OFFICE COMMUNICATIONS SYSTEMS: CONSTRAINTS ON IMPROVED PRODUCTIVITY[1]

Susan M. Clark
Mount Saint Vincent University

Margaret Dechman
Women's Directorate,
Government of Nova Scotia

Laureen Snider
Queen's University

Analysis of the total production cycle of documents indicates the limitations of activity-oriented approaches to office automation. Significant improvements in productivity depend on organizational restructuring rather than on designing office communications systems to fit current bureaucratic structures.

Une analyse du cycle complet de production des documents révele les limites d'une approche orientée vers les activités dans un processus d'automatisation d'un bureau. Toute amélioration significative de la productivité dépend d'une restructuration organisationnelle plutôt que de la mise au point de systèmes de bureautique destinés à épouser les structures existantes.

Improved productivity is the underlying theme of the movement to automate office procedures.[2] The definition and measurement of productivity within an office, however, is not without controversy. Consequently, the claims about how word processors or microcomputers could improve productivity have taken some time to understand and be tested. In this paper we are reporting on one test of the improved productivity claim in an attempt to highlight how office automation can improve the efficiency and effectiveness of an organization and also the limitations on possible improvements.

Background Literature

The early 1980s was a time of speculation with very little data to support or deny the claims that were being made for office automation. In poorly elaborated analogies with the manufacturing sectors, it was argued that by increasing the investment costs per office worker through the introduction of new equipment, a resulting change in work patterns would ensue which would increase the productivity of the office. The figure most frequently quoted was a 30% increase in productivity and/or efficiency. This figure had a certain mythical quality to it and was certainly in need of substantiation. Similarly, although work patterns were expected to change, quite what these changes would be was a matter of debate.

At the time we began the work reported here, much of the available theoretical literature dealing with technological changes focused on the *macro-level*. Within the broadly defined optimistic and pessimistic schools of thought dealing with the impact of technology, there were two major themes (see, for example, Mowshowitz, 1981). The optimists argued that microelectronic technology would lead to a better future for all. Some maintained that the technology could be introduced without radically altering the existing social arrangements and distribution of power in industrialized Western societies. Others, however, suggested that the major effect of computers would be an information revolution which would shift and redistribute concentrations of power in an entirely new direction (Bell, 1981). In opposition to those who see only benefits from the new technology, others see mass unemployment and increasing control by the state and the corporate elite as the inevitable consequence (Braverman, 1974, 1975; Menzies, 1981). If there is the possibility, and this is debatable, of decentralizing the political and economic spheres and of creating alternate "people-friendly" social arrangements, this will result only after a long and hard struggle (Noble, 1978; Kling, 1980).

As might be expected, once the findings from empirical studies were reported, the impact of introducing micro-technology on workers, on their work, and on how they do their work, was seen to be considerably more complex than many theorists had suggested. This complexity arises not only as a result of the characteristics of individual workers but, more importantly, as a result of the nature of the work they do, its relationship to other workers and their work processes, the culture of the organization, the choice of equipment and software programs and the way in which the equipment is introduced into the organization (Zuboff, 1988; Huff, 1990). If we were to characterize our theoretical position, therefore, we would argue not for the importance of direct relationships between the introduction of the equipment and work attitudes, productivity or similar outcome measures, but for the indirect consequences of the equipment as they are mediated by such variables as a person's position in the organization, the structure and culture of the organization, the nature of the equipment and the software, and, the training and user support given. We are suggesting, therefore, that the most useful approach in understanding the impacts of micro-technology at this time is to adopt a structural approach which examines the impact of

computerization within organizational parameters. We obviously would not wish to argue that a particular set of research findings can apply only to a specific set of circumstances. Nevertheless, it is our conclusion that the grand theories which have informed much of the debate about the impact of micro-technology are at a level of generality which cannot be either supported or rejected at this time. Rather, we have to analyze the mediating factors which determine the degree to which the new equipment is accepted and used and its impacts on workers and their work.

Improving Productivity

Traditionally, the methodologies used to measure productivity have reflected conceptual orientations that focus on technological change in isolation from the overall organizational contexts into which equipment is introduced (Belanger, 1983; Bock & Jones, 1987). Managers have identified specific tasks and monitored the speed with which these tasks could be completed before and after computerization. In the area of text entry, for example, increases in the number of key strokes per minute or the number of pages input per hour have been used to demonstrate the productivity gains that result from the installation of a computer system (Kutie, 1977). These gains are for isolated activities, however, and one cannot infer that overall the organization is more productive or more efficient in reaching its goals from studying changes in just some work processes.

