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A Literature Summary

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Committee on Women's Employment and Related Social Issues
Commission on Behavioral and Social Sciences and Education
National Research Council

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COMMITTEE ON WOMEN'S EMPLOYMENT AND RELATED SOCIAL ISSUES

PREFACE

The Committee on Women's Employment and Related Social Issues was established by the National Research Council in 1981 to study the earnings and occupations of women in the labor force. In the course of our first major study, which deals with sex segregation in the workplace, we became concerned about an issue we believe will be increasingly important in the decade ahead--the extent and effects of technological changes in the workplace. The field of information processing, in which so many women work, is being transformed by advances in microprocessing and telecommunications. Although new technologies have the potential to increase productivity, enhance economic growth, create new employment opportunities, and enhance personal development and growth, their rapid introduction and widespread use also raises questions regarding the restructuring of traditional ways of getting work done, the adequacy of training, and the long-term effects on health and safety. We are concerned about how employment opportunities, including job content, career ladders, working conditions, and earnings, are being altered, particularly for women, in conjunction with the introduction and implementation of these new technologies.

Accordingly, we asked Diane Werneke, an economist who studied these issues for the International Labour Organisation and other groups, to prepare a summary of the available literature on microelectronics and working women. As we suspected, her review attests to the paucity of social science research on these issues. Dr. Werneke, who is now a legislative aide for Senator Paul Tsongas, particularly sought information that would contribute to our understanding of how women at different stages of the life cycle are affected by changes associated with

technological change in the workplace; again, the research from this perspective is inadequate. The existing research does suggest, however, that the impact of some of these technologies, as they have been implemented and used in several situations in which they have been studied, has not been positive for women workers. For example, word processing machines have in some cases accelerated a tendency to break up traditional secretarial jobs into various components, one of which becomes full-time data entry or word processing and is removed from other, more general office skills that could lead to advancement.

We believe the lack of research, the somewhat negative initial research results, and the rapidity with which change seems to be occurring increase the urgency for studying the issues involved. Since the technology clearly has the potential to be used in positive, work-enriching ways as well, we hope to contribute to a process of thorough examination and assessment of what is occurring and a discussion of the many alternative ways to introduce and use new technologies in the workplace. It is our hope that the dissemination of this review will contribute to greater understanding of the issues and encourage further research.

To contribute to this task, the committee is currently undertaking an 18-month study of technology and women's employment, with support from the Women's Bureau of the U.S. Department of Labor and a consortium of funds from private foundations and private industry donated to the National Academy of Sciences for self-initiated studies. The study is being carried out by the Panel on Technology and Women's Employment, specifically constituted for this task and chaired by Louise A. Tilly, a historian from the University of Michigan. We look forward to the results of their deliberations.

The committee is grateful to the National Institute on Aging, whose support made it possible to commission and disseminate this literature summary. We are grateful to Christine L. McShane, editor of the Commission on Behavioral and Social Sciences and Education, for her essential assistance in readying the manuscript for publication and distribution by the committee, to Barbara F. Reskin, who served as study director of the committee at the outset of its work, and to Heidi I. Hartmann, the

MICROELECTRONICS AND WORKING WOMEN: A LITERATURE SURVEY

INTRODUCTION

Concern has grown in recent years about the implications of microelectronics for employment, the content of jobs, and the organization of work. Advances in microelectronic technology have made available flexible, powerful, and rapid computing power at low and falling cost. In addition, the reliability, accuracy, and potential for widespread application of microelectronic technology have been suggested as features that will promote its rapid introduction and cause broad changes in the way work is done in the future.

The changes involve many kinds of work. The industrial sector has seen the advance of robotics and computer-assisted manufacturing and design, with the attendant implications for jobs. Attention is also increasingly focusing on the office. The development of microelectronics has created a new generation of office equipment, including word processors, optical character readers, minicomputers, computer output microfilm, and others; this equipment can be linked into systems for the electronic filing, retrieval, manipulation, and communication of information. This capability is expected to profoundly alter the information-handling occupations associated with office work.

The application of microelectronics to office jobs holds the promise of substantial increases in productivity and reductions in costs for a sector of the economy that has been characterized by neither. At the same time, it also carries the possibility of job loss because it is a labor-saving technology, changes in skill requirements because of its technical requirements, and implications for individual job content as well as work organization

because, like any capital investment, it must be optimally used.

Although the literature on microelectronics and office work is growing in this country and in Canada and Western Europe, few studies have given specific attention to the group most likely to be affected by changes in the office: women who are highly concentrated in information-handling occupations as clerical workers, typists, secretaries, bank tellers, bookkeepers, and the like. For example, in the United States more than one-third of all employed women are working in clerical occupations, and in many of these occupations more than 90 percent of the jobs are held by women. Similar concentrations are found in other industrialized countries.

Various reasons have been suggested for the concentration of women in relatively low-level white-collar occupations: the existence of segmented labor markets, their limited occupational and geographical mobility, inappropriate education and inadequate training, and different life-cycle patterns of labor force participation, among others. And these same characteristics may cause women workers to experience difficulties in adjusting to the changes brought about by new technology, as skill requirements and job qualifications are altered. Moreover, it is not only those women who are now employed who will be affected. Clerical jobs have been of key importance in providing women with work for the last quarter of a century. If their growth is curtailed or if they undergo substantial change as the result of new technology, the problems may extend to women who are seeking to reenter the labor force after taking time out for child-rearing and to new entrants equipped only with traditional office skills.

