THE IMPACT OF COMPUTER-MEDIATED OFFICE TECHNOLOGY ON THE LABOUR REQUIREMENTS OF OFFICE ORGANIZATIONS

by

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B.A., University Of British Columbia, 1978

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

School Of Community And Regional Planning

We accept this thesis as conforming

to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

October 1984

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Date: October 4, 1984

Abstract

This thesis challenges the common belief that the use of existing and near-future applications of computer technology results in overall decreases in requirements for clerical and management labour.

Three additive and one negative forms of labour impact have been identified. They are:

System development and implementation,

Equipment operation,

Information use and management, and

Labour replacement and enhancement.

Five distinct areas of application have also been identified. They are:

Large scale data processing,

Small scale data processing,

Clerical document production,

Management decision-making, and

Electronic office networks.

For each area of application, the forms of labour impact which occur in association with the technology are discussed, and changes in employment and productivity levels claimed or documented in the literature are also examined. Tentative findings are then tested using substantive and quantitative information, concerning labour impacts that have occurred in several Vancouver office organizations which have implemented computer technology.

The following is concluded from the research presented in

this thesis. First, in most instances, long-term increases in labour requirements associated with the use of computer-mediated office technology outweigh the negative labour impacts which also occur. Second, the technology is seldom implemented with the primary intention of reducing labour requirements. Instead, far greater weight is given in implementation decisions to such concerns as corporate prestige, document quality, and developing new areas of information management. As a result, substantial negative labour impacts seldomly occur. Third, only a portion of negative impacts which do occur is the result of the labour replacement and enhancement capability of the technology. A large but indeterminate portion is the result of the rationalization, systemization, specialization and centralization of office practises, procedures and employees. Fourth, historic changes in employment levels and labour productivity are not accurate measures of the labour impact of computer use. As a result, it is extremely difficult to quantitatively assess the labour impact of existing or future areas of application. Fifth, the implementation of electronic office networks will be extremely difficult and costly, and will require such large increases in office labour and offers such small labour savings that few will be implemented in the near future.

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Acknowledgement

This thesis could not have been completed without a great deal of assistance from a number of people. Professors Craig Davis and Walter Hardwick displayed an amazing and very welcome willingness over a period of three years, to examine, edit and criticize the innumerable drafts that were submitted to them. Mike Gunder was equally willing to hound and grind me, at every opportunity, to "get the bloody thing done Robert". His efforts were difficult to appreciate at times, but I value the friendship from which they arose. My father, Dan Thompson, provided invaluable moral and financial support over the decade in which I have attended university. Lastly, Wanda Creelman, by being herself, gave me the self-confidence and belief that I could complete "it", during the numerous and lengthy periods in which I had lost both.

I. INTRODUCTION

1. DISCUSSION

This thesis examines the impact of computer-mediated office technology on the long-term labour requirements of office organizations. An impact is defined as an increase, or a reduction or containment in the amount of labour required.

The technological replacement and enhancement[1] of office labour has been a subject of serious concern since the early 1950's, when computers were first implemented in office organizations. A substantial body of literature has developed on this subject, as well as on other issues related to the use of computer technology. And yet, over the course of thirty years there has developed neither a consensus of opinion nor unequivocal empirical evidence as to the precise labour impacts which have and will occur. Instead, the literature is a maze of views comments and analyses, much of which can be held to be subjective or self-serving, according to the personal position, and political and institutional affiliation of the authors.

On one hand for example, are the shrill alarms raised with each new development in computer technology, predicting a rapidly impending, wholesale replacement of office employees by technology. According to this view, the result will be

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[1] Labour enhancement is defined as an increase in labour productivity which is not the result of an increase in the amount of labour

"Automatic Unemployment"[2] and the "Collapse of Work".[3] The fact that these alarms have been raised since the 1950's, without noticeable employment reductions or containments occurring should have been enough to dispel such a view. But it has not. The majority of authors examining this subject continue to reveal in their conclusions a deepseated conviction that the use of the technology has and will cause a reduction in the numbers of office employees. Estimates of the labour replacing effect of the technology range form 2%[4] to 3%[5] per year of all office labour. Others have stated that office automation equipment will increase office productivity by up to 50%.[6] Unfortunately, they neglect to mention the time period over which this will occur, or the precise manner in which it will be achieved.

These estimates have been stated in the face of readily available statistical information that belies such a view. During the period 1970-1980, the estimated number of computers of all sizes in operation in Canada increased by over 1700%.[7] If one were to accept the popular view, it could reasonably be expected that a substantial decrease in the numbers of office employees, or at least a noticeable reduction in their rate of

[2] Hines, C., Searle, G., Automatic Unemployment, Earth Resources Research Ltd., London, 1979

growth had occurred. Instead, while the numbers of employees of all occupations in Canada grew by 29% from 1970-1980, the number of employees in clerical occupations increased by 39%, and the number of managers increased by an amazing 222%. In addition, the numbers of systems analysts and computer programmers increased by 154%, and the numbers of computer equipment operators by 166%.[8] Solely on the basis of these statistics, it is evident that, even if computer technology reduces requirements for some types of office labour, it increases requirements for others.

The primary reason for this contradictory nature of the literature is that the majority of authors emphasize the capability of the technology to reduce or contain office labour requirements. They then seek quantitative evidence of this capability. It is largely ignored that labour displacements can be the result of many factors, that the equipment has been implemented for a variety of reasons other than its labour saving potential, and that additive labour impacts are also associated with its use. A second reason is that in attempting to develop quantitative estimates of overall labour effects,

[3] Jenkins, C., Sherman, B., The Collapse of Work, London, Eyre Methuen, 1979

[4] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980, pg 145

[5] Nora, S., Minc, A., The Computerization of Society A Report to the President of France, MIT Press, 1980 , pg 35

[6] Jacobs, B.A., "Can Electronics Perk Up Office Productivity", Industry Week, 7 July 1980 , pg 54

[7] Canadian Information Processing Society, Canadian Computer Census, Toronto Ontario, Annual , Table 2, pg. 8

[8] Statistics Canada, computer printout, Experienced Labour Force by Detailed Occupation, Male and Female, 1971 and 1981

many authors examine the the technology in aggregate form, and fail to consider that different labour effects are associated with different areas of application.

2. RESEARCH METHODOLOGY

A methodology has been developed which permits a rigorous examination of the labour impacts which occur in association with computer-mediated office technology, and the reasons underlying their occurrence. This methodology is based upon a disaggregation of applications of computer technology into five distinct areas, and a classification of additive and negative labour impacts into four forms of impact. An area of application is defined as a distinct office activity or operation to which the technology can be applied. For each area of application, the forms of labour impacts which occur in association with the technology are discussed, and employment and productivity impacts claimed or documented in the literature are also examined. Tentative findings are then tested using substantive and quantitative information concerning the use of computer-mediated office technology in the Vancouver area, and the labour impacts which have been experienced.

This thesis consists of four chapters, in addition to this introductory chapter. Chapter Two establishes the methodology used in Chapter Three to examine the labour impacts associated with each of the five areas of application identified. Chapter Four reports on the use of computer technology by office organizations in the Vancouver area. This information was obtained through personal interviews conducted with

managerial,supervisory and clerical personnel. Conclusions reached in Chapter Three are re-examined on the basis of this quantitative and substantive information. Chapter Five summarizes the main findings and conclusions concerning the impact of computer-mediated office technology on the labour requirements of office organizations.

3. RESEARCH CONCLUSIONS

The following is concluded from the research presented in this thesis. First, in most instances, long-term increases in labour requirements associated with the use of computer-mediated office technology outweigh the negative labour impacts which also occur. Second, the technology is seldom implemented with the primary intention of reducing labour requirements. Instead, far greater weight is given in implementation decisions to such concerns as corporate prestige, document quality, and developing new areas of information management. As a result, appreciable negative labour impacts seldomly occur. Third, only a portion of negative impacts is due to the labour replacement and enhancement capability of the technology. A large but indeterminate portion of this form of impact is the result of the rationalization, systemization, specialization and centralization of office practises, procedures and employees. Fourth, historic changes in employment levels and labour productivity are not accurate measures of the labour impact of computer use. As a result, it is extremely difficult to quantitatively assess the labour impact of existing or future areas of application. Fifth, the successful implementation of

computer-mediated office technology needed to achieve the "electronic office" or the "office of the future" will be extremely difficult to implement, and will require such large increases in office labour and offers such small labour savings that few office organizations will be willing to commit themselves to such a goal.

II. METHODOLOGY

1. INTRODUCTION

This chapter presents a methodology to examine changes in labour requirements associated with the use of computer-mediated office technology. Section 2 examines various classifications of computer technology found in the literature. These are used to develop a typology of the areas of office activity to which the technology is applied. The classification of areas of application is defined as a system of groupings of computer technology, which are distinguished on the basis of the distinct information management activities or functions of office employees to which the technology is applied. Section 3 establishes a classification of labour impacts that are associated with the use of the technology. The classification of labour impacts is defined as a system of groupings of alterations in labour requirements, which are distinguished on the basis of the replacement and creation of labour associated with the use of the technology, and its operating requirements and effect on information management.

2. AREAS OF APPLICATION

Almost from the date at which computer technology was first used in office organizations, authors have been presenting classifications concerning the technology and its use. Unfortunately, none of them have been specifically developed to examine alterations in labour requirements, and most leave something to be desired, because of their vagueness, emphasis on

technology and future developments, or the date at which they were developed. This precludes the ready adoption of any of the categorizations found in the literature. But examined together, they do reveal a recognition of five distinct areas of application of computer-mediated office technology to the activities and functions of office employees.

Four classifications were developed prior to 1975. Because of this, they give give little if any consideration to the most prominent use of computers today, that of textual information management. The earliest, presented in a 1959 document,[1] is primarily concerned with office mechanization. Van Weeman merely repeats this classification, but does serve to emphasize that one of the main areas of application is large scale, centralized data processing activities.[2]

Two classifications were presented in 1974, both of which emphasize data processing and data management. Gibson and Nolan[3] were mainly interested in identifying the four stages office organizations proceed through in establishing centralized electronic data processing (EDP) departments. Although they identify four stages of growth, and focus on the operational concerns of integrating and controlling an EDP department, their taxonomy does reflect an acknowledgement of two distinct areas

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[1] International Labour Organization, Effects of Mechanization and Automation in Offices, Geneva, 1959 , pg 19

[2] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 149

[3] Gibson, C., Nolan, R., "Managing the Four Stages of EDP Growth", Harvard Business Review, January-February, 1974

of application. Their first stage is concerned with large scale data processing applications, and the fourth stage with information use for management decision-making. That presented by Withington is even more explicit, in its recognition of five generations of computers, each associated with particular organizational effects and types of application.[4] The first three generations are concerned with data processing applications. Within these, a distinction is made between large scale, centralized applications, and more recent applications directed at distributed, small scale data processing activities. The primary basis for the distinction is that large applications are based on mainframe computers and require several employees for their operation, while small applications are based on micro-computers and require only one or two clerical employees. His fourth and fifth generations deal with the application of computer technology to management decision-making activities.

The classification presented in 1976 by Strassman[5] is useful only in that it serves to indicate a transitional period in which, in recognition of developments in communications and textual information management technology and software, there is a shift of attention from data processing applications to office communication networks and clerical document production applications.

Since 1976, classifications have concentrated on the stages

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[4] Withington, F.G., "Five Generations of Computers", Harvard Business Review, July-August 1974

[5] Strassman, P.A., "Stages of Growth", Datamation, October 1976

an office organization will, or ought to proceed through to achieve the automated electronic office, the "office of the future". As such, they largely ignore clerical data processing applications. There is some variation among authors in the number of stages, and in the key words used for each stage. Zisman[6] has somewhat unimaginatively and unsuccessfully imposed the four stages of growth identified by Gibson and Nolan in relation to EDP departments, onto all applications of office information technology. But those presented by Mumby and Harrison[7] , Price[8] , and Rhodes[9] are similar in their identification of three distinct areas of application. One area is that of clerical document production. A second concerns the use of computer technology to enhance management decision-making labour productivity. A third concerns the integration of all office information management activities and equipment into an electronic network.

Based upon the classifications found in the literature, the following typology has been chosen to examine the labour impacts associated with the use of computer-mediated office technology.

Large scale data processing,

Small scale data processing,

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[6] Zisman, M., "Office Automation: Revolution or Evolution", Sloan Management Review, vol.19, no. 3, 1978

[7] Mumby, S., Harrison, N., "A Methodology for the Development of Office Systems", 1982 Office Automation Conference Digest, April 5-7, 1982, San Francisco, Cal.

[8] Price, S.G., Introducing the Electronic Office, Manchester, England, NCC Publications, 1979

[9] Rhodes, J., "Office Automation: At Which Stage Are You?", Computerworld, 28 September 1981

Clerical document production,

Management decision-making, and

Electronic office networks.

The advantage of this taxonomy over others found in the literature lies predominantly in its comprehensiveness. It covers all areas of application of computer-mediated office technology. All others deal with either data processing applications, or document production and electronic networks. A second advantage is that it has been developed specifically to examine labour impacts. Those found in the literature emphasize technological capabilities, and largely ignore labour impacts associated with each area of application.

3. FORMS OF LABOUR IMPACTS

The literature is not immediately helpful in developing a classification of the forms of labour impacts which occur in association with the use of computer-mediated office technology. The form of labour impact emphasized by the majority of authors is that which occurs through the replacement and enhancement of office labour.[10] [11] This has been focused on and repeated to such an extent that it would not be too much of an exaggeration to say that it has been elevated to the status of dogma; a state which has apparently precluded any serious attempts to classify additive forms of labour impacts which also occur in association with the use of computer technology.

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[10] Duffy, J., "Cost-Analysis", Computerworld, 29 Sept 1982 , pg 48

[11] O'Connell, D., "The Information Resource Center", Computerworld vol. 16, no.39a, 29 September 1982 , pg 48

It seems quite obvious that additive forms of labour impacts occur, for instance, when an organization retrains clerical workers to operate newly installed word processors, when systems analysts and computer programmers are hired to integrate a computer system into an office's information management system, and when clerical labour is required to transcribe data from a paper format information storage system to an electronic one. However, it is equally obvious that many authors examining the use of computer-mediated office technology, largely because of their political and institutional affiliations, perceive little benefit in explicitly recognizing that any forms of additive labour impacts occur. Spokespersons for labour or feminist organizations and movements would clearly lose much of the force behind their arguments, and much of their audience, if they were to give equal weight to both additive and negative labour impacts which they can claim are "caused" by computer use. And spokespersons for the equipment vendors see little benefit, for increasing equipment sales, in discussing anything but the ease of implementation and the labour saving aspects of the equipment once in operation. There is an even more telling limitation on the objectivity of many authors whose living depends on the computer industry. Few editors of computer magazines, whose operating budgets depend solely on the advertising of computer equipment and software vendors, would consider for publication an article that presented a balanced discussion of all the different forms of labour impacts, both

additive and negative, which do occur.[12]

Fortunately, even with these biases, there is sufficient information available from which a useful classification can be developed. Three additive forms of labour impacts have been identified. They are the impacts of:

System development and implementation,

Equipment operation, and

Information use and management.

One negative form of labour impact has been identified, which occurs through labour

Replacement and enhancement.