Increasingly, theorists and researchers are realizing that productivity is linked to the fit between technological and organizational factors (Canada: Labour Canada, 1982; Mansell, 1987). In many cases, technological and organizational changes occur simultaneously, and the examination of one, to the exclusion of the other, provides only half of the picture. The area of text manipulation again offers a clear illustration of this phenomenon. Following scientific management principles, some administrators have advocated the development of specialized word processing or computer-related positions. This implementation strategy was adopted because people thought that the cost of computer equipment must be justified by efficient around the clock usage or that it was more efficient to concentrate such work as text entry in the hands of "specialists" i.e. those whose sole task is text entry. The alternative perspective, however, holds that improvements in productivity are most pronounced when decentralized management strategies are utilized (Gordon, 1976; Russel, 1982). "If this is correct, the first place to look for productivity gains would be in the replacement of specialists with generalists, who would find their expertise programmed into their workstation computers" (Russel, 1982: 16). It is obvious that this approach would oppose the development of word processing positions, and would instead promote computers as tools to consolidate all relevant entry and editing procedures in the hands of the author or originator.

To understand the full impact of technological and organizational changes, it is necessary to adopt a research methodology that encompasses the entire production process, rather than focusing on isolated tasks. Although specialized word processor

operators may be able to enter text quickly, there are also indications that the separation of composer and typist creates the necessity for frequent and detailed revisions that can prove very time consuming (Buchanan & Boddy 1982: 6). Thus, it is not clear that such a specialized structure actually decreases the total amount of time required to produce a document.

Recognizing the shortcomings of existing productivity measurements, Taylor (1983) developed a particle- or product-oriented perspective rather than a people- or activity-oriented perspective to describe the entire production cycle. Taylor advocated that researchers identify and track the primary products produced, or services offered, by an organization as a means of comparing the actual productiveness of that organization before and after computerization. In the case of a document, the cycle would begin with the request to produce a document and the conception of the content required; continue through composition, entry, and editing stages; and end when the document was finally stored, released, or discarded.

As Taylor's model encompasses all facets of the production cycle, it is necessary to consider both the active and inactive components of production. The active segments refer to periods when people are working on the particular product under consideration, for example, gathering information, writing a first draft, reviewing previously written materials, making revisions, translating, or printing the final copy. Alternatively, the inactive segments represent periods when the document is laying idle waiting for someone to perform a certain task, such as editing or printing. The time consumed by both active and inactive aspects determines the total amount of time required to produce an end result.

By adopting the approach outlined by Taylor we were seeking a better understanding of how computerization affects people's work and whether the claims of improved efficiency and effectiveness could be substantiated in the organization we were studying.

Methodology

The findings we are presenting are drawn from an impact assessment conducted between 1983 and 1986 for the Office Communications System (OCS) program-2 within the policy branch of a federal government department (Clark et al., 1987). The impact assessment followed a staggered quasi-experimental design with three separate organizational units receiving access to computerized equipment at different points in time. A group entitled "long-term users" had access to computer equipment prior to the commencement of the study, the participants or experimental group received access to a Local Area Network (LAN) early in the project, and the final transitional or quasi-experimental group did not have access to any computerized equipment until shortly before the conclusion of the research. By adopting such a staggered design it was possible to identify changes associated with computerization.

Because the impact assessment focused primarily on the LAN installation, three primary data collections were conducted over a three-year period, from the fall of 1983

to the spring of 1986: a pre-test, six months prior to the installation of the LAN; an interim, six months after the installation; and a final post-test, 20 months after the installation. Although response rates ranged from 79 to 92 percent, with approximately 120 respondents involved at each stage, the turnover in staff meant that only 40 percent of the respondents were available for all three data collections.

The complexity and diversity of the issues to be covered necessitated that the research team utilize a variety of data collection techniques. Self-administered questionnaires were used to collect information on work attitudes, perceived environmental conditions, and health problems, both prior to and following the installation of the LAN. This information was supplemented by personal interviews which were conducted with a subset of the user group to ascertain specific changes in work processes. Researchers also observed training sessions to document the procedures followed, and an additional self-administered questionnaire was distributed shortly after training to solicit the participants' reactions.

The new system was specifically designed to mimic the way in which people worked prior to the introduction of OCS and to support established methods of managing information in department offices. The system was bilingual in that most screens, forms, messages and prompts for the software appeared in the language of the individual user. All users, regardless of their language of use, could create text in either English or French. Every user had access to all the functions available on the system. The functions were grouped into four general categories: document creation, document transmission, document storage, and other functions, e.g., problem-reporting, external communications.

In the site under study, 70 computer workstations were installed on eight floors in the office of the Minister, the Deputy Minister, the Senior Assistant to the Deputy Minister, and other members of the Senior Management Group, Policy Sector Director Generals and their directors, officers and support staff. The workstations were classed as being "plug compatible" with the IBM PC and were linked through a LAN.

