        0 Copg Interdependence   *
                                                                                    0 Stretching                  0 Stretching             *
                                                                                    0 Acting Auton                0 Acting Autonomously    *
                                                                                    0 Getg Feedback               0 Getg Feedback          *
                                                                                    0 Copg Variety                0 Copg Variety           *
                                                                                    0 Covrg Demand                0 Covrg Demand           *
*************************************************************************************************************************************

                                                                                                       09-Jun-86
*************************************************************************************************************************************
 PRODUCE  These changes in      ...and these
          technology:           changes in:
(%)       FREQUENCY of USE        (%)   INFRASTRUCTURE      (%)   ACTIVITIES           (%)  ROLE'S IMPORTANCE         (%)  HELPED IN DOING ROLE
     0.00 Telephone                0.17 Coordination          0.70 Process'g Info       0.00 Producing                0.00 Producing
    10.00 Trad'l Internal          0.06 Expediency            1.88 Using Info           0.00 Directing                0.14 Directing
     0.00 Outs PaperBased         -0.15 Formalization                                   0.00 Mentoring                0.00 Mentoring
    -0.02 Computer Tech            0.14 Info Quality               TASKS                0.00 Mng Conflict             0.17 Mng Conflict
     0.00 Voice Messaging          0.15 Ease of Communictn    0.87 Att'n to Crit        0.00 Innovating               0.00 Innovating
    -0.17 Elec Confernc'g          0.18 Capacity              0.00 Doing Noncritical    0.00 Spanning                 0.03 Spanning
                                  -0.17 Fragmentation         0.00 Importance          -0.13 Coordinating             0.18 Coordinating
(%)       USEFULNESS               0.21 Tempo                 0.00 Costs                0.00 Allocating               0.20 Allocating
     0.00 Telephone                0.03 Amount of Info        0.00 Benefits             0.00 Knowing Unit             0.17 Knowing Unit
    10.00 Trad'l Internal         -0.02 Accessibility         0.00 Distance             0.00 Tech Expert              0.00 Tech Expert
     0.21 Outs PaperBased          0.00 Proximity             0.00 Prioritizing         0.00 Administrating           0.20 Administrating
     0.00 Computer Tech            0.84 Redundancy            0.00 Doing Tasks          0.00 Networking               0.00 Networking
     0.00 Voice Messaging          0.04 Tolerance                                       0.00 Assisting                0.16 Assisting
    -0.02 Elec Confernc'g                                                               0.00 Completing Tasks         0.13 Completing Tasks
                                                                                        0.00 Copg Interdependence     0.17 Copg Interdependence
                                                                                       -0.87 Stretching               0.00 Stretching
                                                                                       -1.16 Acting Auton             0.15 Acting Autonomously
                                                                                        0.00 Getg Feedback            0.16 Getg Feedback
                                                                                        0.00 Copg Variety             0.15 Copg Variety