Little has been written on the impact of new technology on women at different stages of the life course, although changes in skill requirements, job content, and the organization of work may have important implications for the opportunities of women as they age. This literature summary highlights the research that has dealt with new technology and its implications for office work, drawing particular attention where possible to how the effects may apply specifically to women as they age. For example, many studies have suggested that traditional office skills will diminish in importance as new technology advances. This trend may have a greater impact on older women who are not as familiar, comfortable, or flexible as younger ones in working with computer

printouts, terminals, or electronic devices and who may be less willing to undergo training to update their skills.

The paper deals with four major issues raised in the context of new technology. First is the impact of microelectronics on the employment of women, with a focus on the changes in the structure of employment that are likely to occur over time and the requisite alteration in skill requirements. Second is the impact of new technology on employment segregation by sex and on wage inequality. Because relatively few studies have focused specifically on women, overall assessment must necessarily be tentative. Third are changes in job content and work organization, including their impact on job satisfaction and the physical well-being of workers. Finally, because microelectronic technology makes possible the simultaneous communication of written information between physically distant sites, the advantages and drawbacks of working at home or at satellite locations as an alternative to regular office employment are discussed.

In each of the four sections, the main findings of the literature are briefly summarized. Additional and more specialized source material appears in the bibliography. It should be noted that the paper draws from the international literature as well as American sources because, in many cases, much more substantive work has been undertaken by governments and researchers abroad than in this country. The paper does not aim to include all sources of information on the impact of new technology; its purpose is rather to identify and report the major findings while pointing to gaps in information.

THE CHANGING DEMAND FOR LABOR

The introduction of new technology in offices is perceived by most researchers as having a significant impact on jobs and skill requirements. Because microelectronic office equipment is generally labor-saving, predictions have been made of widespread displacement of office workers, in particular those clerical workers whose jobs are characterized as information handling. While new jobs are likely to emerge in response to new technology, the skills in demand are likely to be substantially different from traditional ones that are no longer needed. Consequently, education and access to skill training are likely to emerge as important issues,

particularly for women who dominate those occupations most likely to be affected by the introduction of new technology (Table 1).

Impact on Employment

Many of the early reports from different countries were pessimistic about the impact of microelectronics on office employment. A report prepared for the French government (Nora and Minc, 1980) forecast a considerable savings in employment in large service-sector organizations and suggested that 30 percent of the jobs that might have been created during the 1980s would not be because of the introduction of new technology. A study of office work by Siemens AG in the Federal Republic of Germany, as yet unpublished (cited in Friedrichs, 1979), found that 30 percent of all office jobs could be automated. In the United Kingdom, reports by researchers (Jenkins and Sherman, 1979; Barron and Curnow, 1979) and by trade unions (Trades Union Congress, 1979; Association of Professional, Executive, Clerical, and Computer Staff, 1980) have forecast substantial rises in unemployment as the result of the introduction of new technology.

While it is technically feasible for microelectronics to be introduced at a rapid rate, as implicitly assumed in the studies cited above, thereby creating job dislocation, in practice several factors appear to have slowed down the diffusion of new technology, thereby reducing the immediate pressure for readjustment (Cabinet Office, 1979; Ness, 1980; Hayes, 1980; Arnold et al., 1982). These factors include a lack of skilled workers, capital shortages in the current recessionary environment, and, most important, a lack of awareness among executives of potential applications. At the same time, the productivity gains resulting from the use of new technology have made it feasible for companies to offer new services that would otherwise not be undertaken, thus creating some new jobs when old ones are lost (Zeman, 1979).

Indeed, the evidence that emerges from case studies in Canada, the United Kingdom, and France as well as anecdotal information in the United States suggests that the chief impact of new technology in offices has been a curtailment of the formerly rapid growth of traditional clerical occupations. This has been accomplished by reductions in hiring, attrition, and/or redeployment to other firm activities rather than by layoffs. Thus,

TABLE 1 White-Collar Occupations Dominated by Women and Likely to be Affected by Microelectronics, 1980

Occupation	Percentage Female	Number of Women Employed (thousands)
Bookkeepers	90.5	1,723
Cashiers	86.6	1,346
Secretaries	99.1	3,841
Typists	96.9	991
Bank tellers	92.7	515
Billing clerks	90.2	147
Clerical supervisors	70.5	169
Collectors	56.4	44
Counter clerks	73.4	257
Estimators	56.2	300
File clerks	86.4	280
Insurance adjusters	57.5	100
Office machine operators	72.6	682
Payroll and time keepers	81.0	188
Receptionists	96.3	606
Statistical clerks	78.0	302
Stenographers	89.1	57
Telephone operators	91.8	290
All other clerical	77.1	1,435
Total employed		41,283

SOURCE: Bureau of Labor Statistics (1981) Employment and Unemployment: A Report on 1980. Special Labor Force Report 244. Calculated from Table 23, p. A-22. Washington, D.C.: U.S. Department of Labor.

although there has not been widespread labor displacement in the sense of layoffs, there has been a more subtle loss of jobs (Labour Canada, 1982). This lack of growth is of particular concern to women because it indicates the gradual but nevertheless clear erosion of a key source of their employment. At the same time, it is not clear that they will be able to benefit from the new opportunities that are emerging.

Jobs That Are Disappearing

A Canadian study of the impact of microelectronics on women working in offices (Menzies, 1981) found a sharp reduction in the number of clerical job openings and in the job content of information-handling activities in banking, insurance, and other office work. These disappearing jobs included secretaries, filing and other office clerks, bank tellers, keypunch operators, telephone operators, mail handlers, and related supervisory personnel. Some jobs had been amalgamated so that a worker was engaged in some activities that had previously employed several workers; in a few instances full-time work had been replaced by part-time employment. Similarly, two studies in the United Kingdom that assessed the impact of word processors on office employment found that the proportion of clerical workers, particularly secretaries and typists, on the surveyed companies' payrolls had declined (Equal Pay and Opportunity Campaign, 1980; Bird, 1980). This decline had been brought about largely by not replacing clerical personnel when they left the company. In addition, several companies in Bird's survey indicated that they planned further reductions in the number of clerical workers. A study of office work in 11 French companies found that in most cases the number of typists and secretaries remained the same or was slightly reduced through attrition when word processors were introduced and that the new equipment allowed the companies to do more activities than previously (Enterprise et Personnel, 1981).