Because the impact assessment research was conducted within the policy branch of a federal government department, the primary entities produced were responses to correspondence and more lengthy policy papers. During the personal interviews conducted with support staff, officers, and managers at the three data collection periods, detailed questions dealt with the precise procedures followed and the overall speed and quality of document production. As the procedures varied in accordance with the length of the document, one-half of the respondents were asked to comment on the processing of short documents e.g., correspondence, and the other half were asked to address their responses to long documents, e.g., policy papers. Due to the time requirements for such detailed interviews it was necessary to restrict this component of the research to two specific divisions within the branch under study. Thus, the analysis follows a qualitative format with approximately 20 respondents for each time period.

The Results

The gains and limitations on productivity can be identified most clearly with respect to the processing of correspondence. In the year preceding the introduction of the LAN, the branch processed approximately 950 pieces of correspondence. The average response was four pages and turnaround time was approximately 29 days. The departmental policy, however, required a turnaround time of 10 days. On average 45 copies were made of each reply because of the number of individuals and steps involved in the approval process. Replies were revised an average of 10 times at the branch level and twice at senior management levels. If a letter went through each step just once, an estimated 34 steps were covered between the receipt of a letter and the mailing of an approved reply. These 34 steps included each time a document was handled by a member of the department (e.g., officer's secretary to the officer, back to the secretary, on to the Director's secretary, to the Director, etc.). It should be noted that the officers in the study were operating at a relatively senior level in the organizational hierarchy, where there were only four levels to the Minister's office, with the pattern being officer —> director —>director general —> senior management (e.g., ADM, DM —> Minister's office). Nevertheless, letters were handled a minimum of 34 times within the department. During the year in which the LAN was installed, the volume of executive correspondence climbed steadily until it had reached over 1400 letters. Based on approximately the same number of staff and yet with a 70 to 80 percent increase in workload, the branch was able to process responses in an average turnaround time of 21 days. The number of steps involved in producing the correspondence remained unchanged. Copies of a document did not decrease and there was some indication that the number of copies actually increased. This increase was probably related to the increased number of changes made in documents and the feeling that documents could not be stored safely electronically. Hence, the tendency to make hard copies of all versions of the document and the increase in the total number of copies. Although respondents attributed the improvements in productivity to the installation of the LAN, it was clear that the full potential of the equipment was not being utilized and that further gains in productivity would not occur unless restructuring of the workplace occurred. In looking at each of the stages involved in the production of a document it becomes evident why productivity gains occur and why there are limitations.

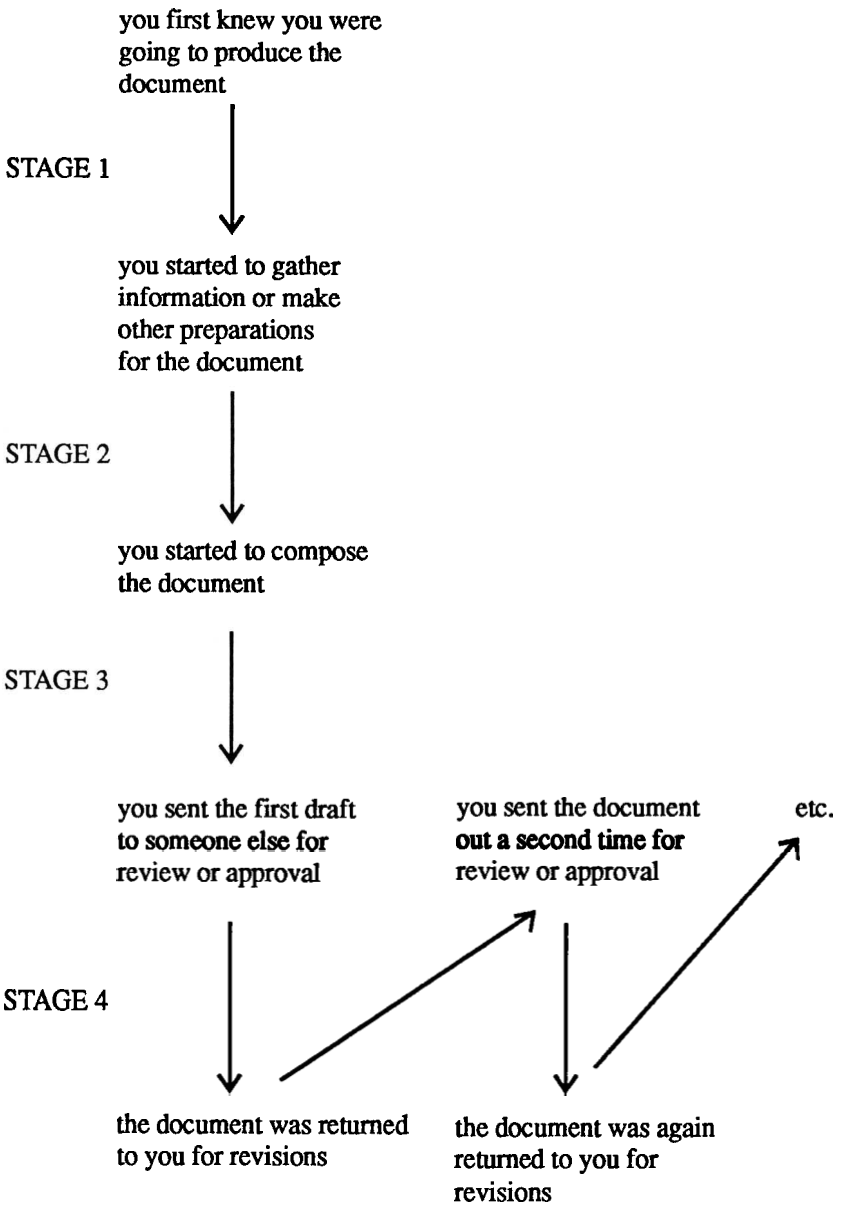
Figure 1 provides a visual representation to assist in conceptualizing the particle tracking approach.

