

**FROM PC'S TO MANAGERIAL WORKSTATIONS:
ORGANIZATIONAL ENVIRONMENT AND MANAGEMENT
POLICY IN THE FINANCIAL INDUSTRY**

Kenneth C. Laudon

April 1985

Center for Research On Information Systems
Computer Applications and Information Systems Area
Graduate School of Business Administration
New York University

Working Paper Series

CRIS #121

GBA 86-37

Published in the Proceedings of the 1985 NYU Symposium,
**Managers, Micros, and Mainframes: Integrating Systems
For End Users**, M. Jarke (ed.), John Wiley & Sons Ltd.,
Chichester, England, 1986.

**FROM PC'S TO MANAGERIAL WORKSTATIONS:
ORGANIZATIONAL ENVIRONMENT AND MANAGEMENT
POLICY IN THE FINANCIAL INDUSTRY**

ABSTRACT

This paper reports on a recent survey of 25 of the largest PC users in the financial industry. The survey focused on non-data processing use of PC's in end user divisions. Descriptive data on the uses, users, quality control, and decision making practices are examined. A stage theory, based on PC telecommunication configurations, is proposed to account for organizational differences in utilization and management

1.0 Introduction

More than any other recent information technology, end-user computing and the micro-computers which support it are posing a challenge to the way organizations think about and use information, and the way managers control the information resource. Having barely adjusted to the first wave of stand alone PC's, managers are now learning that in order to be really useful the PC's must be connected to other corporate information systems and databases. The transition to these fully capable 'managerial workstations' will require--unlike stand alone PC's--a coherent policy. Here we describe some of the organizations that are making this transition, and others who are not.

The focus of our paper is on observed variations in the way organizations respond to the opportunities and challenges posed by PC's. We report here the results of a survey of 25 of the largest corporate users of PC's in the United States. The first questions we raise are descriptive: who uses PC's, for what purpose, and how are PC's managed? A second set of questions is concerned with the development of theory: what explains the differences among organizations in the use and management of PC's?

Personal computers are just one kind of end-user computing. End-user computing is a broader phenomena which includes any "desktop" computing such as made available by an ordinary time-shared terminal. Yet personal computers are probably the most powerful kind of end-user computing because of their rapid growth and the flood of very powerful software which is being written for personal computers.

What is it that makes personal computing such an organizational and management challenge? After all, computing has been around organizations for more than 40 years and PCs can be thought of as simply an extension of the movement towards smaller, more powerful processors. There are three reasons why PC's pose a unique challenge.

First, PC's represent a loss of control by traditional management techniques and specific managerial groups over the computing resource. PC's are after all a little like mass literacy. They are a kind of magic insofar as they empower a large number people to do and to understand things which heretofore were restricted to a small priesthood of professionals. It's as if suddenly the citizens can read, giving them access to the secret texts and data. Personal computing represents a loss of control by the priests of information. The sanctity, accuracy, integrity, and uses of heretofore protected information is challenged by personal computers.

Second, personal computers pose a challenge to organizations because they permit people widely distributed in the organization

From PC's To Managerial Workstations
Kenneth C. Laudon

to form independent judgments as opposed to being restricted to interpretations from on high, and they can, therefore, learn to act on the basis of information that they themselves possess and create, rather than being told how to act. The ability to make informed decisions and judgment, and the ability to act in a rational manner without the intervention of personal authority, is pushed lower in the organization with personal computers. With PC's for instance junior loan officers can track loan portfolios and make independent judgments about new loan agreements in the coming days and weeks rather than waiting for a monthly management information system report to be read by their boss who will instruct them on a monthly basis as to the nature of the portfolio for the next coming month.

In these two broad cultural senses what we are really talking about is changes in the distribution of power, perquisites, advantage, and resources in organizations brought about by PC's. Insofar as information confers power, independence, and advantage, then PCs are very interesting.

But there is a third, more concrete reason why PCs pose a unique challenge to management. In the 1950s and 60s, information systems could be confined to one or two or three data processing centers in the organization. By the 1970s, large organizations may be operating anywhere from five to fifteen data centers involving networks of mini-computers and mainframes. Nevertheless, the information processing function, the information resources of the company, were confined to relatively small cells where key decisions could be slowly made, carefully analyzed, and the data processing and human and technological resources could be carefully balanced, weighed and measured. With micro-computers in the 1980s, however, the organization is composed not of one, two, ten or twenty data centers, but of a thousand, five thousand, twenty thousand data centers insofar as every employee in a conceivable future becomes a data center by virtue of having access to a very powerful micro-computer. Each employee becomes a player, and a powerful one, in the definition of data and information, in its collection, storage, and dissemination.

In this milieu, a number of simple questions which could be asked and answered in the traditional computing milieu of the 1960s and 1970s become problematic:

- What's a good, cost-effective use of PCs?
- How are they currently being used?
- Who is using them? And, where did they get them?
- Who's responsible for the data in PCs?
- How many machines do we have? What software is being used?
- Who's in charge of the uses, the software, the hardware purchase and maintenance?
- How much are we spending on PCs?

From PC's To Managerial Workstations
Kenneth C. Laudon

- What's the total cost of hardware and software purchase, annual maintenance, training costs, communications, and opportunity cost?

Managers are supposed to ask these questions and come up with sensible answers. In the rapid growth environment of PCs managers cannot answer these questions. We are asking general managers today to answer these questions -- not simply data processing managers. This means that managers who have had no exposure to data processing or information systems, who would have a hard time knowing a mainframe from a disk drive, are being forced to think about these questions with very few intellectual tools, very few guidelines, very little prior research, and very little understanding of what other organizations are doing.

Before going much further, we should dispense with a competing view. There is a view which says that PCs should not pose any unique problem because they are simply telephones or fast pencils. In this view, we should not try to account for or manage personal computers any more so than we do telephones. The view here is that PCs are just another piece of office equipment, such as a lamp, a desk, or a telephone, that they pose no unique problems, and they are too widespread in any event to impose management controls. While I may be tempted to argue along these lines, these views are absolute nonsense. If PCs are telephones, then it must be said that they are rather expensive telephones, running around \$5,000 for a complete installation per unit involving hardware and software. Moreover, their annual maintenance, training costs, upkeep, and operation time can run anywhere from an additional \$5,000 to \$20,000. One of the world's largest brokerage firms has an outstanding order for more than 20,000 machines with a large manufacturer involving an expenditure of approximately \$5,000 per machine with all of the bells and whistles added in, and this adds up to a cool \$100,000,000. If PCs are thought of as an electronic pencil, then it must be admitted that these are unusual pencils, very high speed, very intelligent, and very expensive. Therefore, to call PCs nothing more than an additional piece of office equipment is highly misleading and does not appreciate either the power or the cost of PCs.

2.0 Previous Research on End-User Computing and Personal Computers

There is a miniscule professional literature on end-user computing -- three articles are reviewed here. There is a larger semi-professional literature which focuses on one or two organizations. There is a vast popular, trade literature in magazines much of which shows all the signs of consultants looking for additional work.

The most frequently cited articles are those written by Rockart and Flannery (1981; 1983). These articles were based on seven organizations involving interviews with 200 end-users and

From PC's To Managerial Workstations
Kenneth C. Laudon

approximately 50 members of information systems staffs. These articles report end-user computing growing at 50-90% per year. Rockart and Flannery identify six categories of end-users and explore the diverse needs of the end-user population for software, training, and other support. Most end-users (80%) were staff personnel. Over half of the applications of end-user computers were for complex analysis, including financial analysis, engineering calculations, operations research, optimization models and simulations. In this early study, end-user computing was clearly more restricted to the engineering and financial analysis functions than is the case today. In terms of systems scope, over half of the end-user applications involved a single department, and fully a third were for personal use. More than half of the applications were supported by data which was keyed in by end-users themselves.

The Rockart and Flannery article focusses on large mainframes, centralized, time-shared environments, not personal computers. Yet even here users felt there was "no one in charge" and were frustrated in their abilities to locate data they knew was stored somewhere in the corporation or to extract that data once it was located. Flannery and Rockart report that these organizations had no strategy for end-user computing, no sense of priorities, few policy recommendations for top management for the development of end-user computing, and few, if any, recognizable controls over end-user computing.

Another early article is Benson's 1982 study of 67 end-users, 19 IS professionals, and 19 organizations. The organizations were chosen because they were affiliates of the Center for the Study of Data Processing at Washington University in St. Louis. Most of the 67 end-users were from finance, accounting, and administration. The data processing environment included micro-computers and time-shared mainframes. While the environment Benson reports on is a mixed mainframe-micro environment, the software used is largely mainframe software. Benson reports some familiar problems perceived by IS professionals, such as the lack of micro-computer documentation, poor security, no documentation of end-user programs, no program libraries, the fear that end-users would become programmers (and poor ones at that). Benson reports that in one company 20 managers spent more than half of their time in programming end-user applications. Top management was ignorant or indifferent about end-user computing.

A more recent article by Keen and Woodman (1984) is based on a single case study of an insurance company, and partial results from a survey of end-users at 42 large British companies. This article was concerned with micro or personal computers alone. The article addresses a broad range of issues, but focussed mainly on the development of micro-computer policies. Based on the British study, Keene and Woodman argue that the real cost of a personal computer managerial workstation, fully configured with

From PC's To Managerial Workstations
Kenneth C. Laudon

integration of voice and data capabilities in single workstations, and the uses of PCs as generalized communications tools, including teleconferencing, electronic mail, and video conferencing (Teleconnect, 1985).

In the last year, the popular literature has focussed on a single issue: the necessity of linking PC's to the mainframe. Some articles extol the ease in which this can be done (Friedman, 1984), and others the development of new software which will permit tight communication linkages between PCs and mainframes (Murphy, 1984). But most of the literature reports headaches and frustrations in trying to link the PCs to the mainframe (Datamation, 1983; Ferris, 1983).

One of the most interesting surveys in the popular literature was a Datamation survey of a cross section of American businesses. The survey was answered by data processing managers at 2,000 organizations. This is the largest, single study of end-user computing although it is not a study of general managers, or users, but a study of data processing managers' reactions to PCs. DP managers felt that the principal benefit of PCs was improved management and productivity, and a second major benefit was the reduction in the data processing workload. The number one problem cited by data processing managers was data security and control of sensitive information -- more than 40% of the data processing executives expected difficulties in these areas. This was followed by fears of inaccurate data (19%), waste (18%). Most data processing managers felt their should be a coherent management policy with data processing playing a leading role. Seventy percent of DP managers felt they should participate in the decision, along with line managers, to purchase hardware and software. The reality was quite different. While DP managers felt they should participate in the process of developing personal computing in the firm, most DP managers admitted they were not even aware of which employees used personal computers, how they were distributed throughout the firm, or how they were used. Only one-quarter of DP managers knew where all the personal computers were. DP managers felt that they were failing to provide enough training and consulting, and they felt vast improvements were required in providing access to central data bases. DP managers expected in the future that the most rapidly-growing use of personal computers would be its use by management personnel, indicating an increased demand for decision-support applications and, in turn, a resulting increased demand in central data base access. Despite this concern for providing central data base access and support of communications, the survey found that in non-data processing departments, around 80% of the computers are used only as stand-alone devices.

From PC's To Managerial Workstations
Kenneth C. Laudon

hard disks, software, and printer, as well as hidden costs such as local area network connections, shared peripherals (central disk storage), shared pipeline expenses (long-distance communications), shared database management systems, shared mainframe power, and other support costs, comes to a total of \$26,000. With these kinds of expenses, Keen and Woodman argue that managers must develop a corporate strategy. The company studied (Riggins Insurance Company, a pseudonym) adopted several corporate policies in software and systems development, tools for evaluating the benefits of micro-computer installations, and an explicit policy of developing multi-service workstations in which micro-computers are fully integrated into mainframe systems. The emphasis at Riggins was on telecommunications networks for PC's and software compatibility to achieve these long-range goals.