In the United States the demand for many types of clerical workers is also expected to decline as new technology spreads through the office sector. In banking, the growth of employment opportunities for tellers and other bank clerical workers is anticipated to slow down during this decade, as automatic teller machines, minicomputers, and other electronic office

equipment become more widespread (Cox, 1981; Jaffe, 1980). In the insurance industry, the application of computers to such activities as billing and collection, underwriting, claims, data entry, filing, and retrieval and their introduction in branch and agent offices are expected to reduce the demand for many clerical occupations (Bureau of Labor Statistics, 1979). In offices throughout the economy, evidence points both to a reduction in the clerical content of each activity, as machines do work formerly done by people, and to a reduction in the intensity of clerical work in general; the evidence also indicates that employment growth will therefore not parallel the rise in the volume of business that would have occurred in the absence of new technology (Working Women Education Fund, 1980a). Moreover, the application of new technology has, in some cases, reduced the need for lower-level management employees, because the monitoring capabilities of computers reduce the need for direct supervision (Menzies, 1981).

The disappearance of many traditional clerical jobs over time clearly will affect women to a far greater extent than men, because they are so highly concentrated in these occupations. This development also has implications for the employment of women of different ages, although no study has yet analyzed the issue. Casual observation would suggest, however, that the disappearance of these jobs is likely to have a potentially significant impact on women reentering the labor market. The effect on new entrants and on older workers will, of course, depend on the educational qualifications of workers and the availability of training and retraining opportunities.

Emerging Opportunities

It is difficult to predict the full range of job opportunities that will become available with the widespread use of new technology in offices. However, it is clear from a number of studies that the demand for computer and technical specialists will rise substantially. In the United States, the American Electronic Association projects a substantial growth for electronic engineers, computer analysts, and paraprofessional computer technicians (American Electronics Association, 1981). The introduction of new technology has also stimulated the demand for professional and management

personnel, particularly those with computer-related technical experience (Menzies, 1981). Relatively few women are engaged in these occupations, particularly as computer specialists (Gregory, 1982; Menzies, 1981; Arnold et al., 1982).

In the clerical ranks, studies have found that some new positions are being created in word processing in areas such as sales, consulting, and customer support (Bird, 1980). As the introduction of new technology allows businesses to expand their activities, jobs in fields such as public information and consumer services are likely to expand (Matteis, 1979; New York Times, "National Recruitment Survey," Oct. 11, 1981). The extent to which women are able to participate in these and other emerging opportunities, however, will depend crucially on their ability to acquire the requisite skills.

The Skill Mismatch

The introduction of microelectronics into offices alters not only the demand for labor but also the skill requirements across the occupational spectrum. This is particularly true for clerical jobs because although the character of management and professional jobs will change, requiring more technical skills, it is the lower-level office workers who will be faced most directly with the new equipment. Considering the new office machinery and case studies of applications (Menzies, 1981; Bird, 1980) indicates the skills that will increasingly become obsolete. For secretaries and typists, the growing use of word processors will reduce the need for the traditional skills of page layout, speed, and accuracy, because most of the new machines have built-in spacing options and text correction capabilities that allow a typist to input at high speed more easily (Reproductions Review and Methods, 1978). Similarly, reliable and easy-to-use dictating equipment will render stenography obsolete. For filing clerks, the firm-specific skill learned on the job will change as the equipment does. Manual recordkeeping, the posting of data, and hand calculations are likely to disappear over time.

For the new jobs becoming available, a new set of technical skills will be needed. Drawing from the Canadian case studies, Menzies suggests that clerical work will require more value-added skills, such as better

human relations and organizational skills, to help get the work done as well as more technical and general knowledge (Menzies, 1981). Similar ideas have been voiced in the United States: all workers will need to become familiar with computer terminals, and there will be an increasing need for conceptual skills and aptitude for technology, in order to analyze and design information in a way that is appropriate to the objectives for which it is intended (Werneke, 1982).

In the United Kingdom, a conference on new skill requirements for clerical work emphasized the diminishing importance of task-specific skills such as typing, dictation, and the like and agreed that modern office workers will need the abilities to solve problems and to organize work effectively, a knowledge of sources of information and the analytical use of data, and communication and quantitative skills (Manpower Services Commission, 1980). In the French study (Enterprise et Personnel, 1981), similar findings emerged: clerical skill requirements will be broader and more conceptual in nature and will include an aptitude for understanding the flow of work in its entirety. Workers will also need to be able to adapt to new work processes.

There is, of course, the possibility that the new jobs in the clerical field will require fewer skills than previously, rather than different ones. Indeed, it is possible that "deskilling" will occur among secretaries and other clerical workers, whereby jobs are broken up into their component tasks, each to be performed by different workers at different skill levels--and some even by machine. Machines thus substitute electronics for brain power, removing the scope for discretion and creativity from many jobs. This aspect of the introduction of new technology is discussed in the section below on equal opportunities.