Document processing can be described as encompassing the following five stages:

1 - lapsed time between the request and the commencement of work
2 - information collection
3 - creation
4 - review and revision
5 - finalization and storage

Figure 1

Stages of Document Processing



If one follows the production process from conception to completion, the lapsed time for most of these stages includes both active and inactive components. Under document creation, a letter could have an inactive period of four days sitting on someone's desk and an active period of one hour when the recipient composes a response. The following sections will elaborate on all aspects of the production process prior to, during and following the introduction of the LAN.

1. Lapsed Time Between the Request and the Commencement of Work

Because people have tended to consider productivity with reference to the speed of accomplishing specific tasks, little consideration has been given to the amount of time that may be lost waiting for someone to begin work on a particular project. Competing demands and priorities can play a significant role in determining whether work will begin immediately or will be postponed for a day, a week, or a month. At the time of the baseline data collection, officers reported that approximately two to three days usually lapsed before they could direct their attention to any specific piece of incoming correspondence. However, they anticipated that the new computer system would enable them to process their responses more quickly, thus, diminishing the general backlog and improving the turnaround time for each letter. After the LAN had been in place for over a year, it was clear that officers were able to process public inquiries more quickly. The improvements were a consequence of easy access to pre-existing and approved sentences and paragraphs, which resulted in composition becoming less time consuming, and reportedly reduced procrastination. Officers were less overwhelmed by the thought that the task before them was difficult and discouraging.

2. Information Collection

Although it takes a relatively long time to develop efficient electronic information storage and retrieval systems, computer technologies offer great potential for accessing, organizing and cross referencing materials. Officers found that the LAN improved both the speed with which they could collect necessary materials and the quality of the information derived.

Composition of short documents, such as responses to correspondence, was usually accomplished by extracting and adapting similar pre-existing information. For example, a paragraph dealing with a particular issue would be composed in response to one person's inquiry and then that same paragraph would be duplicated and customized to fit other inquires on the same issue. Although this technique did not change with the introduction of the LAN, it did become more systematized. Frequently used paragraphs or quotations were catalogued in group space which could be accessed by all officers working in the same division. This new shared arrangement was deemed to have many advantages both in the areas of time saving and content quality. Firstly, electronic storage permitted efficient and immediate access to one's own and other's work; secondly, it allowed the extraction of appropriate materials; and thirdly, it reduced revisions because the existing content had already been perfected and approved by managers in another context.

The new computer system also had beneficial results for the collection of information for more lengthy policy documents. Prior to the installation of the LAN, officers had to rely on external organizations, such as Statistics Canada, to provide them with necessary statistical information. However, the tables developed by such outside sources did not precisely meet departmental requirements, and requests for customized runs were very costly. Once the LAN was in full operation, data tapes from Statistics Canada were downloaded onto the Network. Because analyses could be conducted in-house, the results were timely and the information generated more closely approximated the policy questions addressed by the department. Time savings resulted because it was no longer necessary to wait for data to be processed outside, and the quality of the information collected was more pertinent and up-to-date.

In addition to the positive changes reported after 20 months of system usage, respondents were eager to further utilize the potential of their new equipment by accessing many more external databases and linking with electronic communications systems. For example, media coverage of events relating to the departmental mandate could be easily obtained through electronic news systems. Unfortunately, the resources were not available to continue with a high level of user support. Consequently, the adaptation or addition of new software was difficult and slowed down potentially beneficial avenues of expansion.