The reasons for the occurrence of each of these forms of labour impact will be discussed in general terms in the following sections. The opportunity is also taken to discuss factors which influence the magnitude of the impacts, and which make the quantitative assessment of each form of impact very difficult.

3.1 System Development And Implementation

Once the decision has been made to implement some form of computer technology, additional labour is needed for system development and implementation. In some instances, this requires the labour of systems analysts and computer programmers. In other instances this integration work requires the labour of office managers and supervisors. Surprisingly,

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[12] Jenkins, C., Sherman, B., The Collapse of Work, London, Eyre Methuen, 1979 , pg 102

few authors recognize that system implementation requires additional labour. They seem to assume that most applications are simply plugged into an organization's existing information management system. But even spokespersons for the equipment vendors admit that most applications rarely directly replace an isolated portion of an information management system. Instead, they combine a number of functions and activities of office employees and machinery, and usually bring with them new functions and activities that are not part of the information management system they are to be integrated into.[13] This results in a restructuring of an office's information management operations, and requires additional labour that would not have been needed if the equipment had not been installed.

There are a number of factors which contribute to the magnitude of this form of impact. Whenever an application is implemented there is a renewed emphasis on a systems approach and the rationalization of information flows and management activities.[14] This is either adopted by existing personnel, or brought with the computer programmers, system analysts and office supervisors hired to integrate the new equipment. The application of systems analysis to information management, and the rationalization of the information management activities of office employees unquestionably makes the operation of the new

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[13] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 178

[14] Robey, D., "Computers and Management Structure: Some Empirical Findings Re-examined", Human Relations, volume 30, number 11, 1977 , pg 63

equipment more effective, and improves the productivity of office personnel. However, this effort at systemization and rationalization is invariably carried beyond the immediate operating requirements of the equipment. This is because improvements in one area highlight inefficiences and incongruities in associated areas, or because they will improve the effectiveness even further of the newly installed equipment.[15] Another problem is that the systemization and rationalization of office work has been occurring for most of the present century,[16] usually in the absence of the technology. These processes continue alongside and often complement the efforts to integrate the newly acquired system. The result is that it is extremely difficult to determine the proportion of additional implementation labour that is strictly necessary for an application, and what proportion only serves to make it more efficient. It is also very difficult to distinguish the amount of additional labour devoted to the systemization and rationalization of an office information management system which would not have been needed if the application had not been installed.

With recent developments in user-friendly, turn-key computer systems, and the provision of implementation labour by equipment vendors and computer consulting firms, there has

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[15] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 152

[16] Giuliano, V.E., "The Mechanization of Office Work", Scientific American, September 1982, volume 247 no. 3. , pg 160

occurred a reduction in the amount of this form of labour that office organizations find themselves requiring. Instead of incurring a long-term labour cost, most of the costs of system development and implementation are added onto the costs of the computer package.

3.2 Equipment Operation

A second form of additive impact occurs because of the need for equipment operation. Most applications require a new set of skills of employees whose duties involve the operation of the technology. This requires the retraining, and often the hiring of additional employees with the necessary skills. The retraining of existing employees is a common occurrence with applications such as word processing, and is unavoidable with applications such as electronic mail, where equipment use constitutes only a portion of certain office employees daily activities. For this training to occur, the labour of employees must be diverted from existing office activities and responsibilities, during the period in which the retraining takes place.

But for some applications, particularily those which are large and complex, additional employees are needed to operate the technology, because equipment use constitutes the primary function of the equipment user. For relatively routine activities such as data entry clerk, the training is not that extensive, and personnel who may have been displaced when the technology was installed can be retrained in a relatively short time. In fact, even in the examinations of authors who stress

the labour displacing capabilities of computer-mediated office technology, it is a common element that most displaced personnel are given the opportunity for retraining in equipment operation, or are found positions elsewhere in the organization.[17]

3.3 Information Use And Management

Most applications have been implemented to allow the development of new areas of information management, and to deal with increases in information processing requirements. For these changes to occur, there must be an increase in the amount of information delivered to the processing location. For most applications, information input is available only in paper document format. To deal with the increase in paper documents, more personnel are needed for document transportation, storage, and data preparation.[18] Another reason for the occurrence of this form of impact is the massive increase in information output. One of the most noticeable effects of computer-mediated office technology is that it has made it much easier to produce paper documents. It has been estimated that computer technology has reduced the cost of producing a paper document by 50%.[19] And Xerox estimated in 1977 that U.S. business maintains four file drawers (18,000 documents) for each of its white-collar employees, and this amount is increasing at the rate of one file

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[17] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 28

[18] McDonald, J.C., Impact and Implications of Office Automation, Economics and Research Branch, Department of Labour, Ottawa, Occasional Paper No. 1, Queens Printer, Ottawa, 1964 , pg 13

[19] The Economist, "Office of the Future" , 30 January 1982 , pg 81

drawer (4,000 documents) per employee every year.[20] Even with recent developments in communication and data capture technology, additional labour is still required to maintain the new information in electronic filing systems.

Much of the increase in the amount and availability of information is achieved to provide managers with more information to be used in decision-making. The usual assumption is that this will improve the productivity of managers, and thus contain the need for future increases in their numbers.[21] But it is quite evident that additional labour is required of managers to examine this information, even if the decision is that it need not have been examined and that no decision is necessary.[22]

3.4 Labour Replacement And Enhancement

Negative labour impacts occur when the mental or physical activities of office employees are replaced or enhanced by computer-mediated office technology. The mental activities which can be replaced are numerical computation, and very simple decision-making for which the events needed to drive that decision are readily identified,[23] as well as the decision-making process itself.[24] The physical office activities which

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[20] Lester, T., "The Office Conundrum", Management Today, November 1978 , pg 120

[21] Sanders, D.H., Birkin,S.J., Computers and Management in a Changing Society, McGraw-Hill, 1980 , pg 234

[22] Lester, T., "The Office Conundrum", Management Today, November 1978 , pg 120

[23] Zisman, M., "Office Automation: Revolution or Evolution", Sloan Management Review, vol.19, no. 3, 1978 , pg 8

[24] Simon, H., The Shape of Automation for Men and Management, New York, Harper and Row, 1965 , pg 58

can be replaced are the transferring or accessing of information from one location to another,[25] which occurs when transferring numbers from one account to another, or when moving a file from a filing cabinet to the office of a user, and the transfer of information from one information format to another. Computer technology can enhance the physical activites of information capture, access, and transfer.[26] It is usually assumed that it can enhance the productivity of decision-making by providing improved access to more timely information.[27]

3.4.1 Alterations In Information Management Procedures

It is usually assumed that when labour reductions or productivity enhancements occur in association with an application of computer-mediated office technology, they are the result of the capability of the technology to replace and enhance the labour of office employees. However, it is evident that a number of processes occurring in office organizations, both directly and indirectly associated with the use of computer technology, also contribute to labour enhancement and replacement.

As already mentioned in connection with implementation labour impacts, the systemization and rationalization of

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[25] Simon, H., The Shape of Automation for Men and Management, New York, Harper and Row, 1965 , pg 38

[26] Bessant, J.R., Bowen, J.A., Dickson, K.E., Marsh, J., The Impact of Microelectronics - A Review of the Literature, University of Ashton, Frances Pinter Ltd., 1981 , pgs 83-93

[27] Barron, I., Curnow, R., The Future with Microelectronics. Forecasting the Effects of Information Technology, New York, Nichols Publishing Co., 1979 , pg 127

information management has been occurring both in the absence and in association with the technology.[28] The result of these efforts is that office labour is replaced and enhanced. It is generally recognized that, in association with computer-mediated office technology, clerical and managerial office activities are more formalized,[29] routinized, and standardized,[30] allowing a greater degree of improvement in efficiency and productivity than would have been the case if these changes had not been made. Quite often, efforts at systemization and rationalization are directed at overall processes of information management, which are not directly related to the use of the technology.[31] Responsibilities of executive personnel have been re-aligned,[32] and changes or reductions have been made in the ratio of secretaries to managers.[33] In any organization, procedures and practises become estabished that with time, are no longer necessary but continue simply because that's the way things have always been done. With increased efforts at systemization and rationalization, many of these are eliminated, and increased

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[28] Giuliano, V.E., "The Mechanization of Office Work", Scientific American, September 1982, volume 247 no. 3. , pg 160

[29] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 272

[30] McDonald, J.C., Impact and Implications of Office Automation, Economics and Research Branch, Department of Labour, Ottawa, Occasional Paper No. 1, Queens Printer, Ottawa, 1964 , pg 4

[31] Rhodes, J., "Office Automation: At Which Stage Are You?", Computerworld, 28 September 1981 , pg 16

[32] Olson, M.H., Lucas, H.C., "The Impact of Office Automation on the Organization: Some Implications for Research", Communications of the ACM, vol. 25, no. 1, 1982 , pg 838

[33] EDP Analyser, "The Coming Impact of New Technology", January 1981, vol.19, no.1 , pg 6

productivity achieved.[34] Even well-established personnel management practises are subjected to close scrutiny. In most offices, people are promoted because of seniority to job classifications that are really beyond the level of activities they perform, or given make-work positions because they have been with the firm for a number of years and are too senior to lay off when no longer needed. As the personnel manager of an office organization implementing a computer system put it:

> People with degrees are hired for jobs that are in fact clerical. Technicians who have been with the company for many years and deserve a promotion are made managers. Again, their work is mostly clerical. If we were to make all management legitimate then we'd reduce our management staff by 30%.[35]

With the increased emphasis on systemization and rationalization that invariably accompanies the technology, the opportunity is often taken to downgrade and eliminate many positions and employees in the pursuit of greater efficiency.

Another process that has been occurring almost since office organizations came into existence is the specialization of office activities.[36] Specialization most often occurs in

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[34] Simon, H., The Shape of Automation for Men and Management, New York, Harper and Row, 1965 , pg 37

[35] Nova Scotia Departments of Labour and Manpower, Education and Development, and the Canada Employment and Immigration Commission, Survey of the Computer and Electronics Industries and Impact of New Technology on Three Companies in Nova Scotia, 1981 , pg 95

[36] Giuliano, V.E., "The Mechanization of Office Work", Scientific American, September 1982, volume 247 no. 3. , pg 160

[37] Earl, M. J., "What Micros Mean for Managers", in Forester, T., (ed.), The Microelectronics Revolution, MIT Press, Cambridge, Mass., 1980 , pg 362

[38] Peitchinis, S.G., The Employment Impacts of Computers and Telecommunications Technology, Calgary, University of Calgary, 1981 , pg 91

response to uncertainty[37] and increased workloads,[38] but also occurs in association with many applications of computer-mediated office technology. In some instances it is necessary, because new employees are needed for full-time equipment operation. But in other instances, the specialization of office tasks merely serves to make the use of the equipment that much more productive, and the management of information more effective. Even before the introduction of computers in offices, secretarial activities were being separated into the distinct office occupations of typist, stenographer and administrative assistant,[39] and similar task specialization was taking place for clerical data processing activities.[40] With recent developments in office automation technology, it has been observed that the secretary/typist occupation is being divided into the occupations of word processor operator, text editor, data entry clerk, administrative assistant and personal secretary.[41] Managerial task specialization has been occurring as well, in the separation of line and staff management functions.[42]

Closely associated with task specialization is the centralization of office personnel to achieve economies of scale

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[39] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 26

[40] Giuliano, V.E., "The Mechanization of Office Work", Scientific American, September 1982, volume 247 no. 3. , pg 160

[41] Peitchinis, S.G., The Employment Impacts of Computers and Telecommunications Technology, Calgary, University of Calgary, 1981 , pg 91

[42] Sanders, D.H., Birkin,S.J., Computers and Management in a Changing Society, McGraw-Hill, 1980 , pg 221

and agglomeration economies. This too has been occurring in the absence of computer-mediated office technology. Centralized corporate planning staffs have been formed,[43] as well as centralized data processing operations and centralized typing pools.[44] With the advent of computers, centralized EDP departments have been formed to take advantage of economies of scale for clerical employees and programming personnel,[45] and word processing pools have been formed to improve the productivity of document production.[46]

Taken together, the systemization, rationalization, task specialization and centralization of office activities and personnel account for much of the labour replacement and enhancement that is usually attributed to the capability of the technology. Unfortunately, there is limited quantitative information to aid in determining what proportion these processes contribute to labour impacts that have been documented. But without doubt, if these processes do not occur prior to and during the implementation of most applications of computer-mediated office technology, very little if any labour replacement or enhancement can be achieved.

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[43] Sanders, D.H., Birkin,S.J., Computers and Management in a Changing Society, McGraw-Hill, 1980 , pg 221

[44] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 26

[45] Champine, G.A., Distributed Computer Systems. Impact on Management,Design and Analysis, New York, North-Holland, 1980 , pg 3

[46] Strauss, S., "Word Processors", The Toronto Globe and Mail, 17 July 1980 pg. T1 , pg 1

3.5 Summary

To summarize this section, three forms of additive impacts have been identified. They are:

System development and implementation,

Equipment operation, and

Information use and management.

One negative form of impact has also been identified. It occurs through the :

Replacement and enhancement of labour.

The principal advantage of this classification is that it allows an objective discussion of the reasons underlying the occurence of distinct additive and negative labour impacts. There is one unfortunate effect of its use however. It demands a discrimination of underlying causes of labour impacts that at times exceeds the level of sophistication of much of the literature. But the benefits of the classification more than compensate for this limitation of the literature.

In the following chapter, this classification will be used to discuss the labour impacts which have and will occur in association with the five areas of application.

III. AREAS OF APPLICATION

1. CHAPTER INTRODUCTION

This chapter presents an examination of the labour impacts associated with each of the five areas of application. The discussion presented for each area of application is separated into seven sections. An introductory section briefly describes the area of application and the technology involved. A second section then presents a critical examination of the common assumptions made in the literature, as to the reasons why the equipment has been or will be implemented. The next four sections present an examination of the four forms of labour impacts. The emphasis in each section is on the reasons why the labour impacts occur. Where available, quantitative information on actual labour impacts is also presented and examined. The seventh section presents a discussion of the overall labour impacts which have occurred, and that can be expected to occur. The final section of this chapter summarizes the main conclusions.

2. LARGE SCALE DATA PROCESSING

2.1 Introduction

This area of application is characterized as consisting of a number of clerical and supervisory personnel routinely and repetitively processing large quantities of numerical information. The raw data is delivered to the processing center, processed, and then output in paper document or electronic format. It is in fact, the area of office work that

most closely resembles a production line. There is a high degree of task specialization,[1] and continuing efforts are made to routinize,[2] systemize and formalize[3] the activities of the personnel and the overall data processing operation. The employees have also been centralized to achieve labour economies of scale and agglomeration economies.[4] With the installation of computer technology, substantial numbers of technical and professional personnel are added to the data processing operation, as well as clerical personnel to operate the new equipment.

The equipment involved is based on a mainframe computer. Early applications included peripheral equipment to prepare and sort punchedcards for data input/output and storage, tape storage devices, and paper printers. More recent systems include disc storage devices and multi-page document printers, optical character readers, and data entry terminals. For many applications, modern communication technology has replaced much of the flow of paper documents into and out of the EDP center.

