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MEASUREMENT OF INFORMATION AND COMMUNICATION IN OFFICE ORGANIZATIONS

A Report

Submitted by

THE CENTRE FOR THE EVALUATION OF
COMMUNICATION-INFORMATION TECHNOLOGIES

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INTRODUCTION

This report is presented to fulfil a contract between the Department of Communications (Canadian Government) and the Centre for the Evaluation of Communication Information Technologies (University of Waterloo), the objective of which was to gain insight into 'what an office is and what it does'. In pursuit of the objective we have : 1) developed procedures and instruments for measuring work processes and communications; 2) collected data from 4 organizations encompassing over 150 individuals; 3) presented preliminary findings based on these data; and 4) provided suggestions for future research on both the behavioural evaluation of office automation technology and the development of the technology itself.

Research Plan

The study was based on two principle assumptions. One was that the major benefits of computer based communication-information technologies would lie with their active use by management and senior staff as compared to clerical and secretarial workers. Management salaries consume the major part of white collar payrolls, and savings that can be made here are potentially much greater than those which can occur at the levels of strictly routine work. On the other hand, the fact that management work is not well understood and typically is non routine is one of the reasons why technolo-

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gy has not yet found a home in most managers' offices. It is far easier to provide a technological response to that which is relatively easy to understand, and that is why such things as word processing and text editing have been developed far more completely than decision support systems or integrated automated offices. In the hope of providing further impetus to the electronic support of managerial activities, we have focused our efforts on the study of managerial and senior staff work, knowing full well that this is a difficult and not well understood area.

The second assumption is that an office can be viewed as an organized collection of information processing centres. The activities can be divided into two parts; work processing, that which occurs at a given centre; and communication, the flow of work, data, information between each of the centres. Work processing indicates what is done by a person on his or her own. Communication provides the linkages which give structure to the organization. Without interaction among th work processing roles it is difficult to conceive of organized activity. Thus, it is not surprising to find that the few studies which have documented several aspects of managerial work all agree that managers spend 60 to 90 percent of their time communicating - talking, listening, and writing.

Outline of the Report.

The report will unfold as follows: First we examine the sample of firms and individuals from which we obtained our data. This will be described in sufficient detail so that the reader can understand the context of our study and the extent to which the results might be extrapolated to other organizations. We next proceed to discuss the data collection procedures and instruments and the rationale which lies behind each. We also indicate how each fits into the total scheme of things.

Following the descriptions of the instruments, we cover the findings that we have made based on each one individually. Furthermore, we critique the particular instrument and its application. We close with a summary of the findings, mentioning how they can be integrated into a more comprehensible whole and how they might be interpreted in terms of their implications for computer based communications information technologies. The final paragraphs include suggestions for revisions in the methodology used to collect the data on office activities. Additionally suggestions for other research which ought to be undertaken if we are to have an understanding of office activities adequate to the specification and provisioning of office automation technology are presented

Added to the report proper are a number of appendices. The first contains the two sets of instruments and instructions we used to conduct our field research. The first set was used for the first three organizations; the second set was used for the fourth. The second contains the coding schemes which were used to analyze the data collected on two of the forms. While the forms themselves were structured, some of the data collected were in a verbal form and had to be coded for computer processing. Attached to this report there are four independent reports in complete form which are to be distributed to the subject organizations. These four reports are proprietary and are not to to be distributed without the consent of both the company concerned and CECIT. They are included to provide DOC with an indication of how the data obtained might be analyzed in terms of the needs of an individual organization. From DOC's standpoint there will be a considerable amount of duplication between the global report and the four individual reports. The reader should keep this in mind when perusing the individual reports.

THE SAMPLE

The total sample was comprised of 163 individuals taken from four organizations. Of the 163, 148 completed all of the various stages of data collection, 8 missed one, and 7 missed two or three. Most of the analyses include only the 156 subjects who participated in all (or all but one) aspects of the study. Of the 156, 109 were managers - they supervised one or more persons. The remaining 47 were staff at various levels in each of the organizations. Secretaries accounted for approx.one fourth of these

The first organization studied was the financial services arm of a university. This unit is responsible for all of the accounting and financial control activities for all of the academic and non-academic departments within the university. Included, for example, are the monitoring of contracts between the university and outsiders and the financial administration of research grants. Data were collected from 37 persons; 36 of them provided input adequate for most analyses. Of these, 11 were managers. Two of the remainder were secretaries. The others were involved in keeping track of accounts in one form or another. Therefore the spectrum of activities covered was rather narrow, with the emphasis being on accounting.

Two organizations were then studied in parallel. One was a manufacturer of styrofoam and other plastic products. The company size was in the order of 250 employees of which 27 managers, salesmen and staff were included in our data collection efforts. All but one provided data sufficiently complete for analysis. Of the remaining 26 subjects, 15 were managers and 11 were clerical staff. This organization, though not particularly large, provided the complete spectrum of activities that one might find in any manufacturing enterprise. Included in the sample were accountants, salesmen, engineers, plant foremen and senior administrators.

The other organization was an insurance company. Most of the senior managers participated in our study, and in fact only 4 of the 29 persons who completed all of the forms were not managers. These 4 were clerical staff involved in data processing in one capacity or another. Although insurance companies do not include a complete spectrum of functional roles (e.g. there were no engineers or managers of manufacturing) a wide variety of sales and administrative functions were included. Furthermore, of all the organizations studied, none was more dependent on paper flow and the storage and retrieval of documents. If the benefits of office automation are likely to be substantial for any organization, surely insurance companies would have to be included among the potential major beneficiaries.

The last organization included in the sample was also the largest. It was the Canadian subsidiary of one of the largest tire manufacturing companies in the world. Our focus was on senior management and 58 of the 65 usable returns were completed by managers. The other 7 were secretaries who were included to study the complementarity of their roles with those of the people they worked for. As was the case for the plastics company, virtually all aspects of management activities were included in the sample. The size of the organization, however, dictated that we only study a small proportion of the total number of managers. Thus, our ability to examine networks of relationships was diminished, since it was unlikely that we included all members of any given network in our sample. We should also note, as we will mention later, the increase in the size of the sample from 30 to 60 created data collection and analysis problems far greater than the ratio of 2 to 1, when compared to the problems encountered with the other three organizations. The study of a very large company was a real education in a number of respects.

METHODOLOGY

We first describe the development and evolution of the instruments and procedures in a general sense, after which we mention how each data collection approach was administered. We then turn to a description of each instrument, discussing its intent, format and the like.

Development and Evolution of Methodology

Everyone actively connected with CECIT during the spring and summer of 1980 (Conrath, Irving, McClean, Ratz, Thachenkary, Wills and Wright) participated in the early development of instruments and procedures to be used in the field studies. The consensus of opinion was that most people really don't know what they do at the level of detail we required. People act and react at work usually without consciously concerning themselves with precisely what their actions are. Thus, we would have to lead them through a step-wise procedure to get our subjects to the point where we could understand the specifics of their work processing and communication activities.