3. Creation

Having compiled all the information to be included in a document, it is then necessary to compose the actual content. For this impact assessment project, the most pervasive and widespread changes in document processing occurred with reference to the preparation of first drafts.

Prior to the installation of the LAN, documents were usually hand written and submitted to divisional secretaries or to the word processing centre for typing. Corrections were inevitably required, and such typing, retyping, and editing often consumed more time than the original composition. The provision of personal workstations for all professionals, placed word processing capabilities right at their finger tips. Although a few officers believed it was an inefficient use of their time to do their own typing, the vast majority directly entered their materials as they composed. Those who utilized the word processing capabilities of the equipment, perceived vast improvements in both the speed with which they could conduct their work and the quality of the completed materials. The time required to produce a first draft was reduced by at least half because it was no longer necessary to wait for secretaries or word processor operators to have time to type or edit documents. Personal access meant that minor revisions could be accomplished in a matter of minutes rather than taking a day or two for someone else to make such changes. Officers also felt that personal inputting and editing encouraged them to make extensive changes, thus, producing a more perfected final document. As text manipulation changed from essentially a support activity to an integral part of the initial composition, professionals found that they could better control both the timing and quality of their work.

4. Review and Revision

The fourth stage of document processing consumed more time than all of the other stages taken together. When the first draft of a memo, letter or report had been completed, it was circulated throughout the various levels of the bureaucracy for approval. Revisions were usually requested at each level, necessitating many modifications before final sign off was reached in the Minister's office, or the appropriate level given the nature of the document.

The LAN configuration was chosen to permit the interaction of individuals at various levels of the organization, and logging and tracking software was custom designed to mimic existing review procedures. However, managers made little use of the equipment because they were discouraged by the bugs that existed in the newly developed software and found it difficult to review materials on the screen. Even when first level managers did attempt to review and forward materials electronically, senior management did not respond. Whereas the aforementioned productivity improvements could be achieved on an individual basis, changes in communication patterns were more difficult to accomplish because of the requirement of a comprehensive commitment by all levels of the organization.

Although review procedures remained consistent throughout the observation period, improvements did arise with respect to the revisions. Documents were usually reviewed by numerous junior and senior level mangers before final approval was obtained, and officers were asked to make many substantive and minor modifications to their original drafts. Personal access to a word processing package meant that officers could input their own revisions without again waiting for the assistance of secretaries or word processor operators. Because so many revisions were typically required, retyping had previously consumed a substantial amount of time. While the revision time was certainly reduced, the time spent waiting for approvals was essentially untouched by computerization.

5. Finalization and Storage

Although officers took responsibility for their own text entry and editing after the LAN was installed, long documents continued to be transferred to secretaries or word processor operators for formatting and printing. This continued reliance on support staff arose because of the complexity of formatting guidelines, the scarcity of letter quality printers, and the need for side-by-side paragraph alignment of bilingual text, a capacity not available on the equipment used by the officers.

Final document storage also created some problems because of the lack of appropriate software. All federal government documents must be assigned appropriate security levels, and retention and disposal schedules must be maintained. Thus, the traditional regulations had to be translated to accommodate electronic as well as textual files. Because the archival software was still in its developmental phase at the time of the impact assessment, users found it difficult and cumbersome to operate. As a consequence, most officers were maintaining their own personal backups. If anything,

the time consumed by document storage was increased rather than decreased after the installation of the LAN.