                                                                                        0.00 Covrg Demand             0.00 Covrg Demand
*************************************************************************************************************************************
```

Figure MODEL-2: Effect of a 10% Change in Traditional Internal Communication

THE STRATEGIC IMPACT OF INFORMATION TECHNOLOGY ON MANAGERIAL WORK -- REGRESSION MODEL * Outside, Paper-Based Communications *

(%)	These changes in technology: FREQUENCY of USE	(%)	...and these changes in: INFRASTRUCTURE	(%)	ACTIVITIES	(%)	ROLE'S IMPORTANCE	(%)	HELPED IN DOING ROLE
0	Telephone	0	Coordination	0	Process'g Info	0	Producing	0	Producing
0	Trad'l Internal	0	Expediency	0	Using Info	0	Directing	0	Directing
10	Outs PaperBased	0	Formalization			0	Mentoring	0	Mentoring
0	Computer Tech	0	Info Quality		TASKS	0	Mng Conflict	0	Mng Conflict
0	Voice Messaging	0	Ease of Communictn	0	Att'n to Crit	0	Innovating	0	Innovating
0	Elec Conferenc'g	0	Capacity	0	Doing Noncritical	0	Spanning	0	Spanning
		0	Fragmentation	0	Importance	0	Coordinating	0	Coordinating
		0	Tempo	0	Costs	0	Allocating	0	Allocating
		0	Amount of Info	0	Benefits	0	Knowing Unit	0	Knowing Unit
		0	Accessibility	0	Distance	0	Tech Expert	0	Tech Expert
		0	Proximity	0	Prioritizing	0	Administrating	0	Administrating
		0	Redundancy	0	Doing Tasks	0	Networking	0	Networking
		0	Tolerance			0	Assisting	0	Assisting
						0	Completing Tasks	0	Completing Tasks
						0	Copg Interdependence	0	Copg Interdependence
						0	Stretching	0	Stretching
						0	Acting Auton	0	Acting Autonomously
						0	Getg Feedback	0	Getg Feedback
						0	Copg Variety	0	Copg Variety
						0	Covrg Demand	0	Covrg Demand

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PRODUCE

(%)	These changes in technology: FREQUENCY of USE	(%)	...and these changes in: INFRASTRUCTURE	(%)	ACTIVITIES	(%)	ROLE'S IMPORTANCE	(%)	HELPED IN DOING ROLE
0.00	Telephone	0.18	Coordination	-0.05	Process'g Info	0.00	Producing	0.00	Producing
.00	Trad'l Internal	0.17	Expediency	0.01	Using Info	0.00	Directing	0.14	Directing
10.00	Outs PaperBased	-0.15	Formalization			0.00	Mentoring	0.00	Mentoring
-0.24	Computer Tech	1.01	Info Quality		TASKS	0.00	Mng Conflict	0.18	Mng Conflict
0.00	Voice Messaging	0.02	Ease of Communictn	0.88	Att'n to Crit	0.00	Innovating	0.00	Innovating
-0.19	Elec Conferenc'g	.00	Capacity	0.00	Doing Noncritical	0.00	Spanning	0.03	Spanning
		-0.18	Fragmentation	0.00	Importance	-0.13	Coordinating	0.19	Coordinating
(%)	USEFULNESS	0.10	Tempo	0.00	Costs	0.00	Allocating	0.20	Allocating
0.00	Telephone	0.03	Amount of Info	0.00	Benefits	0.00	Knowing Unit	0.17	Knowing Unit
0.00	Trad'l Internal	-0.02	Accessibility	0.00	Distance	0.00	Tech Expert	0.00	Tech Expert
10.51	Outs PaperBased	0.00	Proximity	0.00	Prioritizing	0.00	Administrating	0.20	Administrating
0.00	Computer Tech	-0.18	Redundancy	0.00	Doing Tasks	1.15	Networking	0.00	Networking
0.00	Voice Messaging	0.18	Tolerance			0.00	Assisting	0.16	Assisting
.00	Elec Conferenc'g					0.00	Completing Tasks	0.13	Completing Tasks
						0.00	Copg Interdependence	0.18	Copg Interdependence
						0.00	Stretching	0.00	Stretching
						0.00	Acting Auton	0.15	Acting Autonomously
						0.00	Getg Feedback	0.16	Getg Feedback
						1.02	Copg Variety	0.15	Copg Variety
						0.00	Covrg Demand	0.00	Covrg Demand

Figure MODEL-3: Effect of a 10% Change in Outside, Paper-based Communications

THE STRATEGIC IMPACT OF INFORMATION TECHNOLOGY ON MANAGERIAL WORK -- REGRESSION MODEL * Voice Messaging Impact *

These changes in technology:

(%)	FREQUENCY of USE
0	Telephone
0	Trad'l Internal
0	Outs PaperBased
0	Computer Tech
10	Voice Messaging
0	Elec Confernc'g

...and these changes in:

(%)	INFRASTRUCTURE
0	Coordination
0	Expediency
0	Formalization
0	Info Quality
0	Ease of Communictn
0	Capacity
0	Fragmentation
0	Tempo
0	Amount of Info
0	Accessibility
0	Proximity
0	Redundancy
0	Tolerance