It was also clear that because we intended to gather a large volume of data, we would have to establish taxonomies for most dimensions so that we could process the data by computer. There would be no other way to handle the returns from over 150 people. We also recognized, however, the difficulties of using taxonomies. First, there is the problem of ambiguity and cross coder reliability. We tried to minimize this as much as possible by providing clear definitions for each class.

Second, if we created the classes before collecting any data there was always the risk of losing information because of having created boundaries which were not ideal for post data collection analysis. Since there were few adequate taxonomies in the literature, we had to create our own. Consequently, we were very concerned with the problem of ensuring that our a priori categories would be useful ex post. One solution to this problem is to develop taxonomies after data collection, relying on extensive input to be coded after the fact. But this too presents problems. It limits the amount of data which can be collected, especially if it has to be in verbal form. Secondly, it puts tremendous emphasis on the effort required to do the coding.

Our approach was a labour intensive compromise of the two positions. We created a priori taxonomies for almost all of the dimensions of work processing and communication for which we sought data. We also collected a large volume of data in verbal form so that they could be coded or recoded after collection if need be. As it turned out, we did a tremendous amount of coding of data after they had been collected, an effort that created difficulties in meeting existing deadlines.

The actual development of the instruments went through three phases. The first results were tested by means of a small pilot study. The intention was to examine the acceptability of our instruments and procedures to the subjects and to see whether or not we could obtain all of the data which we sought. We did not process the data obtained other than to observe whether or not we could make sense of them. The results of the pilot study led to several changes in the instruments which were incorporated before we collected our sample from the first three organizations.

The phase two instruments were used for approximately 60 percent of our samples, roughly 90 persons who participated in our studies during the summer of 1980. In the process of this field research several suggestions were made regarding how the instruments might be further enhanced to gain greater insight on the work and communication activities of our subjects. These changes were made before we gathered data from the last firm during the fall of 1980. The instruments used for both phase two and phase three are included in Appendices 1.1 and 1.2. The instructions for coding the data after the fact can e found in Appendices 2.1 and 2.2.

Data Collection Procedures

Each of the data collection instruments will be discussed in detail in the following sections, but they need to be identified here so that one can understand the procedures which were used to administer them. They are: 1) Office Services Questionnaire, 2) Task Record Form 3) Communications Diary, and 4) Detailed Task Analysis.

After getting an initial indication of a willingness to participate by the president or senior administrative office of an organization, we asked that someone be assigned as a liaison, a person through whom we could make all of the necessary arrangements to proceed with the study. In addition to expediting matters, the liaison also provided us with data about the organization, such as the organization chart, and job descriptions (if they existed), and suggestions about how and when to administer our data collection instruments to minimize the disruption of the normal office activities.

The procedure for each organization started with a session with senior management to describe what it was that we intended to do, why, what the time commitment on the part of the participants would be, and what the organization might get out of the study for its own purposes. These meetings were designed to accomplish two purposes. One was to get cooperation from management, both because they would be participants themselves and because we wanted to be certain that they would ensure that their staff members who were selected as subjects cooperated as well. If they did not know exactly what was going to transpire, experience has shown us that data reliability suffers substantially. People would participate only on an as need to basis.

The other reason for the meetings was for rumour control. In the past we have had several bad experiences when only one or two persons within an organization knew about an impending field study. Others would hear about the study, but would not know whom to ask for further details. As a consequence, rumours would start, sometimes with disastrous results. When a number of senior managers know what to expect, information is dispersed quickly, and too many people know the facts for rumours to get out of hand to the detriment of field research.

The actual collection of data began with group sessions of ten to twenty persons, depending upon the facilities available. Each session began with an explanation of the study: who we were, what we intended to do, why, what each subject would be expected to do over the next few weeks, how we would protect the confidentiality of responses, and how the data would be used both for the company and for the Department of Communications. This usually took about 15 to 20 minutes.

We then administered the Office Services Questionnaire, using overhead transparencies, to explain how to complete the form. This form required about twenty minutes, on the average, to complete. Immediately following this, during the same group session, we asked each person to complete the Task Record Form - a description of one's job in one's own words, subject to the constraints of the requirements of the form. This was not easy for many of our subjects, as they had not thought about their jobs in this fashion. Because of this, we not only explained what we wanted using overhead transparencies but we also had samples which we distributed. In addition, we circulated among the participants, helping them complete the forms as best we could. For this reason we had two or three members of CECIT staff at each group session, and we never had more than 20 subjects at any one session.

Prior to the end of the group session, we explained the Communications Diary which each person was asked to keep for a period of one week. In addition to the explanation, we gave everyone a set of instructions and a sample diary which they could use as a reference once they began to fill in their own diaries.

The Communications Diaries were kept by everyone in the sample for the same one week period. This was usually the week following the last group session. The procedure was to hand out a new set of diary sheets each morning, collecting the completed ones each evening. This would prevent subjects from filling in copies of previous sheets, and more importantly, it permitted us the opportunity to examine the sheets each evening to see if there were any inconsistencies or incomplete entries that should be corrected. Those that were found were brought to the attention of the person who completed the form. This also provided the means for instructing the participants on the proper way to complete the diaries.

In addition to the checks made each evening, we had someone on premises during the entire week to respond to enquiries about how to record a particular inter- action. The member of CECIT's staff was assigned a desk and a telephone number for the week. The location of the desk and the telephone number were made known to all participants during the group sessions, and the latter was listed on each set of diary instructions.

Following the completion of the Communications Diary, each person was interviewed about the details of some of his or her tasks. This interview usually lasted between an hour and an hour and a half, and was the last thing our subjects had to do in the way of providing us data.

Office Services Questionnaire

The Questionnaire was designed to obtain people's perceptions of their use (volume and frequency) of various office support systems. In addition we asked some questions about how one made use of the service and the extent to which one experienced difficulties with it. While most of the services mentioned were technological (e.g., the telephone, copier, computer terminal, remote facsimile....), we also included the secretary, typist and internal mail.

The primary reason for the questionnaire was to determine the office support services that were perceived to be used and the level of satisfaction with them. The completion of the questionnaire also provided a mechanism by which we could explain the kinds of things that we would be interested in during the study. No matter how detailed one makes an introduction to a study, actual participation usually proves to be far more informative to the subjects.

The questions included on the questionnaire are rather straightforward, and thus would not appear to require additional explanation (see Appendices 1.1 and 1.2). The data obtained were entered into the computer directly from the questionnaire without having to be further coded. The processing was intended to give essentially a summary of individual responses for each of the organizations studied.

Several changes were made in the questionnaire before it was administered to the fourth organization. We identified the typewriter as a support system separate from the typist. All of the other changes were essentially of a cosmetic nature, undertaken to make the form easier to complete. They involved the rewording of certain questions and/or their reordering. Nothing of substance was changed.