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[1] Giuliano, V.E., "The Mechanization of Office Work", Scientific American, September 1982, volume 247 no. 3. , pg 160

[2] International Labour Organization, Effects of Mechanization and Automation in Offices, Geneva, 1959 , pg 30

[3] Withington, F.G., "Five Generations of Computers", Harvard Business Review, July-August 1974 , pg 100

[4] Champine, G.A., Distributed Computer Systems. Impact on Management,Design and Analysis, New York, North-Holland, 1980 , pg 3

2.2 Reasons For Implementation

Prior to the implementation of computer technology, a great deal of clerical labour is required for manual and mechanical numerical calculation, the maintenance of paper document files, and the production of paper documents. It is these three activities at which computer technology greatly outperforms human and mechanical capabilities, once the data has been transcribed into electronic format.[5] Because of this capability, the general assumption has developed that computer technology is applied to this area of office work either to replace clerical labour,[6] or to contain future increases in labour that would be needed to meet increased DP requirements.[7] This assumption is the basis for the belief that large scale clerical labour replacement results from the use of computers for this area of application.[8] And in a few instances this belief has proven to be correct. But in most instances, the technology is implemented primarily for reasons other than its labour replacing capabilities. Because of this, the predicted labour displacements have simply not occurred.

The first installations for this area of application were implemented in the early 1950's, and in fact represented the

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[5] Simon, H., The Shape of Automation for Men and Management, New York, Harper and Row, 1965 , pg 38

[6] Duffy, J., "Cost-Analysis", Computerworld, 29 Sept 1982 , pg 48

[7] Rice, R.E., "The Impacts of Computer-Mediated Organizational and Interpersonal Communication", in American Society for Information Science, Annual Review of Information Science and Technology, vol.15, 1980

[8] International Labour Organization, Effects of Mechanization and Automation in Offices, Geneva, 1959 , pg 51

advent of computer-mediated office technology in offices. Compared to today's technology, these early computer systems were extremely expensive. In addition to the very high equipment costs, substantial costs had to be incurred to create and maintain the necessary operating environments. Special reinforced concrete floors were needed to support the bulky equipment, and temperature, humidity and air purity had to be regimented to within very narrow limits to ensure the correct operation of the computer. Faced with such high capital and operating costs, it might be expected that the offices implementing the technology based their purchase decisions strictly on the cost-effectiveness of replacing mechanical and labour costs with the new technology. However, Withington reports that few organizations that installed large mainframe computers between 1953 and 1958 had clear cost-based justifications for doing so. Instead, organizational image and prestige were the primary reasons.[9] Apparently, to appear progressive, an organization had to have a mainframe computer installed in their DP department. While this may have been true for some of these initial installations, one cannot help but question the general applicability of this statement. Admittedly, it would be very difficult to arrive at definite labour-technology cost comparisons for such newly developed technology. But one cannot help but feel that the offices which installed these early computers must have had more justification

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[9] Withington, F.G., "Five Generations of Computers", Harvard Business Review, July-August 1974 , pg 100

for the massive capital and operating costs required, other than simply an improvement in corporate image.

Other information on this early generation of computers is more revealing on this question. The ILO reported in a 1959 document that, after surveying a number of organizations, labour economies had not been of importance in implementation decisions. Instead, the savings accruing from greater efficiency and the indirect benefits of better information were cited as the primary reasons.[10]

Information on a later generation of computers applied to this area of office work confirms the lack of concern given to the labour saving capability of the technology. In a survey conducted in India in March 1974, over 100 organizations were contacted that had implemented a mainframe computer in their DP department. Respondents indicated the benefits they had achieved with the technology. The results are presented in Table I.[11]

Table I - Perceived Effects of Computer

% of organizations saying yes

	private	public
improved accuracy of information	97	92
speedier business returns	71	69
better managerial control	89	38
reduction in inventories	66	46

[10] International Labour Organization, Effects of Mechanization and Automation in Offices, Geneva, 1959 , pg 114

[11] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 100

increase in business/ output	34	46
improvement in quality of output	40	69
reduction in unit costs	34	8

Once again, the responses indicate that the organizations that installed the equipment were not interested in reducing or containing labour costs. Rather, they were able to achieve things that could not be attained in the absence of the technology. In further support of this, respondents were asked to estimate the number of employees required to complete an activity manually and then compare it with the number needed to do it with the computer.[12] Almost all respondents refused to answer this question, because it was felt the work done on the computer could not possibly be done manually. And finally, when asked for reasons for further computerization, only 11% gave labour containment as a reason. The reason given most often was to undertake more work on the computer that could not be done manually.[13]

Case study information from Canada provides further evidence on the lack of interest in labour savings as a reason for equipment use. The Municipality of Oshawa Ontario implemented a mainframe computer in their property tax accounting operations. Prior to the implementation of the computer, 16 clerical employees were required to process 23,000

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[12] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 76

[13] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 114

property tax accounts. Ten years after it was installed, 40,000 tax accounts were being processed by 12 clerical employees. The computer also required the hiring of one analyst and one programmer to integrate the computer into the tax account processing operations. But the municipality did not look on the net reduction in clerical employment as a saving of the computer system. Instead, the decrease was viewed as an opportunity to upgrade the organization by adding functions and services previously unknown to the city. To meet these goals, 5 additional financial analysts were hired over ten years. So while the computer was associated with a reduction of four clerical positions, it directly caused an increase of seven positions. The following is only a partial list of planned future applications:

urban information system,
street inventory system,
tax cash system,
leased parking system,
business licensing,
traffic monitoring,
fleet maintenance,
personnel records,
on-line inquiries,
local improvements,and
municipal elections.[14]

Without doubt, these new applications will require even more personnel for system development, and data management and use.

The most striking evidence of the lack of emphasis placed on the labour saving capabilities of the technology is the

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[14] Wilkins, R., Microelectronics and Employment in Public Administration: A Case Study in Three Ontario Municipalities, Ont Min of Labour, 1982 , pg 10

response of organizations to displacements that do occur. Instead of converting these displacements into actual employment reductions, as would surely be the case if the organizations were attempting to reduce labour costs, most organizations prefer to assign displaced workers to other areas within the organization. From the Indian survey of over 40 EDP installations, it was found that a total of 918 employees were rendered superfluous because of the use of the technology. Of these, 41% were retrained and then employed in the new EDP operations. Another 59% were transferred to other areas of the organization. Only 0.2% retired, and none were fired or laid off.[15] Even Menzies, hardly an objective observer, notes that in a Canadian organization, when 130 clerical employees were displaced over a ten year period in association with the installation of computer equipment, not one was laid off or fired. All were found positions elsewhere in the organization.[16]

It is evident that most installations for this area of application are not implemented to replace or contain labour requirements. Instead, the use of the technology permits the achievement of goals that are not attainable in the absence of the technolgy. Organizations are willing to incur substantial additional labour and capital costs in the process.

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[15] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 75

[16] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 28

2.3 System Development And Implementation

Once the decision has been made to purchase or lease a computer system, systems analysts and programmers are needed to develop the systems and integrate them into the existing data processing operations. Additional clerical labour is needed to transcribe data before the system can be operational. To maintain existing levels of data processing, increased numbers of clerical employees must be hired during this period.[17] Additional supervisory labour is also needed during this period to achieve the systemization and rationalization of DP operations invariably associated with the installation of mainframe computers.[18] This requirement is reflected in the increase in the numbers of supervisors and managers which has been observed in organizations installing large computer systems.[19]

After the implementation has been completed, very few of the programmers and analysts are needed for the daily operation of the system, other than for minor debugging and system maintenance. But in most instances, once these personnel are

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[17] McDonald, J.C., Impact and Implications of Office Automation, Economics and Research Branch, Department of Labour, Ottawa, Occasional Paper No. 1, Queens Printer, Ottawa, 1964 , pg 13

[18] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 152

[19] Rice, R.E., "The Impacts of Computer-Mediated Organizational and Interpersonal Communication", in American Society for Information Science, Annual Review of Information Science and Technology, vol.15, 1980

hired, there is seldom a decrease in their numbers. This is because new, more complex applications are invariably developed that require their attention. Table II provides an indication of the typical types of applications that are implemented, based upon a survey of over 40 EDP departments in India in 1974.[20]

Table II - Application of Computer Time

	% of computer time used
payroll	15.53
research and development	12.49
stores accounting	10.79
financial accounting	9.75
production scheduling and control	9.15
inventory control	5.71
cost accounting	4.05
program testing	3.95
billing/invoicing	3.91
sales analysis	3.45
education and training	2.69
operations research	1.43
others	16.76

There is obviously a wide range in the number of system development and integration personnel hired by organizations implementing a mainframe computer system. It depends on a number of factors, such as the size and complexity of the system to be integrated, planned future applications, and more recently, the availability of packaged software and custom programming consulting services. But there is some representative survey data available. However, it must be emphasized that the figures represent only programmers and analysts, and do not include the additional clerical and

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[20] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 43

supervisory employees also needed for system implementation. The Canadian Computer Census (CCC) estimated in 1980 that with every computer installation with a purchase value of $40,000 or more (equal to or greater in size than a mini-computer), 9 systems personnel were employed in 1978 and 12 in 1980.[21] These figures are markedly similar to the figures obtained in 1974 in the Indian survey, from which it is estimated that an average of 8 analysts and programmers were employed with each EDP facility.[22] Somewhat smaller figures are available for Canadian federal government EDP operations. In 1977-78, 2632 staff-years were devoted to systems and programming for 566 computers of a size equal or greater than a mini-computer.[23] This averages to 5 staff years per computer. However, a major portion of their system and development labour costs is contracted out, as evidenced by the $14,000,000 EDP consultant costs in 1977-78. $1,531,000 worth of software was also purchased in this year.[24]

For many organizations, an increasing proportion of system development and integration is contracted out to consulting firms, rather than being performed by in-house personnel. It is possible that this will limit the growth of this form of additive labour for organizations which already have their own

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[21] Canadian Information Processing Society, Canadian Computer Census, Toronto Ontario, Annual , pg 13

[22] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 51

[23] Treasury Board, Information Systems Division, Administrative Policy Branch, Review of EDP and Telecommunications in the Government of Canada, Ottawa, 1980 , Tables 3, 16

[24] Treasury Board, Information Systems Division, Administrative Policy Branch, Review of EDP and Telecommunications in the Government of Canada, Ottawa, 1980 , Table 1

system development and integration personnel. And for new installations, it is possible that a much smaller number of full-time employees of this type will be hired. While it is possible that these factors may have an influence on future growth levels for this type of office labour, it does not appear to be supported by the numerical information available. Instead, as evidenced by the CCC information, the average number of systems people for large computer installations increased in just two years from 9 to 12, between 1978 and 1980. And this was during a period when there was a great improvement in the availability of systems consulting services and package software. For federal government EDP operations, between 1974 and 1978 EDP consulting costs increased by over 105%, and software acquisition costs by 84%.[25] But during the same period, systems and programming staff-years increased by 23%. For most large installations, it would appear that the continued expansion in the number of computer applications will at least maintain existing employment levels, and more likely cause an increase beyond the average numbers of system development and implementation personnel than have been presented in this section.

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[25] Treasury Board, Information Systems Division, Administrative Policy Branch, Review of EDP and Telecommunications in the Government of Canada, Ottawa, 1980 , Table 1

2.4 Equipment Operation

A second form of additive labour impact occurs through the need for clerical employees to operate data input/output equipment such as keypunchers, optical character readers and data entry terminals. Other clerical workers are needed for data preparation and paper document management activities. Supervisory and managerial personnel are needed as well, to oversee the activities of these workers and to manage the data processing operations. Centralized EDP operations also require additional support staff for equipment maintenance and routine office activities.

Unfortunately, there is no representative data on labour impacts associated solely with equipment use. Equipment operation and information management personnel numbers for EDP operations are usually combined into "operations" personnel. Therefore, survey information on actual employment levels for equipment operation will be examined in the following section.

2.5 Information Use And Management

Most applications produce output and require input from other areas of the organization. Additional clerical and supervisory labour is needed at an EDP center to deal with these increased input/output requirements. Additional clerical labour is also needed beyond the limits of the EDP center for information transportation and file system maintenance. It is possible that the transferring of displaced clerical personnel to other areas of the organization, commonly associated with the

use of the technology, has partially been in response to these increased information management requirements. Additional managerial labour is also needed to examine the newly available data, and to make decisions on its basis.

Unfortunately, the literature does not contain any quantitative information on this form of impact, beyond the confines of EDP centers. The quantitative information presented below concerns only labour impacts localized to EDP operations, and does not reflect the substantial additive labour impacts which occur elsewhere in the organization in response to increased information management requirements.

As was the case with system development and integration personnel, the numbers of operations employees will vary with the size and type of application, and the sophistication of the technology. The Canadian Computer Census estimated that an average of 16 operations personnel were employed in 1978 in computer installations with a purchase value of $40,000 or more, and 12 were employed in 1980.[26] Information on this form of additive impact for Canadian federal government EDP operations indicates that an average of of 9 operations personnel were needed in 1977-78 for each of their mainframe computers.[27] Much larger numbers were estimated for EDP installations surveyed in India in 1974. An average of 32 personnel were employed in this

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[26] Canadian Information Processing Society, Canadian Computer Census, Toronto Ontario, Annual , pg 13

[27] Treasury Board, Information Systems Division, Administrative Policy Branch, Review of EDP and Telecommunications in the Government of Canada, Ottawa, 1980 , Table 3

capacity, based on the employment levels in over 40 large EDP installations.[28]

On the basis of these figures it appears that an average of 9 to 32 additional operational personnel are needed. However, these figures do not take account of the substantial amount of labour that is diverted for the education of these employees prior to and during the installation of the equipment. It is a common practise in organizations to give displaced personnel the opportunity for retraining and then employment in the new EDP center. From the Indian survey data, of the 918 employees rendered superfluous because of the equipment, 41% were retrained and then found positions in the new operations.[29] And even when in operation, the training of existing staff must be updated and new employees trained. For example, for Canadian federal government EDP operations, training costs amounted to $3,957,000 in 1977-78.[30] Unfortunately, there is no information on the actual amount of labour diverted for these educational needs.

On the basis of the survey available data, there does appear to be a downward trend in the numbers of operational personnel needed for large computer installations. The data available from the CCC indicates a decrease in the numbers of

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[28] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 51

[29] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 74

[30] Treasury Board, Information Systems Division, Administrative Policy Branch, Review of EDP and Telecommunications in the Government of Canada, Ottawa, 1980 , Table 4

operations personnel from an average of 16 in 1978 down to 12 in 1980.[31] This trend is most pronounced in very large computer installations, where the average number of operations personnel decreased from 38 to 28 between 1978 and 1980. It was also in this size of installation that there was the greatest increase in systems personnel during this period, with an increase from 23 to 29. For most large systems, additional systems personnel are hired to develop and integrate more complex computer applications, and most recently, distributed data processing systems.[32] These decreases in operations personnel levels could possibly reflect that the distributed systems are supplying data input direct to the computer in electronic format, thus removing the need for some data input equipment operators and data preparation clerks at the computer installation. However, this merely represents a decentralization of the data entry function.[33] There is no information to indicate that this decentralization results in any changes in overall labour requirements.