Training, Vocational Preparation, and Education

Most people see a solution to the mismatch of traditional task-specific skills and the requirements of the office of the future in basic education, vocational preparation, and ongoing retraining. Merely replacing a typewriter with a word processor in the classroom will not provide women with the skills they need as electronic systems are introduced into the office. More than providing task-specific skills, training is needed to give a broader

understanding of an organization as a system and must lay the basis for the continuous retraining that will be necessary over a career (Peitchinis, 1978; Labour Canada, 1982; Sherman, 1983). Such retraining may be a realistic goal for many office workers. For example, a conference on vocational training for office workers (Manpower Services Commission, 1980) noted that many women have both an interest in office organization and the practical skills of keyboard input, classification, and indexing that could provide the basis for more responsible positions, such as trainers in the use of office equipment, systems designers, promotion, sales and customer service, and computer programming.

Basic training--both classroom and on-the-job--have been explored by the International Labour Office and others (International Labour Office, 1981b). Part of the issue is how to ensure the full participation of women in training opportunities. For example, the proportion of women represented in general management and supervisory training is low, whether it is given in-house or at a training center. Whatever the reasons--lack of desire, inability to invest time and effort in training because of family responsibilities, or the failure of employers to consider them as candidates--the issue needs to be more fully explored. At a minimum, training should be carried out during office hours with arrangements made for time off the job for participants (International Labour Office, 1981b).

The need for broad-based training clearly has implications for women at different stages of their working life, which have not yet been fully explored. Several reports have noted the probable difficulties of older women and those reentering the labor force (Working Women Education Fund, 1980a, 1980b) because these women are likely to have the skills that are most in need of updating. However, it is also these women who may have the most difficulty in acquiring training. For those seeking a job after a period at home with young children, their responsibilities may make it difficult for them to spend the time required to retool. Older women may resist training out of reluctance to change old habits, or they may be overlooked by employers for training courses, because they anticipate a better "return" on an investment in younger employees (Gregory, 1982). This is clearly an important issue that warrants further study, because the opportunity for training and access to it will largely determine who gains access to new office jobs.

A related problem is that of basic education and vocational preparation in schools that do not provide a background that is sufficiently technical to stimulate women to enter technical fields or to acquire more technical skills in their postsecondary training (Werneke, 1982). It is well known that girls in secondary schools take fewer science and mathematics courses than boys (Fox et al., 1980). Even in today's more technologically advanced society, women remain unaware of the increasing mathematical requirements of any field of study. Because girls are disproportionately concentrated in general fields of study in schools, choosing courses in the humanities, languages, and arts as opposed to science, mathematics, and other technical subjects, they leave school without a technical background. This, in turn, influences their choice of study at the postsecondary level of education (International Labour Office, 1981b). Having once shut the door to science and mathematics, women then lack the background to study for the higher-level professions in the computer industry. At a different level, the lack of technical background, which promotes the ability to conceptualize abstractly and spatially, inhibits many women from taking the training in computer applications or systems design that would improve their ability to benefit from new technology (Werneke, 1982).

EQUAL EMPLOYMENT OPPORTUNITIES

The labor markets of the industrialized countries are characterized by a marked degree of job segregation by sex, and for no group is this more evident than for white-collar workers. Although some women have made significant advances into professional and managerial positions in most of these countries in recent years, the majority remain concentrated in clerical occupations that are often poorly paid and hold little prospect of advancement. Whether the introduction of microelectronics will change this picture, creating new job openings that provide greater occupational mobility, depends in large part on the ability of women to acquire more broadly based skills, as discussed in the previous section. It also depends on how microelectronics is used to change the content of jobs and the organization of work, because, while there is the potential to create more challenging and varied jobs, there is also the

possibility of downgrading of clerical work, reducing occupational options and further segregating women into low-skilled jobs (von Weenen, 1980).

Changes in Job Content and the Organization of Work

Two schools of thought have emerged in the literature: one view is that microelectronics can relieve clerical workers from boring and routine work, allowing their jobs to be upgraded and enriched (International Labour Office, 1981a); a second view is that new technology can fragment work, creating a number of lower-level, dead-end jobs (Feldberg and Glenn, 1980). Although many examples have been reported of job enrichment (Chicago Tribune, Sept. 19, 1979:16; Business Week, Aug. 3, 1981; Enterprise et Personnel, 1981; International Labour Office, 1981b), much of the analytical evidence is pessimistic, as many researchers have found that the application of new technology has an adverse effect on job content and the way office work is carried out, enlarging the occupational gap between clerical and other employees.

Focusing specifically on the changes in job content that occur when new technology is introduced, several studies found that clerical jobs had become more fragmented and deskilled (Taylor, 1978; Glenn and Feldberg, 1977; Murphree, 1981; Driscoll, 1981). Taylor's investigations showed that clerical tasks were increasingly carried out in pools or at work stations at which each clerk was responsible for a small piece of the work process. Glenn and Feldberg found that the introduction of new office equipment into several insurance companies made clerical jobs more mechanical, lower level, and narrower in content. In her study of legal secretaries in Wall Street firms, Murphree reported that the specialization of administrative tasks produced an unequivocal decline in the number and variety of secretarial tasks. Driscoll concludes that the specialization brought about by the use of new technology has created a new breed of more menial office workers.

Sex Segregation and Occupational Mobility

The findings cited in the previous section have important implications with regard to sex segregation and occupational mobility. Feldberg and Glenn (1980) found

that the impact of technology varied for different segments of the labor force, particularly for male and female workers. In particular, when new technology was introduced, most of the new computer-related occupations were filled overwhelmingly by men, while the deskilled clerical jobs were filled increasingly by women. At the same time, the disappearance of the more complex and highly skilled clerical jobs cut off a traditional path of occupational mobility for female clerical workers. Thus, the main avenues for clerical workers were either horizontal or downward. According to the Working Women Education Fund (1980a), the highest promotion available when word processing is introduced is often that of supervision of each other.