Several articles in the semi-professional literature have provided important insights into end-user computing and micro-computers, in particular. Private newsletters, such as EDPACS (a newsletter concerned with EDP audit control and security), has published several articles on documentation and security for micro-computer systems (1983; 1984). Richard Canning, in his private newsletter, "EDP Analyzer", has written several case studies documenting the growth in many corporations of end-user computing from 40% of installed capacity in 1980 to predictions of 75% by 1990 (November, 1983). Other case studies focus on the management of end-user computing, documenting the complete absence of a micro-computer policy in many corporations and growing fears that micro-computing has far exceeded the ability of management policy to control it ("EDP Analyzer", February 1984).

The best source of ideas, insights, hunches, and pure gossip is, of course, the popular trade literature. Here, the findings are based often on no case study work at all, no methodology, and scanty reliance on any data whatsoever. Nevertheless, the literature provides keen insights based upon both observers and consultants in the field, discussing problems with managers using micro-computers today. Many of the surveys are disguised marketing surveys. Nevertheless, some of the findings are very interesting. A survey of San Francisco Bay area executives found that they use personal computers more as a tool to communicate or to convince others of decisions that they have already made, rather than as an analytic tool prior to decisions (InfoSystems, 1985). A vast amount of the literature is concerned with the executive use of information systems. One survey found, for instance, that one-third of 100 corporate executives interviewed used PCs for making critical decisions which was up from 8% only two years ago. The same survey found that half of the executives under 50 years of age had adopted micro-computers, whereas only one-fifth of those over 50 years of age had done so (Computer World, 1984). A large part of the literature focuses on the

From PC's To Managerial Workstations
Kenneth C. Laudon

integration of voice and data capabilities in single workstations, and the uses of PCs as generalized communications tools, including teleconferencing, electronic mail, and video conferencing (Teleconnect, 1985).

In the last year, the popular literature has focussed on a single issue: the necessity of linking PC's to the mainframe. Some articles extol the ease in which this can be done (Friedman, 1984), and others the development of new software which will permit tight communication linkages between PCs and mainframes (Murphy, 1984). But most of the literature reports headaches and frustrations in trying to link the PCs to the mainframe (Datamation, 1983; Ferris, 1983).

One of the most interesting surveys in the popular literature was a Datamation survey of a cross section of American businesses. The survey was answered by data processing managers at 2,000 organizations. This is the largest, single study of end-user computing although it is not a study of general managers, or users, but a study of data processing managers' reactions to PCs. DP managers felt that the principal benefit of PCs was improved management and productivity, and a second major benefit was the reduction in the data processing workload. The number one problem cited by data processing managers was data security and control of sensitive information -- more than 40% of the data processing executives expected difficulties in these areas. This was followed by fears of inaccurate data (19%), waste (18%). Most data processing managers felt their should be a coherent management policy with data processing playing a leading role. Seventy percent of DP managers felt they should participate in the decision, along with line managers, to purchase hardware and software. The reality was quite different. While DP managers felt they should participate in the process of developing personal computing in the firm, most DP managers admitted they were not even aware of which employees used personal computers, how they were distributed throughout the firm, or how they were used. Only one-quarter of DP managers knew where all the personal computers were. DP managers felt that they were failing to provide enough training and consulting, and they felt vast improvements were required in providing access to central data bases. DP managers expected in the future that the most rapidly-growing use of personal computers would be its use by management personnel, indicating an increased demand for decision-support applications and, in turn, a resulting increased demand in central data base access. Despite this concern for providing central data base access and support of communications, the survey found that in non-data processing departments, around 80% of the computers are used only as stand-alone devices.

Conclusions From the Literature

Five major conclusions can be drawn from the review of the literature. First, there is virtual unanimity in the belief that end-user computing -- largely based on micro-computers, will be the predominant mode of computing in the 1990s -- consuming upwards of 75-80% of total installed capacity.

Second, there is a clear-cut trend away from stand-alone micro-computers towards more powerful "workstations" which are closely integrated to corporate databases via high speed telecommunications networks.

Third, the single, most important barrier to this vision is the absence of telecommunications networks and software permitting effective linkages between mainframes and PC's. As one wag put it, "It would have been nice if PCs never were invented. Better that intelligent terminals would have been invented instead." Intelligent terminals could have grown in capacity as a part of a mainframe, time-shared network, as opposed to micros which never were intended to be part of a network of computers.

Fourth, many, perhaps most, organizations lack a coherent management policy guiding the development of PC's. In the absence of a long-term strategy, it will be impossible to successfully integrate PCs into the larger organizational data processing framework. The literature suggests that data processing can play a role in this, but it is a role as standard setter, as telecommunications builder and controller, as a supporter of end-user computing providing access to centralized data bases and providing mainframe hardware to support end-users. It is not a role in which data processing is a dictator of applications.

Fifth, the literature points out a good deal of variation among organizations in terms of PC uses, users, and management policy. In some organizations, PC's are purely stand alone devices bearing little relationship to the rest of corporate data processing, and PC use is a matter of individual concern. In other highly visible organizations, PC's are tightly integrated with other corporate information policies, systems and communications networks. Corporate policy here encourages individuals to use PC's.

3.0 Purpose of This Research

The purpose of this research is twofold. First, we want to describe patterns of utilization, management and policy among a group of leading edge users of PC's. Second, we want to develop a theory of PC development which can account for variation among organizations in the utilization and management of PC's.

4.0 Theory and Specific Hypotheses

The theory we propose is based on two propositions and eight related hypotheses. The first proposition is that organizations

From PC's To Managerial Workstations
Kenneth C. Laudon

are at different technical stages in the use of PC's, and that these stages are distinguished by different communication configurations. As an empirical matter, I will argue that there are three such configuration stages (see Figure 1):

Stage 1: Stand-alone PC's

Stage 2: Some PC's linked as terminals to mini's and mainframes

Stage 3: Most (all) PC's linked to corporate wide telecommunications network

I am well aware of recent critiques of Nolan's stage hypothesis on empirical, teleological, and logical grounds (Benbasat, et. al., 1984; King and Kraemer, 1984). I am also aware of the important role which classifications and typologies play in theory development (Kuznets, 1965; Miller and Mintzberg, 1983). Here I only argue that organizations can be divided into some with only stand alone PC's, some with a small proportion of PC's networked, and some organizations with the majority or all PC's closely networked into corporate information processing.

There are two reasons why we should expect this kind of staging in the configuration of PCs. First, the history of the technology is such that these stages correspond roughly with the introduction of technical capabilities. At first, there were stand-alone computers, then widespread development of modems, then micros which could act readily as terminals, and, finally, the development in some organizations of very comprehensive telecommunications networks linking PC's to Information Centers and directly to a number of other main processors. Second, we should expect these stages because of the history of organizational adaptation and learning about micros. We should expect, for instance, that most organizations will begin with simple stand alone micro-computers and eventually learn enough about their potential to develop increasingly sophisticated telecommunications networks. Some organizations may begin the use of micros in Stage 3, but this could be a very risky proposition for an organization which had no prior experience with micros. Therefore, it would be a rare event.

I further propose that the telecommunications stages are related to the use, users, and management of PC's. The gist of the argument is that the more complex and sophisticated the configuration, the more use to which PC's can be usefully put, the more widespread and intense the utilization, and the more elaborate and powerful are the management controls over PC's. This can be expressed in a number of hypotheses:

The more sophisticated the configuration:

From PC's To Managerial Workstations
Kenneth C. Laudon

- H1: The more policy controls over PC's
The less the role of individuals in PC decisionmaking
- H2: The more management--as opposed to clerical-- use of PC's
The greater intensity of management use of PC's
- H3: The wider the range of uses to which PC's are put
- H4: The greater the awareness of PC problems, issues, glitches

An alternative explanation for variations in the uses and management of PC's is that these differences are simply a function of experience. The longer organizations have PC's therefore:

- H5: The more sophisticated the configuration
- H6: The wider the range of uses to which PC's are put
- H7: The more managers will use PC's
The greater intensity of management use of PC's
- H7: The more policy controls over PC's

5.0 Data

In order to explore the hypotheses outlined above, we identified 25 organizations who are known to be large users of PCs, and within these organizations identified specific offices -- which could be a department or a division or a subunit thereof -- which made extensive uses of PCs within the organization. Thus, our study can be thought of as a study of 25 organizations utilizing a sample of offices within these organizations drawn from a wider universe of offices. We chose to focus on specific offices rather than the entire organization simply because the organizations were too large to really know and to understand in any detailed way. Second, the focus of our paper is on real policy and not official policies. Many organizations have officially stated policies which are essentially inoperative in the field. Here, our focus is on what really goes on in offices with regard to PCs.

Once the offices were identified, data was collected by questionnaires filled out by researchers after interviewing users and managers in the office.

The quantitative results produced in this research must be considered exploratory. On the other hand, the organizations that we have identified are among the leading-edge users of personal computers in the New York metropolitan area. Involved

From PC's To Managerial Workstations
Kenneth C. Laudon

in our study are 11 of the largest banks in the metropolitan area, two of the country's largest insurance firms, two of the country's largest brokerage firms, and one of the leading accounting firms. Therefore, the results of this study are biased towards the leading-edge users and the kinds of problems they face and policies they have devised. It is, of course, conceivable that while other organizations may be experiencing different problems and utilizing different policies, the findings in our survey are highly relevant for other organizations which are just now beginning to develop personal computers.

6.0 Descriptive Findings

Figures 4 to 10 illustrate the descriptive findings in our survey. As expected the three most popular uses of PC's are for 'accounting' or spreadsheet applications, word processing and 'analysis aids'--displays and simple modelling of data (figure 4). These areas will maintain their popularity in the next three years. The most interesting finding here is the areas which respondents feel will show the most change. Here, searching and analyzing corporate databases, record processing (downloading of data to PC's), and remote work are the applications which show the greatest anticipated change (starred applications in figure 4).

Figure 5 indicates the percentage of major office groups who use PC's and the hours per week of use. Middle management, professional and clerical users are widely involved in PC use, spending around 10 hours per week on PC's. Senior management is clearly less involved.

Figures 6 and 7 describe the major problems and issues raised by PC's. The leading three issues are security, accuracy of data and programs, and estimating the actual benefits of PC applications. Figure 7 indicates the frequency with which problems were selected as "very important now" and with similar results. The leading "most important problems" are security, accuracy, understanding cost beneficial uses, and training users.

Figure 8 depicts the percentage of organizations reporting that a specific person or unit within the office in fact engages in selected quality control and management practices. The most common management practices (more than 50% of organizations responding affirmatively) involve training users, suggesting and developing applications, and maintaining libraries or databases on PC applications in the office. The least common management practices are checking data quality, checking programs and formulas, and reviewing documentation of PC applications.

Figure 9 is a scattergram which depicts the role of various corporate groups in various PC decisions. Respondents were asked who are the most important decisionmakers on selected issues, with multiple checks possible. The overall power of any one group can be assessed by simply adding up the number of times that group was selected over all issues (Figure 10). The

relative influence of specific groups in specific decision areas can be seen in the scattergram (Figure 9).

In general, individual users are the most powerful decisionmaker, followed by PC Coordinator, Division Manager and Data Processing (figure 10). Data Processing plays a role slightly more powerful than 'No One' --which is low in rank. Data Processing is influential in expected areas: hardware maintenance and networking to PC's. But it is not decisive even here and seems restricted to technical areas.

7.0 Findings: Hypotheses

Figures 11 to 20 present the findings on the eight proposed hypotheses. The top of each bar in a graph indicates organizations with no or very few networked PC's, while the bottom of each bar indicates those organizations with many PC's networked.