Other recent technological developments promise to have even more noticeable effects on the numbers of clerical employees needed for data entry. Optical character readers (OCR's) remove the need for the keying in of numerical

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[31] Canadian Information Processing Society, Canadian Computer Census, Toronto Ontario, Annual , pg 13

[32] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 323

[33] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 272

information via punch cards or computer data terminals.[34] At present their use is very limited, because of their relatively high cost and inaccuracy. But once this problem is solved, and the equipment is produced at sufficiently reduced costs, OCR's may have a dramatic effect on the numbers of operations personnel required for data entry. However, there is no information on labour effects associated with this type of technology.

It is not possible to determine what proportion of average operations employment levels is actually due to the use of the technology. For centralized DP operations which existed prior to the installation of the equipment, substantial numbers of operational employees would already be employed. When the computer equipment is installed, many of the existing personnel are retrained and then employed in the EDP operation. But in many instances, the centralized data processing operation is only established with the installation of the computer equipment.[35] So there is no question of the transferring or retraining of existing personnel. Instead, considerable numbers of new employees must be hired.[36] In these instances, the average of 9 to 32 operations personnel presented above represents a net additive labour impact. It can therefore only be concluded that the operational requirements for EDP centers

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[34] The Economist, "Writing to Computers", 12 June 1982
[35] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 79
[36] Withington, F.G., "Five Generations of Computers", Harvard Business Review, July-August 1974 , pg 102

results in an additive labour impact of uncertain magnitude.

2.6 Labour Replacement And Enhancement

Between 1965 and 1981, the estimated number of mainframe computers in operation in Canada, with a purchase price of $40,000 or more, increased from 1034 to 23,860, an increase of over 2200%.[37] And yet, there is surprisingly little quantitative information on actual labour displacements and reductions that have occurred with large EDP installations. What little there is does indicate that negative labour impacts have indeed occurred, although certainly not to the extent predicted.

The clerical activities of numerical calculation and verification can be replaced, as well as the movement of numerical information from one file location to another, once the information has been transcribed into electronic format. More recently, with improvements in data capture and telecommunications technology, labour needed for data entry and movement can also be replaced,[38] as can clerical production of paper documents.[39] Containment of labour increases occurs because of the availability of excess storage and processing capacity of the computer equipment. This allows an increase in the amount of numerical information manipulation, storage and output, without accompanying increases in clerical labour.

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[37] Canadian Information Processing Society, Canadian Computer Census, Toronto Ontario, Annual , Table 2, pg 8

[38] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 270

[39] Simon, H., The Shape of Automation for Men and Management, New York, Harper and Row, 1965 , pg 38

It has been assumed that the replacement and containment of clerical labour would be accompanied by similar effects in the numbers of supervisory and mid-management personnel. This would be due partly to the replacement of minor routine decision-making.[40] Another portion would occur because it was expected there would be fewer clerical personnel to supervise,[41] and because clerical activity monitoring would be enhanced.[42]

As was the case with the additive forms of labour impacts discussed above, the numbers of displaced employees depends on several factors. These include the type of application, the size of DP operations, the span of time over which the displacements are calculated, and the technology available at the time at which EDP operations are surveyed. Menzies reports a displacement (but not a reduction) of 130 clerical employees over a 10 year period.[43] In a 1959 ILO document, two examples are cited. An insurance company reduced the number of clerical staff in their classification section from 198 to 85, and an electrical company reduced the number of clerical personnel in their DP operations from 30 to 20. A time period is not given

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[40] Simon, H., The Shape of Automation for Men and Management, New York, Harper and Row, 1965 , pg 47

[41] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 156

[42] McDonald, J.C., Impact and Implications of Office Automation, Economics and Research Branch, Department of Labour, Ottawa, Occasional Paper No. 1, Queens Printer, Ottawa, 1964 , pg 28

[43] Menzies, H., Supplementary Material to "Women and the Chip", Informatics Case Studies, Labour Market Development Task Force, Canada Employment and Immigration , pg 4

for either of these examples.[44] For the Municipality of Oshawa, after the installation of a mainframe computer in their tax accounting department, clerical staff were reduced from 16 to 12 over a 10 year period, while the number of property tax forms processed increased from 23,000 to 40,000. For the Municipality of Toronto, over a 20 year period, the numbers of part-time clerks and supervisors needed to prepare annual tax bills decreased from 60 to 2. This was accompanied by a large increase in data processing requirements. However, no actual employment reductions occurred, because of an increase in data preparation and entry requirements.[45] The most comprehensive data available on the displacement effect of EDP technology is provided by Prased and Verma.[46] On the basis of their 1974 survey data on over 40 EDP operations in India, it can be estimated that an average of 21 clerical and other employees were displaced with the installation of EDP equipment. No attempt was made to determine the average period of time over which these displacements occurred or the amount of labour containment that was achieved. It must be emphasized that for all EDP operations surveyed by Prasas and Verma, no displaced personnel were fired or laid-off. Equally important, even though an average of 21 clerical employees were displaced, an

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[44] International Labour Organization, Effects of Mechanization and Automation in Offices, Geneva, 1959 , pg 42,57

[45] Wilkins, R., Microelectronics and Employment in Public Administration: A Case Study in Three Ontario Municipalities, Ont Min of Labour, 1982 , pgs 10 to 16

[46] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 73

average of 7 employees were hired in their place. This reduces the average clerical displacement to 14.

While some of the clerical displacement presented above is undoubtably the result of the labour replacing capability of the technology, a large portion of it is due to labour savings brought about by overall improvements in DP procedures. After the equipment is installed, definite rules and procedures have been developed for clerical workers.[47] There is also increased task specialization for clerical workers,[48] and DP processing operations have been analysed and improved.[49] Clearly, if these improvements were brought about in the absence of the technology, a certain amount of labour savings would be achieved.

Even though there are instances of clerical labour displacement, net clerical employment reductions appear to be more the exception than the rule. There have been redistributions of clerical activity within office organizations,[50] as evidenced by the data presented by Menzies, and Prasad and Verma. But when reductions in clerical labour requirements have occurred, they have usually been more than

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[47] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pgs 152,156

[48] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 272

[49] Giuliano, V.E., "The Mechanization of Office Work", Scientific American, September 1982, volume 247 no. 3. , pg 160

[50] Withington, F.G., "Five Generations of Computers", Harvard Business Review, July-August 1974 , pg 100

off-set by increased demand for clerical labour resulting from increased data processing requirements.[51] The general experience has been that substantial economies in clerical labour requirements have not taken place.[52] The predicted disappearence of supervisory and mid-management personnel has not occurred either.[53] Instead, an overall increase in this type of personnel has been noted in organizations adopting computer systems.[54] The most obvious reason for this is that levels of clerical employment have not decreased. In addition, the new employees needed for such activities as equipment operation also require additional supervisors and managers.

2.7 Overall Labour Impact

It is not possible, on the basis of the information presented in the preceding sections, to arrive at a quantitative estimate of the overall labour impact for this area of application. Most sources provide either employment levels in EDP operations, or the numbers of displaced personnel, but seldom both. Nor is it possible to estimate the amount of

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[51] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 66

[52] McDonald, J.C., Impact and Implications of Office Automation, Economics and Research Branch, Department of Labour, Ottawa, Occasional Paper No. 1, Queens Printer, Ottawa, 1964 , pg 27

[53] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 156

[54] Rice, R.E., "The Impacts of Computer-Mediated Organizational and Interpersonal Communication", in American Society for Information Science, Annual Review of Information Science and Technology, vol.15, 1980

labour that would not be needed in the future because of the use of the technology. And finally, all of the quantitative information presented concerns only employment levels and displacements that are localized to EDP operations. No quantitative information is available on changes in overall labour requirements that have been associated with the use of the technology. It is very unlikely that this sort of data will ever be available. Changes in an office's total employment figures can be in response to a number of factors, such as corporate reorganization, business expansion, variations in volumes of work, and changes in systems and methods, as well as the use of the technology.[55]

However, there is sufficient information to conclude that historically, additive labour impacts have equaled or outweighed any negative impacts that have also occurred. Survey results of a large number of organizations with EDP equipment indicate either that overall labour requirements have not been appreciably affected,[56] or have increased.[57] [58] These survey results concur with the case study information available in the literature.[59]

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[55] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 68

[56] International Labour Organization, Effects of Mechanization and Automation in Offices, Geneva, 1959 , pg 46

[57] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977 , pg 98

[58] International Labour Organization, Labour and Automation, Bulletin number 5, "Automation and Non-Manual Workers", 1967 , pg 46

[59] Wilkins, R., Microelectronics and Employment in Public Administration: A Case Study in Three Ontario Municipalities, Ont Min of Labour, 1982 , pgs 10,16

It is much more difficult to conclude what the future labour impact for this area of application will be. Recent improvements in communication technology have made possible the decentralization of the data entry function.[60] It is not possible at this time to say whether this will have only a redistributive effect or whether labour reductions will occur. Improvements in data capture technology, such as OCR's, appear to have the potential to substantially reduce the amount of clerical labour needed for data entry activities. But predictions have been made for the last 30 years that each new development in computer technology will drastically reduce clerical labour requirements, without noticeable reductions actually taking place. The improvement in the availability of outside system development and integration services, and packaged programming also appear to hold the potential to contain increases in the numbers of in-house systems analysts and programmers.[61] However, recent survey data contradicts this, especially for very large installations. Instead, the growing emphasis on distributed systems, with their accompanying complications of systems design, implementation and operation, promise to result in further increases in the numbers of in-

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[60] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 270

[61] Hough, R.F., An Overview of the Canadian Computer Services Industry, Dept of National Defence, Ottawa, 1981 , pg 28

[62] Champine, G.A., Distributed Computer Systems. Impact on Management,Design and Analysis, New York, North-Holland, 1980 , pg 4

house systems personnel, not decreases.[62] It therefore appears that future developments in computer technology for this area of application will have a variable effect on office employment. But on the basis of historic experience, it is most likely that any negative labour impacts which do occur will be equalled or outweighed by the additive impacts which will be associated with the use of the technology.

3. SMALL SCALE CLERICAL DATA PROCESSING

3.1 Introduction

Since the late 1960's, there have been large price decreases in computer logic and processing hardware costs.[63] These have resulted in the development of first small minicomputers in the early 1970's, and then microcomputers in the mid-1970's.[64] It was also during this period that improvements in interface and communication technology, and system software have allowed the connection of on-line computer terminals to mainframe computers.[65] Because the cost of communication technology has not fallen, the use of on-line terminals has in most instances been restricted to the immediate

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[63] Barron, I., Curnow, R., The Future with Microelectronics. Forecasting the Effects of Information Technology, New York, Nichols Publishing Co., 1979 , pg 66

[64] Hough, R.F., An Overview of the Canadian Computer Services Industry, Dept of National Defence, Ottawa, 1981 , pg 23

[65] Simon, H.A., "The Consequences of Computers for Centralization and Decentralization", in Forester, T., (ed.), The Microelectronics Revolution, MIT Press, Cambridge, Mass, 1980 , pg 220

vicinity of the mainframe to which they are connected.[66] These developments have allowed the application of computer technology to small scale data processing operations employing only a few clerical workers. The estimated number of small mini-computers in operation in Canada increased from 640 in 1969 to 22,000 in 1981, and the estimated number of microcomputers or desk top computers in operation increased from 100 to 62,000 between 1974 and 1981.[67] Unfortunately, there is no information on the estimated number of on-line terminals in use.

It is clear that the widespread use of computers for this area of application must have some impact on labour requirements. Yet there is a paucity of discussion in the literature of these effects, and of actual changes in labour requirements that have occurred. Because of these limitations, the following sections present only a brief examination of the labour impacts of this area of application.

3.2 Reasons For Implementation

The low cost and ease of implementation of the technology has made it attractive to apply it to existing small scale DP operations.[68] One reason for its implementation therefore, is to enhance the productivity of manual and mechanical methods of maintaining small bookkeeping and customer account maintenance operations. But its low cost greatly reduces the need to

[66] Champine, G.A., Distributed Computer Systems. Impact on Management,Design and Analysis, New York, North-Holland, 1980 , pg 4

[67] Canadian Information Processing Society, Canadian Computer Census, Toronto Ontario, Annual , pg 8

[68] Withington, F.G., "Five Generations of Computers", Harvard Business Review, July-August 1974 , pg 106

justify its purchase solely on a cost-effectiveness basis. The result is that the equipment is often implemented to develop new data processing activities that were not considered possible prior to its availability.[69] In these instances, the use of the technology clearly results in increases in labour requirements.

3.3 System Development And Implementation

With the increased availability of packaged software, the implementation of most small computers usually does not require full-time systems analysts and programmers.[70] Although a small amount of additional labour is necessary for minor system de-bugging and adaption to local conditions, the cost of this labour is usually included in the purchase price of the system. But some applications are developed to meet unique data requirements of individual departments and offices, and additional labour must be incurred for the development and implementation of such systems. More supervisory labour is also required during this period, for the specialization and formalization of work tasks which accompanies the technology.[71] Some of this is necessary for the operation of the equipment, but a large proportion of it only serves to make its use that much more productive. But whether the system is developed in-house or purchased pre-packaged, additional clerical labour is

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[69] Sanders, D.H., Birkin,S.J., Computers and Management in a Changing Society, McGraw-Hill, 1980 , pg 241

[70] Hough, R.F., An Overview of the Canadian Computer Services Industry, Dept of National Defence, Ottawa, 1981 , pg 28

[71] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 272

necessary to input data before the system is operational. If existing levels of data processing are to be maintained while this is being accomplished, then additional clerical employees must be hired during this period.

3.4 Equipment Operation

Once the system has been implemented, additional labour is needed to operate the equipment. Most small systems are relatively simple, and only a small amount of additional labour is necessary for operator education. If the equipment replaces manual and mechanical methods of processing data, then existing clerical employees can be retrained. But for new applications, additional employees must be hired.

3.5 Information Use And Management

When the equipment is applied to existing DP operations, its use does not result in additional information. But when new systems are implemented, additional clerical labour is needed to acquire the data to be input, and additional management labour is necessary to make use of the new information. It has been suggested that the use of small systems in peripheral or branch locations has resulted in an increase in the amount of tactical decision-making made at such locations.[72] Prior to the availability of the information, time-pressured decisions had to be made intuitively by the most experienced managers, who were usually located at the head office. But with the newly

[72] Withington, F.G., "Five Generations of Computers", Harvard Business Review, July-August 1974 , pg 103

available information, tactical decisions are now made immediately at the branch or peripheral locations. However, examinations of the effect of computer equipment on the location of employment have not found any decentralization of decision-making that can be attributed to the use of computer technology.[73] Rather, the degree to which decision-making is centralized or decentralized is dependent only on an organization's management philosophy.[74]

3.6 Replacement And Enhancement

The technology can replace the clerical labour needed for numerical manipulation, the production of paper documents, the movement of information and the entry of the same data in more than one account. It can enhance the accessing of information from storage devices, because less labour is needed to access electronically stored information than to obtain paper files from filing systems. The use of a keyboard and terminal does not reduce the labour devoted to data entry. The same amount of labour is necessary to write a number in a ledger, type it on paper, or keystroke it on a computer keyboard.

