Computers in Organizations:

A Survey of <u>PC Week</u> Articles Between 1984 and 1988

by

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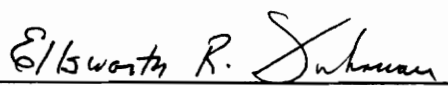
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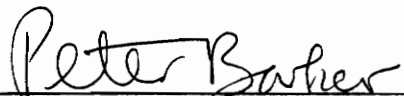
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(Abstract)

The concern of this thesis is the role technology plays in organizational change. The specific issue addressed is the introduction of personal computers (PCs) into work organizations. A review of the literature suggested that both sociological and technological factors must be taken into account when discussing technological change.

<u>PC Week</u> magazine contains strategies which various companies used in introducing personal computers. A thematic content analysis of <u>PC Week</u> was carried out to test certain hypotheses. The articles were also treated as contemporary historical documents. Questions addressed included whether PCs contribute to centralization or decentralization in organizations, whether PCs differ in their organizational effects to mainframes, whether PCs are more successful in some types of organizations than in others, and whether an "opinion leader" plays a significant role in the introduction of PCs.

From the content analysis and the texts, it was concluded that technology did not determine organizational change. While technology determined the limits of certain tools (PCs), organizational goals determined how PCs were implemented. Limited support was drawn for the suggestion that an opinion leader played a role in PC introduction. Little support was gained for

the remaining hypotheses.

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Introduction

A major concern in science studies is what role technology plays in organizational change, and to what extent it is a cause of that change. This thesis is an empirical case study of the impact of technological change. The introduction of personal computers in recent years has led to significant changes in work organizations. While various studies are underway, no comprehensive, up to date account of the impact of this technology has yet been released. Developments associated with personal computers have been rapid and there is little available information with which to work.

However, the "strategies" sections from PC Week magazine provide regular interviews with members of organizations which have introduced, or are the process of introducing PCs. These articles provide the data for this thesis.

A content analysis and general reading of the articles suggested that the interviewees perceived technological and organizational change as organizationally driven. The interviewees were usually middle managers and information specialists. These people saw PCs as a tool with which they could better achieve organizational goals. In general, PCs were not regarded as the motivation behind organizational change.

Review of the Literature

Issues addressed in this study are similar to ones appearing in several historical and sociological accounts of technological innovation and development. These studies deal with the present concern of this thesis, that is; the technological and social effects of the introduction of a particular technology.

Technology as a Tool or Determinant of Change?

Chandler (1977) stresses the importance of the role of middle management in the gradual development of the social structure of modern industry. While technology is important for his account, it is subordinate to the aims and manipulations of a rising class of middle managers. Chandler considers technology more of a tool than a causative factor in organizational change. Where a certain technology, e.g. the railroad, can be used to promote the economic aims of commercial enterprise, it is selectively employed by those in control of such organizations. Hounshell (1983), strikes a more middle ground, describing how both social and technological factors led to changes in industrial organization. Both of these authors agree that technological innovation alone is not responsible for organizational change.

This thesis shares common ground with these studies in examining the extent to which technology is considered as a tool rather than a causative factor in organizational change. That is, how much is a technology used to pursue existing organizational goals, and how much is an organization altered to accommodate a desirable technology?

Invention and Innovation

Vernon Ruttan (1959) creates a synthesized interpretive scheme which can help solve the tension which has existed between the notions of invention and innovation in literature discussing technological change. He proposes that the two be seen as part of the same process, rather than as discrete acts. In doing so, he uses concepts introduced by Usher (1929) and Schumpeter (1955). According to Usher, several steps are involved in a "cumulative synthesis" of previous knowledge to create an invention. Schumpeter defines innovation as whatever causes a change in the production function, where the production function is a resultant of capital, labor and technology.

While this account is theoretical rather than descriptive, it is useful in its emphasis on the processual nature of innovation and invention. One of the guiding assumptions of this thesis is that, as Ruttan points out, invention and innovation are not discrete acts. Thus in the introduction of PCs, information gained through their introduction may be fed back to technical experts and innovators. This stimulates further innovation, and even invention of improvements in the technology and its implementation. The act of innovation may be technological, social, or both. A problem in PC introduction may therefore be solved in either an organizational or technological way (or by a combination of the two).

Innovation and Industrial Organization

Hounshell (1983) provides support for Ruttan's scheme by showing the detailed interaction between technological change and organization. He describes how the "American System", which used interchangeable machine

parts, was a highly problematic technology. The organized technology of mass
production is generally thought to have evolved from this system. It was held
as an ideal for the organization of weapons (and later agricultural machinery)
production, but was not successfully implemented for several decades after its
"invention". Since the interchangeable parts were so difficult to make,
manufacturers had to fight long and hard if they wanted to base their
industrial organizations upon the system. The reason they tried so hard was
that the technology seemed to promise greater efficiency. If certain machine
parts could be used in several different machines interchangeably, fewer parts
would have to be tailored specifically to one machine only. Thus work could be
rationalized if some parts could really be made to fit several machines.

Technology in Social Context

Thomas Hughes (1983) also discusses the evolution of a technological
system, in several different social contexts. He describes the interaction
between the development of electrical power systems and the political and
economic systems in the U.S., Germany and Britain. While the technology
implemented in each country was fairly uniform, and became more so, it met
with different social problems in each case. Problems encountered were solved
in both social and technological ways. Hughes utilizes the notion of a "reverse
salient" (a term taken from the military) to describe how "critical problems"
associated with the new technology were identified and solved. The reverse
salient describes the leading edge of technological development when a part of
this edge lags behind due to some technological problem. Each area which lags
behind constitutes a critical problem. Technology is a problem-solving

activity, but, Hughes stresses, is not autonomous from political and cultural climates. A technologist must often address problems which are not necessarily technological, but may be political, social or legislative (e.g. the British Electrical Lighting Act of 1882).

Technological Diffusion

The evolution of a successful technological system often occurs at the same time as its diffusion. The diffusion of technology in the form of hardware and information (software) was vital to the evolution of electrical power systems to different geographical areas (Hughes, 1983). Rogers (1983) discusses the diffusion of innovation in more general terms. Speaking from a sociological, rather than a technological, point of view, he describes certain social factors which affect the adoption of technology. Rogers equates technology with innovation (thus blurring the invention/innovation distinction), pointing out that a technology contains both a hardware and a software (informational) component. Indeed, an innovation may be entirely informational. He discusses several diffusion case studies, describes the development of the field of diffusion research, and formulates eight sub-areas in this research. Particularly useful for this thesis are the study of opinion leadership, consequences of innovation and (to a lesser extent) the rate of adoption of innovation in different social systems. An opinion leader is an individual within an organization (be it a corporation or a rural village in South America) who is particularly open to innovation. This person must also be a trusted member of the organization, perhaps having the ear of other influential members. He or she will lead the way in employing or encouraging the

employment of an innovation.

Mansfield (1968) provides information on innovations which is more specific to particular types of companies and economic situations. He stresses that the distinction between invention and innovation is a blurred one, but that innovation is the key stage in the implementation of an invention. He points out that while there has often been a significant lag between an invention and its adoption, and thus a slow rate of diffusion, this process may now be speeding up. If this is indeed the case (there is a lack of available evidence) it would probably be due to improved communication channels. In any case, it does appear from empirical studies that the rate of diffusion of an innovation depends largely upon the types of companies to which it applies, and to the economic climate. The introduction of an innovation is risky, and depends on various factors. Some types of innovation have diffused faster than others, depending to a large extent on the expected returns from investment. Since this thesis deals with one kind of technology, however, this is not as significant as the finding that the rate of innovation and diffusion of innovation depends on the size of the organization, the nature of the industry to which it belongs, how much modification is required before the innovation can become efficient, and how much advantage the innovation has over its predecessor. Mansfield provides a mathematical model in which differing rates of diffusion may be explained. This is based on four hypotheses: 1) as the number of organizations adopting an innovation increases, the likelihood of its adoption by a non-user increases. 2) The more profitable an innovation promises to be, the more likely its adoption. 3) For equally profitable

innovations, those requiring greater investments are less likely to be adopted. 4) The probability of adoption depends upon the industry in which the innovation is introduced. For instance, for an equally profitable innovation, one industry might be more likely to adopt it than another if that industry is more willing to take risks than the other, more competitive or better placed financially.

Technology and the Workforce

In contrast to Rogers and Mansfield, Blauner (1964), discusses how technologies which are already in place affect the organization and conditions of the workforce. He discusses printers, textile workers, auto workers and chemical industry workers. He describes the technologies in the industries to which these workers belong as being (respectively) craft technology, machine-tending technology, assembly-line technology and continuous-process technology. He defines the effects of technologies on the worker in terms of his concepts of powerlessness, meaningless, social alienation and self-estrangement.

Blauner concludes that technologies in some industries have the potential to liberate workers from oppressive supervision, and give them a greater sense of responsibility. This occurs notably in continuous process chemical plants. At the same time,in other industries, certain technological systems cause workers to have little or no sense of job satisfaction and a great deal of stress. Their jobs are characterized almost entirely by powerless and meaninglessness (notably in textiles). However, these people may not be socially alienated or self-estranged if the community outside of their place of

work can give their lives sufficient purpose and compensation for the unpleasantness of work. Thus, Blauner concludes, technology can be a factor in increasing or decreasing the quality of workers' lives, while aspects of their lives outside work may compensate for a bad working environment.

More specifically, the ILO (1983) provides several insights on the effects of the introduction of computers (as well as other office technologies) in the public service. Many issues raised here also apply to the private sector (ILO, 1980).

The general effect of the introduction of word processors and personal computers is an increase in productivity. This may lead to some secretarial staff being freed to attend to more (intellectually) demanding tasks. The post of "administrative secretary" may be created, perhaps providing a stepping stone to management in an area of work which has not traditionally offered such prospects. However, at the same time, such duties as typing are delegated to secretarial staff whose jobs may thus be downgraded. Such an effect is known as "bi-polarization", and appears frequently in studies of technological innovations in work organizations.

Prospects for office staff are affected in other ways. The introduction of new equipment requires new skills which existing staff do not usually possess. The expertise required for the handling of computers necessitates the employment of appropriately qualified personnel. Such personnel are increasingly recruited from among university graduates. This brings in staff with a higher degree of education and promotion prospects than those already employed. As a result, the job prospects of existing employees is reduced unless

they are given the opportunity to undergo retraining (and it is not clear that retraining opportunities are at all widespread).

Given bi-polarization and the necessity for retraining, the ILO (1983) suggests that prospects for promotion and job enhancement may be better in the private sector. In the public sector workers may simply be relocated in another area. In private industry this is often not possible, but union agreements may provide job protection. Retraining of displaced workers in such a situation is therefore more likely than in a civil service.

Centralization and Decentralization

The ILO observed both increases and decreases in the centralization of responsibility within organizations upon the introduction of computers. The initial introduction of a mainframe computer with several terminals allows centralization of data files. Management can use such an arrangement to keep track of the performance of employees, since they have access to information on how long each person spends on the computer and what their output is. This, together with the increase in productivity allowed by computers, can lead to a reduction in the workforce.