The findings suggest that in organizations with many PC's networked management is much more likely to engage in specific quality controls over PC's (figure 11); PC Coordinator, Division Manager, and Data Processing play stronger roles (figure 13), PC's are more likely to be used by middle and senior managers and to be less used by clerical workers (figure 14), PC's are slightly more intensely used by middle and senior managers (figure 15), there is more sophisticated use of PC's for retrieving data from corporate databases and internal communications, and somewhat more use for graphics, planning, record processing, and external communications (figure 16), and, in general, a much stronger awareness of problems and issues with PC's--especially in the areas of security, accuracy, training, and internal consulting on applications (figure 17).

The data are broadly supportive of hypotheses H1 to H4.

Figures 18 to 21 examine an alternative set of hypotheses which argue that the observed differences among organizations in the use and management of PC's simply reflect experience, or the number of years PC's have been installed in organizations. In this view, any "stages" or different configurations are simply maturation stages.

These hypotheses (H5 to H8) are not well supported. The average difference in experience with PC's between highly networked organizations and those with stand alone PC's is a matter of a few months (figure 18). More experienced organizations are a little more likely to use PC's for spreadsheets and analysis aids, but otherwise the differences are mixed or only slight (figure 19). In more experienced organizations PC's are much more likely to be used by clerical and professional workers, whereas in less experienced organizations middle management is a more intense user (figure 20)--just the opposite of the hypothesis which would have experience leading towards more management use. In fact early users of PC's seem to be stuck with early clerical applications

From PC's To Managerial Workstations
Kenneth C. Laudon

like word processing. In four of seven management practices organizations with less experience with PC's are more likely to engage in quality control practices (figure 21). This is also opposite of the hypothesis and reasonable conjecture: one would think that quality controls come out of experience.

Another alternative explanation of our findings is that differences in use and management result from the "density" of PC's in an organization, measured on a per employee or even absolute criteria. One could argue that organizations which engage in "technology flooding" (a term coined by my colleagues Mike Ginsberg, Jack Baroudi, and Gadi Ariav for which I take no direct credit) are likely to develop highly articulate management policies and to provide sophisticated support such as networks. As it turns, there are a large number of organizations with high densities of PC's with little or no policy or support (tables not reported here). Our case studies provide vivid descriptions of organizations like this in a state of chaos. We could find no support for these alternative explanations.

8.0 Discussion

Our findings are broadly supportive of the importance of taking into account the telecommunications infra-structure in which PC's are enmeshed when discussing how PC's are used and managed. Still there are some unmeasured variables and causality issues raised. What accounts, for instance, for the differences in PC networking among organizations? Some organizations possessed prior to the emergence of PC's sophisticated telecommunications networks, as well as no doubt an integrative management philosophy which from the beginning envisaged PC's as a part of the existing networks. Organizations blessed with both this technical support and managerial philosophy were perhaps simply in a better position to utilize and manage PC's. We do not have historical data on the organizations' networking capability. The possibility exists that, from an historical point of view, stages in the networking of PC's are in reality stages in the development of corporate telecommunications.

Setting aside history, and focusing on what management should think about now, the data do support the notion that linking PC's into corporate networks leads to more widespread, sophisticated, and intense management use. PC's closely linked to corporate information resources are more likely to be used. The data also support the notion that in order to bring about this link, if history is any guide, PC's must be more actively managed and decisionmaking more centralized and less individualized. The period of "let a thousand flowers bloom" is over.

REFERENCES

Bender, Eric. "Firms Warned on Intuitive Micro Purchase

From PC's To Managerial Workstations
Kenneth C. Laudon

Decisions." Computer World, December 24, 1984.

Benson, David H. "A Field Study of End-User Computing: Findings and Issues." MIS Quarterly, December 1983.

Canning, Richard G. "Future Effects of End-User Computing." EDP Analyzer, November 1983.

Canning, Richard G. "Coping with End-User Computing." EDP Analyzer, February 1984.

Cashin, Jerry. "The Real OA Breakthrough." Software News, February, 1985.

Coon, Jennifer L. "Documenting Micro-Computer Systems." EDPACS The EDP Audit, Control and Security Newsletter. Reston, Virginia: October, 1983.

Data Decisions. "Micros at Big Firms: A Survey." A report prepared by Data Decisions, 20 Brace Road, Cherry Hill, New Jersey 08540. Datamation, November 1983.

Datamation. "Adventures in Micro Land." Datamation, November, 1983.

Ferris, David. "The Micro-Mainframe Connection." Datamation, November 1983.

Freedman, David H. "Tapping the Corporate Data Base." High Technology, April 1984.

George, Don. "Remote Processing Solutions Pop Up on Micros." Software News, February, 1985.

InfoSystems. "Bay Area Executives Use PCs as Afterfact Tool, to Communicate." InfoSystems, March 1985.

Johnson, Jan. "In Search of Missing Links." Datamation, November 1983.

Keen, Peter G. W. and Woodman, Linda A. "What to Do With All M Those Micros" Harvard Business Review, September-October, 1984.

Lasden, Martin. "Enriching the Decisionmaking Process." Computer Decisions, November 1983.

Morris, Paul. "What's All This Talk About IBM's Disoss." Software News, February, 1985.

From PC's To Managerial Workstations
Kenneth C. Laudon

Moore, Andy. "Electronic Mail -- A Little From Here, A Little From There." Teleconnect, January 1985.

Murphy, John A. "Tighter Links Open PC-Mainframe Gate." Software News, December 1984.

O'Keefe, Linda. "IBM's OA Puzzle." Datamation, February, 1, 1985.

Parker, Wayne. "From Altair to AT." PC World, March 1985.

Rockart, John F. and Flannery, Lauren S. "The Management of the End-User Computing." Communications of the ACM, October 1983.

Stallings, William. "The Integrated Services Digital Network," Datamation, December 1, 1984.

Strassman, Paul A. "The Real Cost of OA." Datamation. February 1, 1985.

Teleconnect. "Integrated Voice/Data Workstations Take Off." Teleconnect Magazine, January 1985.

Teleconnect. "What These Integrated Voice/Data Workstations Contain." Teleconnect, January 1985.

TriNet, Inc. "Executive Micro Use on Upswing." Computer World, December 24, 1984.

Verity, John W. "Minis Lose Out to PCs." Datamation, November 1983.

Weinstein, Bernard A. "Office Automation Without Micros." Datamation, November 1983.

TYPES OF FIRMS IN STUDY

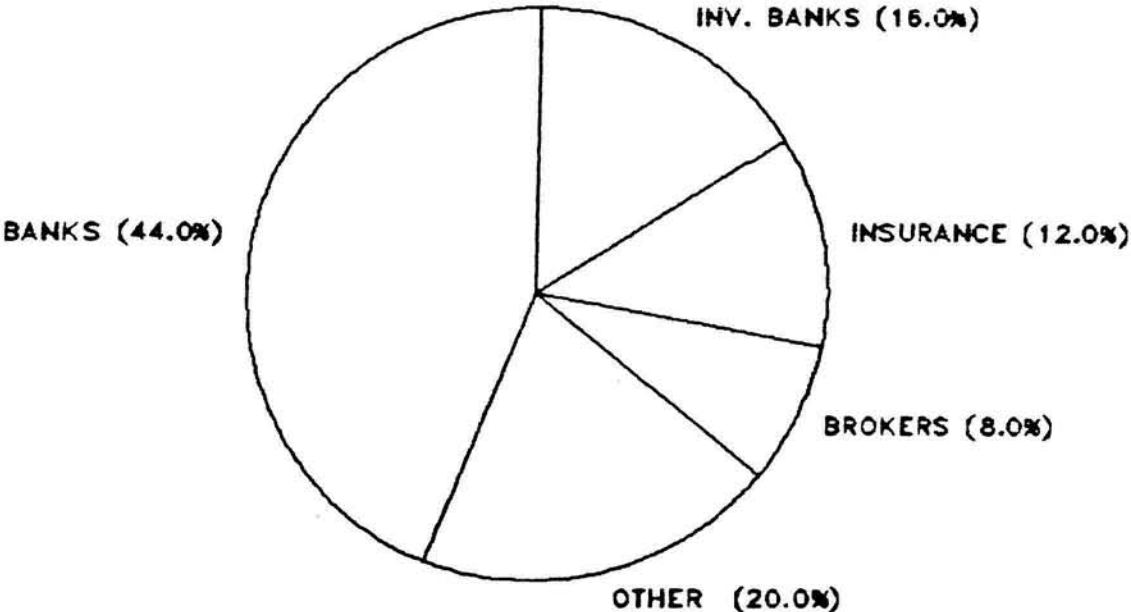


FIGURE 1

FIGURE 3
CONFIGURATION OF PC'S

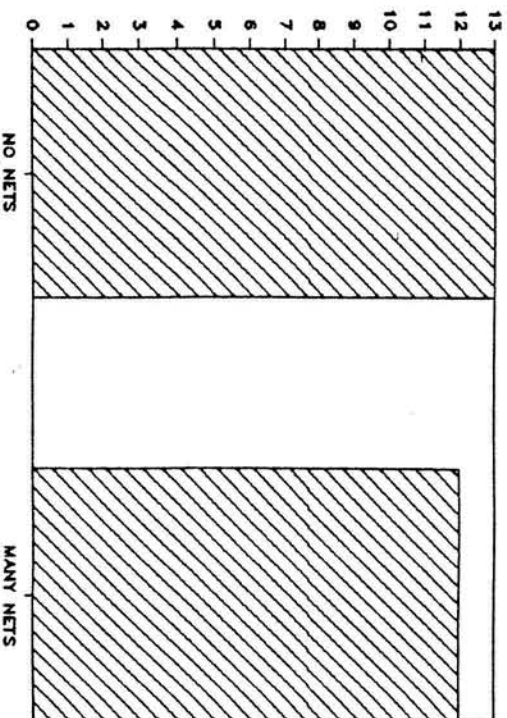
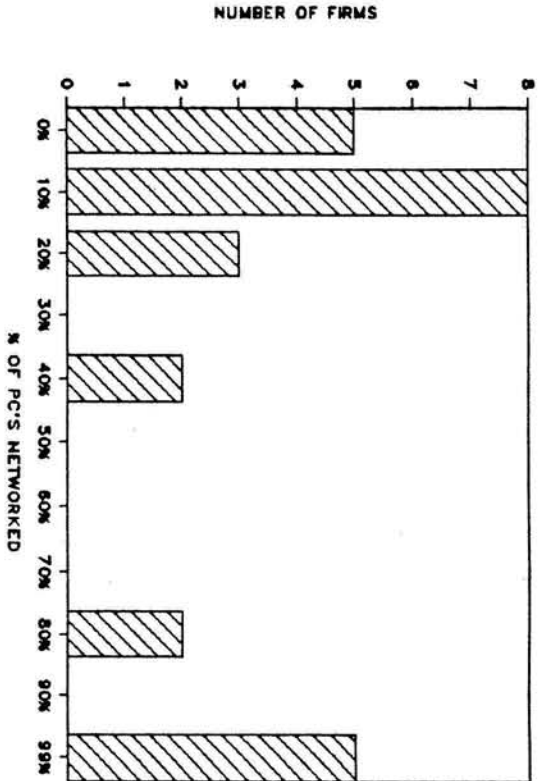


FIGURE 2

CHARACTERISTICS OF FIRMS AND OFFICES

<u>FIRMS</u>	
MEDIAN GROSS REVENUES	3.2 BILLION
MEDIAN NO. OF EMPLOYEES	13,600
MEDIAN NO. OF PC'S	651
AVERAGE YEARS WITH PC'S	3
<u>OFFICES</u>	
MEDIAN NO. OF EMPLOYEES	135
MEDIAN NO. OF PC'S	20
MEDIAN INTERNAL MEMORY	256K
MEDIAN STORAGE	10M