(%)	ACTIVITIES
0	Process'g Info
0	Using Info
	TASKS
0	Att'n to Crit
0	Doing Noncritical
0	Importance
0	Costs
0	Benefits
0	Distance
0	Prioritizing
0	Doing Tasks

(%)	ROLE'S IMPORTANCE
0	Producing
0	Directing
0	Mentoring
0	Mng Conflict
0	Innovating
0	Spanning
0	Coordinating
0	Allocating
0	Knowing Unit
0	Tech Expert
0	Administrating
0	Networking
0	Assisting
0	Completing Tasks
0	Copg Interdependence
0	Stretching
0	Acting Auton
0	Getg Feedback
0	Copg Variety
0	Covrg Demand

(%)	HELPED IN DOING ROLE
0	Producing
0	Directing
0	Mentoring
0	Mng Conflict
0	Innovating
0	Spanning
0	Coordinating
0	Allocating
0	Knowing Unit
0	Tech Expert
0	Administrating
0	Networking
0	Assisting
0	Completing Tasks
0	Copg Interdependence
0	Stretching
0	Acting Autonomously
0	Getg Feedback
0	Copg Variety
0	Covrg Demand

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PRODUCE These changes in technology:

(%)	FREQUENCY of USE
0.00	Telephone
0.09	Trad'l Internal
0.00	Outs PaperBased
-0.03	Computer Tech
10.00	Voice Messaging
-0.05	Elec Confernc'g
(%)	**USEFULNESS**
0.00	Telephone
0.00	Trad'l Internal
0.00	Outs PaperBased
0.00	Computer Tech
10.00	Voice Messaging
-0.06	Elec Confernc'g

...and these changes in:

(%)	INFRASTRUCTURE
0.06	Coordination
0.02	Expediency
0.00	Formalization
0.05	Info Quality
0.15	Ease of Communictn
0.23	Capacity
-0.16	Fragmentation
0.00	Tempo
-0.02	Amount of Info
0.03	Accessibility
0.00	Proximity
0.00	Redundancy
0.13	Tolerance

(%)	ACTIVITIES
-0.92	Process'g Info
0.03	Using Info
	TASKS
0.00	Att'n to Crit
0.00	Doing Noncritical
0.00	Importance
0.00	Costs
0.00	Benefits
0.00	Distance
0.91	Prioritizing
0.00	Doing Tasks

(%)	ROLE'S IMPORTANCE
0.00	Producing
0.21	Directing
0.00	Mentoring
0.00	Mng Conflict
0.00	Innovating
0.00	Spanning
0.00	Coordinating
0.32	Allocating
0.00	Knowing Unit
0.00	Tech Expert
0.00	Administrating
0.00	Networking
0.00	Assisting
0.00	Completing Tasks
0.00	Copg Interdependence
0.19	Stretching
0.00	Acting Auton
0.17	Getg Feedback
0.00	Copg Variety
0.00	Covrg Demand

(%)	HELPED IN DOING ROLE
0.00	Producing
0.92	Directing
0.90	Mentoring
0.00	Mng Conflict
0.00	Innovating
0.00	Spanning
0.00	Coordinating
0.00	Allocating
0.00	Knowing Unit
0.16	Tech Expert
0.00	Administrating
1.12	Networking
0.00	Assisting
0.00	Completing Tasks
0.00	Copg Interdependence
0.00	Stretching
0.00	Acting Autonomously
0.00	Getg Feedback
0.00	Copg Variety
0.00	Covrg Demand

Figure MODEL-4: Effect of a 10% Change in Voice Messaging

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THE STRATEGIC IMPACT OF INFORMATION TECHNOLOGY ON MANAGERIAL WORK -- REGRESSION MODEL          * Computer Technology Impact *
******************************************************************************************************************************
    These changes in       ...and these                                                                                     *
    technology:            changes in:                                                                                      *
(%) FREQUENCY of USE        (%)      INFRASTRUCTURE     (%)     ACTIVITIES        (%)    ROLE'S IMPORTANCE       (%)     HELPED IN DOING ROLE  *
  0 Telephone                      0 Coordination             0 Process'g Info           0 Producing                   0 Producing             *
  0 Trad'l Internal                0 Expediency               0 Using Info               0 Directing                   0 Directing             *
  0 Outs PaperBased                0 Formalization                                       0 Mentoring                   0 Mentoring             *
 10 Computer Tech                  0 Info Quality               TASKS                    0 Mng Conflict                0 Mng Conflict          *
  0 Voice Messaging                0 Ease of Communictn       0 Att'n to Crit            0 Innovating                  0 Innovating            *