Similar findings emerge from studies in other industrialized countries. Menzies (1981) found that in Canada very few clerical workers moved up into professional or management ranks when new technology was introduced; indeed, a few clerks had to accept demotions to remain in the company's employment. In the United Kingdom, Bird (1980) reported that about half of her sample of women working with word processors thought that their career prospects had not been affected by new technology; although many thought that changing jobs would become easier, this was not necessarily seen to increase upward mobility. Interviews with managers revealed that word processing jobs tended to move workers out of the secretarial hierarchy, thereby eliminating a traditional career path. The word processor operators were tied to their jobs because of the investment in their training. Moreover, because the work was organized into pools, the operators did not acquire the necessary knowledge of the workings of a particular department required for promotion to personal secretary. Bird thus found that there was little evidence that new technology opened up senior jobs for women outside the word processing hierarchy; indeed, she found that the proportion of female employees decreased sharply in the more senior grades.

A study of the Australian banking industry (Game and Pringle, 1979) found that jobs that had once promised upward mobility had become routine and dead end in terms of career progression as well as held increasingly by women. Thus, male ledger clerks were replaced by a smaller number of female ledger machinists, who in turn were replaced by input operators. Women who had begun to move into supervisory positions found themselves with

less certain career paths, because with the monitoring capabilities of machines and work rationalization, supervision became less critical for bank operations. In findings similar to those of Glenn and Feldberg, they found that as bank jobs became increasingly routine with the introduction of automatic teller machines and other electronic equipment, they became increasingly "women's jobs" and lower-status occupations.

Implications for Equal Opportunities and Pay

Most researchers have found that the highly skilled positions created by the introduction of new technology are filled by outside recruitment rather than by training and promotion from within (Menzies, 1981; Game and Pringle, 1979; International Labour Office, 1981b; Working Women Education Fund, 1980a). This would seem to imply that little training designed to promote career progression is going on within firms. Indeed, anecdotal information indicates that training is almost always confined to machine use, often supplied by the vendor, and seldom designed to provide the basis for acquiring higher-level skills (Bird, 1980). This is likely to have an adverse effect on older women and those reentering the labor market, because they are the least likely to be trained. Older women in particular will probably be affected by the disappearance of traditional channels of upward mobility.

Within the computer industry, there is a marked degree of sex segregation: women dominate the lower-paying functions, while men are concentrated in the upper echelons, as systems designers, program analysts, electronic engineers, and the like (Greenbaum, 1979; Gregory, 1982; Kraft, 1977; Dubnoff and Kraft, 1984).

The picture emerging from the literature has serious implications for the promotion of equal opportunities as well as for pay structures. If job content is downgraded, it is unlikely that pay in the clerical ranks will improve. It could even increase the average pay differential between women and men. Unfortunately, there is as yet very little in the literature on the impact of new technology on earnings. The report by the Working Women Education Fund, Race Against Time, found that automation was contributing to lower pay for clerical workers, even though word processor operators commanded a premium over conventional typists. In the United Kingdom, Bird

reported that word processor operators were paid at a specialist typist grade, above the salary of typists but not usually as high as that of secretaries. In banks, no additional payments were made to staff for operating teller terminals (Bird, 1980).

THE QUALITY OF WORKING LIFE

Technology can affect jobs either positively or negatively, depending on how it is applied to tasks and what the goals of its introduction are. Both job enrichment and greater efficiency can be achieved by the introduction of new office equipment because of its capacity to eliminate tedious and repetitive tasks. Certainly, many secretaries are pleased by the replacement of their typewriters with word processors because they are relieved of the time-consuming tasks of retyping and correcting and have increased scope for performing nonroutine work (New York Times, Aug. 16, 1982:B12). IBM's slogan, "Machines should work, people should think," summarizes the potential of microelectronics to create a better office environment.

Much of the research to date, however, has exposed a number of disturbing trends: the introduction of microelectronics has resulted in jobs becoming more highly specialized, more strictly regulated, depersonalized, and stressful. The previous section discusses the tendency for many clerical jobs to be deskilled by the use of new technology to fragment work, which, in turn, has implications for the quality of working life. Thus, for example, Glenn and Feldberg's study (1977) of clerical workers in five companies found that with the extensive use of automation, work pooling was introduced, with several adverse features for employees. Jobs became more demanding, as workers experienced pressure to work at a pace set by the machines. Relationships between workers changed. Vertically, they became more impersonal as work was filtered through several layers of supervisors. Within the clerical work group itself, interdependence was reduced, because everyone did the same work; this was reinforced by a change in physical location, as different clerical units were located in separate parts of the building. The process of subdividing the work also prevented employees from gaining an overview of the total work process and their contribution to it, reducing personal identification with work and job satisfaction.

In some cases, the introduction of new technology has caused work to be speeded up, thereby increasing pressure. Many terminals have a built-in tally and error count of the information processed, so that an operator's speed and workload can be assessed by a supervisor (Driscoll, 1981b). Monitoring of work has sometimes led to the specification of quotas. For example at Blue Cross/Blue Shield, two workers were fired for failing to meet their quota for processing claims (Business Week, Aug. 3, 1981). At other companies, monitoring has caused industrial disputes (Mother Jones, Aug. 1981).

Even in instances in which the use of new technology has neither changed the organization of work nor speeded it up, researchers have found that the potential to enrich jobs has been overlooked. For example, Murphree's study of legal secretaries found that the increasing use of word processors had left many secretaries underemployed, bored, and demoralized (Murphree, 1981), as more of their work was transferred to word processing pools. Many were reassigned to more than one attorney, for whom they essentially performed a gatekeeping function. Bird's study produced similar findings: companies planned to reclassify secretaries to administrative assistants responsible to more than one manager. However, Bird suggested that this would not enrich jobs, for it would be the addition of more support functions, rather than having to work for more people, that would broaden responsibility and enhance the possibility of promotion (Bird, 1980).