EXTENT AND INTENSITY OF PC USE

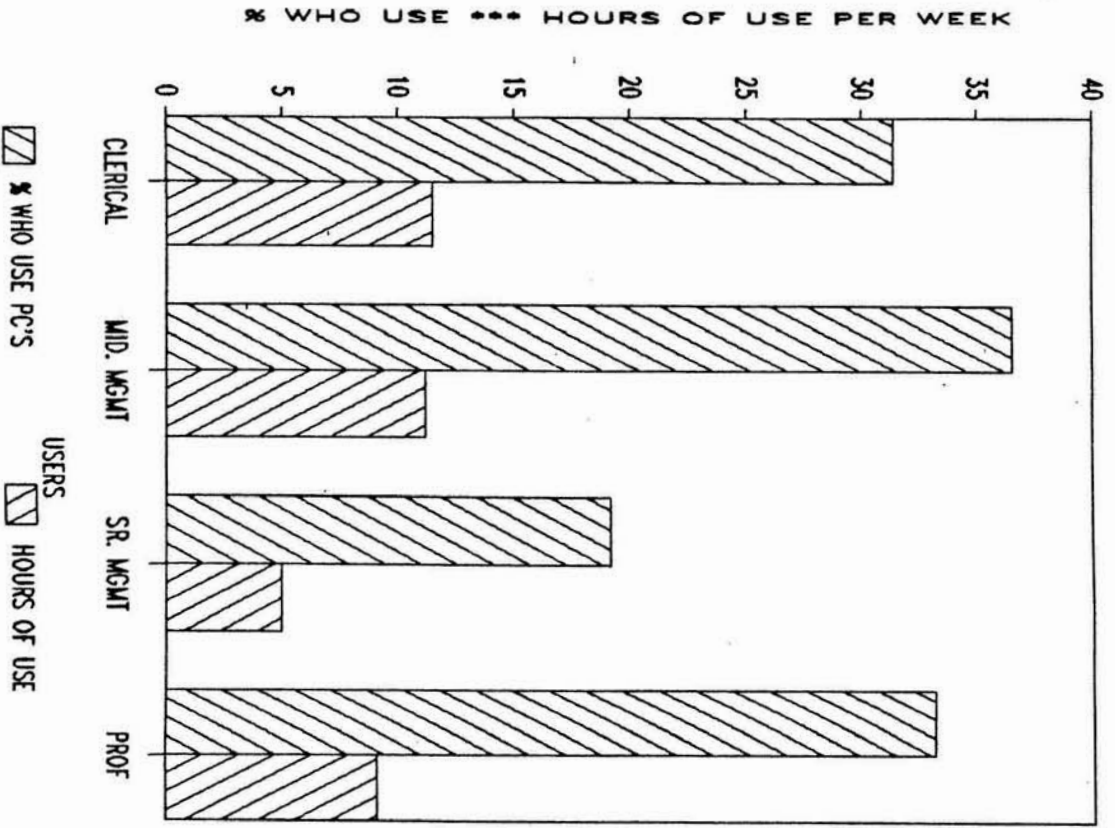


FIGURE 5

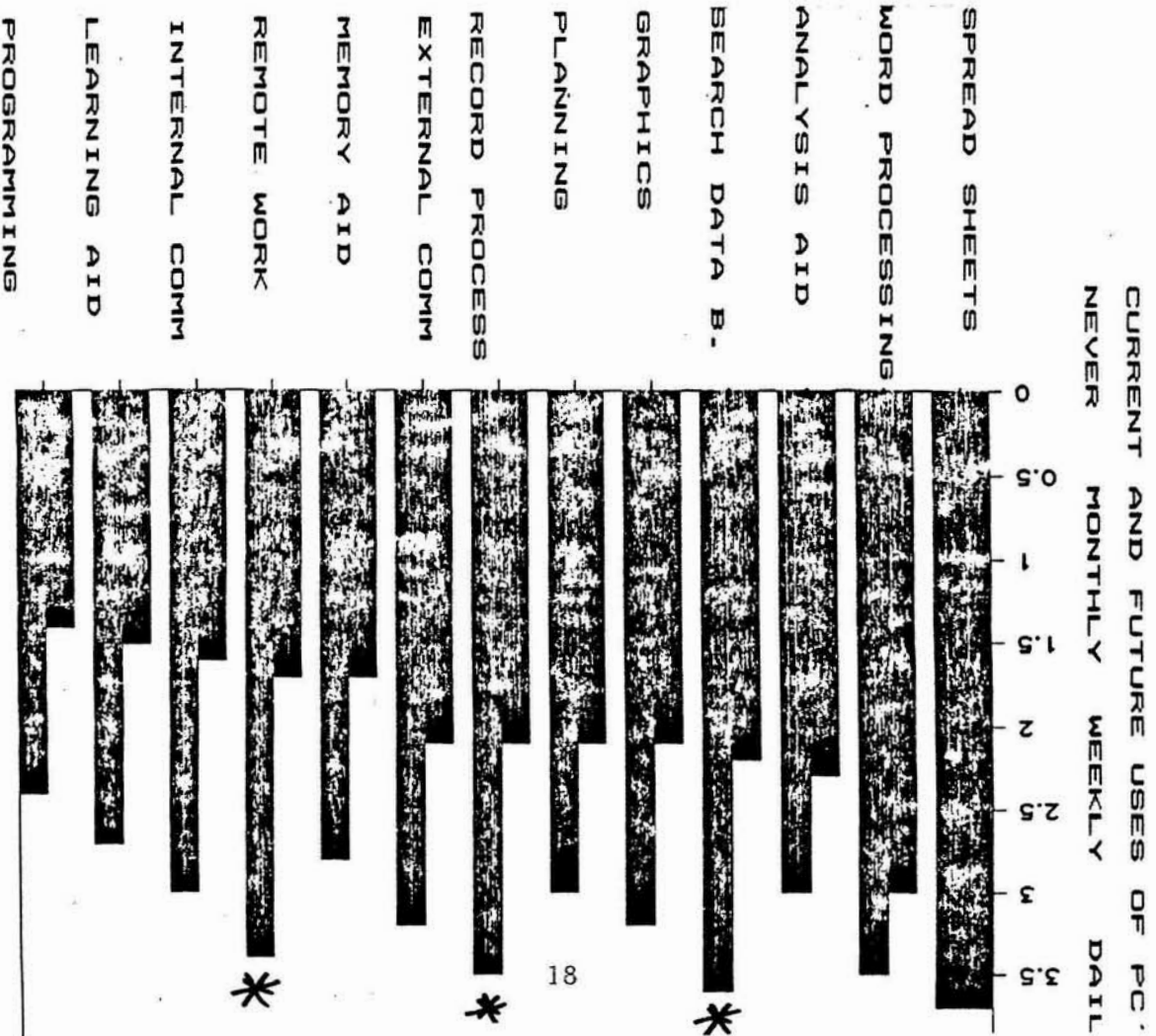


FIGURE 4

PROBLEMS WITH PC'S
 * SAYING VERY IMPORTANT PROBLEM NOW

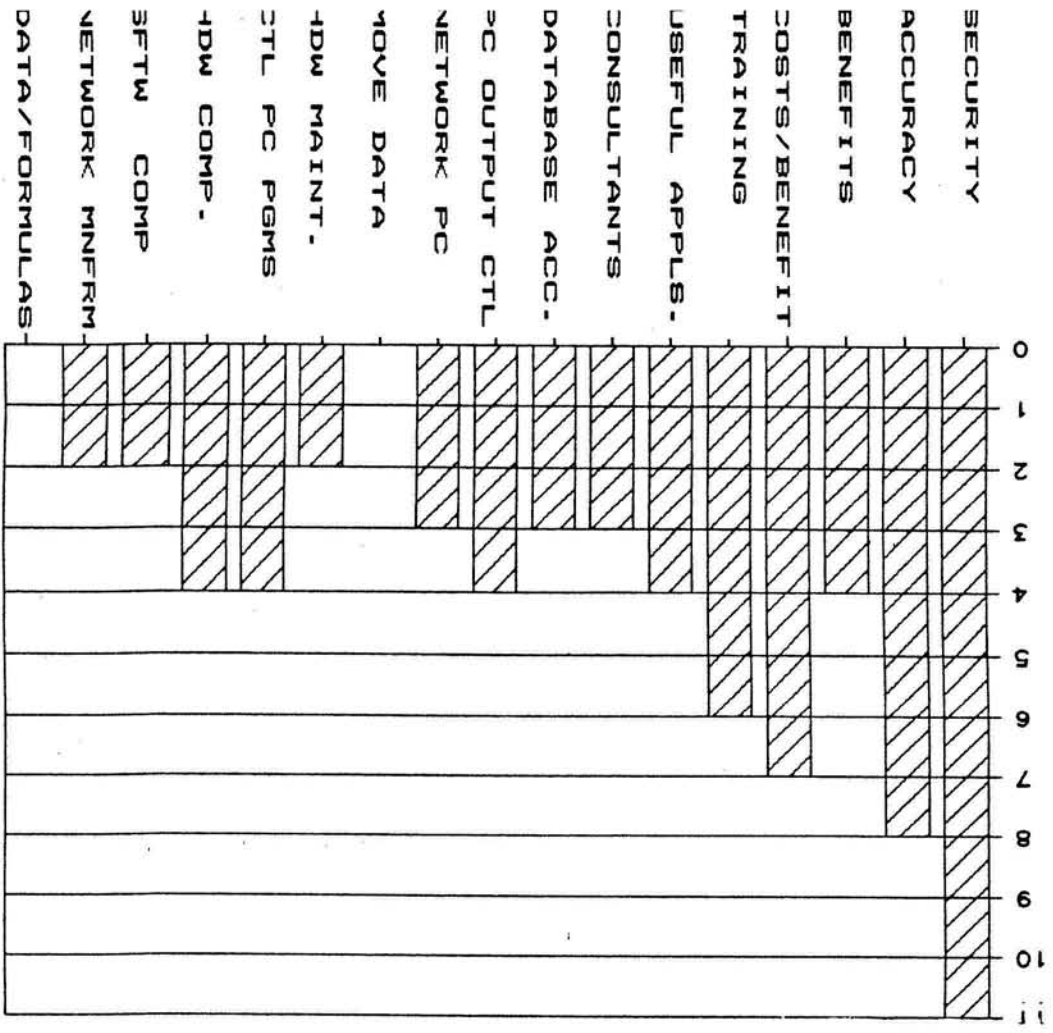


FIGURE 7

PROBLEMS/ISSUES WITH PC'S
 UNIMPORTANT VERY IMPORTANT

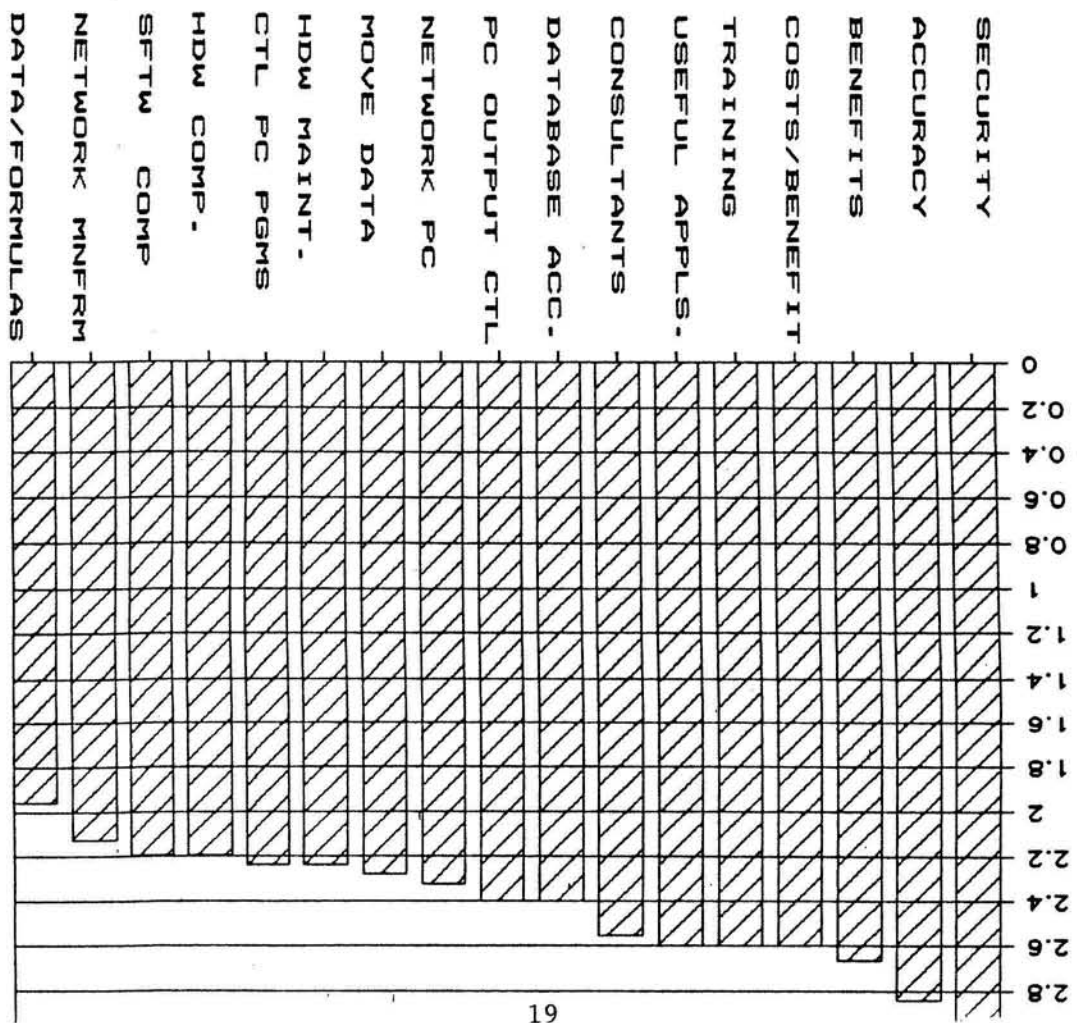


FIGURE 6

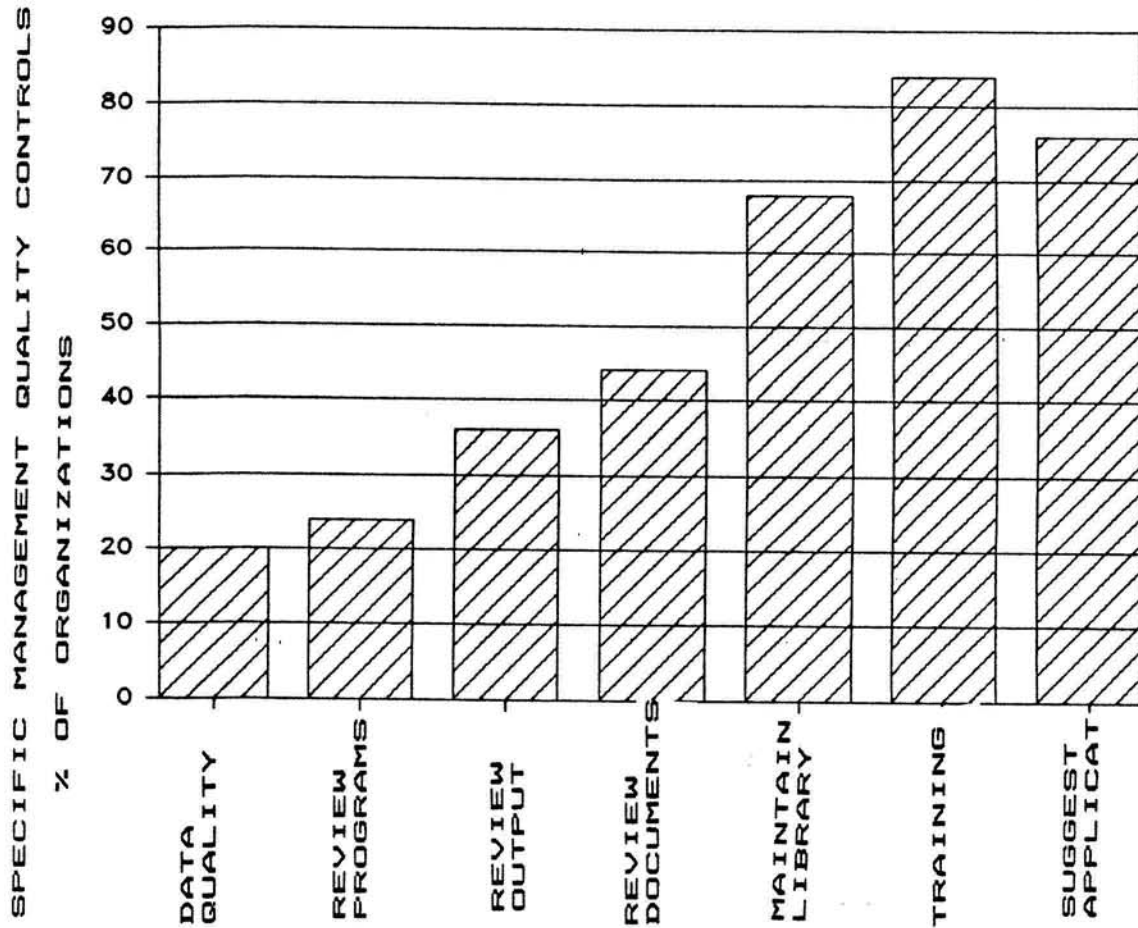


FIGURE 8

TABLE 9
WHO IS MOST IMPORTANT IN MAKING THE FOLLOWING KINDS OF DECISIONS?

ISSUES	Individual Users (1)	PC User Groups (2)	Division Manager (3)	PC Coordinator (4)	Data Processing (5)	Other (6)	No One (7)
HARDWARE PURCHASE	XXXXXXXX	XXXX	XXXXXXXXXX	XXXXXXXXXX	X	XX	
SOFTWARE PURCHASE	XXXXXXXXXX XXXXXXXX	XXXX	XXXXXXXXXX	XXXXXX		XX	
VERSION CONTROL	XXXXXXXXXX XXXXX	XX	X	XX	XXXX		XXX