Total Production Process

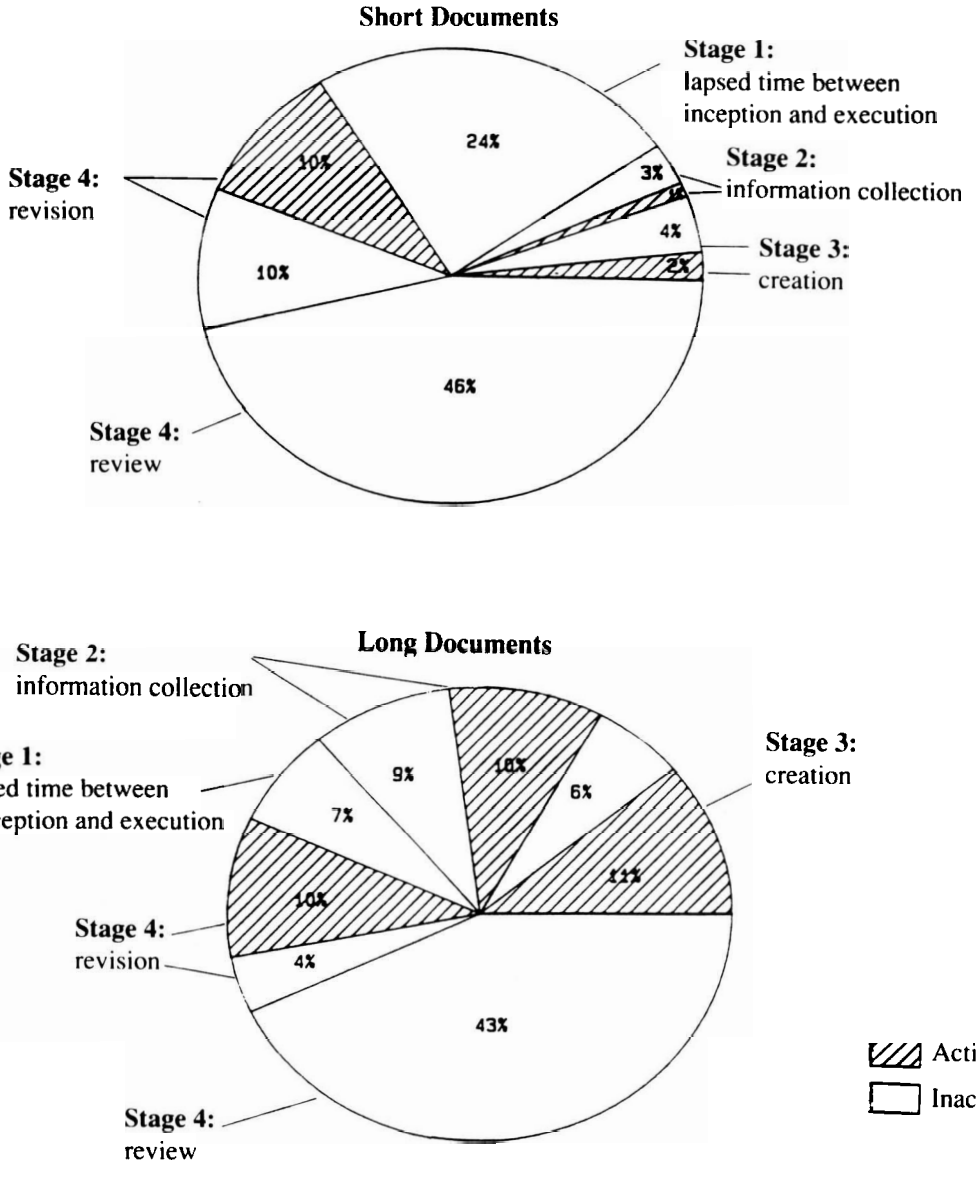
On the basis of the interview data it is possible to assess the proportional allocation of time across the various stages required to produce a document and identify those areas in which computerization has already, or could potentially, have an impact.

Figure 2 illustrates the subdivision of processing time into the various components of document production. The statistics for these diagrams were calculated as an average of the proportional time allocations derived from the post-test interviews. Lapsed times for information collection, creation and review stages include both active and inactive components. Shaded areas represent active components when the author was involved in tasks specifically related to the completion of the document under discussion. Conversely, unshaded areas refer to inactive or waiting periods. Before we discuss the interpretation of these charts, we must reiterate some necessary precautions. The results are based on a very small sample of five short and five long documents. The figures represent the recollections of the authors and should not be considered as precise time sequences. Furthermore, only officers were asked to discuss time sequences so no measurement was taken of the proportion of the review stage that was actually spent working on the document. Having made these qualifications, we must still be struck by dramatic differences in the allocation of time among the various stages and the similarities between the two charts.

One of the most pronounced features of both charts is the relatively small size of the shaded areas. According to these findings, approximately 13 percent of the production time for short documents and 31 percent of the production time for long documents, is spent creating, editing or otherwise improving the text. The remaining proportion consists of waiting periods which occur because of review requirements and competing demands. Although the methodology did not permit an estimation of the amount of time management personnel spent working on the documents, general interview questions revealed that these activities consumed a relatively inconsequential portion of total production time. Thus, the vast majority of lapsed time is concentrated in inactive rather than active features. The length of waiting periods, to a large extent, are determined by departmental priorities and the bulk of documents that are simultaneously flowing through the system. The bottleneck effect also causes an increase in lapsed time at each progressive level of the review process. These findings clearly illustrate the limitations of the activity orientation to productivity. The actual tasks involved in document production represent only a very small proportion of total processing time, thus, computerization is likely to effect only a small part of the production cycle.

Figure 2

Breakdown of Total Processing Time Into
the Various Stages of Document Production



Conclusion

In following the production of documents rather than focusing on individual tasks it is possible to gain a more comprehensive understanding of productivity gains. Over the three-year observation period, computer-related time savings were evident in both the active and inactive components of the information collection, creation, and revision stages; however, little change occurred with respect to the review stage.