  0 Elec Conferenc'g               0 Capacity                 0 Doing Noncritical        0 Spanning                    0 Spanning              *
                                   0 Fragmentation            0 Importance               0 Coordinating                0 Coordinating          *
                                   0 Tempo                    0 Costs                    0 Allocating                  0 Allocating            *
                                   0 Amount of Info           0 Benefits                 0 Knowing Unit                0 Knowing Unit          *
                                   0 Accessibility            0 Distance                 0 Tech Expert                 0 Tech Expert           *
                                   0 Proximity                0 Prioritizing             0 Administrating              0 Administrating        *
                                   0 Redundancy               0 Doing Tasks              0 Networking                  0 Networking            *
                                   0 Tolerance                                           0 Assisting                   0 Assisting             *
                                                                                         0 Completing Tasks            0 Completing Tasks      *
                                                                                         0 Copg Interdependence        0 Copg Interdependence  *
                                                                                         0 Stretching                  0 Stretching            *
                                                                                         0 Acting Auton                0 Acting Autonomously   *
                                                                                         0 Getg Feedback               0 Getg Feedback         *
                                                                                         0 Copg Variety                0 Copg Variety          *
                                                                                         0 Covrg Demand                0 Covrg Demand          *
******************************************************************************************************************************

                                                                                                          09-Jun-86
******************************************************************************************************************************
   PRODUCE  These changes in       ...and these
            technology:            changes in:
(%)         FREQUENCY of USE        (%)     INFRASTRUCTURE      (%)     ACTIVITIES        (%)     ROLE'S IMPORTANCE       (%)     HELPED IN DOING ROLE
       0.00 Telephone                  0.31 Coordination           1.58 Process'g Info         0.15 Producing                 0.14 Producing
       0.08 Trad'l Internal            0.40 Expediency             0.02 Using Info            -0.13 Directing                 1.05 Directing
       0.00 Outs PaperBased           -0.99 Formalization                                      0.00 Mentoring                 0.15 Mentoring
      11.20 Computer Tech             -1.01 Info Quality                TASKS                  0.00 Mng Conflict              0.32 Mng Conflict
       0.00 Voice Messaging            0.70 Ease of Communictn     0.83 Att'n to Crit          1.42 Innovating                0.13 Innovating
      -0.36 Elec Conferenc'g           0.61 Capacity              -1.08 Doing Noncritical      0.00 Spanning                  0.03 Spanning
                                      -0.46 Fragmentation          0.00 Importance            -0.13 Coordinating              0.31 Coordinating
(%)         USEFULNESS                 0.25 Tempo                  0.00 Costs                 -0.08 Allocating                0.33 Allocating