Certain decentralizing qualities of computers may also lead to rationalization. Computerization has facilitated flexible working hours, and even work in the home. While flexible working hours devolve a certain amount of responsibility onto the worker since management is not present the whole time, they also have negative implications. The length of some working days are increased, while overtime, and thus the chance for increased remuneration, may be decreased.

Similarly, there are both advantages and disadvantages to work in the home. The use of a computer terminal by an employee in his/her own home can be useful for two career families and single parent families, and reduces the working day by removing altogether travel to and from work. However, work at home also results in social isolation and the separation of workers, thus reducing their ability to engage in collective action over employment conditions.

Herbert Simon (1979) points out that centralization is usually taken to mean something bad while decentralization is commonly taken to mean something good. He clarifies the definitions of both centralization and decentralization, showing that since there are many components to decision making, a decision might be both centralized and decentralized at the same time. Centralization is organization in a hierarchical form, with functions being transferred from a lower to a higher level. Decentralization is a transfer of function from a higher level to a lower one. Centralization is always relative since no concentration of power is ever absolute, and may occur for several different reasons (p.212). These reasons include the achievement of economies of scale (for instance by concentrating experts in one place), to coordinate independent activities and to control lower level activities in the interest of higher level goals.

Often, decentralization and centralization may occur simultaneously in the same organization. For instance, in many large American corporations during the 1950s production and marketing decisions were being decentralized at the same time as labor relations were being centralized (p.213). An increase

in centralization could allow the gathering together of information from decentralized sources, so that the decision maker(s) could allow for repercussions which might occur throughout the organization. In this way, centralization may actually benefit the various levels in an organization. However, Simon suggests that computers may not have much effect on centralization or decentralization. While computers have often led to the centralization of inventory, production scheduling and so on, they have usually been used as a tool in the organization of management decision making (p.221). Since such changes in decision making have also occurred independently of computers, little can be inferred about the implications of computers for organizational decision making.

Simon wrote his piece before PCs were introduced into organizations. In empirical studies such as those carried out by the ILO (see above and below), the centralization/decentralization issue is considered significant. The question of what implications PCs have for centralization and decentralization is also considered significant for the present thesis. Simon's article serves to emphasize that computers have no necessary implications for centralization in organizations. However, this does not mean that PCs are not employed in certain ways which lead to centralization or decentralization within work organizations (ILO, 1983).

In an article discussing the relevance of economies of scale to computing in the 1980s, Mendelson (1987) suggests that the cost of computing no longer justifies centralization. Arguments in favor of PCs were couched previously in terms of benefits for the end user. The cost of computers favored economies of

scale in the 1960s and 1970s, encouraging centralization. However, with the constantly decreasing cost of PC technology, this is no longer the case. The changes in the economics of computing alone may have facilitated trends towards the use of smaller systems, and thus (it is assumed) decentralization.

In contrast, King (1983) proposes that the debate over whether to centralize or decentralize computing is largely political. This debate has traditionally focussed on issues of efficiency and effectiveness. However, King's "behavioral assessment" (p.319) of the arguments suggest that the important questions behind the debate actually concern the politics of organizations and resources, and in particular the issue of control. Thus, although economic considerations are important, they are secondary to the political ones.

Calhoun (1981), in a similar vein, suggests that despite the rapid advances in microcomputer technology, 'the extent and directions in which development continues will be determined largely by social, not autonomously technical, factors.' While applications in computer technology are already numerous, the effects of these applications are at least partly subject to social control.

Computers, Productivity and Employment
Consistent with the above theme, the ILO found that in some countries, such as Australia and the U.K., trade unions have negotiated for a shorter working week in order to compensate for the increase in productivity and thus prevent job losses. However, as Gotleib and Borodin (1972) stress, no

assumptions about loss of employment can be made given previous technological developments. Previous technological advances have often been accompanied by an increase in employment, although this may also be due to an increase in demand for whatever the technology can provide (e.g. manufactured goods).

Several factors have also mitigated the effects of technology. 1) Most automated systems still require human monitoring; 2) there is often a significant lag between invention and implementation of a technology (although I argue that these two are more closely integrated). This may allow time for manpower training and planning; 3) office work in service industries still requires the interaction of staff with customers; 4) increases in indirect labor, such as maintenance, support functions and supervision can compensate for losses in direct labor caused by increased productivity; 5) computers may be used not for labor reduction but for increased accuracy, especially in areas where there is already only a small amount of labor required; 6) companies fearful of bad industrial relations may modify the introduction of automation.

Despite the apparent optimism of the above points, Gotleib and Borodin warn against complacency and suggest that automation may cause a deceleration in the rate of increase of the labor force, rather than a direct decrease. At the same time, there are areas of industry which have become almost entirely automated (e.g. chemical processes) and others which were (in 1972) in danger of becoming so (e.g.typesetting), with real job losses. Specific groups of employees are thus disproportionately affected by new technologies.

The ILO (1980) supports many of Gotleib and Borodin's predictions. With the support of survey data, the ILO conclude that there has indeed been a reduction in the rate of increase of employment due to structural (organizational) changes and the introduction of new technology. Their study concentrates largely on the introduction of computers into office work. However, they stress that it is difficult to tell whether the cause of a particular employment effect is structural or technological.

New Technology and the Nature of Work

The ILO (1980) study does point out, however, that due to the introduction of word processing systems, secretarial work is now divided into two categories. There is that which involves typing and that which concerns all other secretarial functions. This has in many cases resulted in an increased division of labor, directly attributable to the introduction of the new technology. The amount of decision making by the individual worker is reduced at the same time as individual work functions are more centralized. The pace and repetitiveness of work has also increased in many situations, and the relationship between higher and lower status personnel become more strained. Relationships between workers and customers have also become more.

In order to combat such trends, workers may be organized into groups which may handle all aspects of a certain problem. For instance in banking, individual workers are responsible for a particular group of customers whose cases they closely follow from beginning to end. This is an attempt to increase the workers' sense of responsibility and enhance worker-customer relations. Thus while advanced technologies such as computers may have a dehumanizing

and alienating (in Blauner's sense) effect on the workforce, attempts are being made to reduce such stress.

A Technological Model

The model of technology which has been (to some extent implicitly) presented here is compatible with the philosophical model proposed by Pitt (1983). In this plea for the incorporation of technology into models of scientific change, practical knowledge is considered a crucial part of any definition of technology. Technology can be regarded as an 'input/output transformation process'. this model contains 'first order transformations', 'second order transformations' and, most importantly for this thesis, 'assessment feedback'. The first order transformation process uses an established set of knowledge to solve certain problems. This may involve building some machine, for example a PC, or some kind of "social machinery" such as a bureaucracy (p.84). The second order transformation process 'exhaust(s) what is normally called "technology" in ordinary usage, i.e. the machines' (p.84). This category may include social processes. It is processual in contrast to the more rigid machinery of the first order transformation. The third component of the model is the feeding back of technological assessment. This allows the upgrading of the knowledge base for further decision-making.

Relevance of the Literature for this Thesis

Since personal computers are considered (at least for the purpose of this study) as a particular form of technology, the concern of this thesis is similar to Hounshell's. While he studied the social and technological problems associated with implementing "American System", this study deals with the social and technological issues raised in the implementation of personal computers. It is clear from Hounshell's work that the problems encountered in

developing the technology of interchangeable parts provided information which
was fed back into attempts to improve that technology. Problems encountered in
the introduction of PCs to organizations also provide information for those
implementing the technology. This feedback allows subsequent applications of
the technology to be better adapted to particular circumstances. The
technology is adapted to the organization as well as the organization adapted
to the technology.

While Hughes was describing a relatively uniform technology, personal
computers are a more complicated technology. Personal computers contain both
a hardware and a software component. Problems associated with personal
computers may arise from the interaction of hardware or software, or both, with
the social situation. Nonetheless, the notion of the "reverse salient" is a useful
theoretical one for the purposes of this thesis. The leading edge of the
technology is constituted by the current PC hardware and software combined.
Problems encountered in the implementation of PCs will cause the leading edge
of the technology to lag behind in some areas. These problems must be
identified and solved in either a technological or social fashion, in the same
way as in Hughes' analysis. His concept provides a means by which processes in
the introduction of PCs may be theoretically interpreted in a useful yet simple
way.

From the study of PC Week strategies it is clear that certain people are
associated with the introduction of computers in organizations. These
individuals, or small groups of individuals are considered as "opinion leaders" ,
following Rogers (1983). The opinion leader will often persuade other members

of the organization to consider the introduction of PCs.

Social and Technological Factors

The interpretations of the interaction between technological and social factors mentioned above are compatible with the concerns of this thesis. Neither the technology nor social factors alone can explain the changes occurring in the work organizations studied. The purpose behind examining interviews with members of particular organizations is to determine how PCs have been incorporated into the social structure, and how the critical problems of their introduction were solved.

Innovation, Invention and Diffusion

A basic assumption of this study is that invention, innovation and diffusion are intimately connected in a form of cycle. In the case of computers, critical problems in their introduction are continually being identified and solved. Information gained in this way can feed back into the process of invention and innovation (Pitt, 1983), thus aiding the introduction of computers into other organizations [1].

In this way the reverse salient as described by Hughes (1983) advances. The reverse salient in this study is the advancing PC technology. It is recognized that this includes both a software and a hardware component. However, the software component is more than the floppy disks and packages which accompany the computer hardware. The software also comprises an informational component which is fed back into the innovation process via the experience of those who have already implemented PCs into certain

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[1] Personal communication, Dr. Nicholas Mullins, June 1988.

organizations. Indeed, the PC Week "strategies" themselves are a part of this feedback mechanism. They are published in order to show potential PC customers how PCs have been introduced into other organizations, and how problems have been solved in these organizations.

Both the organizational and technological aspects of PC introduction are discussed in the PC Week articles. Feedback from PC implementation is therefore both technological and organizational. This is compatible with the assumption that issues of centralization and decentralization are a combination of social and technological concerns. Since centralization and decentralization are functions of the way in which PCs are used in organizations, it is possible to bring such issues within the scope of this study. PCs are being used to centralize information storage, but also to decentralize functions such as the retrieval of sales information for branch personnel.

A conclusion of this study is that the decision of whether to introduce PCs into organizations depends largely on the extent to which PCs are perceived by potential clients to have been successful and popular in organizations where they have already been installed. Whether an organization uses mainframe or PC technology is also dependent on this factor. Such a decision may also be dependent on political and economic considerations. Mainframes have often been perceived as a centralizing technology, while PCs are perceived as a decentralizing one. An organization which values either centralization or decentralization may base its decision on such political and technological criteria. Cost-benefit types of analysis may become of prime importance when a centralized PC network is compared to a centralized mainframe. In such a case,

political decisions on centralization and decentralization become irrelevant.