Task Record Form

Everyone was asked to think about his/her job in terms of the tasks that had to be completed to carry out the job. A task was defined as an element of work which could be seen as something complete by itself, which had an identifiable beginning and end and a recognized output. We noted that most people would identify anywhere from 5 to 25 tasks that basically defined their job, and we provided a mock-up of a completed form to give our participants a picture of what it was that we wanted. The information we required was a brief verbal description of the task, who or what initiated it, what the results of its accomplishment were and to whom or where the results went. In addition, we asked for an estimate of the frequency with which it was undertaken, how much time one spent doing it for each occurrence, and the perceived relative importance of the task.

The initial purpose of the Task Record Form was to obtain a description of one's job sufficient for a later interview, at which time the details of some of the more important tasks would be obtained. For this reason we asked people to describe what they did in their own words, rather than trying to constrain them by providing a set of precoded classes within which they had to fit their work. We also intended to use the data to establish a profile of activities, by task type, which occurred in each organization, noting the relative amount of time spent on each along with its relative perceived importance.

As one can see from the forms used, the emphasis was on the input/output aspects of the tasks. We had hoped to use the data obtained to determine work flow, but problems in the consistency of descriptions made this virtually impossible. The output of one task which was the input of the second task, was often described in two completely different ways. Thus, the linkages were often unidentifiable.

On the other hand, the Task Records provided us with our only relatively complete picture of the total activity undertaken by the people in our sample population. Hence, we were motivated to establish coding schemes ex post to create a data base for further analysis, especially one that could reflect differences across hierarchical levels and functional departments. This was done, and the taxonomies and the instructions for their use can be found in Appendices 2.1 and 2.2.

The major change in the form between its use for the first three organizations and the fourth concerned the creation of a clear distinction between the conditions which initiate a task and the source of these conditions. It was this confusion which was partially responsible for the difficulty in identifying sources uniquely. The earlier version asked for a single response to question of what or who initiates the task. Thus, it was often difficult to disentangle the source from the triggering event itself.

Communiations Diary.

We have had considerable experience with the use of communication diaries for collecting data about interpersonal communication. Hence we had a good idea about the kinds of data which would be feasible to obtain. Since we were interested in developing communication networks we needed to be able to identify the "other party" to each interaction and who initiated it. To determine the support technology used we asked for the mode employed for the communication event, and if failures to get through occurred, how they were handled. We also asked for an estimate of the elapsed time of the interaction, a departure from previous experiences where we had used a set of precoded time intervals. Finally, we asked if an intermediary was involved, such as someone transferring a telephone call or dropping off a written message on one's desk.

One purpose of using the Communications Diary was to examine the actual communication network used within an organization to determine its functioning structure. For this purpose, we planned to use the Hypergraph Structural Analysis technique developed by McClean and Conrath.

Another goal was to examine the communication failures to the extent that they would be recorded, to see how they were handled. This is one area in which existing technology might be of considerable assistance. A third reason for using the form as designed was to get an estimate of the amount of time spent communicating, knowing that we would only obtain a lower bound, both because of failure to record and because of people's tendency to underestimate of the elapsed time of most events.

The only coding of the data was that which was required to identify the other party or parties to the interaction. Since all intra-organizational communicators were to be identified uniquely, this involved a significant amount of time. Other of the data on the Diary were capable of being entered directly into a computer file.

The Communications Diary also underwent a change after its use for the first three organizations. As one can see by comparing the Diaries in Appendices 1.1 and 1.2, we dropped the question regarding intermediaries, and asked for additional data about three other subjects. One was the location of the two or more parties to the interaction. This was in response to earlier work on the relationship between physical inter-personal distances and mode use. A second source of additional data was the question on the volume of paper involved in the non-aural forms of communiation. Previously we could determine the frequency and the elapsed time, but not the volume per se. The third addition was the task involved in the interation. Prior to distributing the diaries, we wrote in the four most frequently performed tasks for each individual (obviously these were unique to each individual). We then asked them to check off those that were involved in a particular communication. The changes were made both because we felt that the additional data would be valuable, and to determine whether or not it was feasible to obtain this additional information.

Detailed Task Analysis

This form was developed to get at the details of what one does on the job, in contrast to the generalities obtained from the Task Record Form. Here we have the capability to take a task and break it down into a number of specific operations, each of which begins with some initiating event and concludes with an identifiable output. Questions were asked not only about the communication aspects of one's work, but about the work processing activities and the support systems or aids which were used as well. Data were also gathered on the location where the activity took place and on whether or not it was scheduled, and if so by whom.

The intention of this form was to learn enough about certain aspects of one's job to be able to determine their potential for the use of technological support systems. Because we knew that such information would not be easy to obtain, we devised the form for use by an interviewer rather than the interviewee. A member of CECIT's staff would meet with an individual, already having reviewed that person's Task Record Form and job description (if one existed), with the intention of getting detailed data about the tasks that the interviewee felt were most important.

Because of the wealth of data involved, we created pre coded classes for all of the relevant dimensions except for the nature and source of inputs and outputs. This was done to speed up the interview process, and also enhance the conversion of the interview data into a format which could be processed by computer. It is not appropriate at this time to discuss all the difficulties encountered while attempting to convert the data from the Detailed Task Analysis interview sheet to a computer processible format, but needless to say, they were substantial. Most of the problems which we identified with _a priori_ taxonomies and ex post taxonomies arose. Coding has still not been completed, and the profiles obtained from the interviews will probably not be available for several weeks. Nevertheless, whatever the validity of the data that have been coded, the interviews did provide excellent insight into the activities of each organization. This clearly affected the content of the reports prepared for each organization and enhanced our ability to provide them with relevant advice. All will receive addendums to the reports as soon as the analysis of the coded detailed task data is complete.

SUMMARY FINDINGS

Only the findings relevant to the entire sample will be discussed here, although they may include comparisons across the four organizations studied. Results which are unique to a given organization can be found in the individual reports prepared for each.

This summary is organized according to the instrument used for data collection. The final integration of these remarks can be found in the concluding section. The data themselves are contained in Appendices, each arranged according to the organization from which the data were obtained: .1 refers to the financial services unit, .2 to the manufacturer of plastic products, .3 to the insurance company, and .4 to the tire manufacturer.

Office Services Questionnaire.

A total of 155 persons from the four organizations completed the questionnaire (see Appendices 3.1, 3.2, 3.3 and 3.4). The analysis of their perceptions will be done according to four different groupings. First we will look at the access one has to the various support services and the constraints which are perceived to exist for each, including its location. Second, we will examine the usage patterns in terms of frequency and volume. Third, we will note the difficulties users have with particular services. Finally, we will comment on how our respondents, especially the managers, used specific services, such as typists and the telephone.