DATA DEFINITIONS	XXXXXX		XX	XXXXXXXXXX XXXXX	XXXX	X	X
HARDWARE MAINTENANCE	XXXXX	X	XXX	XXXXXXXXXX XXX	XXXXXXXXXX	XX	XXXX
ACCESS TO CENTRAL DATA	XXXX	XX	XXXX	XXXXXXXXXX XX	XXXXXX	XX	XXXX
NETWORK TO OTHER PC'S	XXX	XX	XXX	XXXXXXXXXX XX	XXXXXXXXXX	X	XX
NETWORK TO FIRM TELECOM	XXXXX		XX	XXXXXXXXXX XXXXXX	XXX	XXX	
TRAINING/CONSULTING	XXXXXXXXXX XXXXXXXXXX	XX	X	XXXXX	XXXX	XX	X
NEW APPLICATIONS	XXXXXXXXXX XXXXXXXXXX	X	XXX	XXXX		X	XXX
ACCURACY OF PC DATA	XXXXXXXXXX XXXXXX	XX	XX	XXXXX	XX		XX
SECURITY OF PC DATA	XXXXXXXXXX		XXXXX	XXXX			XXX
CONTROLLING DISSEMINATION OF PC REPORTS, DATA	XXXXXXXXXX	XXX					
SPECIFIC DAY-TO-DAY USES AND APPLICATIONS	XXXXXXXXXX XXXXXXXXXX	XXX	XXXX	XXX	XX	X	XX
MAINTAINING A LIBRARY OF PC APPLICATIONS	XXXXXXXXXX	XX	XXX	XXXXXXXX	XX	X	XXXXX X