Pitt's model fits the unfolding of PC technology as represented in the PC Week articles. A PC technology is developed (first order transformation), is implemented into a social organization (second order transformation) and information gained through critical problems identified and solved is fed back into the process (assessment feedback).

From the literature outlined above, several preliminary hypotheses can be proposed in Methods and Materials.

Materials and Methods

The "Strategies" sections from PC Week magazine are used in this thesis to gain contemporary information on PC introduction. These articles provide regular interviews with members of organizations which have introduced, or are the process of introducing, PCs. The interviewers ask similar questions in each case, the data may be regarded as a type of survey. The reporters are not the same for every article, but are come mainly from a pool of regular contributors. This factor is borne in mind so that differences in focus according to different contributors can be checked for using content analysis. They cover the period between February, 1984 and February, 1988 and a large variety of different organizations.

By using a thematic content analysis of these articles, certain issues and trends in PC introduction can be identified. The data from the content analysis test certain preliminary hypotheses, and suggest others. The articles are also treated as an historical resource. The most interesting and significant issues which arise from a straight reading of the materials is presented in the discussion.

Objectives

The articles are analyzed to discover what those employees in the organizations studied perceive as; the relationships between the type of organization and the success and effects of PC introduction, changing patterns of introduction, indications of centralization or decentralization and the differences between the effects of PCs and mainframes in these organizations. A further important issue is whether different types of organizations are seen as particularly successful in introducing PCs.

Other questions include: Why were computers introduced? Who in each organization supported the introduction of computers into that organization? What reasons were given to explain the perceived need for personal computers? [2] What are the effects of widespread computerization on employment patterns and working conditions? How has the introduction of personal computers affected (if at all) the economic state of the companies.

Additional questions arise from a study of the literature relevant to computer introduction [3], but are difficult to answer satisfactorily given the nature of the data. These are: 1) has reorganization resulted from the introduction of personal computers? 2) has it been necessary to lay off workers due to the labor-saving effects of computers? 3) how much, if any, retraining of employees has occurred? 4) has computerization increased efficiency so that

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[2] Possible reasons include the necessity of cutting down paperwork, solving data storage problems, or simply that the company feels a need to maintain a hi-tech, prestigious profile.

[3] For example, the two ILO case studies described in Chapter 1.

the company has increased productivity? 5) has there has been a shift in the proportions of skills in the workforce, that is, are people with different types of skills are now being employed, thus gradually changing the nature of the workforce?

Theoretical Considerations

This thesis shares common ground with the studies in the literature review in examining the extent to which technology is regarded as a tool rather than a causative factor in organizational change. While many managers and executives see PCs as a tool which is necessary or desirable for the efficient running of their organization, others see a certain necessity in keeping up with the leading edge of technology (perhaps in order to compete with their rivals). A question which then arises is to what extent is the state of the art technology dictating to management and to what extent is management using that technology merely as a tool? Is an executive making a decision to install PCs merely to maintain prestige through using current technology? Or has the executive looked at methods for achieving the goals of the organization and settled on the current PC technology?

A change in the organization may be driven by an organizational or a technological innovation. By using the PC Week articles, the this claim may be assessed by looking for the presence of different types of solutions for particular problems. For instance, in the International Institute of Finance, a Washington based bureau set up to assess and monitor Third world debt, the introduction of PCs led to a change in the working patterns of economists. PCs were placed in a central laboratory, where, it was found, employees

communicated ideas more freely than before (when they were in individual offices). This helped them better to appreciate an overall picture of Third world debt, and to exchange information which was useful in their individual analyses, but which they might not otherwise have used.

The "reverse salient"

PCs contain both a hardware and a software component. Problems associated with the use of personal computers may arise from the interaction of hardware or software, or both, with the social situation. Nonetheless, the notion of the "reverse salient" (Hughes, 1984) is a useful theoretical one for the purposes of this thesis. The reverse salient is a position on the leading edge of technology. At this point, implementation of the technology lags behind due to some critical problem (which may be technical, social, or both). The hardware and software aspects of PC technology are, for the purposes of this study, considered as parts of the same technology. Problems encountered in the implementation of PCs or software will cause the leading edge of the technology to lag behind in some areas. These problems must be identified and solved in either a technological or social fashion.

In the analysis of PC Week articles, attention is paid to the ways in which explicitly stated problems are solved. For instance, where a problem is common, it will often be documented in a computing newsletter within an organization. Staff trained in the use of computers will work to solve the problem and relay its solution to others through the newsletter. The newsletter may be considered as a feedback mechanism whereby critical problems are clearly identified, and their solutions fed back into the social system in which

the technology is implemented. Thus the leading edge of technology may advance further.

Care is taken in the content analysis of the articles to differentiate between hardware and software considerations (although strictly speaking they are considered part of the same technology).

Feedback

The PC Week "strategies" themselves can be considered a part of a feedback mechanism. They are published in order to show potential PC customers how PCs have been introduced into other organizations, and how problems have been solved in these organizations. Problems encountered and solved in the introduction of PCs to organizations (as reported in PC Week) provide information for others considering introduction of the technology. This feedback allows subsequent applications of the technology to be better adapted to particular circumstances. The technology is adapted to the organization while the organization to some extent adapts to the technology.

"Opinion Leaders"

From the study of PC Week strategies it is clear that certain "opinion leaders" Rogers (1983) are at least initially associated with the introduction of computers in organizations. One person may be made aware of a technology which is useful to the organization, perhaps by a technical representative from a computer company, an employee of a different company which has already successfully introduced PCs, or, as is often the case, a person who owns a computer at home. The opinion leader must have influence

within the organization and must be open to innovation. He or she will often

persuade other members of the organization to consider the introduction of PCs.

This may be a matter of providing a cost/benefit analysis to demonstrate the

possible advantages of PCs, or it may be a matter of demonstrating a

particularly innovative (possible) use of PCs within a particular division of the

organization. For instance, in many organizations, cost/benefit analyses must

provided before any division is provided with PCs. In other cases, individuals

may acquire a PC for their personal use and bring it to work, for example, to

make inventory control easier. This demonstrates to an organization that

computers can be gainfully employed, and encourages further (official) PC

purchases.

Centralization/Decentralization

The question of what implications PCs have for centralization and

decentralization is significant for the present thesis. Neither the technology

nor social factors alone can explain the changes occurring in the organizations

studied. The purpose behind examining interviews with members of these

organizations is to determine in what ways PCs have been incorporated into the

social structure. Centralization and decentralization are functions of the way

in which PCs are used in organizations, and it is possible to bring such issues

within the scope of this study, since both the organizational and technological

aspects of PC introduction are discussed in the PC Week articles.

Classification of Organizations

The types of organization analyzed are sorted into different

classifications. These classifications are necessarily broad, but allow some

assessment of the differential effects of PCs in different types of organization.

The classes are:- Financial services (e.g. banks, insurance, etc.), retail (e.g.

department stores), service (e.g. hotels, catering), administrative/bureaucratic

(e.g. local authorities, universities), manufacturing, and communications/media

(e.g. newspapers, TV stations, telecommunications company.

Hypotheses

From the literature outlined in Chapter 1, and the considerations above,

several preliminary hypotheses are proposed. The main assumptions of this

thesis are that organizational changes do occur due to the introduction of PCs,

and that PCs constitute a different technology from mainframe computers. The

hypotheses are stated along with their null hypotheses.

1) a) Centralization or decentralization in organizations is not due directly to

PC introduction. It is due, rather, to the way in which organizations arrange

themselves upon the introduction of PCs.

b) Centralization or decentralization is due directly to PC introduction.

2) a) PCs will differ in their organizational effects from mainframe computers.

b) PCs will not differ in their organizational effects from mainframe computers.

3) a) The introduction of PCs is in many cases sparked by the encouragement of

an "opinion leader".

 b) The introduction of PCs is not sparked by the encouragement of an "opinion

leader".

4) a) The success of PC introduction will vary according to the type of organizations.

b) The success of PC introduction will not vary according to the type of organization.

<div align="center">Content Analysis</div>

The articles are analyzed by defining themes from the hypotheses, and identifying these themes in the articles. One theme will usually be a sentence long. A dictionary of words associated with or acceptable to define particular themes is used (see appendix). Themes are counted and used to confirm or disconfirm the hypotheses. The results are tabulated in the appendix.

For example, one theme would be reference to centralization or decentralization. These actual words might not be used, making it necessary to define other words which would count as a reference to centralization or decentralization. For instance, the <u>distribution</u> of data to an "end-user" (the person who uses the PC) would count as a move towards decentralization (as also do references to self-contained units, independence, etc.). The <u>gathering</u> in of information to a centralized point would count as centralization. [4]

<div align="center">Reliability</div>

Similar articles from other computer magazines (<u>Datamation</u> and <u>Computer World</u>). A further reliability check is carried out by using a different

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[4] One article illustrates clearly the association of mainframes with centralized data, and PCs with decentralized data. "Our industry is so data rich, and I think we see mainframes as the repository of this data,"..."But we see the PC as a way to give each user their franchise, so that they can act independently and have information in a timely manner." (Connecticut Mutual Insurance, <u>PC Week</u>, 24th April, 1984.)

coder to code a sample of the articles. This sample is composed of an article from every year covered.

Organization and Processing

Themes from the content analysis are counted to measure support for the hypotheses and to suggest further issues. The main themes identified are 1) number of PCs, 2) productivity (a stated increase in productivity is taken as a measure of success of introduction), 3) centralization/decentralization, 4) training (that is, whether training occurred on PC introduction), 5) standardization (of hardware and/or software), and 6) justification (that is, whether requests for PCs by employees had to be justified).

Additional information, such as the date of interview, and the interviewers name, is listed in the appendix. The results are organized in groups (in tables, see appendix) according to year and type of organization. Changes over time in the interviews and differences in results according to differences in organization can thereby be assessed.

Discussion

PC Introduction

In almost all the articles surveyed, one division of the organization was responsible for the introduction of PCs. This might be the Information Systems (IS), Management Information Systems (MIS), the Data Processing department (DP) or the Information Center (IC). Information Centers are often set up specifically to take care of users needs in the process of, or in the wake of, PC introduction. MIS and DP, however, usually already work with the mainframe, and seem to comprise the most logical choices for a department to administer computerization.

MIS, DP or IC contain employees trained in the use of computers and programming. They may evaluate the employees' computing needs and set hardware and software standards accordingly. They are frequently responsible for training users in the new technology, although this function may be contracted to an outside agency. Their other main function is "user support". The users, that is, the people using PCs (or any computer) will encounter problems, particularly right after PC introduction. MIS, DP or the IC provide answers to questions, custom tailored computer programs for specific user needs, and may even service, (or administer the servicing of) machines.