Looking at access one finds certain services which are universally available. All but two persons claimed they had access to a copier, and all but one to a telephone. Furthermore, only 15 did not have access to a typist, and of these all but one or two were typists themselves or were involved in data processing, working directly on computer terminal. At the other extreme is remote facsimile and Telex/TWX. Three of the organizations had remote facsimile units, and yet only 31 of the 123 persons responding indicated that they had access to them. Of the 88 respondents who worked for organizations that had Telex units, only 51 perceived they had access to them. Perceived access to computer terminals fell in between these extremes.

A major factor affecting perceived access was the location of the service. For the vast majority of the people, both the facsimile device and the Telex terminal were located on another floor of the same building or in another building. Thus, many were not even aware of the existence of these two services. Granted, a lack of need also contributed to the lack of awareness since in both cases alternatives existed (mail, telephone, etc..). Hence, the need was not likely to be acute.

In contrast, only 5 of 140 persons did not have access to a typist located on the same floor. The ratio was 23 of 152 for a copy machine and 14 of 84 for a computer terminal. Convenience would appear to be a factor in perceived access, and where one locates a service is definitely going to affect the rate of its usage. This is consistent with the large body of data describing the relationship between distance and both the rate of and the mode used for communication. The greater the physical distance, the lower is the likelihood of face to face communication between any two persons and the greater is the use of the telephone.

Another factor affecting access are the limits put on the use of a particular service. Interestingly, the proportion of the respondents who indicated limits to the use of the telephone, a copier and a typist were about the same, between 30 and 35 percent. The nature of the limits were somewhat different, however. For the telephone, 20 percent claimed a dollar limit and 10 percent a time limit. For the copier the same proportion indicated a dollar limit, but 15 percent stated there was a quantity limit. For the use of typists, the constraint was one of time. Time was also the major factor limiting the use of computer terminals, as almost half of those who indicated access to a terminal claimed this as a constraint.

Of course the major impact of limits should be on usage but there is little in our data to suggest that this is the case. Maybe our respondents were just reciting company policy and/or they had guilty consciences. Copiers were used several times a week by 96 percent of our subjects, and 62 percent claimed use at least several times a day. The rates were almost as high for the use of typists, 88 and 57 percent respectively. Only for the computer terminal do we see a much lower rate of utilization of those who have access to one, and that undoubtedly reflects the nature of their tasks more than anything else. However, it also reflects, in certain instances, the difficulty of getting access to the computer itself.

The volume per use of a service is directly related to the frequency of use. The typical use of a typist or a copier involves 2 to 4 pages of material; whereas people using a computer terminal note that one page of material is the most common case. If one were to take the frequency of utilization times the typical volume, one could get a rough measure of the total usage of each of the given support services that are involved in written matter. The copier clearly heads the list.

As a basis of comparison with the Diary data to be discussed later, we should note the perceived frequency of face-to-face and telephone conversations. Over 78 percent of the people claim that they use the telephone on the average at least ten times a day, and another 20 percent use it between 3 and 10 times a day. This is even higher than the frequency of face-to-face interaction: 66 percent claim at least 10 per day, while another 25 percent checked 3 to 10 a day, on the average. These results are interesting in light of the Diary data which indicate that face-to-face communication was far more common for all four organizations, and in only one case was the use of the telephone even close. Either people overestimated their use of telephone, and/or they failed to record actual uses on the Diary.

Turning to perceived levels of difficulty with the use of an office service or communication system, face-to-face meetings led the list. Only 23 percent claimed little difficulty (0 to 5 percent of the time), while 29 percent indicated that they had problems more than 15 percent of the time.

If one were to rank order the more common support services according to the proportion of time one experiences difficulties in their use, the computer terminal would head the list (24 percent claiming problems more than 15 percent of the time). The problem here is the difficulty of getting on the computer and computer down time, though several mentioned their complaints concerned the quality of the data. One of the difficulties with computer based services is that the computer system is blamed for many things which are human error.

The telephone system and the external mail service were next in line in terms of the perceived level of experienced difficulties. In each case about 15 percent of the respondents suggested that there were significant problems (difficulties arose over 15 percent of the time). The nature of the problems, however, were quite different. Most complaints about the use of the telephone concerned the difficulty of getting the person called on the line. As often as not the line was busy or the person was not there.

The federal mail system was also cited. It was accused of being not only slow but too unpredictable in terms of the date of delivery.

There are computer based solutions to both the telephone and the mail delivery problems, but before one rushes off to implement them, please note the level of perceived difficulties with the computer. If office automation is going to solve problems and not just relabel them, issues of computer capacity and quality of input are going to have to be resolved first. The latter is a particularly thorny problem since its resolution is generally outside the realm of technology. However, the improvements in optical character recognition technologies may soon reduce this problem.

We conclude our comments on the perceived levels of difficulties with various services by noting that the uses of copiers, internal mail systems and typists seem to be relatively satisfactory. This is notwithstanding the fact that 90 percent of the people proofread typists' output and find it satisfactory less than 60 percent of the time, and that over 35 percent of the respondents indicated they check the output of the copier and some of them were not satisfied with the results either. What has happened is that people have come to expect a certain quality level for a given service, and if that is met, they are satisfied. This is a big hurdle for computer based technology, for many people expect the computer to be perfect, often even when the input is not. A greater appreciation of what the computer can and can not do is essential before the results of its wide spread use are going to be perceived as satisfactory.

We close our discussion of the Questionnaire results with some comments on /us how certain services are used. First, the use of intermediaries, such as secretaries or service operators, to handle a particular service varies greatly according to the organization and the hierarchical position of the person wanting the service. We found everything from 'do it yourself' organizations to those who make heavy use of service professionals. Our first thought was that this would reflect the size of the organization, but this was not the case. Apparently organizational policy is the ruling factor, though seldom was anyone able to state why a given policy existed. The tradeoff seemed to be between highly accessible services (the 'do it yourself' philosophy) and more limited and often sophisticated services run by 'professionals'.

Two other findings surprised us somewhat. One was the fact that the vast majority of our respondents gave their typists hand written drafts of material to be typed. Little use was made of dictation, the dictaphone and other similar technologies. Also, very few composed rough drafts on the typewriter. Since both typing and speaking are much more rapid than writing a draft by hand, increases in the efficiency of the preparation of written material could certainly be forthcoming.

The other surprise was that almost half of the people noted that they had their incoming phone calls intercepted by a secretary or receptionist at least some of the time. The telephone ring was often viewed as an undesirable interruption, and what one wanted was an intelligent telephone answering device which could determine whether or not the person should pick up his or her line. Some computer based telephone systems can provide this service within a given PBX. This should be of interest to some managers.

Task Record Form

The data obtained from the Task Record Forms will be discussed in the following sequence. First, we will note the distribution of tasks, according to the categories we have developed, for each of the four organizations. We then look at the classes of input sources and output destinations to obtain a rough image of work flow in terms of intra-departmental, intra-organizational and external linkages. We conclude by returning to the distributions of tasks, but this time looking at their relationships with hierarchical level and functional department.