Occupational Stress and Other Health Issues

Perhaps no other issue associated with new technology has received more attention than occupational stress and other health problems. Occupational stress refers to excessive strain caused by a job. Over a prolonged period, it can lead to a number of serious health problems, including heart disease, ulcers, and hypertension as well as psychological reactions (Haynes and Feinleib, 1980). Studies in the United States have shown that women working in clerical occupations experience higher rates of stress on the job than men or women in most other occupations (Working Women Education Fund, 1981). Secretaries were found to have the second-highest incidence of stress-related diseases because their jobs required rapid work pacing, long hours, and repetitive or

monotonous work--factors leading to a high level of stress (Sauter et al., no date).

The use of new office equipment has been found by several studies to contribute to increased stress among clerical workers. Researchers at the University of Wisconsin School of Preventive Medicine found that operators of visual display units performing routine work often feel tightly controlled by their jobs because decision making is done by the machine. In addition, workers may have little understanding of how the machine works, adding to the feeling of loss of control and creating stress, especially when the pace of work is also increased (Sauter et al., no date). The health effects were most pronounced among those users with routine jobs and among clerical workers whose jobs had been deskilled or downgraded as the result of the introduction of new equipment.

In another study by the National Institute of Occupational Safety and Health (NIOSH), operators of visual display units at an insurance company showed greater stress ratings than any other group of workers, including air traffic controllers (Gregory, 1982). In other research, workers reported fatigue, monotony, and loss of security and job meaning, as the enjoyable aspects of clerical work, such as variety, personal contacts, and natural work breaks were eliminated by the introduction of new equipment and the consequent changes in job content and work process organization (Smith, 1981).

In a study that investigated the impact of the application of computer-based systems to the routine clerical work of mortgage loan servicing, Turner found that workers who used computers more intensively had relatively less attractive jobs than those who did not, because using the system increased both the workload and the pace of work. The net result was an increase in stress symptoms and in job dissatisfaction (Turner, 1980).

A four-month investigation of work at American Telephone and Telegraph revealed that excessive supervision, computer monitoring, and management quotas had made occupational stress pervasive in the Bell System (Mother Jones, 1980). Many workers were found to have alcohol and drug problems. Indeed, the situation became so serious that 1980 contract negotiations resulted in the establishment of a committee on the quality of work life to propose solutions. Occupational stress is likely to affect women of different ages differently. For example, women with family responsibilities in addition

to their job duties may find that conflicting demands increase the pressure they experience, particularly because child care arrangements are often inadequate, flexible working hours are available to only a small number of clerical workers, and part-time work with job security and fringe benefits is still the exception. With little "give" in their schedules, these women may have extra problems in carrying out their responsibilities. Similarly, many older women without experience with automated office systems may find working with machines and the increased pace of work particularly hard to deal with. There is a serious gap in the literature on new technology and occupational stress.

The use of new office equipment, particularly video display units, has been found to cause other health problems. Long hours at the terminal can cause eye, neck, and back fatigue and more serious problems (Working Women Education Fund, 1981). A great many problems have to do with poor office design, particularly improper lighting. Uncomfortable chairs, lack of humidity, and poor ventilation also contribute to strain. These problems can be corrected by careful planning of the office environment and by attention to preventive measures such as the provision of frequent eye examinations for those using the terminals (Hamilton, 1981). This should be a particularly relevant consideration for older workers required to use the terminals. In addition, researchers have suggested the need for higher-quality equipment, with a minimum of screen glare and easier-to-read characters (Chamot and Dymmel, 1981; National Research Council, 1983), and for standards on the number of hours per day to be spent at a terminal (Hamilton, 1981).

Reversing the Trend

Many researchers believe that the tendency for the quality of working life to deteriorate when new technology is introduced is the result of a failure to take into account the social design of the office (Driscoll, 1981a; Wynn, 1979; Turner, 1981). Generally, in applying technology the emphasis has been on increasing productivity and cutting costs and labor requirements. This focus has, in many cases, left the human and social dimensions of office work unaddressed, thus impeding the effectiveness of the organization. Driscoll found that

the new office systems neglect the personal and interdependent nature of office work by failing to provide any motivation for most employees to work for organizational objectives. And yet, it is interesting to note that lack of motivation has been found to be an important cause of low productivity (McGregor, 1960).

In her research on how an office performs the required tasks, Wynn found that the work is rarely recognized as the intellectual, problem-solving activity that it is. As a result, systems designers tend to view the office as comprised of documents to be produced, messages to be delivered, and records to be updated or filed as if these are the same kind of objects that are manipulated in a factory environment. Wynn concluded that in places where the work of an office is people and not just paper flow, there is a need for a broader perception of the office--one that enhances human interaction and communication.

Clearly, employers play a key role in how new technologies are introduced into the workplace. Arguing that managing automation does not end with the purchase and installation of new equipment or office systems, Zuboff concluded that management should think through the kind of office and environment that they want to foster (Zuboff, 1982b). The assessment should include not only desired changes in job content but also how they will affect employee expectations for job satisfaction and career mobility as well as what organizational and cultural changes will be stimulated by the introduction of new technology (Zuboff, 1982a).