PC Week articles usually contain an interview with at least one member of the staff in such departments. They also generally contain an interview with an employee who is not a computer expert but whose work has benefitted from the introduction of PCs. This person might have found some novel use for PCs or might be an "opinion leader", perhaps having pioneered the use of PCs in the

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organization before others were awake to their potential. Those who have done this are invariably portrayed as highly motivated individuals with the foresight to seize on a technology which allows them to do their job better. For example, in Fluor Corp. (PC Week, March 26th, 1985), "There was one project manager in particular who 'very much saw the direction IBM was moving in,'... This manager had his own IBM PC at home , and pushed for a pilot project to bring IBM PCs in ..." (p.42) Groups may also perform the function of opinion leaders. In the case of Wells Fargo Bank, (PC Week, November 6th, 1984) "individual groups are spearheading the PC movement."

Very occasionally, someone who doubts the benefits of PCs is also interviewed. While they are allowed to explain their opposition to PCs, they are have the semblance of anomalies within an environment receptive to PC technology. For example, the director of Yale Medical Center's Biomedical Computing Unit questions the advantages of PCs (PC Week,July 10th, 1984). While other members of his organization were apparently keen to put PCs to a variety of uses, this man "seems perplexed by the trend toward the desktop micro at Yale...'To me, the PC isn't technologically interesting. However, people around here seem to think otherwise.'" (p. 41)

Standardization

Often the types of PC chosen is affected by the type of mainframe which is already installed in the company. IBMs appear to be the most popular mainframe in the sample of articles, but this is more than likely because the

articles are requested from IBM or IBM compatible "shops"[5] . Since PCs are often

used as intelligent terminals as well as stand alone workstations, it may be

cost-effective to install a PC which can easily communicate with the

mainframe. Apart from being economically sound, such a move can also save

time and effort. If the microcomputers are not of the same make as the

mainframe, specialized software must be purchased or designed before the two

can communicate. Standardization of hardware and software also allows a

company to create a local area network (LAN). [6]

Although many mainframes were IBMs, the IBM PC was late coming into

the microcomputer market (1981). Often, organizations had already bought

microcomputers made by companies like Apple, Radio Shack and Osborne by the

time the IBM PC came out. Nevertheless, mainly because of its compatibility

with mainframes, organizations considered it (or an IBM compatible) worth the

extra investment.

Problems

One early "problem" associated with PCs was an inability on the part of

IBM to supply organizations with sufficient supplies of PCs. I use the term

"problem" guardedly, since a shortage of PCs may be taken to imply a lack of the

technology, rather than a difficulty associated with it. Since the articles are so

pro-PC, they are not unwilling to point out a problem which implies a great

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[5] A "shop" is a jargon term for the place where the
computers have been introduced. It is generally used where one
particular brand of computers (e.g. IBM) is used exclusively.

[6] A LAN is where a number of PCs are linked by cable in a
limited area. These networks can be linked over long distances
via telecommunications satellites.

demand for the technology.

However, a problem in the supply of a technology might also be taken as indication of a problem in the technological system which manufactures PCs. Information about the demand for PCs would be fed back to the manufacturers, who would then attempt to compensate, thus advancing the leading edge of technology. This is compatible with Hughes (1983) notion of the reverse salient described earlier. The lack of PCs would constitute a "critical problem" which would have to be solved before the technological front could advance.

Another problem associated with the initial introduction of the IBM PC concerned the lack of available software. When the IBM PC was launched, most of the software on the market was designed for other machines. Software was often therefore developed within the organizations which adopted the IBM PC. One interesting case was Connecticut Mutual Insurance (PC Week, April 24th, 1984), who commissioned W. H. Jones & Associates to design a word processing package which would run on IBM PCs, but which had similar capabilities to the Wang dedicated [7] word processors already in use. The result was a software package called "Multimate", which became an standard national package. [8]

Many companies with IBM PCs subsequently settled on Multimate as their standard word processing package. Standardization on particular software

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[7] A "dedicated" word processor denotes a piece of office equipment which is designed specifically for word processing. It is generally more expensive than a word processor, but cannot perform functions (such as spreadsheet analysis or database management) other than word processing.

[8] W. H. Jones & Associates even changed their name to "Multimate International".

packages is very common. There are several reasons for this:– 1) When standard software is used, files may be sent manually from one part of the company to another. Often an executive will type up a letter and have his secretary edit, print and send it. When software is standardized this is much easier. 2) Standardization of software is economically sound, since a company can buy a particular package in bulk, or else buy a site license [9] for the package, as happened at Pacific Gas and Electric (PC Week, January 8th, 1985). 3) One division of the company is usually primarily responsible for the training of personnel and for supporting computer users during any problems they might have. This division is usually very short staffed, since companies seem reluctant to spend much money training computer users. If they have only a small number of packages to teach and support, they can maintain a reasonable workload. If software packages proliferate, the support and training staff become overburdened, since it is difficult for them to be experts in all packages.

Since the available training staff is so limited, and companies often have many different divisions, individuals from each division will often be trained to train others in their group. This would be very difficult if there were an unlimited number of software packages in the company.

While it is difficult to demonstrate conclusively from the results of content analysis, it seems that the more centralized a company is before PC

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[9] A site license allows an organization to copy a software package and its manuals. This is cheaper to the customer than buying many copies of the same package. It also benefits the vendor in reducing their overheads.

introduction, the greater will be its demands for standardization. Highly centralized organizations generally required a fairly high degree of accountability on behalf of its employees. This would often involve sending electronic mail or floppy disks, probably to some central processing unit. In order to do this, software and hardware had to be relatively compatible, demanding at least some standardization.

Justification

In many articles the explicit reasons given for the introduction of PCs are economic. Time-sharing on mainframe computers is costly. Using a spreadsheet, like Lotus 1-2-3, an analyst can do calculations with a limited amount of data much faster and cheaper than on the mainframe. If such use is extensive (and it seems to be, from the articles), the PC quickly pays for itself.

However, especially when PCs were newly on the market, it was not obvious that they were cost-effective. While they had been successfully implemented in a number of places, no organization could conclusively guarantee that the PC would be successful for them. Therefore, when implementing PCs, many companies forced employees who wanted PCs to go through a justification procedure before they were provided with the technology. The justification procedures were of varying degrees of rigor, but most involved some kind of cost-benefit analysis.

Despite organizations requiring such a procedure, many personnel admitted that it was very difficult to quantify the benefits which PCs had, or could possibly, bring to their work. Since in many cases the PC allowed greater accuracy, for instance in the compiling of financial analyses, or allowed

employees to do things they couldn't do before, such benefits could not easily

be quantified in terms of such measures as man-hours (see Bechtel Corp., PC

Week, 27th March, 1984).

Training

While in most of the organizations there is some training, the tables are

to some extent deceptive. Most training appears to be almost perfunctory. It

seems that most companies would prefer to give their employees no training at

all, since it costs them money. In order to minimize costs and maximize the

returns from their employees, many companies will send PCs home with their

professional staff. They also may offer discounts if employees want to buy their

own PCs. In this way, employees can to a large extent train themselves in the

use of PCs, and may even do overtime without the company or organization

having to pay them for it.

Many organizations will give their staff software packages which will

teach them how to use PCs and software. This minimizes the amount of time

support staff need to spend with employees. Employees are encouraged to use

support services only when they have problems. As a further self-help device,

newsletters are instituted in a large number of companies. In the newsletter,

problems faced by several computer users will be documented and the solution

will be provided, either by support staff, or other employees. The newsletter

behaves as what can be described as a "feedback mechanism". When a problem

arises, it is addressed by the users and its solution fed back into the

technological system.

The Nature of the Materials

The articles upon which this analysis is based are undoubtedly biassed towards PCs. They are also patchy in character, particularly towards the end of the period studied. By this time, the authors of the articles appeared to assume that the reader knew rather a lot about PC introduction, since much information that was initially included was eventually left out (such as the number of PCs, the types of software used, facets of the organizations). They came to focus more on highly specialized, technical aspects of PC implementation (such as which is the best type of local area network to settle on).

Given that the articles are so pro-PC technology, it is interesting that the image of PC implementation which they suggest is not in the slightest technologically deterministic. The picture which they seem to portray is of the organizations implementing PCs determining to a very large extent the way in which PCs are organized. This may be a way of demonstrating to the organizational personnel who read the magazine that here is a useful **tool** which can help promote organizational interests.

Since the articles are so pro-PC, it is unlikely that they would include tales of organizations who had incredible difficulties with PCs. Therefore, it is not surprising that most of the companies have at least one positive productivity theme.

Support of the Hypotheses

Any support for the hypotheses is qualified by the biassed nature of the material. Any confirmation is gained from (to a large extent) points of view expressed by middle management. Clearly, the objectivity of the data is

severely limited. However, the hypotheses are assessed below in the light of the data while the subjectivity of the data is tacitly assumed.

Coding of the PC Week articles lends support to hypothesis 1 a), that is: Centralization or decentralization is not directly due to the introduction of PCs. There are a variety of centralization and decentralization concerns expressed within the articles themselves. These appear to be determined by the organizational structure and goals existing before the introduction of PCs. PCs are regarded in most of the articles as a tool whereby members of the organizations studied can achieve certain aims. For instance, a PC is a tool which can help process data more quickly and on a smaller scale than a mainframe. The aim of processing this data existed before the PCs were introduced, although the introduction of the PC may mean it can be done more cheaply or faster.

It is difficult to confirm or disconfirm hypothesis 2 a) given the nature of the results of the content analysis or from a reading of the articles. The only respect in which PCs can be said to different in their organizational effects from mainframes is in their increased portability and flexibility. However, an organization which puts a premium on centralization will organize their PCs in just as centralized a manner as they would around a mainframe. While many interviewees admitted that PCs could give them greater flexibility and freedom to work autonomously, others expressed reservations. Many organizations required rigorous justification procedures before individuals were allowed to use PCs. Those who required such procedures also tended to standardize on particular hardware and software.

PCs are now being used in many cases to perform functions previously done on the mainframe, and can thus hardly be regarded as radically different in their organizational impact. Mainframe use does not, however, usually decrease. In many cases it actually increases. The reasons for this are that use of the PC often acclimates employees to computing in general and that the mainframe is now freer to perform functions to which it is better suited (e.g. very large statistical analyses). One executive stated 'The main impact of the personal computer has been to educate the user to see more possibilities for using computers'.

There is limited support for the hypothesis that the introduction of PCs is sparked by an "opinion leader". Such a person was usually referred to as a "pioneer" (e.g. see Connecticut Mutual Insurance, PC Week, 24th April, 1984). Unless the interests of these individuals clearly coincided with those of the organization from the beginning, it took a long time before they were taken notice of. Alternately, there were a few extremely high placed executives in certain companies who were well disposed towards PCs. These people clearly made a difference. For instance, in McKesson (PC Week, 4th September, 1984) "there was great enthusiasm for the idea (putting a PC on almost every manager and executive's desk), but the project was dropped when it's sponsor left McKesson." In Fleet Financial (PC Week, 5th August, 1986), one senior vice president described another executive, "...' he sees part of his role as spreading the gospel of PCs for analytical purposes throughout the company, sowing seeds in the form of financial planning models.' He said that the message was getting through."