The most immediate and comprehensive changes that occurred as a result of computerization were concentrated in the active components of document processing. The LAN enabled more efficient access to stored information, officers could create correspondence and memoranda more quickly because of the ease of accessing previously entered materials and the time required for retyping was virtually eliminated by electronic editing. Although respondents unanimously recognized these changes as improving their work, in total, such activities consumed only a small portion of the time required to complete a document.

Some positive changes also occurred with respect to the inactive components of the productive process, but there is much room for continued improvement. After approximately 1.5 years of computer usage, the respective roles of officers and support staff had been modified to create more autonomous work procedures. However, the impacts of these changes were restricted to the information collection, creation and revision stages, leaving review procedures virtually unaffected. The amount of time consumed by the inactive component of information collection was substantially reduced by the development of in-house databases which enabled officers to manipulate their own data rather than waiting for the necessary statistics to be provided by other government departments or outside agencies. Time savings were also evident in the inactive components of the creation and revisions stages. With the expanded access made possible by the integrated network, officers entered and edited most of their own text, thus, diminishing delays that had previously been created by waiting for secretaries or word processor operators to type or retype documents. Although it is clear that these new procedures improved overall production time, the new system had virtually no impact on the review segment, which consumed the highest proportion of processing time for both short and long documents. Even at the time of the final data collection, 20 months after installation of the LAN, review procedures still accounted for 46 percent of the processing time for short documents and 43 percent of the processing time for long documents (Figure 2). Improvements in this area, to a large extent, depend upon the development of more autonomous work procedures. Bottle necks created by the hierarchical nature of the bureaucracy can only be diminished through a further reorganization of work processes. However, such an outcome requires significant change in the entire administrative structure.

Productivity-related impacts depend upon the interrelationships between technical and organizational factors. By focusing on the speed of accomplishing specific tasks, such as text entry, traditional measures have precluded considerations of the complex interactions that influence both quantitative and qualitative changes in the

total production process. When examining the full cycle from conception to completion of a service or product, it is clear that most of the lapsed time is consumed not by the performance of specific activities but instead by waiting for individuals to address their attention to the task at hand. Although advanced computer capabilities offer some improvements in the speed and quality of information collection, text creation, and editing, the most significant impacts occur when technological change is accompanied by simultaneous changes in work processes and job responsibilities. Because most of the lapsed time for document production is created by waiting for a variety of people to perform their production component, the most pronounced reduction in overall completion time is dependent upon the formation of autonomous work procedures.

The findings from this study suggest that the productivity claims for office automation may have been over-estimated because of an incomplete understanding of the total document-production cycle. Without considerable restructuring of the organization in addition to the installation of appropriate hardware and software, user support and commitment to the system at all levels, office automation can have a potential impact on only limited aspects of the production cycle. While office automation can improve productivity in these limited areas, its full potential has yet to be demonstrated.

ENDNOTES

1. Research for this article was partly funded by the Canadian Workplace Automation Research Centre (CWARC) of the Federal Department of Communications. The opinions expressed in this article are those of the authors, and do not necessarily represent an official position of the federal government.

2. In this paper, we are using the phrase office automation, computerization and the introduction of microtechnology interchangeably to refer to the introduction of computer equipment and software designed to assist office workers. This involves such systems as dedicated work processors, terminals to access mainframe computers and microcomputers whether stand-alones or networked.

3. The OCS program was established by the Federal Government in 1980. A joint initiative of the Minister of Communications, the President of the Treasury Board and the Minister of Regional Industrial Expansion, the OCS program involved five field trials in federal departments, which allowed for the testing of Canadian office automation systems. The research we are reporting was conducted as an impact assessment of one of the field trials and as a follow-up study funded by CWARC.

REFERENCES

Belanger, Marc (1983). "The Facts", *CUPE*, Vol. 5, No. 7.

Bell, Daniel (1981). "The Information Society: The Social Framework of the Information Society", *The Micro-electronics Revolution*, Tom Forester, ed. Cambridge, Massachusetts: M.I.T. Press.

Berman, Bruce (1986). "Bureaucracy and the Computer Metaphor", prepared for Conference on Technology and Social Change. Edinburgh: University of Edinburgh and SCIT Queen's, June 12–13.

Bikson, T.K. and Gutek, B.A. (1983). "Training in Automated Offices: An Empirical Study of Design and Methods", IFAC/IFIP Joint International Conference on Training for Tomorrow, Netherlands.

Blauner, Robert (1964). *Alienation and Freedom.* Chicago: The University of Chicago Press.