From a different perspective, Driscoll has suggested the need for employees themselves to participate at some stage in the system design. He found that most studies show that employees produce more and make innovations more readily in organizations structured to allow them to participate in decisions, to identify with organizational objectives, and to share in the rewards of productivity and innovation (Driscoll, 1981a). Participation alone may be only part of the solution to reversing the trends of downgrading job content, increased stress, and job dissatisfaction because of the difficulty of ensuring practical user input. Employees tend to focus on the job at hand and do not necessarily have the perspective required to view the entire system. They are also unlikely to be familiar with the technology and its implications. Turner (1981) suggests that systems designers must explicitly incorporate work design into plans for changes in the office. Jobs could be made

better by increasing decision-making discretion. In his research he found that giving workers more autonomy in their jobs compensated for the additional pressures of computer work, as indicated by decreased strain and increased job satisfaction. Another approach is to create work groups of workers with different skills so that they can see the relation of many different tasks to the whole product and can learn from each other and acquire new skills (Working Women Education Fund, 1980a; Mumm et al., 1978; Association of Professional, Executive, Clerical and Computer Staff, 1980).

It should be noted, however, that this solution is not easily applied. In the United States, few clerical workers are organized sufficiently to bring attention to the potential and actual problems caused by the application of new technology. Few women have trade unions or other organizations to represent their interests or the degree of awareness of the issues to deal adequately with them in their own workplaces (Working Women Education Fund, 1980a). In Europe, where clerical work is much more unionized, a number of new technology agreements have been negotiated over the introduction of new office equipment, particularly the use of video display units. While different unions have emphasized different areas of negotiation, several features are common to almost all agreements: agreement to consult about change; no compulsory layoffs; agreement to offer training and retraining as necessary; no loss of pay; and regulations on the use of video display units from a health and safety perspective (Trades Union Congress, 1979).

WORKING AT HOME AND AT REMOTE SITES

One aspect of work organization that is beginning to change with the advance of new technology is the physical location of jobs. In the past, office workers have needed to work in close proximity to each other to exchange verbal and written information: the closer physically that workers were located, the faster information was communicated. However, because new technology permits rapid communication between geographically separate sites, there is no technical reason why certain tasks have to be performed in an office (The Economist, 1981; Peltu, 1980). Many office workers can now work in remote sites using terminals, electronic mail, and teleconferencing (Word Processing World, 1979).

There is growing interest in both North America and Europe in the idea of remote site working. Although there are no estimates of the number of workers currently involved, some business analysts in the United States have predicted that as many as 15 million workers could be engaged in home work by the middle of the next decade (Business Week, May 3, 1982).

There are a number of potential advantages and disadvantages in working at remote sites. One trend that is being viewed with concern by employment analysts is the wholesale movement of information-intensive activities of companies to new and distant geographical locations. The most extreme example is the moving of clerical activities of a New York company to Barbados, where data entry clerical workers receive data and relay the processed information back to New York via satellite (Business Week, March 15, 1982). Other examples are banks that have moved clerical activities to states where banking legislation is more advantageous (U.S. News and World Report, Feb. 2, 1982). The disadvantage of this trend from an employment viewpoint is that while the receiving area may be able to expand its clerical opportunities, the sending area is likely to be left with a declining employment base, which is likely to affect women in the sending areas particularly.

Much of what has been written on remote site work has been on professional and technical workers using a portable microcomputer at home. For them, having a computer to use at home or on a business trip is highly convenient and gives greater flexibility (Gregory, 1982). For example, a university professor used his computer, which was linked to the central university processor, to respond to messages left by students and colleagues, to schedule appointments, to type text and edit it, and other kinds of tasks. In this way he was able to work on research for uninterrupted periods of time and complete his required communications with others when it was convenient to him, thereby making more efficient use of his time (D. Ness, 1980). While in principle home work could be beneficial for both male and female professionals, in practice it may not be realistic. There is a tendency to view home work as the panacea for professional women with young children, but home work is not a solution to child care. The idea that mothers can work efficiently at a terminal while taking care of children does not mesh with the realities of computer work at either professional or clerical levels (Gregory, 1982).

Work at home and at remote sites among clerical workers has certain benefits but also a number of significant drawbacks. From an employer's point of view, remote workplaces make it possible to draw from a larger pool of labor, including the homebound work force of handicapped and older workers and, perhaps most significantly, women with young children. For example, one organization, faced with a critical shortage of clerical workers, recruited many women in this situation (Manning, 1981). A large bank established a satellite location for word processing at a community college, 25 miles from headquarters, in order to find skilled workers who were not able or willing to travel to the central business district (Mertes, 1981). Employers have also found that working at home or at remote sites can increase the productivity of individual workers and, by reducing expensive center-city office space, can reduce costs and overhead (Manning, 1981).

Women working either at home or at a convenient but nonurban or non-city-center site have a number of advantages. The most publicized potential benefit of working from home is that it increases the number of available options for combining work and child-rearing (Gordon, 1976). Many women currently leave the labor force for a lengthy period to raise children; when they return, they may find themselves irretrievably behind in their career development and, in the current context, unfamiliar with the new office technology. Some choose to work part time, but in general these jobs are less well compensated than full-time work. Working at home can provide the opportunity for more flexible scheduling of full-time work around the needs of children and child care arrangements. In this context, researchers point to the need for child care facilities to look after children while their mothers work, even in the home (Gregory, 1982). Working at home can also provide opportunities for handicapped and older workers who may not be able to commute to work.

Although home work offers the advantage of increased flexibility, a number of drawbacks cannot be disregarded. Working at home can cause isolation from office developments, resulting in difficulties in making business contacts, the absence of fertilization of ideas or feedback, anonymity, and the lack of social contact (Albertson, 1977; Labour Canada, 1982). There are also potential health and safety problems (Clavaud, 1981). In an office, the installation of video display units may more easily

take into account ergonomic factors such as lighting and air ventilation; a terminal in a home, however, may be more likely to be located in an area that is too small and that has inappropriate lighting. Home users may have less incentive to make the needed changes than would office management. And because the costs of operating machines are lower at night, there is an incentive for night work at home, which can further contribute to the stress and isolation of working at home. Gregory (1982) reports a study that found increased stress among women with families working at home. It is becoming important to set standards and regulate work so that those who choose to work at home will have the same protections as those who remain in the office (Werneke, 1982). In addition, Gregory (1982) raises the problem of pay and finds that the piece-rate systems and reduced benefits associated with home work could leave women working at home considerably worse off in financial terms than their office counterparts.