There is little information on the proportion of clerical labour devoted to the various activities in small scale DP operations. But it is evident that most of the labour is involved in the data entry function. Because of this, and the

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[73] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 270

[74] Sanders, D.H., Birkin,S.J., Computers and Management in a Changing Society, McGraw-Hill, 1980 , pg 241

small number of employees involved, it is very unlikely that actual employment decreases occur because of the labour replacing and enhancing capability of the technology. And any substantial increases in processing requirements will require more employees to enter the data. The productivity of the operation is increased however. But a large portion of this is due to the formalization and specialization of work tasks achieved in implementing the system, and not to the labour replacement and enhancement capability of the technology.[75]

3.7 Overall Labour Impact

The overall labour impact for this area of application is dependent on how many small systems are applied to existing manual and mechanical DP procedures, and to processing new information not done prior to its installation. For existing operations, its use does result in relatively small increases in labour productivity. But some additional labour is necessary to achieve this increase, and a large portion of the productivity increases is due to task specialization and formalization, and not to the technology itself. When it is implemented for new applications it results in increases in the requirements for clerical and management labour.

The recent proliferation of on-line terminals and small computer systems makes it very difficult to determine the overall labour impact of this area of application. Much of the

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[75] Bjorn-Anderson, N., Hedberg, B., Mercer, D., Mumford, E., Sole, A., (eds.), The Impact of Systems Change in Organizations, Germantown, Maryland, Sijthoff & Noordhoff, 1979 , pg 272

equipment is financed through general expense accounts of individual departments rather than capital accounts,[76] to meet the special needs of individual departments.[77] The result in most large organizations, is that there is no one person who knows how many small computers are in operation, how many on-line terminals are connected, where they are located, or what they are being used for.[78] Without this information, the only measure available to assess labour impacts is changes in overall employment levels. But as already discussed, such changes can be in response to a large number of factors, other than the use of an indeterminate amount of computer equipment. Thus it is very unlikely that accurate estimates can ever be developed of the overall labour impact of this area of application, except possibly for very small organizations.

4. CLERICAL DOCUMENT PRODUCTION

4.1 Introduction

The production of textual documents by clerical employees has received much of the attention in the literature since the late 1970's. The equipment applied to these activities consists primarily of stand-alone and shared-logic word processing systems, intelligent photo-copiers and printers, and electronic textual information storage systems. Authors examining the

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[76] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 178

[77] Hough, R.F., An Overview of the Canadian Computer Services Industry, Dept of National Defence, Ottawa, 1981 , pg 28

[78] Wohl, A., "We're not really sure how many we have", Datamation, vol. 28, no.5, 1982

technological impacts on labour requirements for this area of application almost exclusively concentrate on the labour effects of word processing equipment. The following sections reflect this emphasis.

4.2 Reasons For Implementation

The general belief in the literature is that word processing equipment is implemented to reduce or contain clerical labour costs. This belief is developed through the following process. First, word processing equipment has the potential to increase the productivity of document generation. Some estimates of this potential increase are: 100%,[79] 200-250%,[80] and 200-400%.[81] And these estimates are in fact supported by actual increases in the productivity of document generation of 450%[82] and 100-700%.[83] Second, office organizations are actively searching for methods of containing rising clerical costs.[84] Third, equipment costs are falling rapidly, making the technology much more attractive as an

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[79] Stursberg, R., Automation and Employment: A Review of the Debate on the Implications of Information Technology, Ottawa, March, 1981 , pg 24

[80] Hines, C., Searle, G., Automatic Unemployment, Earth Resources Research Ltd., London, 1979 , pg 13

[81] Abraham, S.M., "Is Office Automation the Best Darned Thing You've Ever Seen. Maybe", Computerworld, 28 September 1981, Special Report, vol. 15, no.39 , pg 23

[82] Jecchinis, C.A., The Impact of Microelectronic Technology on Employment: A Survey of Current Research Studies in Selected West European Countries, Labour Market Research Unit, Ontario Manpower Commission, Toronto, 1980 , pg 30

[83] Wilkins, R., Microelectronics and Employment in Public Administration: A Case Study in Three Ontario Municipalities, Ont Min of Labour, 1982 , pg 13

[84] Robey, D., "Computers and Management Structure: Some Empirical Findings Re-examined", Human Relations, volume 30, number 11, 1977 , pg 31

economic substitute for clerical labour. Fourth, the office sector is undercapitalized, in comparison to other sectors. One estimate is that there is only $2000 of capital invested in office equipment per office employee, in comparison to $25,000 per U.S. factory worker.[85] Therefore, word processors are implemented to reduce or contain clerical labour costs.

However, there are several flaws in this argument. Firstly, the sector is not undercapitalized. The author of the figure of $2000, M. Zisman, has since 1978 revised his estimate of the level of capitalization to $15,000 to $20,000, which in his words "is pretty damned high".[86] Secondly, most organizations are just not that concerned about rising clerical labour costs. Rather, they are mainly concerned about rising management labour costs.[87] But most importantly, offices do not want more paper documents. They are already having enough problems coping with the numbers of paper documents. It has been estimated that U.S. business maintains an average of 4 file drawers containing 18,000 documents per office employee, and that these numbers are rising by 4000 documents per employee each year.[88] Because a large portion of documents are produced for use within an organization, this problem can only be exacerbated by installing word processors that have the

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[85] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 15

[86] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 178

[87] Norris, C.I., "Office Automation", Computer Decisions, April 1981 , pg 56

[88] Lester, T., "The Office Conundrum", Management Today, November 1978 , pg 120

potential to increase document production by up to 700%.

The only organizations, or departments of organizations, which can benefit from installing the equipment are those in which standard documents are routinely produced for use outside the organization. Examples of these are legal firms, insurance companies, typing pools and certain government agencies. But for the majority of users, there is no direct economic benefit. This is reflected by the lack of interest in the technology displayed by organizations. In a survey of the 100 largest companies in the U.S., less than half had any intention of installing word processing equipment.[89] And in spite of annual predictions that the use of word processors is about to take off, sales continue to be relatively low. In 1982 the estimated consumption of word processing systems in the United States was only 179,224. While there are no comparable figures for the total consumption of typewriters, 1,840,657 typewriters alone were imported into the U.S. in 1982.[90]

Even when the equipment is installed, it is not installed because of its capability to reduce or contain clerical labour costs, nor is any attention given to its potential impact on productivity.[91] But when the equipment is installed for reasons other than improving productivity, it cannot be expected that

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[89] Strauss, S., "Word Processors", The Toronto Globe and Mail, 17 July 1980 pg. T1 , pg 1

[90] U.S. Department of Commerce, Bureau of the Census, Computers and Office and Accounting Machines 1982

[91] Peitchinis, S.G., The Employment Impacts of Computers and Telecommunications Technology, Calgary, University of Calgary, 1981 , pg 92

its use will result in a negative impact on clerical labour requirements.

4.3 System Integration

Text processing software was first developed by programmers employed in large EDP operations. But it was not long before word processing equipment was being marketed with its own software package. The result is that for most installations, little or no additional labour is required for program development. But additional labour is required to integrate the equipment into existing document production operations. This is especially the case with shared-logic systems, which require a centralization of clerical employees for equipment operation.[92] To achieve this centralization, it has usually been necessary to redistribute activities amongst existing and newly hired employees. The typing function has been taken away from secretaries, and new procedures developed for the delivery and pickup of copy at the word processing pools.[93] The additional labour needed for system integration is most evident when office managers or word processing coordinators are hired.[94] But the extensive nature of the adjustments in document production activities and procedures also requires additional labour beyond the immediate limits of word processing operations. The

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[92] Friedrichs, G., Micro-electronics- a New Dimension of Technological Change and Automation, Club of Rome Conference, West Berlin, 1979 , pg 54

[93] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 182

[94] Wilkins, R., Microelectronics and Employment in Public Administration: A Case Study in Three Ontario Municipalities, Ont Min of Labour, 1982 , pg 13

additive effect of this requirement on overall labour requirements is seldom taken into consideration.

4.4 Equipment Operation

The requirement for equipment operation usually results in an increase in clerical labour requirements. In those instances where stand-alone word processors simply replace electric typewriters, then existing typist or secretarial personnel can be retrained. But when new word processing pools are formed, or when the typing function is removed from secretarial staff and given to equipment operators, then additional employees must be hired.[95]

The training of operators also adds to the amount of additional labour needed for equipment operation. Obviously this does not happen when trained operators are hired. But when existing staff are retrained or untrained personnel are hired, then additional labour costs must be incurred. With the high turnover rates common among clerical workers, the additive labour costs of operator training can become quite substantial. One estimate is that 30% of all clerical workers have been at the same job for less than one year.[96] The effect of this can be seen in the additional labour costs incurred by the Municipality of Toronto for operator training. Of the 320 employees whose labour was diverted for a word processing course consisting of

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[95] Russell, R.A., The Electronic Briefcase: The Office of the Future, Occassional Paper no.3, Montreal, Institute for Research on Public Policy, 1978 , pg 15

[96] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 60

two weeks of half day sessions, only 190 were still employed at the time the word processing operations were examined.[97]

4.5 Information Use And Management

The most obvious effect of the use of word processing is a substantial increase in the number of paper documents produced. In operations where documents are produced primarily for use outside the organization, there is relatively little increase in the amount of labour needed for the use and management of the newly available documents. But even in these instances, if word processing pools have been formed, additional clerical labour is needed for the transportation of documents to and from the centralized word processing operations. In fact, it has been found that this additional labour equals or outweighs any enhancement in productivity that is achieved.[98] But in most organizations, the majority of documents are destined for use elsewhere within the organization or corporate network. One estimate of this internal flow of documents puts it at 70% of all documents produced.[99] If the use of the technology can result in an increase of up to 700% in the number of pages produced, then additional clerical labour is clearly needed for the management of paper filing systems and the movement of documents. And it must not be forgotten that most of these

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[97] Wilkins, R., Microelectronics and Employment in Public Administration: A Case Study in Three Ontario Municipalities, Ont Min of Labour, 1982 , pg 16

[98] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 182

[99] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 26

documents are destined for use by managerial employees. With an increase in the number of documents, additional management labour is necessary to absorb the information they contain, even if the decision is that nothing need be done about it.[100]

4.6 Labour Replacement And Enhancement

The only clerical activity that can be replaced by the technology is the typing or keystroking of unaltered portions of standard documents and letters, once these portions have been transcribed and stored in electronic format. It enhances the production of paper documents, by allowing the editing of less standard portions of letters or documents. The text entry function is not enhanced. It has been found that while the speed of keystroking is faster with word processors, more typing errors are made than with electric typewriters. This necessitates that more time be spent on text editing for error correction. In fact, it has been estimated that if revisions are greater than 40%, it is faster to retype the whole document. Because of this, the use of word processing equipment for the production of nonstandard documents has been estimated to be 9 to 18% less productive than electric typewriters.[101]

A number of instances have been documented where actual employment reductions have been associated with the use of the technology. And some quite amazing increases in the numbers of

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[100] Lester, T., "The Office Conundrum", Management Today, November 1978 , pg 120

[101] Poon, A.L., Office Automation Feasibility Studies, Presentation made at B.C. Computer and Office Automation Show, 10 February 1982

documents generated have also been cited, allowing a containment in the numbers of employees needed for document preparation. Employment decreases of 50% to 60% in the number of typists in typing pools have been cited,[102] and actual increases in document generation of 148%,[103] 450%[104] and 700%[105] have also been noted. Most if not all of these have occurred in operations where the generation of standard form letters or documents is the predominant function. But a number of factors, other than the labour replacement or enhancement capability of the technology, account for a substantial portion of these increases in document generation, and decreases in labour requirements.

The use of word processing equipment is invariably associated with task specialization, employee centralization, and the routinization and systemization of information management activities. In many instances, the typing function has been taken away from secretaries, and in others secretarial activities have been divided into the separate functions of

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[102] Forester, T., (ed.), The Microelectronics Revolution, MIT Press, Cambridge, Mass., 1981 , pg 276

[103] Robey, D., "Computers and Management Structure: Some Empirical Findings Re-examined", Human Relations, volume 30, number 11, 1977 , pg 32

[104] Jecchinis, C.A., The Impact of Microelectronic Technology on Employment: A Survey of Current Research Studies in Selected West European Countries, Labour Market Research Unit, Ontario Manpower Commission, Toronto, 1980 , pg 30

[105] Wilkins, R., Microelectronics and Employment in Public Administration: A Case Study in Three Ontario Municipalities, Ont Min of Labour, 1982 , pg 13

[106] Bessant, J.R., Bowen, J.A., Dickson, K.E., Marsh, J., The Impact of Microelectronics - A Review of the Literature, University of Ashton, Frances Pinter Ltd., 1981 , pg 91

administrative and correspondence secretaries.[106] Even greater task specialization has been observed, with the specialization of the secretarial/typist occupation into the five occupations of: word processor operator, text editor, data entry clerk, administrative assistant and personal secretary.[107] And after the installation of the equipment, text processing operations are more formalized and the activities of operators more routine.[108] But most importantly, particularly with shared-logic systems, there is a centralization of personnel into word processing pools.[109] [110] [111] All of these improve the productivity of text processing operations, and undoubtably are responsible for most of the productivity improvements that have been documented. But much of the rationalization and routinization is not strictly necessary for the operation of the equipment. It only serves to make its use that much more productive. If these processes had occurred in the absence of the technology, similar improvements in text production would have been achieved.

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[107] Peitchinis, S.G., The Employment Impacts of Computers and Telecommunications Technology, Calgary, University of Calgary, 1981 , pg 91

[108] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 156

[109] Friedrichs, G., Micro-electronics- a New Dimension of Technological Change and Automation, Club of Rome Conference, West Berlin, 1979 , pg 54

[110] Strauss, S., "Word Processors", The Toronto Globe and Mail, 17 July 1980 pg. T1 , pg1

[111] EDP Analyser, "The Coming Impact of New Technology", January 1981, vol.19, no.1

4.7 Overall Labour Impacts

The majority of authors examining the labour impact of word processing equipment concentrate on the negative impacts which can occur through the replacement of labour by technology. In their search for proof of technological labour replacement, they largely ignore the underlying reasons for any negative impacts associated with the use of the equipment. They also largely ignore the substantial additive labour impacts that are also associated with its use. It is not possible to derive an estimate of the overall labour effect of the technology. But it is clear that the additive labour impacts outweigh any negative impacts that also occur. In a recent survey of 4000 U.S. offices, it was found that in all but special cases, such as legal departments, few direct cost savings result from the use of word processing equipment.[112] And in Canada, the installation of the equipment has been accompanied by overall increases in the numbers of office staff.[113] The continued use of word processors can only be expected to have similar overall labour impacts in the future.