On a similar note, when a particular division of the company responsible for PC introduction wanted to gain support for PCs, they would target top management for training, before anyone else. Once top management saw the potential uses for PCs, they often threw more support behind them.

From the available data it is virtually impossible to say whether PC implementation is more successful in particular types of organization. PCs, while being introduced in various different types of organization, are often used to perform similar functions. Thus in a manufacturing company, a PC may be used to process employee payroll. It may be used to perform the same function in a retail company or in a government bureaucracy. It is therefore very difficult to conclude that a PC is more productive in one context than in another.

A historical reading of the articles strongly supports the point of view expressed in the literature reviewed. That is, from the perspective of the interviewees, PC introduction is not determined by the technology alone, but is also strongly influenced by social factors. Indeed, in the articles surveyed, PCs are regarded by most interviewees as a tool with which they can achieve organizational goals better. Thus in an organization which is strongly committed to centralization, PCs will be used in such a way as to reinforce that organizational pattern. The case is the same for an organization committed to decentralization.

A good example of this is the high tech company Tektronix (PC Week, 27th August, 1985), which was forced to reorganize when it found that many of its highly qualified personnel were leaving to set up their own, smaller

companies. These companies were in direct competition with Tektronix, and were located in the same geographical area. At the same time, the company was losing valuable human resources. Management made a decision to decentralize. A study on personal computer support was undertaken, which found that, "if decision making power is to rest with the individual employees, then so must the computing power. The report noted that since individual initiative was the cornerstone of Tek(tronics) philosophy, PC policies could not dictate strict hardware and software standards."

In contrast, companies which are highly centralized do tend to have rigorous justification procedures and strict standards in both hardware and software. For instance, at American Medical International (PC Week, 5th November, 1985), "... financial systems have become tightly standardized (and) we've had top management support for centralization." Such standards are enforced by technical staff refusing to support users when unapproved software or hardware causes problems, and by the organization refusing funds for unauthorized purchases.

Conclusion

According to the interviews surveyed, the decision to introduce PCs into organizations appears to depend largely on whether PCs are perceived by organizations contemplating their implementation to have been successful and popular in those where PCs have already been installed. Whether an organization uses mainframe or PC technology also appears to rely on this factor. Such a decision may also depend on company political and economic considerations. An organization which values either centralization or decentralization may base its decision on such political as well as technological criteria.

Cost-benefit types of analysis may become of prime importance when a centralized PC network is compared to a centralized mainframe. This is especially true where PCs are connected to the mainframe and used as terminals. In such a case, where economics take precedence, political decisions on centralization and decentralization often become irrelevant.

Middle Management

From the perspective of the interviewees, most of whom are middle-level managers, the PC is merely a tool which can be used to fulfil organizational aims. This is compatible with the picture of technology drawn by Alfred Chandler (1977). In his account, middle managers came to determine more than any other factor (e.g. technology, availability of capital or public policy) the course taken by American business. While not all the organizations studied in this thesis were businesses, the views expressed by middle managers in most of the organizations suggested support for Chandler's hypothesis. The term "tool"

arose in reference to PCs in almost every article. That PCs appeared to reinforce the existing power structure (centralized or decentralized) also suggests PCs were not seen as a determining factor in organizational change.

Innovation

Despite PCs being regarded by interviewees as merely a tool, they may be classified as an "innovation" by Ruttan's (1959) definition. He described an innovation as a change in the production function, where the production function is a resultant of capital, labor and technology. The introduction of PCs is the introduction of a new technology. Interviewees commonly referred to the money which PCs had saved their organizations, while others suggested that more work was being done with the same amount of personnel. These factors combined satisfy Ruttan's conditions for innovation. Since software is considered for the purpose of this thesis as a part of PC technology, and software is continually being developed, there is a certain amount of innovation going on in organizations even after PC introduction.

Diffusion and Feedback

The PC Week "Strategies" sections to some extent act as a method of communicating small and large innovations to a wide audience. Problems addressed and solved are described for the benefit of organizations which might be looking into the pros and cons of PC implementation. Newsletters, which are frequently distributed throughout the organizations studied, can also be regarded in this light, although their audience is limited to the individual organization. These pamphlets are a vehicle for tips on PC use, for the airing of problems associated with PCs, as well as their solutions. Information Centers,

Data Processing departments and Management Information Systems often act in a similar way. Rather than actively disseminating in ormation, however, they wait for the PC user to come to them for the solution to problems and further information on possible PC uses.

I suggest that the "Strategies", newsletters, and the above departments are both 1) mechanisms by which PC technology is diffused and 2) feedback mechanisms for assessments of and critical problems (from Hughes, 1983) in, PC technology. Thus, as in Pitt's (1983) model of technology, the knowledge base associated with PCs is constantly being upgraded.

Where is the reverse salient?

Since the organizations studied here are so diverse, and are not in general connected in any coherent way, it is hard to see where the reverse salient of PC technology can be identified. This study would have to be greatly extended to allow a clear picture of the leading edge of PC technology. Any such study would be further complicated by the fact that PCs are a technology still under development. As soon as a study came out, it might be instantly out of date. However, for the present purposes, I suggest that there are many small leading edges of technology and many minor critical problems which are constantly addressed within individual organizations. Each organization has slightly different problems which it aims to solve by using PCs. Therefore problems which each encounters in PC introduction are also likely to vary. The notion of a reverse salient is thus of limited use in this thesis, except on a very small scale, a different one than Hughes intended.

Changes in the Workforce?

Any support for the ILO (1980, 1983) studies, and for Gotleib and Borodin (1973) is strictly limited and anecdotal. Since the articles studied were biassed towards a management perspective and PCs, it would be surprising if they included much information on problems with labor relations due to the new technology. However, there were several hints as to the effects on employment and the changing quality of jobs due to PC introduction.

Gotleib and Borodin's (1973) and the ILO (1980, 1983) suggest that computers will not actively reduce manpower, but will slow down an increase in manpower. This is borne out in several interviews. Some executives suggested that had PCs not been introduced into their organization, they would not have been able to meet their obligations, since they did not take on extra employees. In the "Strategies", PCs are mainly used by highly paid personnel. If the productivity of these personnel is increased using PCs, it is not necessary to employ more people, even if demand for their services increases. Were PCs being used only by low-paid secretarial staff, they might not be so cost-effective.

For instance, at Kennedy space center (PC Week, 3rd September, 1985), one manager elaborated, "People want to know 'when are we going to see a payback? When are you going to be able to fire 100 people?' he noted, however, that the Kennedy launch operation has struggled to meet a growing launch schedule with a workforce that has remained stable."

Information provided in PC Week is consistent with another Gotleib and Borodin (1973) hypothesis, namely, that indirect labor, in the form of support staff for computers, can compensate for job losses. Many of the staff

interviewed were employed specifically to help in the introduction and use of PCs. However, these people were often few in number, and could barely keep up with the demand for their services. An emphasis was therefore placed on self-help on the part of PC users.

The notion that bi-polarization (ILO; 1980, 1983) occurs due to the introduction of PCs is confirmed by some of the articles which discuss the relationship between managers and their secretaries. More managers are starting to write their own memos and letters, which can free some secretaries from routine tasks and allow them to perform more executive functions. For instance, at New York Life Insurance (PC Week, 2nd April, 1985), "With communications and sales illustration software right in the office, secretaries can handle illustrations and Master Record Briefs requests... a number of agents buy a second PC for their secretaries, which has led to secretaries taking a wider role in the insurance business."

<div align="center">An Alternative Scenario</div>

The perspective of the interviewees in the articles studied (including those in Datamation and ComputerWorld) is one of middle management using PCs as a tool. However, an alternative view of PC implementation is possible.[10] It is impossible to tell whether the testimony of the interviewees is reliable, since there are no outside controls in this study. Therefore, instead of PCs being a tool for middle management to better achieve organizational ends, they could be a middle management fad. That is, these managers may have implemented

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[10] Personal communication, Dr. Ellsworth Fuhrman, August 1988.

PCs on such a large scale out of a desire to keep up with a fashion trend. With no outside measure of productivity in this thesis, the justification for PC implementation is thrown into question. The numerous themes of productivity (see Appendix A) appearing in almost every article could be mere opinion.

Suggestions for Further Research

In order to test the reliability of the picture given in this thesis, or the alternative scenario above, independent measures of productivity (as well as the other themes as coded in Appendix A) are necessary. Such measures might include a study of company records, year-end reports, tax information and employment records. Since these are not totally independent, they could be supplemented by government employment, productivity and tax information. Confirmation of the above thesis would demonstrate middle managers' perception of PCs in organizations to bear at least some relation to reality (that is, at least a reality as perceived by government studies).

Summary

"Strategies" sections from PC Week magazine were coded using content analysis for themes which would shed light on the hypotheses (outlined in Materials and Methods). The articles were also read from an historical point of view.

The coding results (see Appendix 1) showed no support for the hypothesis that PCs have different organizational effects from mainframes. Mainframes are not discussed at any length in the articles, making any contrasts between mainframes and PCs difficult to assess. No support was gained for the hypothesis that PCs are more successful in particular types of organizations. Productivity was taken as a measure of success. Because the articles are so pro-PC, there were positive productivity themes in most of the articles, making it hard to differentiate between success in different types of organization.

Support was gained for the hypothesis that centralization or decentralization is **not** caused directly by PC introduction. Limited support could be elicited for the notion that the introduction of PCs is sparked by an "opinion leader".

The results of an historical reading of the articles confirmed several theoretical ideas outlined in the literature review. These ideas included Chandler's (1977) proposal that middle managers are of prime importance for the organization of American business, Ruttan's (1959) theory of innovation, Hughes (1983) notion of the reverse salient, and concepts introduced by the ILO (1980, 1983) and Gotleib and Borodin (1973). The latter two concerned changes

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in working environments during and after the introduction of PCs, and were supported by anecdotal evidence from the "Strategies".

However, any confirmation or disconfirmation of the hypotheses is tempered by the fact that the articles are so biassed towards both PCs and middle management. Consequently, independent measures would be required to test the validity and reliability of this thesis.

Bibliography

Attewell, P. & J. Rule. "Computing and Organizations: what we know and what we don't know", Communications of the ACM, Vol. 27 (1984), 1184-1192.

Beheshtian, M. "Personal Computers and Decision-makers", Journal of Systems Management, May (1986), 32-35.

Berting, J., S.C. Mills & H. Wintersberger. The Socioeconomic Impact of Microelectronics, Oxford: Pergamon Press, 1980.

Blauner, R. Alienation and Freedom. Chicago: University of Chicago Press, 1964.

Calhoun, C. "The Microcomputer Revolution? Technological Possibilities and Social Choices", Sociological Methods and Research, Vol. 9 (1981), 397-437.

Cerveny, R. P. & D. A. Joseph. "Large Business Organizations' Use of PC Technology", Journal of Systems Management, (June, 1986), 14-17.

Chandler, A. D. The Visible Hand. Cambridge, Mass.: Harvard University Press, 1977.

"Computers, People and Productivity", Journal of Organizational Behavior Management (special issue), Vol. 6 (1985).