OVERALL SCORES FOR DECISION GROUPS

H-1: CONFIGURATION & MANAGEMENT PRACTICES

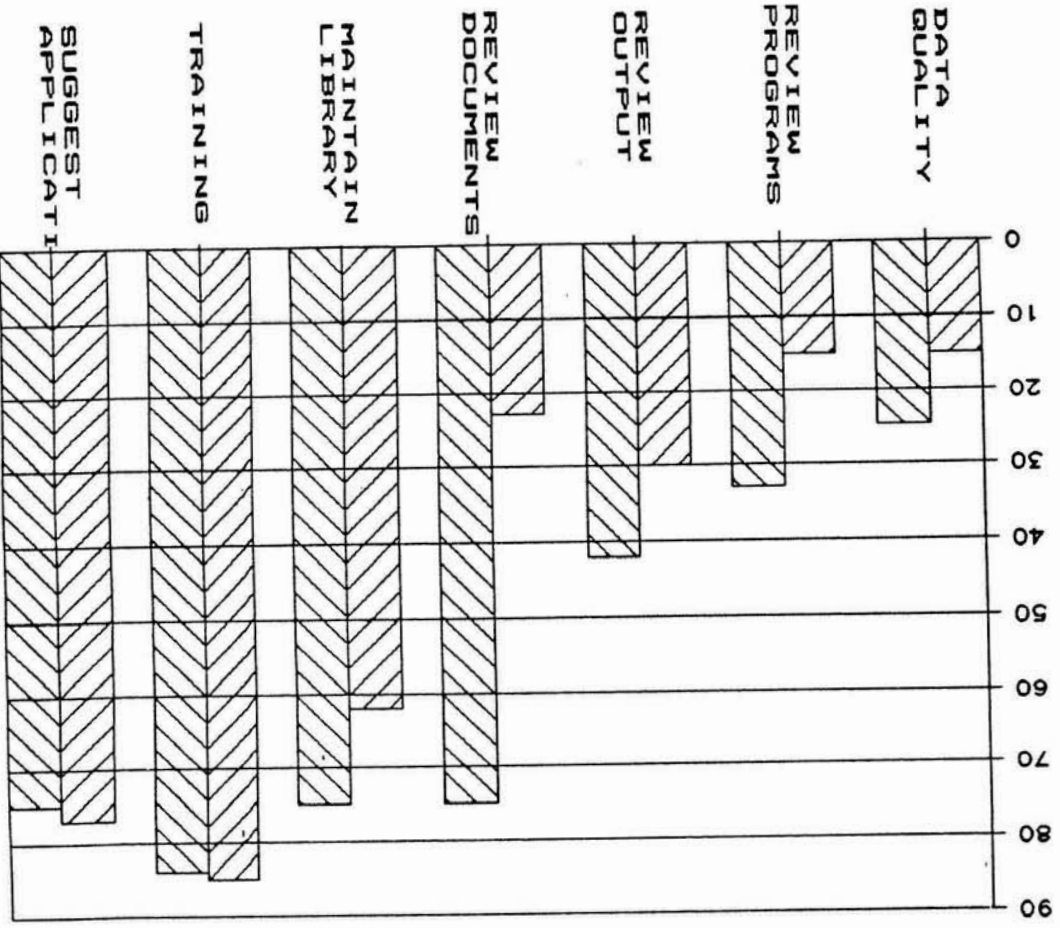


FIGURE 11

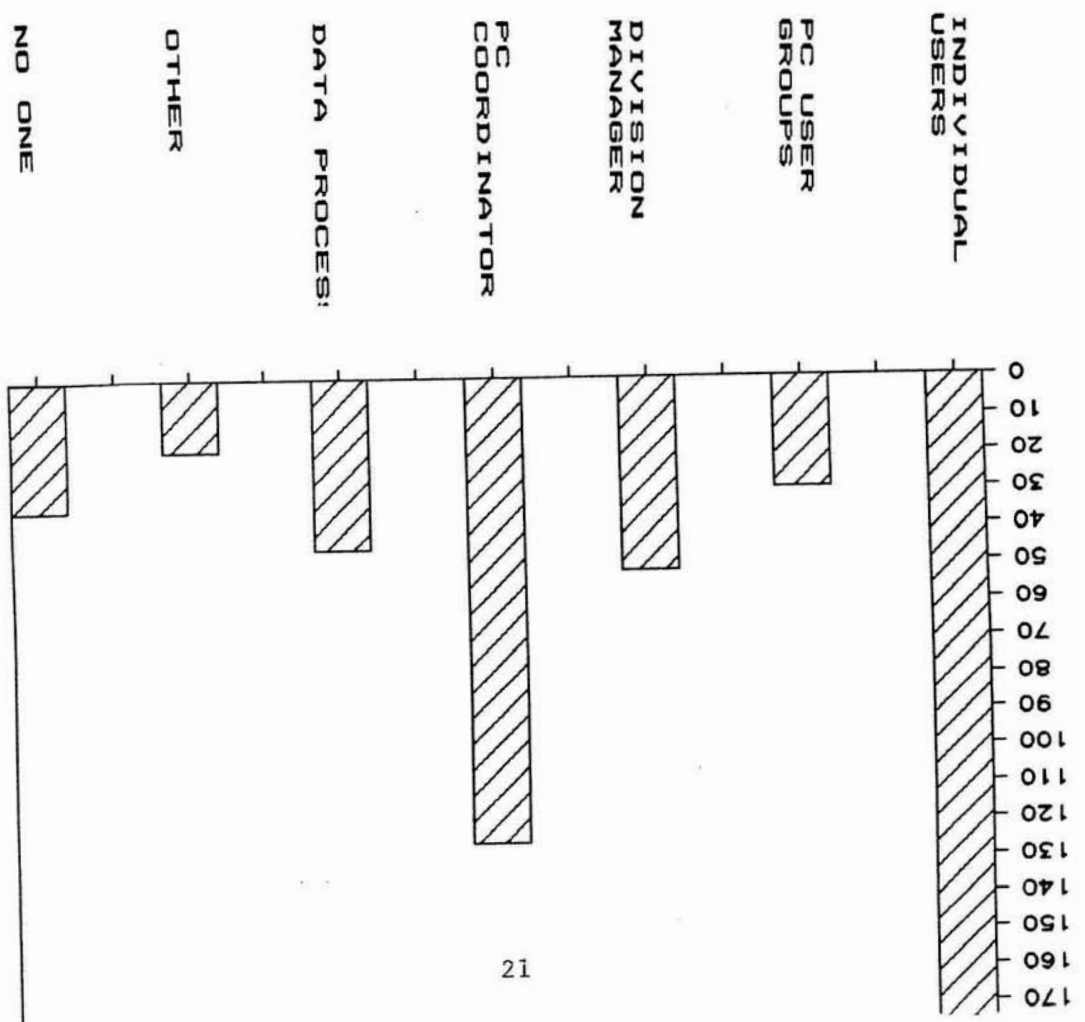


FIGURE 10

H-1: CONFIGURATION AND DECISIONMAKING

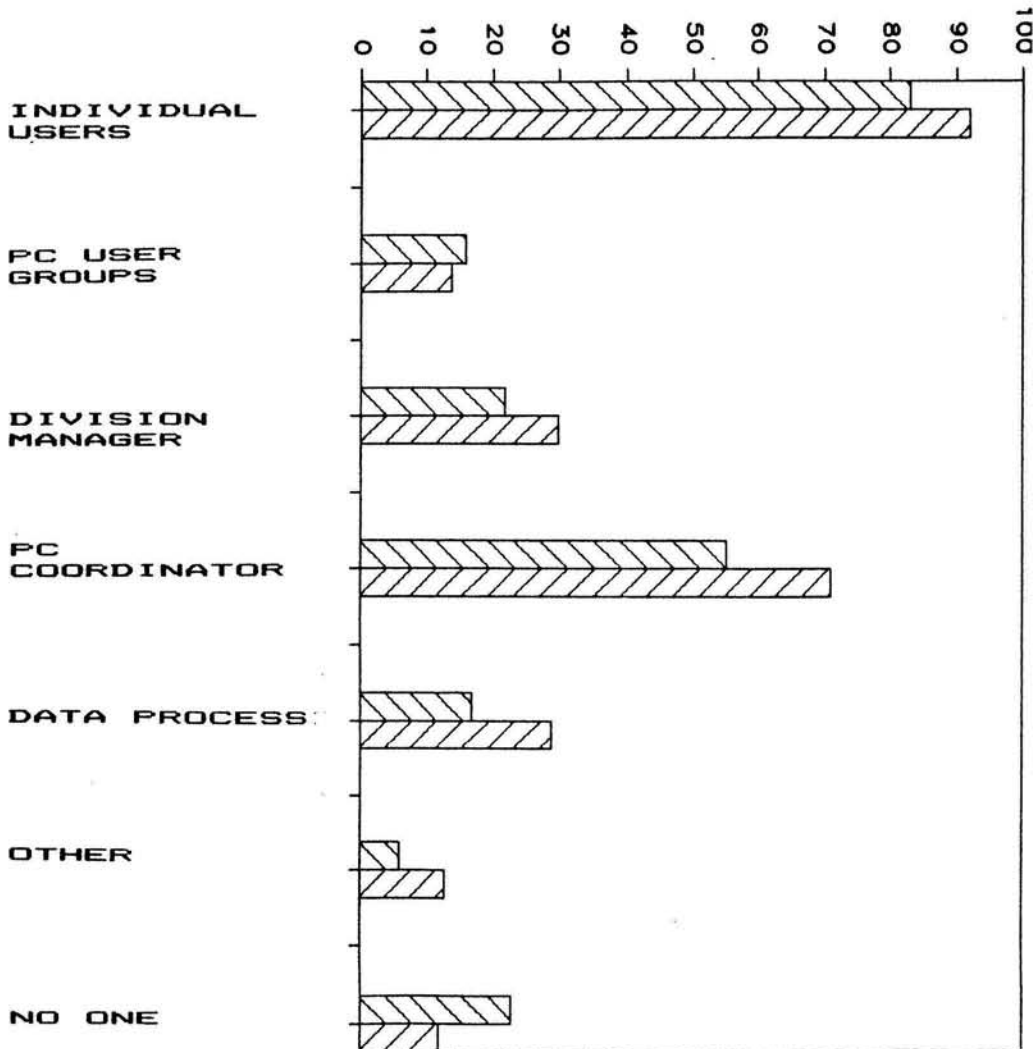


FIGURE 13

TABLE 12
WHO IS MOST IMPORTANT IN MAKING THE FOLLOWING KINDS OF DECISIONS?

ISSUES	Individual Users (1)	PC User Groups (2)	Division Manager (3)	PC Coordinator (4)	Data Processing (5)	Other (6)	No
	XXXX	X	XXXXXX	XXXX		X	
HARDWARE PURCHASE	00000	0	000	00000	0	0	
SOFTWARE PURCHASE	XXXXXX	XX	XXXXX	XXXXX		X	
VERSION CONTROL	000000		00	00000	0		0
DATA DEFINITIONS	XXXXXX	XX	X	XX			X
HARDWARE MAINTENANCE	000		0	00000000	00		
ACCESS TO CENTRAL DATA	XXXX	X	X	XXXXX	XXX		XX
NETWORK TO OTHER PC'S	0		00	0000000	000000	00	0
NETWORK TO FIRM TELECOM	X	XX	X	XXXXX	XXXX	X	XX
TRAINING/CONSULTING	000		000	00000000	0	00	
NEW APPLICATIONS	XXXXXXXXXX	X		X			X
ACCURACY OF PC DATA	0000000000	00	00	00		0	0
SECURITY OF PC DATA	XXXXXXXXXX	X		XX	X		X
CONTROLLING DISSEMINATION OF PC REPORTS, DATA	00000000	0	000	0			0
SPECIFIC DAY-TO-DAY USES AND APPLICATIONS	XXXXXXXXXX	X	XX	X	X		X
MAINTAINING A LIBRARY OF PC APPLICATIONS	0000000000	00	00	000		0	0
	XXX	X	X	XXX			XXXX
	00000	00	0	0000000	0	0	0