       0.00 Telephone                 -0.02 Amount of Info         0.89 Benefits               0.00 Knowing Unit              0.16 Knowing Unit
       0.00 Trad'l Internal           -0.06 Accessibility          0.00 Distance               0.00 Tech Expert               0.45 Tech Expert
      -0.08 Outs PaperBased            0.00 Proximity              1.73 Prioritizing           0.00 Administrating            0.19 Administrating
      11.18 Computer Tech             -0.04 Redundancy             3.14 Doing Tasks           -1.10 Networking                0.38 Networking
       0.00 Voice Messaging            0.18 Tolerance                                          0.00 Assisting                 0.35 Assisting
      -0.17 Elec Conferenc'g                                                                   0.00 Completing Tasks          0.26 Completing Tasks
                                                                                               0.00 Copg Interdependence      0.31 Copg Interdependence
                                                                                               0.35 Stretching                0.71 Stretching
                                                                                               0.00 Acting Auton              0.84 Acting Autonomously
                                                                                               0.32 Getg Feedback             0.15 Getg Feedback
                                                                                               0.00 Copg Variety              0.15 Copg Variety
                                                                                               0.00 Covrg Demand              0.00 Covrg Demand
******************************************************************************************************************************
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Figure MODEL-5: Effect of a 10% Change in Computer Usage

THE STRATEGIC IMPACT OF INFORMATION TECHNOLOGY ON MANAGERIAL WORK -- REGRESSION MODEL * Electronic Conferencing Impact *

These changes in technology:

(%)	FREQUENCY of USE
0	Telephone
0	Trad'l Internal
0	Outs PaperBased
0	Computer Tech
0	Voice Messaging
10	Elec Conferenc'g

...and these changes in:

(%)	INFRASTRUCTURE
0	Coordination
0	Expediency
0	Formalization
0	Info Quality
0	Ease of Communictn
0	Capacity
0	Fragmentation
0	Tempo
0	Amount of Info
0	Accessibility
0	Proximity
0	Redundancy
0	Tolerance

(%)	ACTIVITIES
0	Process'g Info
0	Using Info
	TASKS
0	Att'n to Crit
0	Doing Noncritical
0	Importance
0	Costs
0	Benefits
0	Distance
0	Prioritizing
0	Doing Tasks

(%)	ROLE'S IMPORTANCE	(%)	HELPED IN DOING ROLE
0	Producing	0	Producing
0	Directing	0	Directing
0	Mentoring	0	Mentoring
0	Mng Conflict	0	Mng Conflict
0	Innovating	0	Innovating
0	Spanning	0	Spanning
0	Coordinating	0	Coordinating
0	Allocating	0	Allocating
0	Knowing Unit	0	Knowing Unit
0	Tech Expert	0	Tech Expert
0	Administrating	0	Administrating
0	Networking	0	Networking
0	Assisting	0	Assisting
0	Completing Tasks	0	Completing Tasks
0	Copg Interdependence	D	Copg Interdependence
0	Stretching	0	Stretching
0	Acting Auton	0	Acting Autonomously
0	Getg Feedback	0	Getg Feedback
0	Copg Variety	0	Copg Variety
0	Covrg Demand	0	Covrg Demand

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PRODUCE These changes in technology:

(%)	FREQUENCY of USE
0.00	Telephone
-0.01	Trad'l Internal
0.00	Outs PaperBased
0.15	Computer Tech
0.00	Voice Messaging
11.79	Elec Conferenc'g

(%)	USEFULNESS
0.00	Telephone
D.00	Trad'l Internal
-0.10	Outs PaperBased
-0.04	Computer Tech
0.00	Voice Messaging
10.97	Elec Conferenc'g

...and these changes in:

(%)	INFRASTRUCTURE
-0.43	Coordination
-0.20	Expediency
1.24	Formalization
-0.05	Info Quality
-0.39	Ease of Communictn
-2.08	Capacity
0.26	Fragmentation
-0.31	Tempo
-0.05	Amount of Info
0.05	Accessibility
0.00	Proximity
0.10	Redundancy
-0.09	Tolerance

(%)	ACTIVITIES
0.49	Process'g Info
2.70	Using Info
	TASKS