Tables 1.1 through 1.4 contain distributions of tasks for the subject organizations according to the frequency the task type was mentioned, the total elapsed time involved in each of the tasks in man days per year, and the perceived rank order of importance. Table 1.5 lists the taxonomy of tasks used throughout our analyses.

To get some idea of the validity of the task data, we calculated the number of man days per respondent which were accounted for by the tasks listed in the task record forms. Presumably the higher the number of work days per year for which we have data, the more complete is our picture of the activity which takes place within a given organization. The financial services personnel (Table 1.1) accounted for 146.8 days of their time per year, on the average. The figure for

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TABLE NAME      TASK DISTRIBUTION
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               ---------------------------------------------------------
               = FREQUENCY        = TIME                  =  RANK                    =
               ---------------------------------------------------------
TASK           = NO.      -      % = NO.        -       % =  1   2   3   4   5 >5 =
=========================================================================
  1 - Q        =  11.00   -   5.0 =    269.71  -   5.2 =  2   3   2   2   1   1 =
  2 - B        =  76.00   -  34.2 =   1828.75  -  35.2 = 14  14  10  11   6  21 =
  3 - T        =   6.00   -   2.7 =    197.43  -   3.6 =  1   0   2   2   0   1 =
  4 - P        =  12.00   -   5.4 =    379.86  -   7.3 =  4   2   3   1   2   0 =
  5 - E        =  28.00   -  12.6 =    858.43  -  16.5 =  4   7   5   5   3   4 =
  6 - H        =  13.00   -   5.9 =    434.36  -   8.4 =  7   2   1   2   0   1 =
  7 - I        =   8.00   -   3.6 =    110.93  -   2.1 =  1   1   0   2   3   1 =
  8 - D        =  20.00   -   9.0 =    274.43  -   5.3 =  4   1   1   2   2  10 =
  9 - F        =   5.00   -   2.3 =    142.29  -   2.7 =  0   0   1   0   1   3 =
 10 - A        =  31.00   -  14.0 =    663.07  -  12.8 =  7   6   5   2   5   6 =
 11 - G        =   6.00   -   2.7 =     75.00  -   1.4 =  1   1   0   1   0   3 =
 12 - M        =   5.00   -   2.7 =     43.86  -   0.8 =  0   0   1   0   1   4 =
=========================================================================
```

Table 1.1

```
TABLE NAME      TASK DISTRIBUTION
----------
               ---------------------------------------------------------
               = FREQUENCY        = TIME                  =  RANK                    =
               ---------------------------------------------------------
TASK           = NO.      -      % = NO.        -       % =  1   2   3   4   5 >5 =
=========================================================================
  1 - B        =  22.00   -  15.5 =    972.14  -  19.0 =  5   5   4   2   3   3 =
  2 - E        =  15.00   -  10.6 =    597.71  -  11.7 =  1   3   3   4   2   2 =
  3 - D        =  14.00   -   9.9 =    491.43  -   9.6 =  3   3   4   3   0   1 =
  4 - H        =  24.00   -  16.9 =    909.71  -  17.8 =  9   3   2   2   1   7 =
  5 - F        =   5.00   -   4.2 =    207.43  -   4.1 =  0   1   1   2   0   2 =
  6 - T        =   4.00   -   2.8 =     61.71  -   1.2 =  1   1   1   1   0   0 =
  7 - I        =  13.00   -   9.2 =    378.86  -   7.4 =  2   0   5   1   1   4 =
  8 - S        =  10.00   -   7.0 =    538.63  -  10.5 =  4   3   1   1   1   0 =
  9 - A        =   7.00   -   4.9 =    170.29  -   3.3 =  1   1   1   1   2   1 =
 10 - P        =  18.00   -  12.7 =    514.00  -  10.0 =  4   2   2   1   4   5 =
 11 - G        =   3.00   -   2.1 =    106.29  -   2.1 =  0   0   0   1   2   0 =
 12 - Q        =   2.00   -   1.4 =    142.86  -   2.8 =  0   1   0   0   1   0 =
 13 - M        =   4.00   -   2.8 =    100.57  -   2.0 =  0   2   0   2   0   0 =
=========================================================================
```

Table 1.2

```
TABLE NAME      TASK DISTRIBUTION
----------
               ----------------------------------------------------------------
               = FREQUENCY        = TIME                   =   RANK           =
               ----------------------------------------------------------------
TASK           = NO.     -      % = NO.         -        % =  1  2  3  4  5 >5 =
================================================================================
 1 - D  =   38.00 - 20.4 =   1720.71 - 31.3 =  9  9  4  3  1 12 =
 2 - A  =   15.00 -  8.1 =    444.00 -  8.0 =  0  1  3  3  3  5 =
 3 - H  =   31.00 - 16.7 =    770.14 - 14.0 =  4  6  3  4  3 11 =
 4 - E  =   38.00 - 20.4 =    965.28 - 17.5 =  7  3  6  5  3 14 =
 5 - B  =    8.00 -  4.3 =    474.86 -  8.6 =  1  0  1  0  1  5 =
 6 - F  =    3.00 -  1.6 =    160.00 -  2.9 =  1  0  0  1  0  1 =
 7 - M  =    8.00 -  4.3 =    146.57 -  2.7 =  1  1  1  3  0  2 =
 8 - G  =    7.00 -  3.8 =    105.71 -  1.9 =  1  1  2  1  0  2 =
 9 - P  =   17.00 -  9.1 =    427.43 -  7.7 =  3  2  2  3  1  6 =
10 - I  =   14.00 -  7.5 =    224.29 -  4.1 =  1  0  1  2  2  8 =
11 - Z  =    1.00 -  0.5 =     17.14 -  0.3 =  0  0  0  0  1  0 =
12 - S  =    2.00 -  1.1 =     65.14 -  1.2 =  0  1  0  0  1  0 =
13 - C  =    3.00 -  1.6 =     22.00 -  0.4 =  0  1  0  0  1  1 =
14 - T  =    1.00 -  0.5 =     34.29 -  0.6 =  0  0  1  0  0  0 =
================================================================================
```

Table 1.3