Cooper, C. M. & J. A. Clark. Employment, Economics and Technology. New York: St Martin's Press, 1982.

Danziger, J. N. "Social Science and the Social Impacts of Computer Technology", Social Science Quarterly, Vol. 66 (1985), 3-21.

Drucker, P. Innovation and Entrepreneurship. New York, Harper and Row, 1984.

Gotleib, C. C. and A. Borodin. Social Issues in Computing. New York: Academic Press, 1973.

Holsti, O. R. Content Analysis for the Social Sciences and Humanities. Reading, Mass.: Addison-Wesley publishing Co., 1969.

Hounshell, D. A. From the American System to Mass Production. Baltimore: Johns Hopkins University Press, 1984.

Hughes, T. P. Networks of Power. Baltimore: Johns Hopkins University Press, 1983.

International Labor Office. The Effects of Technological and Structural Changes on the Employment and Working Conditions of Non-manual Workers. Geneva: International Labour Office, 1980.

_____. The Effects of Structural Changes and Technological Progress on Employment in the Public Service. Geneva: International Labour Office, 1983.

King, J. L. "Centralized versus Decentralized Computing: organizational considerations and management options," Computing Surveys, Vol. 15 (1983), 319-349.

Mankin, D., T.K. Bikson & B. Gutek. "Factors in Successful Implementation of Computer-Based Office Information Systems: a review of the literature with suggestions for other OBM research," Journal of Organizational Behavioral Management, Vol. 6, Nos. 3/4.

Mansfield, E. The Economics of Technological Change. New York: Norton, 1968.

Mansfield, E., J. Rappaport, A. Romeo, E. Villani, S. Wegner & S. Husic. The Production and Application of New Industrial Technology. New York: Norton, 1977.

Mowshowitz, A. "Social Dimensions of Office Automation," Advances in Computers, Vol. 25 (1986), 335-403.

Perolle, J.A. "Intellectual Assembly Lines: the rationalization of managerial, professional and technical work," abstract.

Pitt, J.C. "The Epistemological Engine," Philosophica, No. 2 (1983), 77-95.

Rogers, E.P. Diffusion of Innovations. New York: Free Press, 1983.

Ruttan, V. "Usher and Schumpeter on Invention, Innovation and Technological Change. Quarterly Journal of Economics. (1959), 596-606.

Simon, H.A. "The Consequences of Computers for Centralization and Decentralization," in M. Dertouzos and J. Moses (eds.). The Computer Age. Cambridge: MIT Press, 1979.

Utterback, J. "The Process of Technological Innovation Within the Firm," Academy of Management Journal, Vol. 14 (1971), 75-88.

Weber, R.P. Basic Content Analysis. Beverley Hills: Sage Publications, (1985).

Weber, R. "Computer Technology and Jobs: an impact assessment model," Communications of the ACM. Vol. 31 (1988), 68-77.

Appendix A

Materials Surveyed

PC Week "Strategies" sections were coded for indications of:
1) The number of PCs in the organization.
2) Decentralization associated with the introduction of PCs (e.g. PCs might be used to help pursue an old, or recently implemented policy of decentralization [or centralization]).
3) Centralization associated with the introduction of PCs.
4) Increased productivity associated with the introduction of PCs (e.g. PCs might have saved a certain amount of money, allowed staffing levels to be kept constant while productivity increased, or allowed staffing levels to be reduced while productivity was maintained).
5) Standardization of hardware and/or software (i.e. an organization may have dictated which standard equipment is to be implemented, while enforcing this by denying user support or financial support for unauthorized alternatives).
6) Justification of requests for PCs. An employee who wishes to be assigned a PC may have to go through a justification procedure (e.g. cost/benefit analysis) before being granted the request.

The results of the coding are presented in the tables below. Not all articles surveyed are are present in the tables, since several had no identifiable codes. A plus (+), or multiple of a plus represents a positive attitude expressed in the theme present in the article, while a minus sign (−), or multiple thereof) represents a negative attitude. For instance, a positive them of centralization would be constituted by an interviewee stating that PCs are helping his/her company to achieve greater centralization, and so on.

A Note on Classifications

The classifications are necessarily broad and, unfortunately, in one or two cases, arbitrary. This was necessary in order to limit the number of classifications. Thus, for example, wholesale distributors are classed as retail, book publishers are classed as manufacturing, and management consultants are classified as service industries.

Key

Financial Services = banks, insurance companies, brokerages, etc.

Retail = department stores, retail chain stores, etc.

Service Industry = catering (e.g. restaurant chains, hotels), transport services. utilities, entertainments (e.g. TV, newspapers, casinos), management consultants, etc.

Administrative/Bureaucratic = government bureaus, local governments, federal and state government organizations (e.g. state health departments), universities, etc.

Manufacturing = traditional heavy industry. such as steel manufacturers and car manufacturers, chemical companies, consumer goods manufacturers, etc.

\# = number of PCs in the organization
D = decentralization
C = centralization
P = productivity associated with PCs
S = standardization (usually in both PCs and software)
J = justification, required of users before they are given PCs
O.L. = opinion leader
T = training
+ = positive theme (e.g. a positive attitude was expressed)
− = negative theme (e.g. disapproval was expressed)
~ = estimated number
> = more than

Table 1

Financial Services

1984

	Price[11] Waterhouse	Connecticut Mutual Insurance	Chemical Bank	Bank of New England	Coopers & Lybrand[12]
#	700	300	600	90	
D	+				
C					
P	+	+	+	+	+
S		2+	–	+	–
J		+	–		
OL		+			
T		–		+	2+
N=	4	7	4	4	3

---

[11] Accountants.

[12] Accountants.

Table 1 (contd.)

Financial Services

1984

	Metropolitan Life	Harris Bank	Shearson/ American Express	Wells Fargo Bank	Trans- America
#	300	80	500		120
D				+	
C	+				
P	2+	2+	+		2+
S				+	2+
J		+			
OL				2+	
T	3+		3+	+	
N=	7	4	5	5	5

Table 1 (contd.)

Financial Services

1985

	L.F. Rothschild, Unterbers, Towbin[13]	New York Life Insurance	Charles Schwab & Co.[14]	Blue Cross & Blue Shield
#	50		200	50
D				
C				
P	+	2+		
S			+	+
J				+
OL				
T				2+
N=	2	2	2	5

---

[13] Brokerage firm.

[14] Discount brokerage firm.

Table 1 (contd.)

Financial Services

1985

	Home Life Insurance Co.	American Medical Insurance	Security Pacific National Bank
#	200		3000
D			2+
C		3+	
P	+		2+
S		+	
J			
OL			
T	3+	+	2+
N=	5	4	7

Table 1 (contd.)

Financial Services

1986

	Visa USA & Visa International	Kaiser Foundation Health Plan	First Interstate of California	US Bancorp
#		300	500	˜165
D		+		
C	2–			
P				+
S		+	–	–
J		+		
OL				
T		+	+	+
N=	2	5	3	4

Table 1 (contd.)

Financial Services

1986

	Deloitte Haskins & Sells	John Hancock Financial Services	Prudential Insurance Co.	Fleet Financial Group
#	2000	1000	3000	150
D	2+			
C		+		
P	+		+	
S	+		+	+
J	+	+		+
OL				
T	+	+		2−
N=	7	4	3	5

Table 2

Retail

1984

	Avon	McKesson [15]
#	4000	40
D		+
C	+	2-
P		+
S		
J	+	
OL		+
T		
N=	3	6

---

[15] Distributor of consumer goods and pharmaceuticals.

Table 2 (contd.)

Retail

1985

	Bloomingdales	National Video Inc.	Recreational Equipment Inc.[16]
#	80	100	>100
D			
C			+
P	+		2+
S	+	+	+
J	+		
OL			
T		+	2+
N=	4	3	7

---

[16] Chain of stores which sells sporting gear.

Table 2 (contd.)

Retail

1986

	Belk Stores	Carter Hawley Hale Stores Inc.	Neiman-Marcus	Giant Food Inc.
#	220	560	100	125
D	3+	−		
C		3+	+	
P	+	+	+	
S	2+	+		+
J				
OL				
T		+		
N=	7	8	3	2

Table 3

Service Industry

1984

	Sprint[18]	Public Service of New Hampshire	A.D.[17] Little	Ramada Inns	Resorts Intl.[19]
#	100		˜100		60
D	2+				
C					
P		+	2+		
S	–	+			
J		+			
OL					+
T	2+	+		+	
N=	6	4	3	1	2

---

[17] Management and research consultants.

[18] Long distance telephone company.

[19] Company which owns and runs casinos.

Table 3 (contd.)

Service Industry

1984

	Florida Power & Light	American Airlines	Oakland Coliseum	ABC News	American Auto. Association
#	225	25	14	207	120
D					
C				+	
P	3+	+		2+	2+
S	2+	+			
J	+	+			
OL					
T	+	+	2+		+
N=	8	5	3	4	4

Table 3 (contd.)

Service Industry

1984

	Columbia Pictures	New York Times
#		90
D	+	
C		
P		+
S		+
J		
OL		
T		+
N=	1	4

Table 3 (contd.)

Service Industry

1985

	Pacific Gas & Electric	Pacific Bell	Portland General Electric	
#	1500	5000	>150	
D				
C				
P	+		+	
S	+		−	
J		+		
OL				
T	2+	+	2+	
N=	5	3	5	

Table 3 (contd.)

Service Industry

1985

	Portland General Electric	Holiday Inns	Penn. Central Corp.[20]	Transway Intl.[21]
#	>150	900	˜60	200
D		+		
C		−		
P	+	+	+	+
S	−		+	
J				
OL				
T	2+			+
N=	5	4	3	4

---

[20] Railroad Company.

[21] Goods transportation company.

Table 3 (contd.)

Service Industry

1986

	Burger King	Wendy's Intl. Inc.	Knight– Ridder[22]	Bell Canada	Airborne Express
#	˜300	260	480	1800	>200
D	+				
C					
P			+·	+	2+
S				2+	+
J		+			
OL					
T	+	+		+	2+
N=	4	3	2	5	6

---

[22] Knight-Ridder publishes several newspapers, including the Miami Herald.

Table 3 (contd.)

Service Industry

1986

	McKinsey & Co.[23]	Georgia Power	Harbridge House[24]	Manpower Inc.
#	6-700	554	40	1800
D		2+		
C	+			
P	+		2+	+
S	+	+		
J				
OL				
T	+	+	+	+
N=	5	5	4	3

---

[23] Management consultants.

[24] Management consultants.

Table 3 (contd.)

Service Industry

1986

	Southern Pacific Railroad	Leaseway Transportation Corp.
#	350	˜400
D		
C		+
P	+	
S		
J		
OL		
T	+	
N=	3	2

Table 4

Administrative/Bureaucratic

1984

	University of California Office of the President	Yale University	Federal Home Bank Board	New Jersey Dept. of Public Health
#	70	300	30	27
D	+		+	
C				−
P				+
S	+		+	
J				
OL				+
T	+			+
N=	4	1	3	5

Table 4 (contd.)