-1.30	Att'n to Crit
0.00	Doing Noncritical
0.00	Importance
1.11	Costs
0.00	Benefits
0.00	Distance
0.00	Prioritizing
0.00	Doing Tasks

(%)	ROLE'S IMPORTANCE	(%)	HELPED IN DOING ROLE
0.00	Producing	0.00	Producing
0.00	Directing	-0.20	Directing
0.00	Mentoring	0.00	Mentoring
0.20	Mng Conflict	-0.44	Mng Conflict
0.00	Innovating	0.00	Innovating
1.79	Spanning	-0.04	Spanning
0.20	Coordinating	-0.28	Coordinating
1.05	Allocating	-0.29	Allocating
0.00	Knowing Unit	-1.40	Knowing Unit
0.00	Tech Expert	-1.21	Tech Expert
0.00	Administrating	-1.47	Administrating
0.00	Networking	0.00	Networking
1.23	Assisting	-0.24	Assisting
0.00	Completing Tasks	-0.19	Completing Tasks
0.00	Copg Interdependence	-0.26	Copg Interdependence
0.00	Stretching	-0.91	Stretching
0.00	Acting Auton	-0.38	Acting Autonomously
0.00	Getg Feedback	-0.23	Getg Feedback
1.11	Copg Variety	-0.23	Copg Variety
0.00	Covrg Demand	0.00	Covrg Demand

Figure MODEL-6: Effect of a 10% Change in Electronic Conferencing

THE STRATEGIC IMPACT OF INFORMATION TECHNOLOGY ON MANAGERIAL WORK -- REGRESSION MODEL   * More Attention to Critical Tasks *

These changes in technology:

(%)	FREQUENCY of USE
0	Telephone
0	Trad'l internal
0	Outs PaperBased
0	Computer Tech
0	Voice Messaging
0	Elec Conferenc'g

...and these changes in:

(%)	INFRASTRUCTURE
0	Coordination
0	Expediency
0	Formalization
0	Info Quality
0	Ease of Communictn
0	Capacity
0	Fragmentation
0	Tempo
0	Amount of Info
0	Accessibility
0	Proximity
0	Redundancy
0	Tolerance

(%)	ACTIVITIES
0	Process'g Info
0	Using Info
	TASKS
10	Att'n to Crit
0	Doing Noncritical
0	Importance
0	Costs
0	Benefits
0	Distance
0	Prioritizing
0	Doing Tasks

(%)	ROLE'S IMPORTANCE	(%)	HELPED IN DOING ROLE
0	Producing	0	Producing
0	Directing	0	Directing
0	Mentoring	0	Mentoring
0	Mng Conflict	0	Mng Conflict
0	Innovating	0	Innovating
0	Spanning	0	Spanning
0	Coordinating	0	Coordinating
0	Allocating	0	Allocating
0	Knowing Unit	0	Knowing Unit
0	Tech Expert	0	Tech Expert
0	Administrating	0	Administrating
0	Networking	0	Networking
0	Assisting	0	Assisting
0	Completing Tasks	0	Completing Tasks
0	Copg Interdependence	0	Copg Interdependence
0	Stretching	0	Stretching
0	Acting Auton	0	Acting Autonomously
0	Getg Feedback	0	Getg Feedback
0	Copg Variety	0	Copg Variety
0	Covrg Demand	0	Covrg Demand

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PRODUCE These changes in technology:

(%)	FREQUENCY of USE
0.00	Telephone
0.06	Trad'l Internal
0.00	Outs PaperBased
-0.17	Computer Tech
0.00	Voice Messaging
-2.72	Elec Conferenc'g

(%)	USEFULNESS
0.00	Telephone
0.00	Trad'l Internal
2.43	Outs PaperBased
0.00	Computer Tech
0.00	Voice Messaging
-0.27	Elec Conferenc'g

...and these changes in:

(%)	INFRASTRUCTURE
3.29	Coordination
1.99	Expediency
-1.75	Formalization
1.62	Info Quality
1.70	Ease of Communictn
2.12	Capacity
-1.99	Fragmentation
2.44	Tempo
0.35	Amount of Info
-0.22	Accessibility
0.00	Proximity
-0.51	Redundancy
0.49	Tolerance

(%)	ACTIVITIES
-1.80	Process'g Info
-1.97	Using Info
	TASKS
10.00	Att'n to Crit
0.00	Doing Noncritical
0.00	Importance
0.00	Costs
0.00	Benefits
0.00	Distance
0.00	Prioritizing
0.00	Doing Tasks

(%)	ROLE'S IMPORTANCE	(%)	HELPED IN DOING ROLE
0.00	Producing	0.00	Producing
0.00	Directing	1.57	Directing
0.00	Mentoring	0.00	Mentoring
0.00	Mng Conflict	2.00	Mng Conflict
0.00	Innovating	0.00	Innovating
0.00	Spanning	0.33	Spanning
-1.52	Coordinating	2.13	Coordinating
0.00	Allocating	2.25	Allocating
0.00	Knowing Unit	1.95	Knowing Unit
0.00	Tech Expert	0.00	Tech Expert
0.00	Administrating	2.30	Administrating
0.00	Networking	0.00	Networking
0.00	Assisting	1.86	Assisting
0.00	Completing Tasks	1.47	Completing Tasks
0.00	Copg Interdependence	2.00	Copg Interdependence
0.00	Stretching	0.00	Stretching
0.00	Acting Auton	1.67	Acting Autonomously
0.00	Getg Feedback	1.79	Getg Feedback
0.00	Copg Variety	1.75	Copg Variety
0.00	Covrg Demand	0.00	Covrg Demand

Figure MODEL-7: Effect of a 10% Change in Attention to Critical Tasks