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[112] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 182

[113] Russell, R.A., The Electronic Briefcase: The Office of the Future, Occassional Paper no.3, Montreal, Institute for Research on Public Policy, 1978 , pg 15

5. MANAGEMENT DECISION-MAKING

5.1 Introduction

Since the earliest applications of computer technology, claims have been made that the use of the technology results in decreases in the numbers of managers. Part of this decrease is assumed to occur because fewer clerical workers are needed after computer equipment is installed in DP operations, thus reducing the need for managers to supervise their activities. As discussed in Section 2,this in fact has not occurred. But much greater stress is placed on the reduction in the numbers of managers, which is assumed to occur through the technological replacement of decision-making activity,[114] and by the enhancement of decision-making labour productivity through the provision of greater amounts of more timely information.[115] [116]

The applications of computer-mediated office technology specifically directed at management decision-making activities are of three forms. Electronic Mail and Messaging Systems (EMS) permit the electronic transmission and storage of textual information between decision-makers within an organization. Management Information Systems (MIS) may include this

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[114] Abraham, S.M., "Is Office Automation the Best Darned Thing You've Ever Seen. Maybe", Computerworld, 28 September 1981, Special Report, vol. 15, no.39 , pg 33

[115] Barron, I., Curnow, R., The Future with Microelectronics. Forecasting the Effects of Information Technology, New York, Nichols Publishing Co., 1979 , pg 127

[116] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 136

communication capability. But the primary function is to provide individual access via computer terminals to local and remote electronic information storage systems. The information accessed is both textual and numerical in nature. Lastly, much of the data processing which occurs in both large and small scale DP operations is conducted to provide data for use in operational and strategic planning decision-making. At this date, very few MIS or EMS are in operation, other than in demonstration or trial projects.

5.2 Reasons For Equipment Implementation

In discussing the reasons for the implementation of computer technology specifically directed at management decision-making, it is first necessary to critically examine two widely held beliefs. Together, they form the basis for the popular conclusion that the use of computer-mediated office technology has and will substantially reduce the amount of labour required for management decision-making. However, both beliefs are largely unsubstantiated, and based on erroneous assumptions.

The first belief is that computer technology has and will be implemented with the specific intent of replacing decision-making. Two statements exemplifying this belief are: "The work of managers is being routinized, standardized and then given to machines",[117] and, there will be a "shrinkage in mid-manager

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[117] Abraham, S.M., "Is Office Automation the Best Darned Thing You've Ever Seen. Maybe", Computerworld, 28 September 1981, Special Report, vol. 15, no.39 , pg 33

ranks as the procedures and processes that form the backbone of administration are automated".[118] Historically, very little decision-making has been automated,[119] and there is no evidence that computer technology has ever been implemented with the specific intent of replacing decision-making. Admittedly, some very formalized and simple decision-making is replaced with large EDP operations. But these decisions are automated only because they are part of a highly formalized and systemized data management operation, and not because of any specific intent to automate decision-making. Furthermore, the automated decisions are themselves highly formalized, and are of such a simple and repetitive nature that they are relatively easy and inexpensive to automate. But these are not characteristics exemplified by most decision-making. Most of the decision-making taking place in offices is highly complex, has not been formalized and made routine, and is not repetitive.[120] And much of the information used for decision-making is textual or verbal, not numerical, and usually is not accessed from the information files of the decision-maker's organization.[121] To automate even the very simple decisions made by a few managers would require an

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[118] Menzies, H., Supplementary Material to "Women and the Chip", Informatics Case Studies, Labour Market Development Task Force, Canada Employment and Immigration , pg 10

[119] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 153

[120] Kotter, J.P., "What Effective General Managers Really Do", Harvard Business Review, vol. 60, no. 6, November-December 1982

[121] Simpson, A., (ed.), Office of the Future: No.1. Planning for the Office of the Future, not dated , pg 99

enormous investment in additional labour and capital over an extensive period of time.[122] It is very doubtful that the small amount of labour that actually could be automated would warrant such an investment. It is therefore very unlikely that organizations will implement computer technology in the future with the specific intent of replacing management decision-making.

The second belief is that MIS and EMS will be implemented because they can enhance decision-making productivity, through their ability to provide additional and more timely information to line managers than existing means of accessing information.[123] According to this belief, this apparently demonstrable improvement in labour productivity will allow organizations to reduce or contain the numbers of managers. The basis for this belief lies in the following questionable or erroneous assumptions. Firstly, it is assumed that managers want more information than they presently have access to, and that they are having problems accessing it.[124] But most managers already have to deal with too much information, and they have only to ask to receive a great deal more. Nor are they

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[122] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 133

[123] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 136

[124] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 136

interested in the aggregate summarized data which an MIS can provide.[125] And the untimeliness or unavailability of information in most instances cannot be solved simply by installing an EMS or MIS.[126] Secondly, it is assumed that the increased availability of information provided by an MIS or EMS increases decision-making labour productivity.[127] But if a manager expends more time, examining more information, to reach the same or perhaps more effective decision, his decision-making labour productivity must of necessity decrease, not increase. A final assumption, and largely an implicit one, is that an EMS or MIS is demonstrably of economic benefit to an organization. Yet there is no quantitative information available on improvements in management productivity resulting from the use of an EMS or MIS. Nor are there any measures of decision-making productivity,[128] [129] and it is very unlikely that there ever will be. Most decision-makers do not follow an identifiable decision-making process, and are not themselves aware of how they arrive at decisions, let alone the amount of time devoted

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[125] Mintzberg, H, "The Managers Job: Folklore and Fact", Harvard Business Review, July/August 1975 , pg 2

[126] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 137

[127] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 136

[128] Dooley, A., "Report on 1981 Office Automation Conference in Houston, Texas", Computerworld, 30 March 1981, vol.15, no.13 , pg 13

[129] Goldfield, R.J., "The Automated Office in the 1980's", Dun's Review, March 1980 , pg 138

to each decision.[130] But without some means of measuring the economic benefit of a computer system alleged to improve decision-making productivity, there is little economic incentive for organizations to implement the technology.

What reasons then could organizations have for implementing a computer system which is very expensive and will take an indeterminate amount of time to implement, is of little practical use, can only increase overall labour requirements, and whose economic benefit cannot be assessed? The absence of economic reasons for equipment implementation has never completely restrained organizations from installing expensive computer systems. Many of the extremely expensive mainframe computers installed in the 1950's were implemented not for economic reasons, but rather because of concerns for corporate prestige. To be progressive, an organization had to have a mainframe computer. And many of the MIS installed in the 1960's appear to have been implemented more for the user's prestige derived from possessing an impressive oaken MIS station, rather than from any economic justifications. It is quite possible that a few MIS and EMS will be implemented in the future, because of the novelty of communicating via computer terminals, and the personal and corporate prestige associated with the presence of office computer technology. But when the equipment is installed for these reasons, it is unlikely that any serious attention will be paid to the possibility of improving labour

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[130] Mintzberg, H, "The Managers Job: Folklore and Fact", Harvard Business Review, July/August 1975 , pg 2

productivity.

Historically, most computer systems implemented to assist management decision-making activities have not been implemented to enhance labour productivity. Instead, inventory control, cash accounting and corporate modelling applications for instance, have been implemented to provide more information for corporate planning decision-making, which was not possible in the absence of the information.[131] Additional labour is required to make use of the information, and this is reflected in the growth in the numbers of corporate operational and strategic planning personnel.[132] Planning decisions may be more effective, but the increased effectiveness is achieved by increasing management labour requirements. This is indicative of what may be expected of any computer system which provides more information for decision-making, and which is implemented for reasons other than to reduce labour requirements.

5.3 System Development And Implementation

For the successful implementation of any computer system, additional labour is required. Even such a relatively straightforward application as a prepackaged EMS requires additional labour to identify the location of management equipment users, and for the small amount of custom programming required for adaption to local conditions. More complex

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[131] Sanders, D.H., Birkin,S.J., Computers and Management in a Changing Society, McGraw-Hill, 1980 , pg 233

[132] Simon, H., The Shape of Automation for Men and Management, New York, Harper and Row, 1965 , pg 221

applications directed at planning activities require substantially greater amounts of implementation labour. Systems analysts and programmers are needed to develop the systems, and to establish the procedures to ensure that the necessary data is entered into the computer system. Additional labour is also required of existing supervisory and management employees who are familiar with the existing manual systems, and corporate planning information requirements. But even these additional labour requirements are minor compared to those needed to successfully implement an MIS. Early attempts at developing MIS in the 1960's are widely acknowledged as failures, because they were only capable of providing already available aggregate data.[133] But most managers make use of unprocessed data from a variety of sources in their decision-making. For an MIS to be of any use it must therefore provide the user with easy access to raw data stored in both local and remote information storage locations.[134] And this must be achieved for the unique data requirements of every user of the MIS. Futhermore, most MIS are envisioned as being only part of a complete electronic office information system, which will require that managers use the MIS to access textual files as well as data. This capability will require a very sophisticated user interface language, which of necessity must be developed for the unique information

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[133] Mintzberg, H, "The Managers Job: Folklore and Fact", Harvard Business Review, July/August 1975 , pg 52

[134] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 pg 137

availability, and information requirements of the organization. To achieve this will require a substantial increase in the numbers of programmers and analysts employed by an organization, for a lengthy but indeterminate amount of time. It will also require the diversion of existing management, supervisory and clerical employees, to explain information requirements, management practises and information sources. If an organization is to maintain existing levels of information processing during this lengthy period, it is clear that additional clerical, supervisory and management employees must be hired.

It is very difficult to determine the overall magnitude of this form of labour impact. The labour needed to implement an EMS is relatively small, and most likely will be provided by the company marketing the computer system. Some planning applications are also available prepackaged. But many are developed by the programmers and analysts already employed by organizations in their large scale DP operations. Thus it is not possible to distinguish what proportion of their labour is involved in developing planning applications such as cash accounting or production scheduling systems, and what proportion is devoted to clerical DP applications such as customer billing systems. It is even more difficult to determine the magnitude of the additional labour that will be required to implement an MIS. In addition to the programmers and analysts that will need to be hired, labour will have to be diverted from existing employees throughout an organization. New clerical, supervisory

and management employees will also be needed throughout the organization during the period in which the MIS is being developed. The most that can be said is that the development of an MIS will be very expensive in terms of additional labour costs.[135]

5.4 Equipment Operation

MIS and EMS are intended for the use of management employees. Unlike other areas of application, equipment use is not the primary function of managers. And because the systems will be installed to assist existing managers, additional employees cannot be hired to operate the equipment. Labour of existing management employees must therefore be diverted from other activities, to learn how to use the equipment effectively, and then to use it in their daily activities. EMS are relatively simple to operate, and do not require a great deal of time before they can be operated effectively. But for an MIS to be of use, it must provide access to textual and numerical information in a variety of locations in the organization. This requires a complex user interface language, which in turn will require substantial additional labour of potential users to learn how to operate the system effectively. Once this has been achieved, additional labour will then be necessary for the operation of the equipment for daily information accessing

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[135] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 134

purposes.

At this date there are few EMS and MIS in operation, and no information is available on the amount of additional labour required of managers to learn how to use the systems, or of the amount of time devoted to equipment operation. The magnitude of this form of labour impact is dependent on the degree to which equipment use replaces existing methods of accessing information, and to a lesser extent on the accessing of previously unavailable information. But because an MIS or EMS requires that a manager devote his own labour to information accessing, rather than relying on the labour of support staff to provide desired information, it can be concluded that the operation of either type of system will have an indeterminate, but additive impact on management labour requirements.

5.5 Information Use And Management

Any computer system that improves the availability of information can be expected to have an additive impact on the amount of labour required of management personnel. Corporate planning applications, such as cash accounting and inventory control systems are implemented to provide information that was not previously available.[136] New decision-making opportunities are created, requiring additional management labour. The result is an increase in the numbers of managers involved in corporate

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[136] Sanders, D.H., Birkin,S.J., Computers and Management in a Changing Society, McGraw-Hill, 1980 , pg 233

planning activities.[137] The same effect can be expected with the use of EMS and MIS. Both allow the accessing of previously unavailable information, which will require additional labour for its examination. Additional clerical labour will also be needed with an MIS or EMS, to capture and manage the new information the system is to provide. It is therefore clear that the use and management of the information provided by applications directed at management decision-making activity results in overall increases in the requirements for clerical and management labour.

5.6 Labour Replacement And Enhancement

Many authors encountered in the literature stress the negative labour impacts that have and will occur through the technological replacement of decision-making labour. To this date very little of this has occurred.[138] The emphasis in this section will therefore be on whether any significant replacement of decision-making labour will occur in the future.

For decision-making to be replaced by computer technology, the decision-making process followed by managers must be accurately identified and then programmed. The information used in the decision must also be identified and then captured in the organization's electronic information bases. Finally, and this point is usually ignored by most authors, the economic benefits

[137] Simon, H.A., "The Consequences of Computers for Centralization and Decentralization", in Forester, T., (ed.), The Microelectronics Revolution, MIT Press, Cambridge, Mass, 1980 , pg 220

[138] Van Weeman, B., "The Impact of Computers on Office Work", in Berting, J., Mills, S.C., Winterberger, H., The Socio-Economic Impact of Micro-electronics, Pergamon Press, Toronto, 1980 , pg 153

of automating the decision will need to outweigh the additional costs of achieving it, before the labour replacement will be attempted. Examinations of the daily activities of managers have found that their actions are characterized by brevity, variety and discontinuity.[139] It was not possible to identify when they were involved in decision-making, how much labour they devoted to each decision, or even the process they followed in reaching a particular decision. Nor were they themselves aware of how they reached a decision, or all the information used to reached a decision.[140] Most managers strongly favour accessing information verbally, and devote as much as 37% of their labour to face-to-face contacts and 9% in telephone conversations.[141] Many of these contacts are with people outside their organization.[142] Only 8% of their labour is expended in examining documents, and 8% analysing information. It is conceivable that after a great deal of effort, the method used by a manager to reach a simple decision could be identified and programmed. But the information needed for that decision would still have to be accessed and input into the computer system. This would require that an office employee contact the person, who is often outside the organization, and then enter the

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[139] Mintzberg, H, "The Managers Job: Folklore and Fact", Harvard Business Review, July/August 1975 , pg 52

[140] Kotter, J.P., "What Effective General Managers Really Do", Harvard Business Review, vol. 60, no. 6, November-December 1982

[141] Rhodes, W.L., "How to Boost Your Office Productivity", Infosystems, October 1980 , pg 38

[142] Simpson, A., (ed.), Office of the Future: No.1. Planning for the Office of the Future, not dated , pg 99

information into the computer. But there is little value in doing any of this because most managers do not make the same decisions periodically, using the same information. Instead, each day requires new decisions, and requires the accessing of new information from sources of which only the manager is aware.[143] Given these characteristics of management decision-making, there does not appear to be any economic benefit in attempting its automation. It is therefore very unlikely that any decision-making replacement will occur in the near future.

Another common belief is that an MIS or EMS can enhance the labour productivity of decision-making. An EMS allows a terminal user to access information from any other user connected to the system. But as already mentioned, many of the daily contacts made by managers are with persons outside the organization. Unless these persons also use a compatible EMS, they must still be contacted in person or via the telephone. But even if more contacts could be made with an EMS, more labour would then be required, not less, to make use of the information in a decision.