Working in an area outside the city center offers benefits to women and appears to have fewer drawbacks than working at home. Cutting the time and expense of commuting would enable many women to combine work and home responsibilities more easily. Working at remote sites could also aid in the development of child care facilities, which has been hindered in part by the lack of agreement on optimal location (Gordon, 1976). There is, however, one drawback in working at remote sites: for groups of less-skilled workers, working away from the main office environment, the ability to make business contacts within and outside the office may be impeded and avenues for acquiring new skills and promotion may be curtailed (Werneke, 1982). Consequently, researchers suggest that the development of remote site working should be viewed with some caution. For some, it will suit their particular circumstances, work, and work style. For others, particularly those performing less-skilled clerical tasks, there is the danger of isolation and the curtailment of opportunities (National Executive Forum on Office Workstations in the Home, held by the Board on Telecommunications and Computer Applications, National Research Council, Nov. 9-10, 1983).

CONCLUSION

Despite the substantial volume of literature that has been produced in recent years on the impact of

microelectronics, a limited amount of work has focused on its effects on the jobs of working women. This is true despite the fact that women are concentrated in those white-collar occupations that are expected to undergo substantial change as the result of the application of new technology. What evidence there is from case studies and other materials, described briefly in this report, suggests the curtailment of traditional clerical jobs and a significant change in the skill requirements of emerging opportunities. The extent to which women will be able to gain entry into new occupations depends crucially on their access to and participation in training and, more fundamentally, a change in the substance of their education. To date the evidence has not been encouraging.

Studies show the tendency of new technology to be applied in such a way as to specialize and downgrade existing clerical jobs. This tendency has been linked to unfavorable changes in the quality of working life, as some jobs have taken on the characteristics of assembly line work and have become more impersonal and less satisfying. Changes in the content and organization of jobs in some cases have also increased pressure and stress on workers, raising issues of health and safety.

New technology has the potential to alter the organization of work in other fundamental ways, opening the possibilities of work at remote sites and at home. This has been taken to be an advantageous development for women, particularly those with children, but closer inspection of the matter shows there are a number of important drawbacks to these arrangements and that working at home is not a substitute for child care facilities.

Whatever the impact of microelectronics on working women in general, its effects will certainly vary among women at different stages of the life cycle. To date the literature has not addressed this subject, although it seems clear that the changes in work will affect disproportionately older women, less experienced women, and those returning to the labor market after a spell at home. If the research community is to develop the necessary background for informed policy recommendations, an in-depth approach linking perceived changes in the office to the situations of women at different stages of their careers must be taken.

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This report reviews the current debate in the industrialized countries on the impact of microelectronics on employment. It is one of the first reports to focus specifically on women, arguing that they will be disproportionately affected by new technology. It recommends the broader participation of women in technical education, the provision of adequate training facilities, job sharing, and reductions in working hours to meet the potential problems of labor displacement and skill mismatches.

International Federation of Commercial, Clerical, Professional and Technical Workers (FIET)
1980 Bank Workers and New Technology. Geneva: FIET.
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These three reports are based on information received from FIET affiliates in banking, insurance, and industry on the impact of new technology on employees. The reports indicate no widespread layoffs have as yet been noticed but warns that many jobs are likely to be affected in the future. They outline courses of action for trade

unions, including the negotiation of new technology agreements providing for job security and health and safety precautions.

International Labour Office
1981 The Effects of Technological and Structural Changes on the Employment and Working Conditions of Non-Manual Workers. Report II, Advisory Committee on Salaried Employees and Professional Workers, Eighth Session, Geneva.

This report describes trends in employment in banking, insurance, and general office work and in this context discusses the likely impact of new technology. It finds that those most at risk are workers with few skills, particularly women.

John Kendrick
1980 Analytical Summary and Perspectives on the Impact of Microelectronics on Productivity and Employment. Paper submitted to the OECD Special Session of the Working Party on Informatics, Computer and Communications Policy, Paris, May.

This paper argues for a more moderate view of the impact of new technology on employment. Although microelectronics has the potential to spread quite rapidly, labor displacement will be less than many have predicted because of the effect of productivity gains on prices and the demand for services.

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This report provides an overview of the subject in Europe and contains excerpts from many government and trade union reports.

Joyce Selby Smith
1980 Implications of Developments in Microelectronic Technology on Women in the Paid Work Force. Paper submitted to the OECD Working Party on Informatics, Computer and Communications Policy, Paris, March.

Focusing specifically on women, this report shows the extreme concentration of women in clerical occupations and why these occupations are the most likely to be affected by microelectronics. Because of their inappropriate educational backgrounds and skills as well as their lack of geographical mobility and low degree of organization, women may find difficulties in adjusting to the changes brought about by new technology. The report recommends that policy initiatives be undertaken to encourage girls to participate in a wide range of nontraditional subjects at school and in subsequent training. Retraining efforts should focus on promoting occupational mobility and not reenforce existing patterns of occupational segregation.

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Ida Hoss
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Although written more than two decades ago, this study of the first wave of computer automation holds true today. Hoss found that office automation brought about a redivision of labor and a specialization of function that had negative effects on the structure of work organization and the occupational profile of the work force.