```
TABLE NAME      TASK DISTRIBUTION
----------
               ----------------------------------------------------------------
               = FREQUENCY        = TIME                   =   RANK           =
               ----------------------------------------------------------------
TASK           = NO.     -      % = NO.         -        % =  1  2  3  4  5 >5 =
================================================================================
 1 - E  =   63.00 - 14.0 =   1372.71 - 11.5 =  9 10  9  6  8 21 =
 2 - G  =   46.00 - 10.2 =   1759.71 - 15.0 = 12 10  6  8  2  8 =
 3 - P  =  103.00 - 22.9 =   2320.14 - 19.4 = 23 21 11 14 13 21 =
 4 - S  =   14.00 -  3.1 =    507.43 -  4.2 =  3  1  1  3  3  3 =
 5 - A  =   16.00 -  3.6 =    462.00 -  3.9 =  2  1  3  2  2  6 =
 6 - H  =   59.00 - 13.1 =   1693.50 - 14.2 = 12  7 15  4  7 14 =
 7 - I  =   14.00 -  3.1 =    506.71 -  4.2 =  2  4  1  1  3  3 =
 8 - M  =   23.00 -  5.1 =    514.28 -  4.3 =  2  4  2  1  5  9 =
 9 - L  =   25.00 -  5.6 =    475.57 -  4.0 =  0  5  5  8  4  3 =
10 - G  =   28.00 -  6.2 =   1132.26 -  9.5 =  3  4  5  7  3  6 =
11 - R  =   26.00 -  5.8 =    471.57 -  3.9 =  3  2  3  4  5  9 =
12 - B  =   22.00 -  4.9 =    369.71 -  3.1 =  1  1  3  1  3 13 =
13 - T  =    6.00 -  1.3 =    431.43 -  3.6 =  2  1  0  0  0  3 =
14 - F  =    2.00 -  0.4 =     17.14 -  0.1 =  0  1  1  0  0  0 =
15 - C  =    1.00 -  0.2 =     17.14 -  0.1 =  0  0  0  0  0  1 =
16 - Z  =    1.00 -  0.2 =     34.29 -  0.3 =  0  1  0  0  0  0 =
================================================================================
```

Table 1.4

TASK TAXONOMY (see definitions)

P - Planning, Budgeting, Analyzing (Future Oriented).

D - Deciding, Authorizing, Approving (Action Oriented).

E - Evaluating, Auditing, Controlling, Co-ordinating, Monitoring, Reviewing (not concerned with people)

H - Human Relating, Supervising, Appraising performance, Staffing, Motivating (People Oriented).

M - Interactive Formal Meetings

I - Informing, Reporting (one-way flow)

A - Advising, Counselling, Assisting, Recommending, Problem Solving Instructing, Acting as a liason (two-way flow)

S - Selling, Convincing, Persuading, Advertising (change oriented).

G - General Administration, Paperwork, (Managerial level).

F - Completing Forms, Filing, Recording, Logging (Algorithm Oriente

T - Typing, Transcribing, Copying, Writing (going from one med[illegible] t another).

B - Bookkeeping, Accounting, Calculating, Inventorying, Invoicing (number crunching at clerical level).

O = Orders, Requests, Invoices, Bills

Q - Arranging/Scheduling of meetings, appointments, Handling telephone calls, Distributing mail (secretarial tasks).

Z - Zero (don't know).

Table 1.5

the plastics manufacturer was 192.3; it was 174.6 for the insurance company and the personnel of the tire manufacturer accounted for 205.3 days per year of their time, on the average. These figures compare with 225 to 240 working days per year for most salaried employees.

The first thing one notices when comparing the four tables is the disparity across the organizations. One should not be surprised to find that bookkeeping/ accounting is the primary task for the financial services organization. What is surprising is the variation in emphasis on human relations/motivating/supervising tasks. For the small manufacturer it ranks number one, and this has been substantiated by previous field research in the same company. For other organizations, human relations tasks rank second to fourth in importance, depending upon the measure one uses.

The emphasis on planning/analyzing and decision making/ approving tasks also varies, but part of this variation reflects some ambiguity in the definitions of the two tasks. At times it was difficult to determine whether a task fitted into one or the other (e.g., policy making) and thus one might wish to regard the sum of the two as a more relevant class. If so, the combination ranks number one for all but the financial services unit, and the latter had the highest proportion of non-managerial subjects.

The major conclusion that one can draw from the distribution of tasks is that those which are the most difficult to programmable, are at or near the top of the list for most managers. This will be even more obvious when we look at the breakdown by hierarchical level. Number one in terms of man days is human relation type tasks. Office automation is not likely to be of assistance here, and, in fact, the fear is that the reverse might take place. Time saved in routine tasks will need to be spent on human relations to overcome the depersonalization which often takes place with increased use of computer based technology.

There is little doubt that the computer has a role to play in planning, decision making and evaluating the progress of an organization, but this is the realm of decision support systems, which is still an art. What our results do point out is that without the integration of decision support software and hardware, office automation may have little to offer the manager. This point has to be emphasized for it is on the more complex tasks that the manager's time is spent. The technology to come has to support these effectively and with ease if it is manager.

Table 2 provides some insight on _sources of input and destinations of output_. For the purposes of analysis, we have placed the sources and destinations into four categories: one's self or readily available files; intra-department; intra-organization but external to one's department; and external to the organization. A fifth category was created for the tire company because of its use of a committee made up of all senior managers. This we have called the executive group.

One of the striking things about the patterns of sources and destinations is their similarity across the first three organizations. If one include the executive group as intra-departmental for all of the departments, the pattern for the fourth group is similar as well. The bulk of inputs and outputs are divided evenly between intra-departmental and external to the department but intra-organizational. The proportion which crosses organizational boundaries remains rather small; in the four cases it ranged from 13.6 to 16.7 percent. Relating to oneself is of equal or greater importance.

There are two conclusions that one can draw from this consistent pattern of work flow. One is that any system for expediting work flow would have to exist company wide if it were to achieve significant benefit. A company could reorganize to increase the within departmental work flow relative to that which crosses departmental lines, but as long as most organizations maintain a functional structure (each of the ones studied did), this will have to be accommodated by the new computer based communication-information systems.

TABLE 2

INPUT SOURCE AND OUTPUT DESTINATION

Organizations

	.1		.2		.3		.4	
Source/Destination	S	D	S	D	S	D	S	D
Self-Files	28	37	69	37	70	26	159	92
Intra-Dept.	105	142	71	121	73	103	127	155
Intra-Org.	107	143	75	138	100	118	255	279
External	45	59	63	22	54	44	95	124
Executive Group							91	113

The other conclusion is that input and output which crosses organizational boundaries is a sufficiently small proportion of the total (unfortunately, we do not have a measure of its importance), that systems which are integrated across these boundaries do not appear to be required at this stage. Current means may not be ideal, but they suffice. In support of this conclusion one might note that the vast majority of the uses of courier services are for intra-company work flow.

Appendices 4.1 through 4.4 contain the distribution of task categories according to one's level in the hierarchy for each of the four organizaions. We have condensed the data for management in Table 3 listing just the four tasks which occupy the most time and are ranked highest in importance. This confirms the comments we made earlier regarding management tasks and the extent to which they are amenable to the use of office automation technology. The problem of designing support systems is anything but trivial, and the answer is clearly not merely an extension of word processing/text editing or electronic mail. It is not that these can not help, but they are not the basis of the electronic office of the future. Complex software designed to assist the manager in his planning, evaluating (auditing and reviewing) and decision making roles, is what will be required. Given the difficulty that we have with present management information systems, the systems of the future are not just around the corner.

TABLE 3

DISTRIBUTION OF MANAGEMENT TASKS

Task	Man Days	Rank		
		1	2	3
Planning	3272	30	25	18
Human Relations	2968	25	15	18
Evaluating	2851	16	16	17
Decision Making	1992	11	13	12

We thought it would be useful to look at the distribution of tasks by departments. These can be found in Appendices 5.1 through 5.4. We are not going to discuss the content of the individual tables, but we do think it is worthwhile noting the wide variation in tasks, even using our general categories, across departments. Were we to create a finer taxonomy, the variation would appear to be even more pronounced.