Bock, Douglas B. and Jones, Beth H. (1987). "Productivity Measurement in Office Automation", Paper presented at the Sixth Annual Office Systems Research Association Conference, New York.

Braverman, Harry (1974). *Labor and Monopoly Capital.* New York: Monthly Review Press.

——— (1975). "Work and Unemployment", *Monthly Review*, Vol. 27, No. 2, 18–31.

——— (1986). "Control of the Machine", *Environment*, Vol. 18, No. 7, 26–36.

Broom, Leonard and Selznick, Philip (1970). "Technology and Human Relations", in *Automation, Alienation and Anomie.* Simon Marcson, ed. New York: Harper and Row Publishers, 11–26.

Brunet, Lucie (1980). "Word Processors: Source of Emancipation or Alienation for Office Workers", *Quality of Working Life*, Vol. 3, No. 4, 17–19.

Buchanan, David A. and Boddy, David (1982). "Advanced Technology and the Quality of Working Life: The Effects of Word Processing on Video Typists", *Journal of Occupational Psychology*, Vol. 55, No. 1, 1–11.

Burawoy, Michael (1978). "Toward a Marxist Theory of the Labor Process: Braverman and Beyond", *Politics and Society*, Vol. 8, No. 3/4, 247–312.

Canada: Labour Canada (1982). *In the Chips: Opportunities, People, Partnerships* Ottawa: Labour Canada.

Clark, Susan, Dechman, M., Drake, P. and Snider, L. (1987). *Work, Work, Work: Impacts of Office Automation on Work, Workers and Workplaces.* Montreal: Canadian Workplace Automation Research Centre.

Communicado Associates (1982). *Changing World of Work: Towards the Integration of Women in the High Technology Labour Force in the National Capital Region.* Ottawa: Supply and Services.

Dubin, Robert (1970). "Automation: The Second Industrial Revolution", in *Automation, Alienation and Anomie.* Simon Marcson, ed. New York: Harper and Row Publishers, 152–164.

Gordon, David M. (1976). "Capitalist Efficiency and Socialist Efficiency", in *Technology, the Labour Process, and the Working Class*, Rosalyn Baxandall, ed. New York: Monthly Review Press, (1976), 19–39.

Gutek, Barbara A. (1984). "Women's Work in the Office of the Future", in *The Technological Woman: Interfacing with Tomorrow*. Jan Zimmerman, ed. New York: Praeger, 159–168.

Hald, Alan P. (1981). "Toward the Information-Rich Society", *The Futurist*, Vol. 15, No. 4, 20–24.

Huff, Sid L. (Spring 1990). "Evaluating Investments in Information Technology", *Business Quarterly*, 42–45.

Kanter, Rosabeth Moss (1977). *Men and Women of the Corporation*. New York: Basic Books Inc.

Kling, R. (1980). "Computers and Social Power", *Computers and Society*, Vol. 5, 6–11.

Kutie, Rita Catherine (1977). *An Analysis of the Job Dimensions of Word Processing Secretaries, Administrative Support Secretaries, and Traditional Secretaries and the Correlation of These Job Dimensions With Job Satisfaction Scores*. Ph.D. dissertation. Michigan: University Micro films International.

Mansell, Jacquie (1987). *Workplace Innovation in Canada*, prepared for the Economic Council of Canada. Ottawa: Department of Supply and Services.

Menzies, Heather (1981). *"Women and the Chip: Case studies of the effects of informaties on employment"*. Montreal: Institute for Research in Public Policy.

——— (1982). *Computers on the Job*. Toronto: James Lorimer and Company.

Mowshowitz, A. (1981). "On Approaches to the Study of Social Issues in Computing", *Communications of the ACM*, Vol. 24, No. 3, 146–155.

Noble, David (1978). "Social Choice and Machine Design: The Case of Automatically Controlled Machine Tools, and a Challenge for Labor", *Politics and Society*, Vol. 81, No. 3/4, 313–347.

——— (1984). *Forces of Production: A Social History of Industrial Automation*. New York: Alfred A. Knopf.

Offe, Claus (1984). *Contradictions of the Welfare State*. London: Hutchinson.

Russel, Robert Arnold (1982). *Office Automation: Key to the Information Society*. Montreal: The Institute for Research on Public Policy.

Taylor, James R. (1983). "Conceptual Impediments to Productivity", *Optimum*, Vol. 14, No. 1, 9–40.

Winner, Langdon (1977). *Autonomous Technology: Technics-Out-of-Control as a Theme in Political Thought.* Cambridge, Massachusetts: M.I.T. Press.

——— (Winter 1980). "Do Artifacts Have Politics?" *Daedalus*, Vol. 104, No. 1,

Zuboff, Ahoshana (1988). *In the Age of the Smart Machine.* New York: Basic Books.