The use of an MIS will allow the user to access local and remote textual and numerical information storage files. It is usually assumed that the use of an MIS will improve productivity by providing additional and more timely information, and by reducing the amount of labour devoted to accessing information files. But as already mentioned, most managers already have to

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[143] Mintzberg, H, "The Managers Job: Folklore and Fact", Harvard Business Review, July/August 1975 , pgs 50-52

deal with too much information, and can easily obtain more if desired, without resorting to the use of an MIS. And many of the problems of the unavailability of information cannot be solved by installing an MIS.[144] But even if managers did want more information, additional labour would be required for its examination. This can only decrease the labour productivity of decision-making, even though the final decision might be more effective. Nor can the use of an MIS reduce the amount of labour required of managers for accessing information files. In the absence of an MIS, a manager can make use of his support staff to obtain the needed information. But with an MIS, the manager must expend his own labour in using the MIS to obtain the information. This can only further decrease management productivity.

5.7 Overall Labour Impacts

The historic experience of the use of computer systems directed at management decision-making has been an increase in overall labour requirements. The implementation of corporate planning applications has resulted in increased numbers of managers, and has also required additional programmers analysts as well as clerical employees. The use of computer technology has not been associated with the replacement of management decision-making, and it is very unlikely that this will alter in

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[144] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 136

the future. On close examination, recent developments in computer systems, such as EMS and MIS, which are alleged to improve management productivity, do not have the capability to do so. MIS in particular are very expensive and difficult to implement, and their potential benefit cannot be accurately assessed. It is therefore very unlikely that their use will become widespread in the near future.

Organizations have found that the most effective way to improve the productivity of managers is by removing as many ancillary activities as possible from managers, and giving them to support staff such as secretaries and file clerks. But the use of an EMS or MIS requires that managers themselves perform clerical tasks such as file accessing, which can only decrease their productivity. In those few instances where EMS and MIS are implemented, the result can only be an increase in overall requirements for management, clerical and system analysis and programming labour.

6. ELECTRONIC OFFICE NETWORKS

6.1 Introduction

Since the late 1970's this area of application has received most of the attention in the literature. The principal effect of the technology is the replacement of the storage and movement of paper documents within an organization.[145] An electronic office network has been described as "an integrated electronic

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[145] Zisman, M., "Office Automation: Revolution or Evolution", Sloan Management Review, vol.19, no. 3, 1978 , pg 4

system which links together in an integrated whole computers, word processors, intelligent copiers, information bases, facsimile transmitters, teleprinters and video-conferencing".[146] The popular belief is that the use of such systems will dramatically reduce office labour requirements. Estimates of the overall negative impact range from 20%[147] to 50%[148] for clerical labour and 30% for management labour.[149] At this date, there are no full-scale electronic office networks in everyday operation. However, there are a number of very small demonstration projects funded by computer manufacturers, and a small number of trial projects in government offices.[150]

6.2 Reasons For Implementation

A prominant author has stated that the "office of the future" will be thoroughly entrenched in Canadian business by 1995.[151] Others have been even more emphatic, stating that paper-based information systems will be completely replaced by

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[146] Peitchinis, S.G., The Employment Impacts of Computers and Telecommunications Technology, Calgary, University of Calgary, 1981 , pg 67

[147] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 130

[148] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , p66

[149] Poppel, H.L., "Who Needs the Office of the Future?", Harvard Business Review, vol. 60, no. 6, 1982 , pg 151

[150] Canada Department of Communications, Trying Out The Future. Office Communications Systems In The Federal Government, not dated , pg 3

[151] Menzies, H., Supplementary Material to "Women and the Chip", Informatics Case Studies, Labour Market Development Task Force, Canada Employment and Immigration , pg 25

the same date.[152] For this dramatic changeover to occur within such a short period of time, it could be expected that there are clear economic incentives to implement such systems. Instead, there are only reasons not to. The most obvious deterrent is the enormous cost required for system implementation. It has been assumed that the widespread use of word processors and desktop computers will provide the infrastructure on which an electronic network can be based.[153] But most computer equipment is not physically capable of communicating with any other computer equipment. Nor are their software systems compatible. To establish an electronic network, an organization would have to discard most of its existing computer equipment and paper filing systems, and then purchase new compatible equipment. And while there have been large decreases in memory and processing hardware costs in recent years, the cost of communication technology has increased and is expected to continue doing so.[154] This can only make electronic networks that much more economically unattractive in the future.

In addition to these very large capital costs, an organization would have to hire large numbers of employees for the long period of time it would take to implement the system. Rather than being a simple matter of providing every office employee with their own terminal, it is generally acknowledged

[152] Barron, I., Curnow, R., The Future with Microelectronics. Forecasting the Effects of Information Technology, New York, Nichols Publishing Co., 1979 , pg 32

[153] Barron, I., Curnow, R., The Future with Microelectronics. Forecasting the Effects of Information Technology, New York, Nichols Publishing Co., 1979 , pg 17

[154] Champine, G.A., Distributed Computer Systems. Impact on Management,Design and Analysis, New York, 1980, pg 4

that a fundamental change is required in how offices operate.[155] To achieve this change, a great deal of additional labour will be required to rationalize and systemize office activities and information flows, before the equipment can be installed.[156] It is expected that the cost of this additional labour will equal or exceed the cost of the technology itself.[157] But even after a system has been implemented, few labour savings can be achieved. The only direct labour saving can occur through the replacement of the clerical labour needed for the internal movement of paper documents and the maintenance of paper filing systems. But unless all organizations implement compatible electronic networks, which is very unlikely, a large number of paper documents will still be coming into an organization. Additional clerical labour will be needed to transcribe these documents into electronic format, and direct the information to the proper location.[158] This additional labour requirement could easily outweigh any clerical labour replacement that might also be achieved.

Faced with such enormous implementation costs, and such negligible labour savings, few organizations will implement

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[155] Simpson, A., (ed.), Office of the Future: No.1. Planning for the Office of the Future, not dated , pg 10

[156] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 130

[157] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 178

[158] Russell, R.A., The Electronic Briefcase: The Office of the Future, Occassional Paper no.3, Montreal, Institute for Research on Public Policy, 1978 , pg 20

electronic networks in the near future.[159] However, there have been instances in the past where very expensive computer systems have been implemented primarily for reasons other than potential labour savings. It is possible that a few electronic office networks will also be implemented for no other reason than to improve corporate prestige. If so, their use will result in overall increases in labour requirements.

6.3 System Development And Implementation

In most offices, the activities of employees and the storage and movement of information are very unsystematic and unrationalized.[160] Prior to the installation of an electronic network, additional labour will be needed to examine the activities of every employee, and the manner in which information is stored, utilized and moved within the organization. A very sophisticated user interface language will also have to be developed, reflecting the unique information availability and management requirements of the organization.[161] This preliminary work will take a number of years, and will require a large number of full-time system and work activity

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[159] Peitchinis, S.G., The Employment Impacts of Computers and Telecommunications Technology, Calgary, University of Calgary, 1981 , pg 68

[160] Ellis, C.A., Nutt, G.J., "Office Automation Systems and Computer Science", Computing Surveys, vol.12, no.1, March 1980 , pg 54

[161] Spinard, R.J., "Office Automation", Science, 12 February 1982, vol. 215, no. 4534 , pg 808

[162] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 130

analysts, programmers and information management specialists.[162] A substantial amount of labour of existing managers and clerical employees will also be needed to assist in these processes. To maintain existing levels of information processing during this long period, additional managers and clerical workers will have to be hired. Further amounts of labour will then be needed to install the equipment and to deal with discrepancies that become apparent as information bases are interconnected.[163] Finally, additional clerical labour will be required to transcribe existing paper filing systems into electronic format. It has been estimated that offices maintain an average of 18,000 paper documents per office employee.[164] Even if optical character readers are used, a number of additional clerical workers will be needed to operate the equipment and direct the transcribed information to the appropriate storage location. As already mentioned, it is expected that the cost of all this additional labour will equal or exceed the cost of the equipment itself.[165]

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[163] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 140

[164] Lester, T., "The Office Conundrum", Management Today, November 1978 , pg 120

[165] Uttal, B., "What's Detaining the Office of the Future?", Fortune, 3 May 1982 , pg 178

6.4 Equipment Operation

Once an electronic network has been successfully implemented, additional labour will be needed for the operation of the new equipment. It has been estimated that 70% of all internal mail originates in other organizations.[166] And in an examination of a large Canadian office, it was found that at least 45% of incoming mail originated from beyond the corporate network.[167] Unless all offices implement compatible electronic networks, which is very unlikely, additional clerical labour will be necessary to operate equipment to transcribe this information into electronic format on a daily basis.

Most proposed networks emphasize the operation of multi-function work stations by secretaries and managers.[168] Additional labour will be required of such employees to learn how to operate the equipment and the complex interface language. Once this has been achieved, additional labour will then be needed for the daily operation of the equipment. It has been suggested that the use of the technology will reduce the dependency of managers on their support staff for the activities of document file accessing and document production.[169] But

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[166] Barron, I., Curnow, R., The Future with Microelectronics. Forecasting the Effects of Information Technology, New York, Nichols Publishing Co., 1979 , pg 150

[167] Menzies, H., Women and the Chip, Montreal, Institute of Public Policy, 1981 , pg 26

[168] Simpson, A., (ed.), Office of the Future: No.1. Planning for the Office of the Future, not dated , pg 11

[169] Peitchinis, S.G., Technological Changes and the Demand for Skilled Labour, Studies on the Employment Effects of Technology, Department of Economics, University of Calgary, Alberta, 1979 , pg 46

support staff are employed so that managers need not expend labour on ancillary tasks. If managers, unskilled in keyboard use, must access files and key in textual documents themselves, then additional labour will be required of them. Additional labour will also be demanded of secretaries to access files and distribute information electronically. It is noteworthy that much of the task specialization that has been occurring in offices, has been achieved to remove ancillary activities from the responsibilities of managers and secretaries.[170] The task despecialization that is necessary for equipment operation can only result in increases in the numbers of secretaries and managers, if existing levels of productivity are to be maintained.

6.5 Information Use And Management

Unlike other areas of application, the use of electronic networks will not result in increases in the amount of labour needed to make use of and manage additional information. While other types of computer technology are capable of producing more data, or in certain instances more textual documents, communication technology only provides an alternate means by which information may be transmitted and accessed. It has been stated that "studies have shown a net increase in the volume of

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[170] Peitchinis, S.G., The Employment Impacts of Computers and Telecommunications Technology, Calgary, University of Calgary, 1981 , pg 91

[171] Olson, M.H., Lucas, H.C., "The Impact of Office Automation on the Organization: Some Implications for Research", Communications of the ACM, vol. 25, no. 1, 1982 , pg 843

communications as a result of automated systems".[171] It is difficult to understand how such a statement could be made with only a small number of demonstration and trial projects in operation at this time. But it is even more difficult to understand why such an increase should occur. It is not an unreasonable assumption that if information is worth accessing or conveying, it will be, whether verbally, in paper format or even electronically. The only possible reason for an increase in the volume of communication is that managers would make use of the technology to access previously unavailable information.[172] But as already discussed in Section 5, most managers already have access to enough information, and can easily obtain more if desired. And most of the problems of the untimeliness or nonavailability of information cannot be solved simply by installing communication technology.[173] The use of an electronic network will not result in increased volumes of information communication, beyond the levels attainable with face-to-face and telephone contacts, and the movement of paper documents.

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[172] Simpson, A., (ed.), Office of the Future: No.1. Planning for the Office of the Future, not dated , pg 10

[173] Vyssotsky, V.A., "The Use of Computers for Business Functions", in Dertouzos, M.L., Moses, J., (eds.), The Computer Age: A Twenty - Year View, MIT Press, Cambridge Mass., 1980 , pg 137

6.6 Labour Replacement And Enhancement

The only labour that can be replaced with the installation of an electronic network is the clerical labour needed for the internal movement of paper documents, the maintenance of paper filing systems, and the operation of equipment to produce multiple copies of documents. But any decrease in the numbers of office clerks involved in these tasks will not be an accurate measure of the labour replacement that actually occurs. This is because additional labour will be required of managers and secretaries to transmit and acccess information in electronic format; tasks which were previously performed by the displaced employees.

It is unlikely that any clerical labour replacement that does occur will be converted into actual employment decreases. The necessity to transcribe paper documents during the system implementation period and after the system is operational will most likely require at least as many additional employees as are displaced. As has been the case with other areas of application, it can be expected that displaced personnel will be given the opportunity for retraining and then employment in the transcription of paper documents into electronic format.

The availability of video-conferencing does have the potential to replace the labour expended in travelling to and from face-to-face contacts, although some labour will still be necessary to make the contact via a computer terminal. If information transfer is the only reason for personal contacts, it could clearly be done much easier through the exchange of

paper documents or telephone conversations. But it is evident that personal contacts are made more for social reasons than for the transferring of information. The projection of a person's image on a computer terminal cannot replace the social function of personal contacts. It is not expected that the availability of video-conferencing will noticeably reduce the amount of management labour expended in travelling to and from face-to-face contacts.

The use of the technology will not in itself enhance labour productivity. However, the installation of an electronic network can be expected to be associated with an enhancement in overall productivity. This will be the result of the systemization, rationalization and routinization of office activities and information flows, that is required before the equipment can be implemented. Obviously, if these improvements are carried out in the absence of the technology, similar enhancements of overall productivity would be achieved.

6.7 Overall Labour Impacts

Few electronic networks will be implemented in the near future. They are extremely difficult to implement, and the small amount of labour savings that may be achieved will be far outweighed by the large amounts of additional labour required for their implementation and operation, and the equally large capital costs necessary for equipment purchase. In the few instances where they are implemented, overall increases in clerical, management, professional and technical labour requirements will occur. Any improvements in overall office

productivity that might be achieved will be the result of the systemization, rationalization and routinization of office activities and information flows required for the implementation of the technology, and not the result of the technology itself.

7. CHAPTER CONCLUSION

The following is concluded concerning the impact of computer technology on the labour requirements of office organizations.

First, in most instances computer systems are not implemented to replace or enhance labour. Rather, they are implemented partly because they permit the processing and generation of information that was not considered possible in the absence of the equipment, and partly in response to non-economic concerns. Organizations are willing to incur substantial capital and labour costs in the process, and little importance is given to the capability of the technology to replace or enhance labour.

Second, both additive and negative labour impacts are associated with the use of computer technology. Largely because of the reasons for equipment installation, in most instances additive impacts outweigh any negative impacts that may also occur.

Third, a large portion of the negative impacts attributed to the capability of the technology to replace and enhance labour, are in fact the result of the systemization, rationalization and routinization of information processing procedures.

Fourth, new and near future areas of application will not have the substantial negative labour impacts commonly predicted. Word processors are of economic benefit only in the production of standard documents. Because of this, their use will not become widespread. And even when installed, their use results in increases in overall labour requirements. Very few management information systems and electronic office networks will be implemented in the near future. They are very difficult and expensive to implement, and of little practical benefit. In the few instances where they are installed, increases will occur in overall requirements for clerical, management and professional labour.

Fifth, it is very difficult to quantitatively assess the labour impact of computer technology. While negative impacts are usually confined to the immediate operating environs of the equipment, additive impacts occur throughout an organization. And changes in information processing procedures invariably accompany the technology, which also affect labour requirements. These factors preclude the use of changes in labour productivity and employment levels as accurate measures of overall labour impacts resulting from computer use.

IV. LABOUR IMPACTS IN VANCOUVER ORGANIZATIONS

1. INTRODUCTION

A number of office organizations in the Vancouver area were contacted to test the validity of the conclusions reached through the examination of the literature. Specifically, information was sought to answer the following questions.