The concern here is that office automation software may well have to be tailored to the needs of a given department, as well as having the capability of integrating a department with the activities of the organization as a whole. In other words, a single system with common software for all may not satisfy the needs of particular functional users. They will want support systems designed to reflect their individual needs, and perhaps their individual managerial styles. While this is feasible, it puts tremendous emphasis on software rather than hardware, and we already are facing a shortage of competent programmers and systems designers. The black box by itself is not likely to be the answer. It is making that black box respond to one as an individual that is much more likely to provide the realization of the office of the future.

Communications Diary

We will commence our discussion by referring to the Diary summaries for each of the organizations. These include the totals of all responses, the percentages of each item in comparison with the total number of interactions, and a breakdown according to whether the communication was sent or received. We then look at the mode usage and organizational affiliation matrices, according to hierarchical level. These same matrices are also presented by department so that one can see the extent to which there are variations across departments by mode usage and by intra-organizational versus external communication patterns. We will close with a brief discussion of Hypergraph Structural Analysis which has been conducted for each individual organization.

The global summaries, which can be found in Appendices 6.1 through 6.4, provide interesting similarities and differences among the four organizations. Three of them, the exception is the plastics company, follow the typical pattern of face-to-face interaction accounting for 50 to 60 percent of the total and telephone communications amounting to about 30 percent. The plastics company exception, use the two predominant modes about equally. The reason for the high telephone traffic of the manufacturer of plastic products can be found in the departmental breakdowns. The marketing department was a very heavy user of the telephone. Furthermore, there was a substantial amount of intra- organizational communication by telephone. This was because the company is physically spread over three plants and a headquarters building, and it is much easier to use the telephone than to take the five minutes required to walk and meet with someone.

The flow of paper was substantial in all organizations, especially when hand delivered material was included. The plastics manufacturer had the least amount, just over 15 percent of all recorded communications, which one might expect since it was the smallest company and had not bureaucratized its procedures. The heaviest user of paper was the insurance company, which is no surprise, with the large tire manufacturer not far behind. The latter's use of paper was partially a reflection of its size. Procedures often required written copy.

It is also instructive to look at failures; an inability to contact the intended recipient. Most of there occurred as a result of incomplete telephone calls. If one assumes that all of the failures were associated with the telephone they amounted to 30 to 40 percent of the initiated calls. If anything, this figure is likely to be understated, because of failures to record repeated attempts. The most common response to a failure, was to try again, with leaving a message that the 'other party' call back being a close second. In only a few cases, about ten percent of all of the failures, did the person accept a substitute or leave a message with content.

There are technological solutions to the busy signal, especially if it is within a given switcher. Several electronic PBX's have a line monitoring capability which signals the calling party when the line they want is free. While the recorded message can respond to a call when someone is not there, most people feel that is not nearly as satisfactory as information obtained from a secretary. The ability to make enquiries and get an immediate response is valued by the large majority of callers. One other way to handle the problem is to avoid it altogether. This can be done by a computer message system, for example, as the called party need not be there to receive the message, but can read the message as soon as they check in on their terminal. The aural equivalent is the answering service.

One final comment about the summary statistics taken from the diaries concerns the amount of time spent communicating. If one takes the number of interactions recorded during the week and multiplies by the average length, and then divides by the number of persons keeping the diary, one can get the average number of hours spent communicating. There is a direct correlation between the proportion of the sample in management and the amount of time recorded on the diary. The average for the tire company was 23.66 hours; for the insurance company it was 12.48 hours; and for the plastics manufacturer and the finanacial services unit it was 12.17 and 9.54 hours respectively. The latter three figures are rather low given the literature on management which suggests that most managers spend between 60 and 90 percent of their working time communicating.

We now turn to the mode usage by organizational affiliation of the 'other party' matrices, according to one's level in the hierarchy (see Appendices 7.1 through 7.4). First we should mention that written communications are understated. That is because they are recorded here only if they did not occur as part of a face-to-face interaction. Given the statistical routines available to process the data, we could not permit double counting as we did in the global summaries.

The findings are not at all clear cut. Regarding the relationship between hierarchical position and the organizational affiliation of the other party, the results are completely mixed. In one organization, the financial services unit, a greater proportion of management interactions were internal to the unit than was the case for the staff. The reverse was true for the insurance company. In the other two organizations there was no distinction between level in the hierarchy and the organization affiliation of the other party. It would seem that the functional role of a manager was a more important determinant of his/her communication behaviour than his/her hierarchical level.

With one exception, the insurance company, the more senior the manager, the more likely he or she was to interact by means of face-to-face contact. The reason for the exception was the large number of external contacts involving management. As we have noted before, there is a very strong correlation between distance and the use of the telephone. Since all external contacts would have been with someone located in another building or another city, it is not surprising that the telephone was used.

Considering the same sort of matrices, but now calculated according to department, we can see more glimpses of how certain organizations operate. There are as many differences among the departments within a given organization as there are between organizations. Looking past the financial services organization because the sample taken from any given department was too small (from 3 to 7), we can note that the financial activities in the other organizations rely on paper to accomplish their work, even when most of their records are on computers.

Headquarters' activities vary. In the insurance company we found that they were heavily involved in paper flow and had relatively few interactions face-to-face. This is in contrast to the corporate leaders of the tire company. They had the least reliance on paper of any of the organizational divisions.

It is difficult to come to any definitive conclusions based on analyses of the individual departments of the organizations studied. Behaviour varied among them, both within an organization and across organizations for departments of the same type. This is what we found for the distributions of tasks as well, and it makes generalizations most hazardous. Perhaps the safest thing to say at this point is that one should not generalize. Systems will have to be devised that can adjust to the 'personalities' of organizational units. Without a large sample across a number of organizations, one cannot say whether the most important boundaries of organizational personalities lie at the frontier of a functional department or at the level of the organization itself.

We mentioned at the beginning of our discussion of the diary data that we have conducted Hypergraph Structural Analysis for each of the four organizations. Basically what the technique does is to group people together according to the intensity of their interactions (frequency, volume, etc.). This permits us to build up an image of the organization as it is reflected in the communication networks which are actually used. Groups are rank ordered according to the average frequency of communication (weighted according to the homogeneity of the patterns), and members are added as this average descends. In addition, one can identify the roles of the individuals both within and without the groups. There are those who are key to a group, who link its members together. Others link one group to another or to individuals outside of the group. Furthermore, one can determine at any time the strength of the relationship between non-members of any given group and its members. As a consequence, one not only can look at the communication groups which appear to be essential to the organization, at least empirically speaking, but at the profiles of each individual member of that organization (what groups he or she belongs to, how they relate to other groups, etc.) Thus, one can compare existing organizational boundaries with those suggested by the Hypergraph Structure, either to change the structure or to encourage changes in the communication patterns. Since communications technology has a major influence on the patterns created, Hypergraph Structural Analysis provides a vehicle to study the changes in these patterns before and after the implementation of a particular system.