Administrative/Bureaucratic

1984

	Georgetown University	U.S. Postal Service
#	few hundred	250
D		
C		
P		+
S		
J		
OL		+
T	2+	+
N=	3	4

Table 4 (contd.)

Administrative/Bureaucratic

1985

	State Legislature of Alaska	Govt. of Tampa, Florida	U.S. Census Bureau	National Park Service
#	50	27	508	
D				+
C				
P	2+	+		
S		+		2+
J				−
OL				
T		2+	+	
N=	3	5	2	4

Table 4 (contd.)

Administrative/Bureaucratic

1985

	University of Delaware	House of Representatives	Virginia Polytechnic & State University	NASA
#		300	>4000	4000
D				2+
C			−	
P		+		
S		+	−	
J			3+	
OL				
T	2+	+		
N=	2	4	6	3

Table 4 (contd.)

Administrative/Bureaucratic

1986

	The Univ. of Madison, Wis.	St. Barnabas Medical Center	The Univ. of Waterloo	Cornell University	Inst. of Intl. Finance
#	4,500	35	3–10,000	˜6000	23
D	+		2+	+	
C					
P		2+			
S		+	+	+	
J					
OL					
T					+
N=	2	4	4	3	2

Table 4 (contd.)

Administrative/Bureaucratic

1987

	Los Angeles Police Dept.
#	2
D	
C	
P	+
S	
J	
OL	
T	
N=	2

Table 5

Manufacturing

1984

	Ciba-Geigy	Martin-Marietta	Dennison	Bechtel Corp.	Allergan
#	100			450	117
D					
C				+	
P	+		+		2+
S		+	+	+	+
J					
OL			+	+	
T	+	−		+	
N=	4	2	3	5	4

Table 5 (contd.)

Manufacturing

1984

	Bendix	Addison-Wesley	Clairol	Coca-Cola USA	Georgia-Pacific
#	20	40	56		~200
D		+			2+
C			+		
P	2+		+		+
S	+		2+	+	+
J	+				
OL					
T	+		+	+	+
N=	6	2	6	2	6

Table 5 (contd.)

Manufacturing

1984

	Levi Strauss	Pfizer Pharmaceuticals	Readers Digest	BMW
#	370	<200	75	
D			–	+
C			2+	
P	2+	3+		4+
S	+		+	
J		+	+	+
OL				+
T		+	3+	
N=	4	6	9	7

Table 5 (contd.)

Manufacturing

1985

MITRE		FMC Corp.	General Foods	Time Inc.	Coats Paton plc	Coats & Clark USA
#	100	600	600			
D				+		3+
C			+			
P		+		+	+	
S	+	+		−	2+	+
J						
OL						
T		+	3+	+		+
N=	2	4	5	4	3	5

Table 5 (contd.)

Manufacturing

1985

	Fluor Corp.	Lawrence Livermore Nat.l Lab.	Petrolane Inc.	Intel Corp.	Chevron-Gulf
#	400	2800		1000	2200
D					
C					2+
P	+	+	2+	+	2+
S	+		+	2+	+
J				2+	+
OL	+				
T	2+			3+	2+
N=	6	2	3	9	9

Table 5 (contd.)

Manufacturing

1985

	Fire-stone Tire & Rubber	Grummun Aerospace	Tektronix	Sun-Diamond	Canadian Pacific
#	>500	˜500	2000	˜25	600
D			+		
C			−	+	+
P		+	2+	+	2+
S			−	+	
J	+				
OL					
T		+	2+	+	
N=	2	3	8	5	4

Table 5 (contd.)

Manufacturing

1985

	Clorox Co.	Kodak	SmithKline Beckman	Gillette	West Point Pepperell
#	˜300	4000	3200	400	200
D		2+	3+	+	+
C					
P	2+	+	+	+	+
S	2+	−	2−	−	2+
J	2+		+	2+	2+
OL					
T	3+	+	+	+	+
N=	10	6	9	7	8

Table 5 (contd.)

Manufacturing

1986

	Nabisco	Ocean Spray	Merck & Co.	Pills- bury	Campbell Soup Co.
#	1300	65	1000	700	861
D					+
C					
P	+	+			2+
S	+		+	+	
J		+	+		2+
OL					
T		+		+	
N=	3	4	3	3	6

Table 5 (contd.)

Manufacturing

1986

	Reynolds Metal Co.	Steel-case Inc.	Johnson Controls Inc.	Schwinn Bicycle Co.
#	650	>500	~900	35
D			+	
C				
P	2+	2+		
S		+		
J	+			
OL				
T	+		+	+
N=	5	4	3	2

Table 5 (contd.)

Manufacturing

1987

	Tanner Southwest[25]	General Electric	Forest Products Lab.	Del Monte Corp.	Polo Ralph Lauren
#		26000	˜500	550	
D					
C		−			+
P	+		2+		2+
S					
J			+		
OL					
T					
N=	1	2	4	1	3

---

[25] Construction company.

Table 5 (contd.)

Manufacturing

1987

	Wickes Corp.	GE Answer Center	Land-O-Lakes	Louisiana Pacific Corp.[26]
#			˜75	˜150
D			−	
C				
P	+	3+	2+	+
S				
J			+	+
OL				
T	2+	+		−
N=	3	4	5	4

---

[26] Forest products.

Table 6

Total Scores

	Financial Services	Retail	Service Industry	Administrative/ Bureaucratic	Manu- facturing
#[27]					
D	6	3	7	9	16
C	3	4	2	-2	8
P	20	7	26	9	64
S	8	7	10	8	23
J	7	2	5	2	23
OL	1	1	1	1	2
T	20	4	25	12	38
N=[28]	108	42	99	66	230

---

[27] Total number of PCs in each class has been excluded since a) there are different numbers of companies in each group and b) to average these out over the number of organizations would be meaningless, since they are of varying size and structure and since some do not give the number of PCs in their organization.

[28] Since N represents the total number of themes coded for in the articles, # is still included. Therefore, the columns do not add up to N=.

Table 7

Strategies in Other Magazines

1987

	Mellon Bank	Adolph Coors Co.
#		
D		
C		
P	+	
S		+
J		
OL		
T		
N=	1	1

Table 7 (contd.)

Strategies in Other Magazines

1987

	Tenneco Inc.[29]	Monsanto[30]	Heinz	Pillsbury
#				
D		+		+
C				
P	+		+	
S			+	
J				
OL				
T				
N=	1	1	2	1

---

[29] Oil Company.

[30] Chemical company.

Strategies (in PC WEEK)
1984

February
28th
Jenkins, A. `Avon Puts a New Face on PC Usage'

March
6th
Paul, L. `IBM's PCs Create'
13th
Duffy, R. `Personal Computing Blasts Off at Martin Marietta' 20th
Frazier, D. `PCs Bring New Ideas to 101-Year -Old Dennison'
27th
Paul, L. `Bechtel Corp. Constructs Organized'

April
3rd
Paul, L. `Sprint'
10th
Jenkins, A. `Price Waterhouse'
17th
_____ `PSNH Plugs Into PCs'
24th
Kramer, K. `Connecticut'

May
1st
Kramer, M. `Chemical Bank'
8th
Ruby, D. `Consultant, Heed Thyself'
15th
Mandell, P. `Counting on Competitive'
22nd
Jenkins, A. `Ramada Inns Plays Host to PCs'
29th
Ruby, D. `Telecommuters' PCs Support Allergan Clinical Research Staff'

June
5th
Jenkins, A. `Slot Machines, Con Artists and Microcomputers'
12th
Pallatto, J. `Bendix Engineers Build Custom Quality Control Program'
19th
Ruby, D. `The University of California Office of the President'
26th
Pallatto, J. `Florida Power and Light Extending its Reach With Pcs'

July
3rd
Jenkins, A. `Coopers & Lybrand Counts IBM Among its PCs'
10th
Porter, M. `PCs Go Ivy League'
17th
Pallatto, J. `PCs Take Off'
24th
Ruby, D. `Metropolitan Life: pcs insure efficient management'
31st
Jenkins, A. `Addison-Wesley: pcs replace blue pencils'

August
7th
Mandell, P. `Clairol Colors Its World With PCs'
14th
Ruby, D. `PCs Capitalize on Opportunity'
21st
Pallatto, J. `Coca-Cola USA: pcs are the real thing'
28th
Porter, M. `Oakland Coliseum'

September
4th
Littman, J. `McKesson: pcs keep the information flowing'
11th
Ruby, D. `Micros Keep Watch on the Savings Industry'
18th
Pallatto, J. `Georgia-Pacific'
25th
Jenkins, A. `Shearson/American Express: pcs meet the big board'

October
2nd
Greitzer, J. `PCs Are Woven Into Company Plan'
9th
Ruby, D. `PCs in Public Health'
16th
Mandell, P. `Georgetown University'
23rd
Porter, M. `Drug Industry, PCs Booming at Pfizer'

November
6th
Littman, J. `Wells Fargo Bank'
13th
Ruby, D. `Reader's Digest: pcs tell a lasting story'
20th
Jenkins, A. `AAA: managing the hotline'

27th
Porter, M. `PCs Get Top Billing at Columbia Pictures'

December
4th
Greitzer, J. `Transamerica'
11th
Ruby, D. `BMW: PCs in the Fast Lane'
18th
Mandell, P. `At the US Postal Service, PCs Deliver'
25th
Littman, J. `Managing the News That's Fit to Print'

1985

January
8th
Littman, J. `PG & E: utility gains power with pcs'
15th
Porter, M. `L.F. Rothschild, Unterbers, Towbin: investing in compaq'
22nd
Littman, J. `Pacific Bell: networking pcs'
29th
Pallatto, J. `Local Area Networks: running the automated factories of the future'

February
5th
Zonderman, J. `Fitting PCs Into Academia'
12th
Jenkins, A. `Mitre'
19th
Pallatto, J. `FMC Corp: PCs, Wangs link conglomerate's diverse product lines'
26th
Jelcich, S. `General Foods: getting pcs and people working together'

March
5th
Ruby, D. 'PCs Are Still Machine of the Year at Time Inc.'
12th
Mullins, N. 'The Thread That Binds'
19th
_____. 'Thread Maker Outfits its Mills With a Tailored PC Network'
26th
Mandell, P. 'No More Us and Them'

April
2nd
Zonderman, J. `Starting From the Top'
9th
Zarley, C. `Spanning the Alaska Wilderness'
16th
Greitzer, J. `Charles Schwab and Co. Inc.: pcs are a lucrative part of the portfolio'
23rd
Mullins, C.J. & N.C. `A Well-Oiled Machine'
30th
Ruby, D. `PCs and CRAYs Make an Odd Couple at a Weapons Lab'
(Lawrence Livermore).