1) Why is computer technology implemented? Is it to reduce labour costs, or for other reasons?

2) What is the impact of computer use on overall labour requirements? Does it result in increases or decreases?

3) Are changes in productivity and in labour requirements in response to improvements in information management procedures, as well as computer technology?

4) Are historic changes in an organization's employment levels an accurate measure of the labour impact of computer technology?

2. METHOD ADOPTED AND PROBLEMS ENCOUNTERED

Information was collected through personal interviews, rather than through the administering of a structured questionnaire. This method was adopted, partly because of the nature of the desired information, and partly because it was necessary to contact several persons in each organization. That this was the more suitable method is manifest in the problems encountered in obtaining information. Although over 80 organizations were contacted, information was obtained from only 12. Part of this difficulty results from the fact that the

level of computer use in Vancouver is far below the level in other major cities in Canada.[1] But the primary reason lies in the information sources within organizations. Although large organizations are the major users of computer technology, there is seldom one person who can provide the desired information. For example, the person responsible for overall computer use in the head office of a major utility company was contacted. While he was aware that a number of home computers had been brought to work by employees, he had no idea how many word processors or small computers were in use, or how many on-line terminals were connected to the main computer. Nor did he know the purpose for which the technology was being used, or its effect on labour requirements. For smaller organizations, the office manager was the primary source of information. Unfortunately, there is a high turnover rate amongst this type of office employee. Very few of those contacted were employed with their organization when computer equipment had been purchased. Nor did they know why it had been implemented, how much was in use, and often were unaware of existing employment levels. Finally, in no instance were figures available on estimated or actual changes in labour productivity. Nor was any information available on additional labour required during the period when computer systems were being implemented.

Information was obtained on the use of word and data processing systems in: five legal firms, one accounting firm,

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[1] Siller, F., Warren, J., A Study of Automated Office Systems, November 1982 , pg 17

one board of trade office, one school board, one word processing center, one mining company head office, and two engineering firms.

3. REASONS FOR EQUIPMENT IMPLEMENTATION

Of the 12 organizations providing information, only the school board installed computer technology with the specific intent to reduce clerical labour costs. All others installed the equipment because it allowed improvements in document production and data processing that were not attainable solely with manual and mechanical methods. The primary reason given for the installation of word processors was improved document quality. Surprisingly, even legal firms emphasized improved document quality as being more important than increased speed of standard legal document production.

Data processing applications were installed in legal and engineering firms primarily to improve the accuracy and promptness of customer billing, which could not be achieved solely by hiring more accounting clerks. The equipment also allowed the development of data manipulation applications in accounting, mining and engineering firms, which were not considered possible prior to its availability.

4. OVERALL LABOUR IMPACT

Only the school board indicated that computer use had reduced its labour requirements. One organization indicated that the technology had had no noticeable labour effect. All others perceived the use of computer technology as increasing

their overall labour requirements. The most common reason given was that additional clerical employees were required for equipment operation. This was especially the case with word processors, where word processing pools had been formed with new employees, or the typing function removed from legal secretaries and given to newly hired operators. Additional clerical labour was also required, because once installed, new uses were found for the word processors, and the editing capability resulted in more time being spent on revising document content and correcting typing errors.

Most legal firms indicated that their numbers of lawyers increased as a direct result of client billing applications. Such systems increase cash flow, thereby allowing the firm to expand its business and hire more lawyers. The engineering and mining firms also indicated that their numbers of professional employees increased, because the technology allowed the development of new, more complex data management activities.

5. ALTERATION OF INFORMATION MANAGEMENT PROCEDURES

All organizations providing information altered information management procedures during and after the installation of their computer equipment. Word processing pools were formed with existing and newly hired employees, and dispersed data entry responsibilities centralized in one employee. The only organization reporting a reduction in labour requirements was the school board, which installed a 20 terminal mainframe computer. Eight clerical employees were laid-off in the purchasing, accounts payable and accounts receivable departments

within one year of the installation of the mainframe. Part of this reduction was achieved by removing the typing function from employees and giving it to four newly hired word processor operators. Another portion was achieved by decentralizing much of the data entry function to high school offices, where eight data entry terminals were installed.

But many of the changes in information management procedures were not necessary for the use of the equipment. In all the legal firms contacted, continued efforts were being made to reduce the ratio of legal secretaries to lawyers, and many of the ancillary tasks of both these types of employees were being removed and given to other employees. This task specialization was most evident in the removal of client billing responsibilities from lawyers, and the typing function from secretaries. Efforts were also being made to improve the systemization of information management procedures. Several legal office managers emphasized that improvements in task specialization and systemization, and not the technology, were the primary reason for increases in the number of lawyers not being accompanied by equivalent increases in the numbers of support staff.

6. EMPLOYMENT DATA

Detailed employment figures were obtained from three legal firms. Unfortunately, none of the firms were able to provide information on changes in productivity, or volume of work performed.

6.1 A - Legal Firm

This firm had been using word processing equipment for over 10 years. When contacted, they had two standalone word processors and a six terminal shared-logic system. The shared-logic system was used for accounting, customer billing and word processing. The equipment was installed primarily to improve the quality of documents, and to increase the profitability of the firm by improving the accuracy and promptness of customer billing. It was installed in August 1979, and was associated with task specialization, in the removal of the preparation of standard legal document from the responsibilities of legal secretaries. There had also been continued efforts to reduce the ratio of legal secretaries to lawyers. Accounting and customer billing procedures also were improved. The office manager indicated that this increased task specialization and improved profitability allowed the firm to increase its number of lawyers by 54%, while increasing the number of support staff by only 20%.

Table III - Employment Levels - Legal Firm A

	1979	1982	% change
legal secretaries	60	74	+ 23
word processor operators	2	8	+ 300
receptionists	11	11	0
accounting clerks	12	12	0

others(librarians, photocopy clerks, filing and message clerks)	15	15	0
total support staff	100	120	+ 20
lawyers	50	77	+ 54
total employees	150	197	+ 31

6.2 B - Legal Firm

This firm had two standalone word processors and a six terminal shared-logic system. The standalones were used to prepare non-standard correspondence. They were installed a number of years ago, to improve the quality of document appearance. It had been found that their use reduced the productivity of correspondence production, because of the editing capability. The shared-logic system was used for the preparation of standard legal documents, and customer account maintenance and billing. It was installed to improve the profitability of the firm by allowing more accurate and prompt customer billing. It was also implemented because it allowed an improvement in document appearance, and enhanced the production of standard documents. But the office manager emphasized that the equipment was also implemented to enhance the image of the firm. The system was installed as part of a complete redecoration of the head office, and the computer terminals were a very visible element in the reception area for clients. The office manager was hired during this period, to improve the

activities of clerical and professional employees. She described herself as a "systems person", and had reduced the ratio of legal secretaries to lawyers, and removed many of the ancillary data management responsibilities from the lawyers. She also reduced the number of receptionists, and removed the preparation of standard documents from the responsibilities of many of the legal secretaries. The activities of accounting clerks and typists were also systemized and specialized. The office manager felt that the increased profitability achieved with the accounting application was one of the main reasons for the expansion in the numbers of lawyers. But she was emphatic that it was the task specialization and systemization, and not the technology, that allowed this increase to occur without a corresponding increase in the numbers of support staff.

Table IV - Employment Levels - Legal Firm B

	February 1981	July 1982	% change
legal secretaries	29	25.5	- 12
word processor operators	2	10	+ 400
accounting clerks	4	4	0
librarians	2	1	- 50
paralegals	11	10	- 9
receptionists	6	3.5	- 42
others	13	15	+ 15
total support staff	67	69	+ 3
lawyers	38	48	+ 26
total employees	105	117	+ 11

6.3 C - Legal Firm

This firm was the only organization that had maintained a detailed time-series record of employment levels and equipment installations. The standalone units were purchased to improve document quality. The leased and then in-house computer was initially installed to improve the accuracy and promptness of customer billing. The computer was then used to support a shared-logic word processing system. This was implemented partly to enhance the production of standard legal documents and partly to improve document appearance. Throughout the period

covered by the employment data, the office manager had been reducing the ratio of legal secretaries to lawyers, systemizing and specializing the tasks of clerical and professional employees.

Table V - Employment Levels - Legal Firm C

personnel categories	Feb/81 stand alone W.P.	April/81 leased time-sharing for acct	July/82 in-house computer	Sept/82 shared logic W.P.	Dec/82 OCR	Feb/83	% Change Feb/81 to Feb/83
secretaries	67	64.5	71	76	75.5	71	+ 6
word processor operators	3	3	5.5	6.5	7.5	8.5	+ 183
receptionists	7	6	8	8	8	8.5	+ 21
accounting clerks	9	10	13	11	14.5	13.5	+ 50
filing clerks, messengers	6	6	7.5	6	7	7	+ 17
photocopy, microfilm operators	5.5	5	5	3	5.5	5.5	0
library personnel	2	2	2.5	2.5	2.5	2	0
admin. personnel	4	3	4	4	3	3	- 25
total support	103.5	99.5	116.5	117	123.5	119	+ 15
lawyers	75	75	91	92	92	94	+ 25
total employees	178.5	174.5	207.5	209	215.5	213	+ 19

Even with the detailed employment data presented above, it is not possible to assess quantitatively the labour impact of

computer technology. Task specialization and systemization, and not the technology, are responsible for the containment in clerical support staff, during the period when the numbers of professional employees increased. These improvements obviously have an effect on total employment levels as well. Because of this, even if information were available on changes in volume of work performed and labour productivity, it would not be possible to determine the quantitative effect of computer use on overall labour requirements.

7. CHAPTER CONCLUSION

The conclusions reached through an examination of the literature are substantiated by the information concerning computer use in Vancouver organizations. The use of computer technology results in overall increases in labour requirements, and is not implemented to reduce labour costs. Instead, organizations are willing to incur additional labour and capital costs to achieve other benefits of computer use. Document quality is the primary reason for the installation of word processors, and improved speed of standard document production is of only secondary importance. Increased corporate profit and new areas of data management, are the main reasons for the installation of data processing applications. Task specialization and systemization have both additive and negative impacts on specific categories of office employees. But overall, such improvements are the cause of most of the containment of clerical labour costs usually attributed to computer technology. These improvements have a substantial

effect on overall employment levels. This negates the use of employment data as a means of assessing quantitatively labour impacts resulting from computer use.

V. CONCLUSION

1. RESEARCH CONCLUSIONS

To this date, there has been a failure to examine objectively the labour effect of the use of computer technology in office organizations. Most authors reveal in their approach to the subject a simplistic belief that because computer technology is capable of replacing and enhancing labour, it is implemented for just such reasons. This belief then becomes a filter through which they examine the labour effect of existing and future areas of computer application. It is not surprising that they are able to find evidence that computers have and will result in substantial decreases in clerical and management labour requirements. But it has not and will not.

Historically, organizations have displayed a remarkable lack of interest in the labour saving capabilities of the technology. Many authors attribute this to a general ignorance on the part of managers to the supposedly readily apparent labour saving benefits of computers. That this lack of awareness should continue, after over 30 years of widespread computer use, and unstinting efforts of equipment vendors to market their equipment, is very difficult to accept. A much more plausible reason is that managers are quite aware that computer applications almost invariably require at least as much additional labour to implement and operate, as they are capable of replacing. As a result, organizations have turned to the equipment primarily to develop new areas of numerical and

textual information management, that could not be achieved solely with mechanical and labour inputs. In the process, they have willingly incurred additional labour and capital costs. Most of these increases in labour requirements would not have occurred in the absence of the technology.

When organizations have attempted to reduce labour costs, task specialization, systemization and centralization have been the proven means of attaining such results. These processes are often necessary for the effective implementation and use of computer systems. But they are usually carried beyond immediate operating requirements. A great deal, probably the majority, of reductions in labour requirements commonly attributed to the technology, are in fact the result of these processes. Because of this, even if quantitative information were available on changes in productivity and work loads, overall employment figures are not useful as a measure of the labour impact of computer technology.

The belief in the labour saving capability of the technology has also been responsible for the erroneous perception of the labour impacts of future areas of application. Both management information systems and electronic office networks will be extremely difficult and costly to implement. They will require substantial increases in labour requirements during the long periods needed for their implementation. And once in operation their use can only further increase requirements for both clerical and management labour. These increases will far outweigh any labour savings that may also be

achieved. As a result, the use of such systems will not become widespread in the near future.

2. POLICY IMPLICATIONS

Most efforts at policy development have been directed at finding possible responses to a slowdown in the rate of office employment growth, resulting from technological labour replacement. These efforts have been misdirected. Existing areas of application are associated with increases in overall labour requirements. Thus computer use has had a major positive influence on historic growth rates of office employment. The most important policy question then becomes, will this positive effect continue to the same degree in the near future? At least one author has suggested that the use of computer equipment in large organizations, particularily large public organizations, is nearing a level of saturation.[1] And this appears to be substantiated by decreasing rates of growth in the estimated number of large computers in operation in Canada.[2] If this assessment is accurate, then future rates of office employment growth will be influenced primarily by the implementation of what are today future areas of application, and the use of existing applications in small organizations. However, even though electronic office networks will increase overall labour requirements, their use will not become widespread. The

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[1] Siller, F., Warren, J., A Study of Automated Office Systems, November 1982 , pg 15

[2] Canadian Information Processing Society, Canadian Computer Census, Toronto Ontario, Annual , 1982, pg 8

continued positive influence appears therefore to depend on the increasing use of computer equipment in small organizations. Unfortunately, this has received almost no attention in the literature. Until this changes, the influence of computer use on future employment growth rates will remain unknown.

3. FURTHER AREAS OF RESEARCH

The lack of information on the use of computer technology in small organizations is representative of the state of the literature concerning all aspects of computer use in organizations. Any objective research cannot help but contribute to the general level of understanding of this subject. But there are three areas that warrant close examination.

It cannot be expected that the primary conclusion of this research, that computer use is associated with increases in overall labour requirements, will noticeably weaken the commonly held belief that the technology only decreases labour requirements. This can only be achieved through a detailed survey of a large number of organizations. Information should be sought to determine why specific applications have been implemented, and what their effect has been on labour requirements. The survey conducted by Prasad and Verma in India in 1974 serves as an example that such a survey is possible and would provide valuable information.[3]

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[3] Prasad, K., Verma, P., Impact of Computers on Employment, Macmillan Book Co. of India, Madras, 1977

Much more exacting research is needed to quantify the labour effect of different areas of application. This will require a very close examination of the labour requirements of several organizations, prior to, during, and after a computer system is implemented. It will also require the identification and exclusion of labour effects resulting from task specialization and systemization, not strictly necessary for the implemention and operation of the equipment.

This research has concentrated on labour impacts within organizations. But the accurate assessment of the impact of computer technology on national office employment levels requires an understanding of the employment structure of the office sector. Some preliminary research has been conducted on the Canadian office sector.[4] But much more is needed, to determine the size and type of organizations which implement different applications of computer technology, and the number and categories of employees within the organizations.

If these research questions are objectively addressed, most of the uncertainties of the labour impact of computer-mediated office technology will be dispelled.

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[4] Hough, R.F., An Overview of the Canadian Computer Services Industry, Dept of National Defence, Ottawa, 1981

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