SUMMARY AND CONCLUSIONS

This final section is divided into two subsections. The first summarizes the technological implications of our findings to date. The second discusses the procedures and instruments used in our field research, indicating their strengths and weaknesses. Both subsections include suggestions about where we might go from here.

Technological Implications

The image we hold of an automated office is one where the manager is an active user of the technology. The automated office is more than just communicating word processors, or an electronic mail system, or an electronic PBX. It is an integrated communication-information system which may be used in support of management. Hence, managers were the focus of our research effort.

Our findings, which are consistent with the few studies which have taken a close look at managerial work, suggest that the predominate activities are those which are hard to program. On the one hand they involve human relations, the supervision and motivation of subordinates and others to ensure that they do what the manager thinks ought to be done. These activities are not likely to be assisted by office automation technology. More likely, the requirement for them may increase especially if the electronic office is not responsive to the needs of the individuals using it. On the other hand, a considerable amount of time and effort is spent by managers on the planning, decision making, evaluation and control sequence. To the extent that these activities can be routinized, the development of appropriate decision support systems is clearly feasible. However, the higher one goes up the managerial ladder, the more complex and less routine is the activity of the manager. He or she still needs support systems, but to date these have been operated by intermediaries and by service professionals.

To enable managers to accept electronic devices in their offices, the system must be responsive to what it is that they do. This would seem to imply that the automated office will exist in an integrated form if, and only if, it incorporates certain appropriate decision support systems. Without these one might find the various pieces of an office automation, but their actual impact will not be substantial. Only when the electronics can be used to react to individual and departmental requirements, and at the same time provide the means to integrate these with the rest of the organization, will one achieve the potential of the office of tomorrow. This is essentially a software problem, and many people are already working on its resolution. Given the shortage of skilled systems programmers and people with visions of an integrated office, the office of the future is still a long way off.

Turning to something more specific, we found the anomaly that people want direct and immediate access to others, but are unwilling to permit others immediate and direct access to themselves. Obviously, there is no technology available to solve this conundrum, but there are things which can help. A computer based message system is one. Even though its current use has been largely restricted to computer professionals, it has been well received. The advantage of such a system is that a message can be received as soon as it is sent - immediately, if the other person is prepared to receive it. In fact, one can carry on a dialogue via the comuter, though it presently requires reasonable typing skills.

The issue which is often raised regarding electronic mail and computer based message systems is that managers neither can nor are willing to type. However, in the few cases where they have had access to a convenient message system (e.g. the Continental Illinois Bank of Chicago), the unwillingness has evaporated. The value of the system seemed to exceed the effort required to use it and the possible loss in status by using a keyboard.

A final point concerns the impression that people have of the computer. While most of our respondents were willing to accept typing, copying and telephone services that were less than perfect, there was the expectation that the computer would not err. Even though it is generally recognized that comuter input comes from humans, and most often the problems lie with bad input, there is the presumption that when the computer does not respond as it should, it is the "computer's fault". If more and more of the tasks in an office are to be assisted by the computer, a greater appreciation of its strengths and limitations is required. This suggests two things. One is that office workers ought to be better educated about the computer's capabilities, the roles it is presently playing and those it might play in the future. Fortunately, younger people entering the workforce are better informed along these lines, but the "oldtimers" should not be ignored for they too will be influenced by the growth of the electronic age.

The other suggestion is that the introdution of any new office automation technology should be accompanied by an education programme, not only to train people in its use, but more importantly, to inform people how it will affect their work and what role the new technology will play in the general scheme of things. Without this understanding, acceptance of the automated office will be slow in coming.

Issues of Methodology

The use of the Questionnaire was rather straightforward. The data obtained were useful as a start, and the subjects were better informed about our objectives after they had completed the form. What was missing were questions on attitudes toward the organization's human and technical environments, factors which will influence the acceptance of computer based systems. It was not our intention to cover this in our study as we focused on what managers do, but future studies should not ignore attitudes. They form a threshhold which must be crossed before one will give a new system a fair trial.

The Task Record Form was very useful in obtaining a rough description of what one does, but it was extremely difficult to code since people used widely differing vocabularies to describe what they do. However, precoded formats would not have helped as there would have been the difficulty of translating our vocabulary into theirs. This problem was even greater for the Detailed Task Analysis, which is still undergoing a recoding process.

Unfortunately, there is no widely accepted language which one can use to describe what a manager does, certainly not to the extent that the descriptions can be converted into their technological implications. A great deal of work is still required in this area and it would appear that developments will have to be made by trial and error, and in the field. We see no other solution to the problem, recognizing that definitive results are not going to be forthcoming in the shortrun. Before we start to construct buildings, we need to map the terrain on which they will be built.

The Diary again proved to be a reliable data gathering instrument, but the data obtained tell only part of the story. We can better understand communication both in terms of technology and its organizational implications using the diary, but these are only parts of the electronic office of tomorrow. We need to know how communication interacts with what one does on one's own. A possible solution is a detailed work log, but these have not been successful in the past. Another, is to make greater use of trained observers, but it is difficult to observe visually the content of much of the activity that goes on in an office. Perhaps a combination of logs, observation, interviews and electronic recording is the answer.

Some final comments regarding what needs to be done are now in order. First, we need more research on what goes on in an office and how this might actively be supported by the technologies of the future. People from different perspectives ought to be invited to participate in this task. Second, field trials of new technology ought to be monitored closely, especially using "before and after implementation" studies. No matter how much we learn about an office, it is unlikely that we will be able to model the expected impact, economic or human, of new technologies without the opportunity to monitor their implementation. Furthermore, the important feature of training and its effects should be included in this monitoring.

Our present approaches provide us with only a static picture of an office. This may be sufficient for initial insights, but the dynamics of an organization and its use of technology should be our goal. Without an understanding of these dynamic processes we will be hard pressed to understand either which technologies are appropriate and how they should be integrated, or how they should be implemented. Both are critical issues and substantial field trial research would appear to be necessary to resolve them.