H2: CONFIGURATION AND USERS

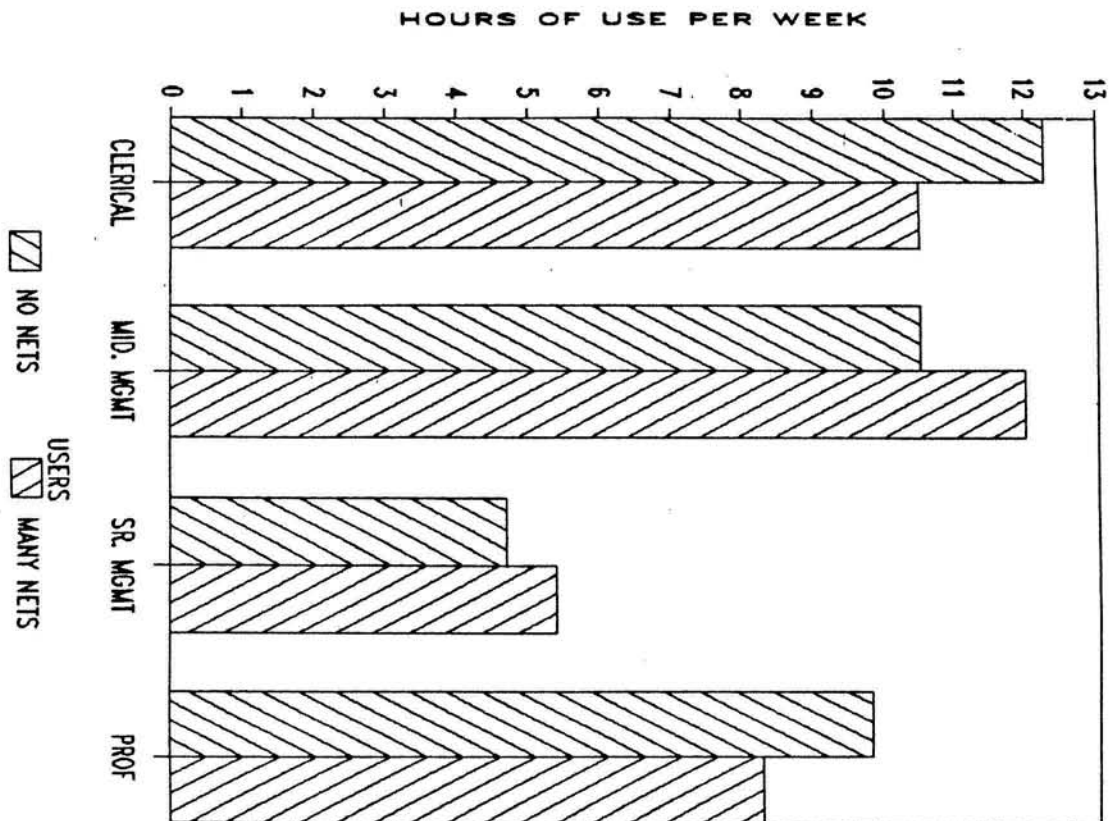


FIGURE 15

H2: CONFIGURATION AND EXTENT OF USE

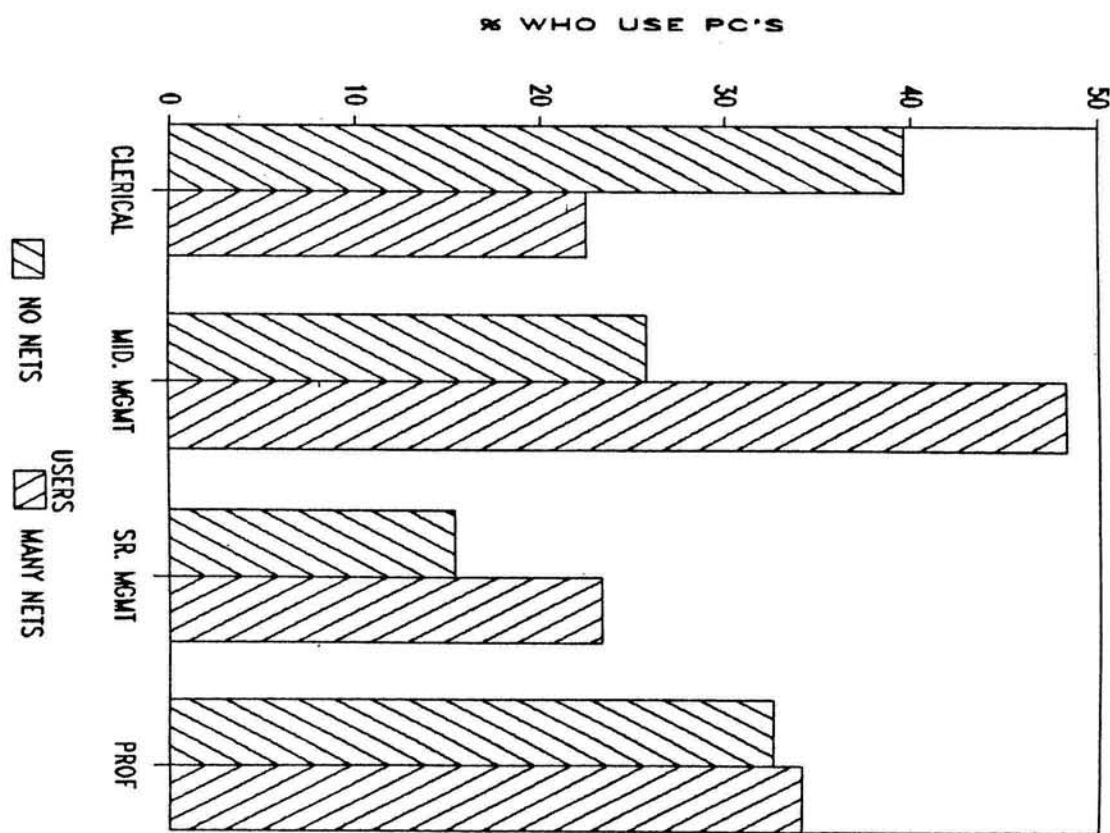


FIGURE 14

H-3: CONFIGURATION AND USES

NEVER MONTHLY WEEKLY DAIL

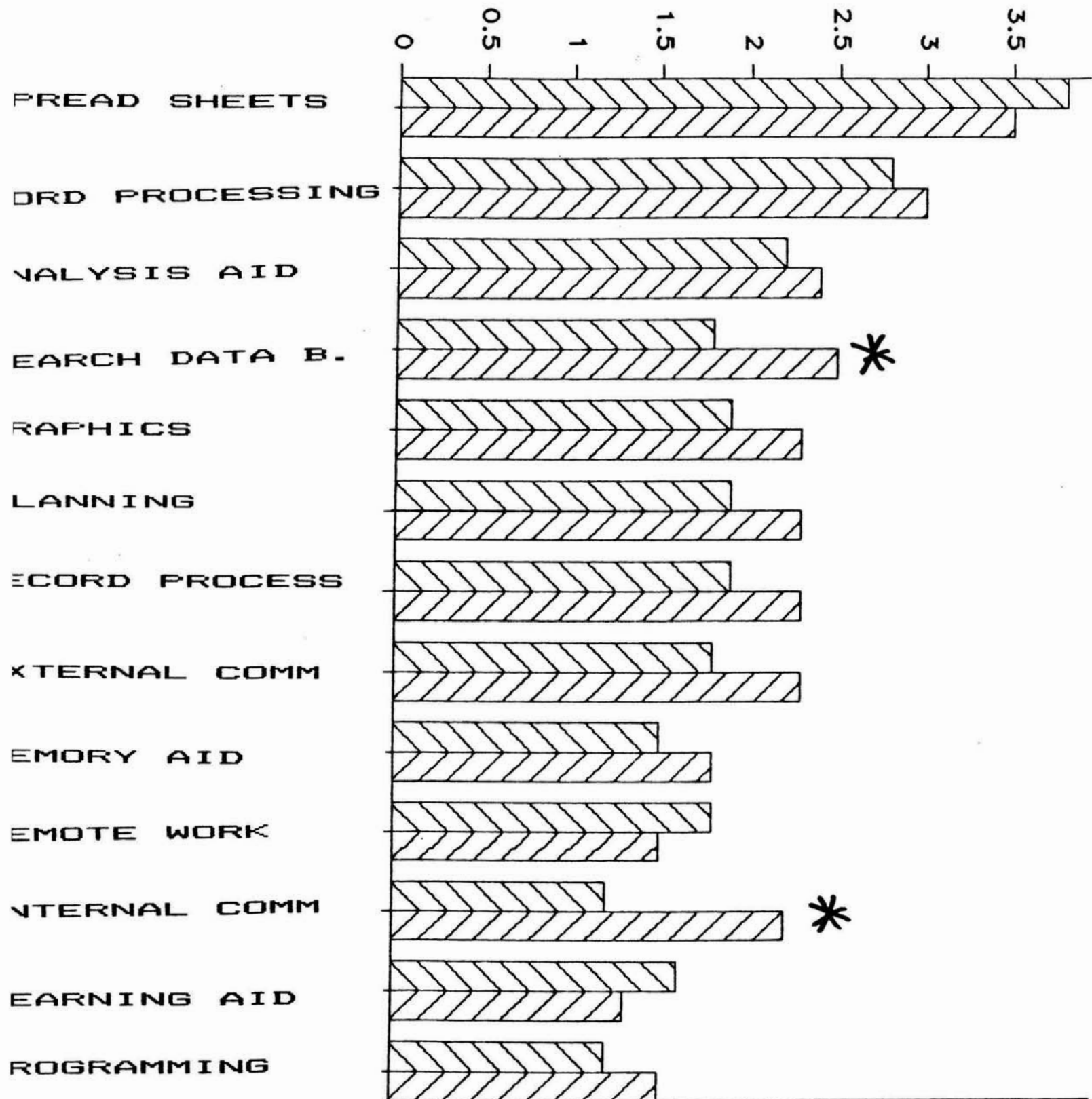


FIGURE 16

H-5: NETWORKING AND AGE OF PC'S

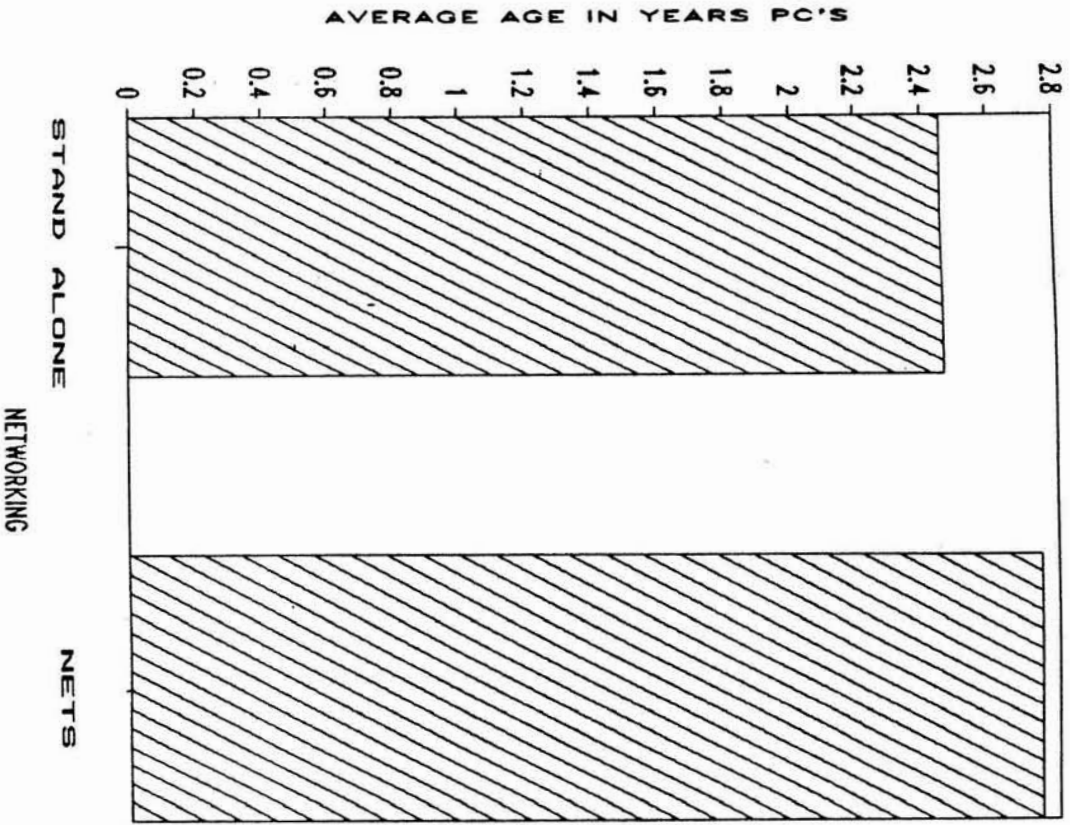


FIGURE 18