May
7th
Mandell, P. `Census Bureau Automation Will Make Counting Americans as Easy as 1,2,3'
14th
Jenkins, A. `Managing Majestic Resources'
21st
Zarley, C. `Pioneer Hi-Bred International Sees in PCs the Seeds of Farmers' Survival'
28th
Littman, J. `Like Money in the Tank'

June
4th
Pallatto, J. `At the University of Delaware, PCs Expand Into the Humanities'
11th
Rubin, C. `Intel Corp.'
18th
Mandell, P. `PCs Are Working on the Railroad'
25th
Ruby, D. `PCs Take a Seat in the House of Representatives'

July
2nd
Littman, J. `PCs Keep the Gears Oiled in the Chevron-Gulf Merger'
9th
Zarley, C. `Portland General Electric Adds Voltage With PCs'
16th
Jenkins, A. `Firestone Tire and Rubber: "rust bowl" behemoth uses pcs to keep budgets low, creativity high'
23rd
Mandell, P. `Bloomingdales: surviving the retail downturn pc style'
30th
Littman, J. `PCs Fill a Vacancy at Holiday Inns'

August

6th
Porter, M. 'Insurance Courier Prescribes PCs for Paperwork Ills'
13th
Jenkins, A. 'Head of the Class'
20th
Ruby, D. 'Grummun's Productive PCs'
27th
Zarley, C. 'Turning Tektronix Around'

September

3rd
Pallatto, J. `Keeping NASA Flying'
10th
Zarley, C. `Captains of Video'
17th
Jelcich, S. `Home Life Insurance Co.'
24th
Greitzer, J. `Sun−Diamond Growers: fruit−nut co−op uses pcs to prune inefficiencies'

October

1st
Mandell, P. `Canadian Pacific Ltd.'
8th
Zondeman, J. `PCs Help Reorganize Penn Central Corp'
15th
Porter, M. `PCs Computerize Transway'
22nd
Zarley, C. `PCs Give Forestry−Products Firm a Sharp Market Edge'
29th
Straube, M. `Cooperative's Farmer Share Information For Better Harvests, Higher Profits'

November

5th
Guttman, M.K. `AMI: pcs offer urgent care for hospital management'
12th
Greitzer, J. `Early Start With PCs: waiting for ibm wouldn't wash with clorox co.'
19th
Zarley, C. `Recreational Equipment Inc.'
26th
Bryant, S. `Security Pacific National Bank'

December

3rd
Pallatto, J. `Kodak Develop an Innovative Strategy'
10th
Zarley, C. `SmithKline Beckman'

17th
Jenkins, A. `Looking Sharp With Fewer Micros'
24th
Ruby, D. & Call, B. `Micros at the Mill'

1986

January
7th
Mandell, P. 'PCs Join Fast-Food Battle'
14th
Winkler, C. 'Cooking With Custom PCs'
21st
Mandell, P. 'Ocean Spray Concentrates on PCs'
28th
Winkler, C. 'Merck & Co.'

February
4th
Zarley, C. `Wendy's International Inc.'
11th
Ruby, D. `PCs Cook Up New Business at Pillsbury'
18th
Jenkins, A. & Dech, L. `Visa USA and Visa International'
25th
Rubin, C. `Kaiser Foundation Health Plan'

March
4th
Pallatto, J. `PCs At Knight-Ridder'
11th
Ruby, D. `Office System Outshines PCs at Bell Canada'
18th
Littman, J. `Alza Corporation'
25th
Zarley, C. `Airborne Express'

April
15th
Jelcich, S. `PCs and Non-Profit Oganizations'

May
6th
Urrows, H. & E. `Campbell Soup Company'
13th
Greitzer, J. `First Interstate of California'
20th
Call, B. `St. Barnabas Medical Center'
27th

Jenkins, A. `Georgia Power'

June
3rd
Kramer, M. `The University of Waterloo'
10th
Zarley, C. `US Bancorp'
17th
Ruby, D. `Reynolds Metal Company'
24th
Karon, P. `Deloitte Haskins and Sell'

July
1st
Jenkins, A. `John Hancock Financial Services'
8th
Pallatto, J. `Prudential Insurance Co.'
15th
Greitzer, J. `Carter Hawley Hale Stores Incorporated'
22nd
Kramer, M. `Harbridge House'
29th
Call, B. `Cornell University'

August
5th
Ruby, D. 'PCs Bring Culture Shock to Fleet Financial Group'
12th
Karon, P. `Manpower Incorporated'
19th
Zarley, C. `Steelcase Incorporated'
26th
Burns, D. & S. Venit `Can PCs Help Save the Southern Pacific Railroad?'

September
2nd
Pallatto, J. `Neiman-Marcus'
9th
Pallatto, J. `Leaseway Program Keeps Trucks on the Move'
16th
Karon, P. `Johnson Controls'
23rd
Jenkins, A. `Artificial Intelligence Meets Practicality'
30th
Zarley, C. `Giant Food Inc.'

October
6th
Gralla, P. 'A New Photo Technology for an Old World'

14th
Karon, P. `Getting a Handle on Third-World Debt'

November
10th
Wilkinson, S. 'PCs pull Firm From Bankruptcy into the Black'
18th
Stoll, M. `Microcomputers Provide Key Cog in Development of Robotics Workstations'

December
16th
Pompili, A. `PCs Help Schwinn Bicycle Co. Pedal Forward to Productivity, Profits'

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January
13th
Bonner, P. 'Builder Picks LANs Over Mainframe'
Pallato, J. 'Lap-Tops Take the Grand Tour and Bring New Business Home'
20th
Pompili, A. `Beyond "Just The Facts, Ma'am"'

February
17th
'PCs, LANs Take on Burden of Coordinating Complex Activities of Technicians, Data Processing Staffers at Nuclear Generator'

March
24th
Strom, D. 'Giant Gannet Publishing Continues to Make Headlines With Connectivity'
_____. 'LANs and PC-to-Mainframe Links Keep Airline Flying High'
31st
Strom, D. 'Terminals: What the Doctor Ordered'

April
7th
Pompili, A. 'General Electric Gets it All Together With PC-Coordinator Support Program'
14th
Helliwell, J. 'Porsche Runs on Smooth Network'
21st
Call, B. 'At Sanders, Engineers Climb the Career Ladder'

May
19th
Zarley, C. 'Forest Products Lab: Micros Find a Role in a Mini World'
Kramer, M. 'Southwestern Bell Links LANs in Five States'

26th
Leeke, J. 'At Del Monte Corp., MIS Staffers Enroll in PC Training'

June
2nd
Gralla, P. 'At USA Today, the PC Makes Front-Page News'
9th
Zarley, C. 'At Tonka Toys, PCs Lay the Groundwork in R & D'

August
11th
Strom, D. 'Sophisticated Data Network Accelerates Hyundai Success'

November
10th
Wilkinson, S. 'PCs Pull Firm From Bankruptcy into the Black"

December
1st
Moskowitz, R. 'Customer Hot Lines Keep on Humming'

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January
5th
Stoll, M. 'Brewery Keeps its Memorabilia on Tap'

February
2nd
Wilkinson, S. 'Simulation Gives Clear Picture of Assembly Line'
23rd
Stoll, M. 'Lap-Tops Hit the Road for Truck Repair Calls'

Strategies in other magazines

Barry, T. 'Johns Hopkins Stays at Head of IS Class' Datamation, 15th January, 1988.

Berman, B. `Technofright: why new tech rattles old-line management' Working Smart, May 1986, Vol.3, No.5.

Bloombecker, B. 'Of Systems, Solidarity, and Struggle' Datamation, 1st November, 1987.

Brand, E. 'Internal Network is Right Number at GTE' Datamation, 15th January, 1988.

Carlyle, R.E. 'Banking on Software' Datamation, 15th April, 1987.

_____. 'Intel Sees Standards as Multivendor Base'

_____. 'Multivendor Policy For IS at Met Life' Datamation, 15th January, 1988.

Craig, J.L. `G.E.'s Electronic Corporate Ladder' Datamation, April 15, 1986.

Donaldson, W.H. `Putting People First' New York Times Book Review, Books and Business section.

Flynn, M.K. 'Grand Union's Stock Boy is a Spaceman' Datamation, 15th January, 1988.

Foley, M.J. 'Baxter Travenol Takes a Big Dose of DDP'

Francis, R. 'Case IH Tests Its IS Mettle' (Case IH, metalworking) Datamation, 15th January, 1988.

_____. 'Tenneco Drills With Dp Dollars' Datamation, 15th January, 1988.

Gullo, K. 'Bank of New England Grows Image Minded' Datamation, 15th January, 1988.

Harriman, C. 'Shoes on Track at Reebok' Macintosh Today, 11th January, 1988.

Hedrich, R.T. `Improving Productivity at the Northern Trust' Datamation, May 15, 1986.

Jenkins, A. & Bridges,L. `Checking the PC Dividends' PC Week, Nov.19, 1985.

Jelcich, S. `Wanted:secretary' PC Week, Nov.19, 1985.

Knight, B. `Info Center Concept Enters Middle Age' Software News, Oct. 1985.

Lamb, J. 'Lloyd's of London Attempts to Insure its Future' <u>Datamation</u>, 15th January, 1988.

La Motta, T. & Bernknopf, J. `Performance, Not Flash' <u>Information Center</u>, May 1986.

LaPlante, A. 'Deloitte Haskins & Sells Decentralizes PC Support' <u>InfoWorld</u>, 2nd March, 1987.

McCusker, T. 'Using Technology to Listen Better' (Allergan, pharmaceuticals) <u>Datamation</u>, 15th January 1988.

_____. 'Monsanto Needs One Sweetener: Standards' (process manufacturing)

_____. 'Heinz Embarks on IS Course to Handle a Growing Variety' <u>Datamation</u>, 15th January, 1988.

McWilliams, G. 'Data are Passengers at System One' (System One Corp., airline reservations, i.e. transportation)

Moad, J. 'DuPont Seeks Global Communications Reach' <u>Datamation</u>, 15th January, 1988.

Nicita, M. & Petrusha, R. `Bookwatching' <u>Popular Computing</u>, Sept. 1985.

Poe, R. 'Nissan Drives Toward Parallel Development' <u>Datamation</u>, 15th January, 1988.

Runyan, L. 'Fresh Look for IS at Pillsbury' (food & beverages) <u>Datamation</u>, 15th January, 1988.

Schatz, W. 'IT the Best of Breed at Agriculture Dept.' <u>Datamation</u>, 15th January, 1988.

Stephens, M. 'Coors Links PCs to Monitor Flow of Beer' <u>InfoWorld</u>, 24th August, 1987.

Stone, P.S. 'Move to PCs Saves Fish From Drowning'

Terkowitz, R.S. `The "Post's" Prototype of a Productivity Center' <u>Software News</u>, Oct. 1985.

Wade, E.C. `Controlling the Electronic Home' <u>Newsweek</u>, Nov.26, 1984.

<u>Vita</u>

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Professional Qualifications

Bachelor of Science (General Science) University of Edinburgh, 1985.

Professional Achievements

Instructor in Sociology of Science (3000 level), VPI & SU, 1st summer session, 1988.

Research Interests

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