H-4 CONFIGURATION AND PROBLEMS

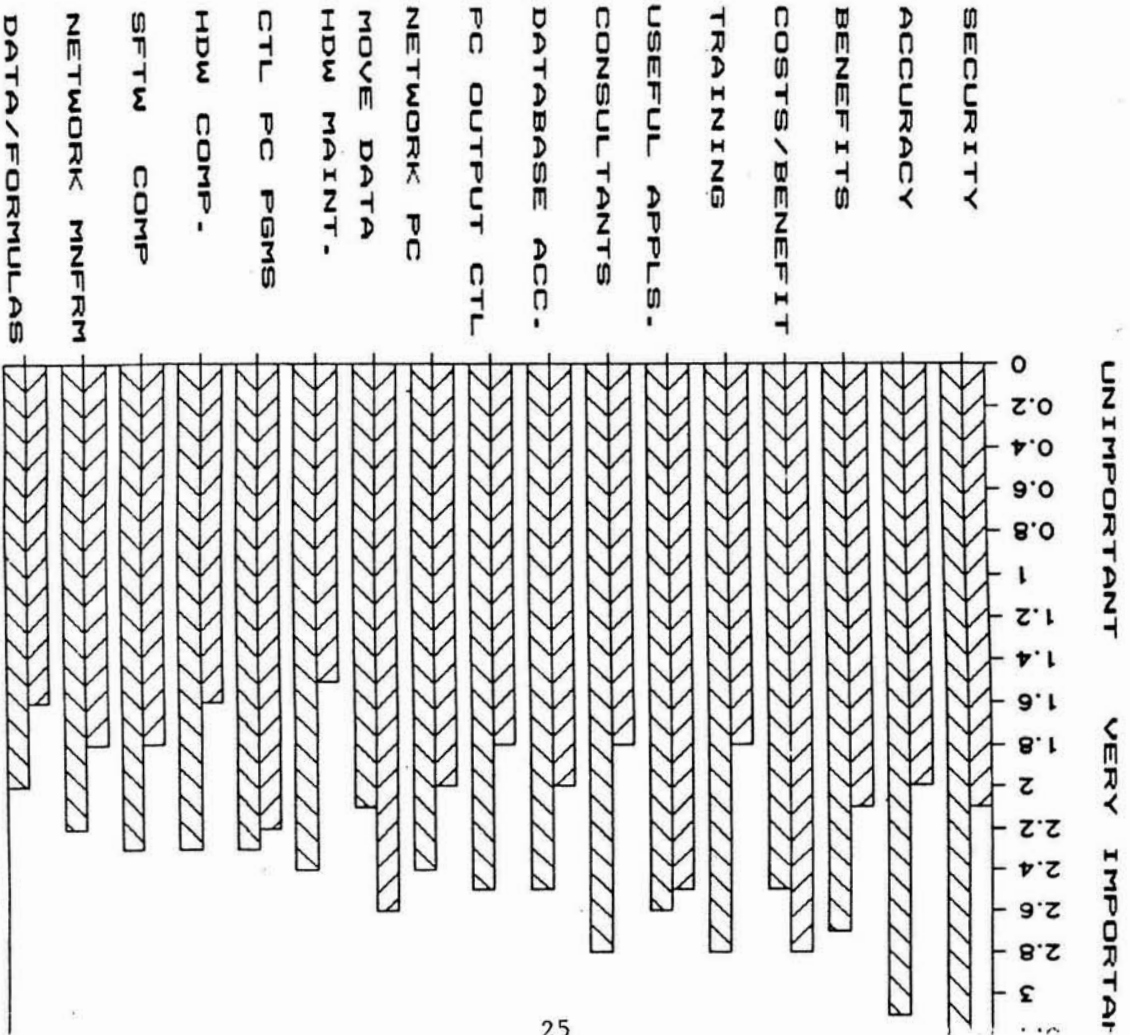


FIGURE 17

H-7: YEARS PC'S AND INTENSITY OF USE

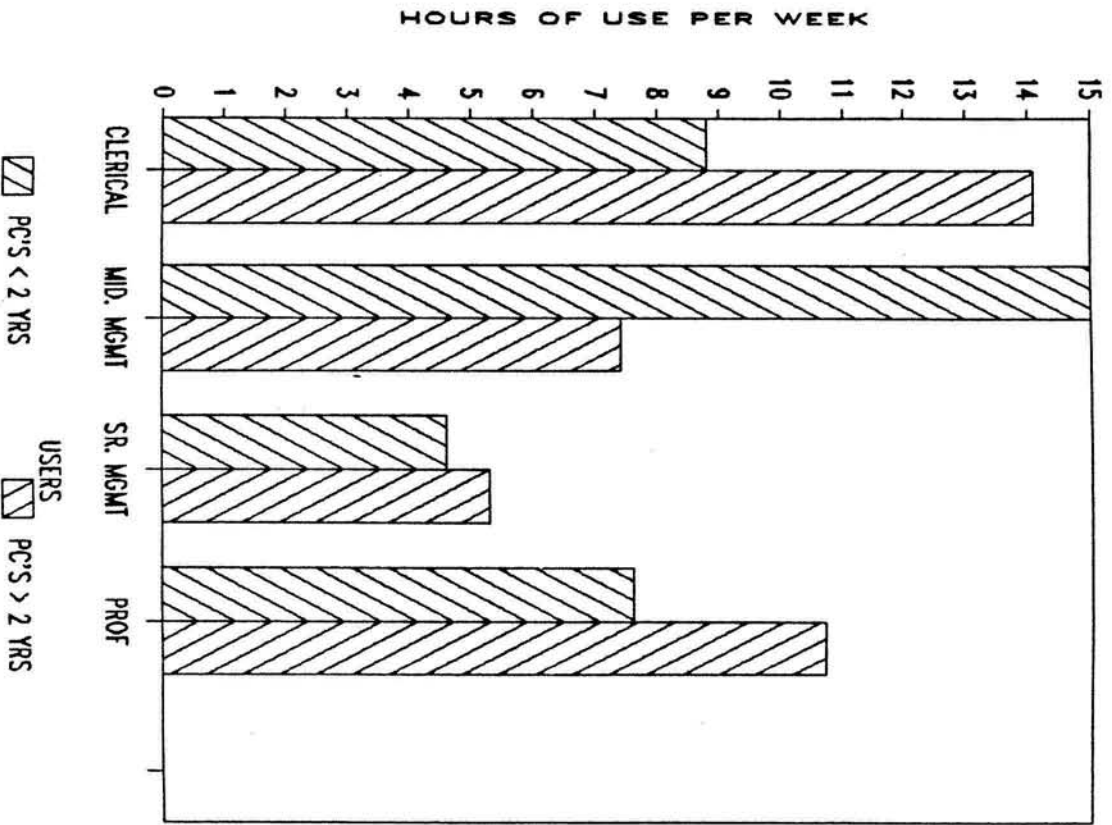


FIGURE 20

H-6 YEARS PC'S AND USES

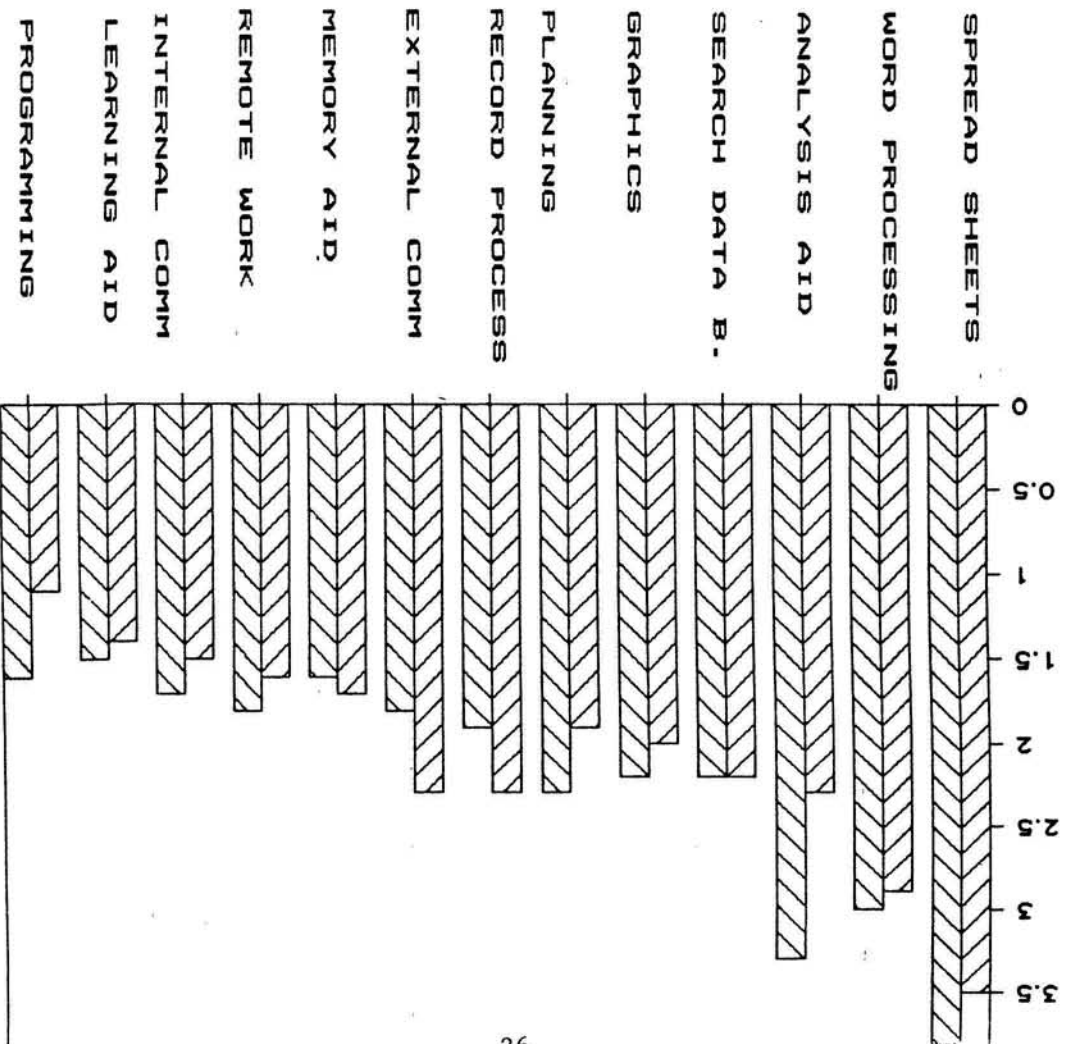


FIGURE 19

H-8 YEARS PC'S AND MANAGEMENT PRACTICES
% OF ORGANIZATIONS

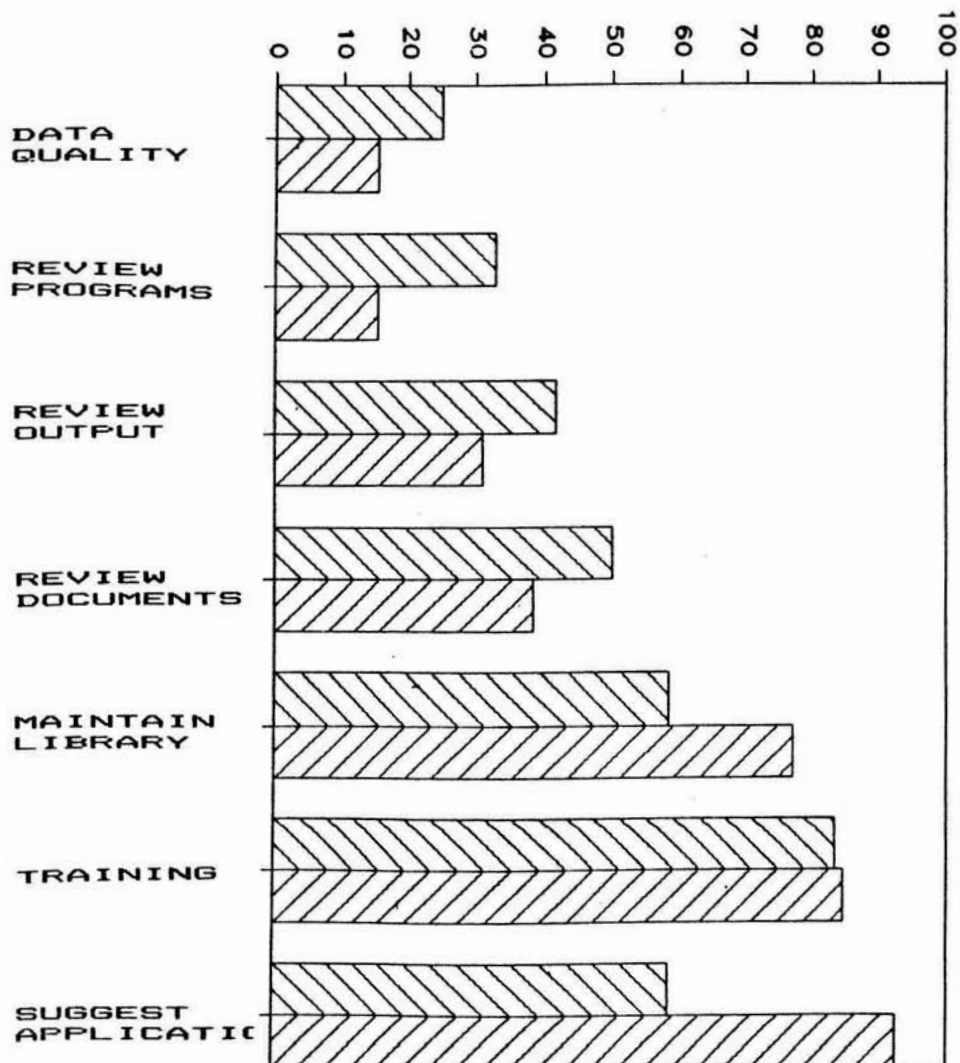


FIGURE 21