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Office Automation: A Review of the Litterature

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Résumé de l'article

Au cours des dernières années, les bureaux sont devenus le lieu principal des changements technologiques, ce qui a soulevé d'importantes interrogations touchant les perspectives d'avenir des employés de bureau au Canada. Même s'il y a eu beaucoup de recherches sur le sujet, on n'en a guère fait l'analyse critique. Cet article s'efforce de combler cette lacune en se préoccupant surtout de trois points: l'emploi, la qualification et la qualité de vie au travail. La présente recherche utilise la distinction établie par Glenn et Feldberg (1983) entre les modèles de recherche suivants: l'acceptation par consentement *(consensus)* et l'attitude d'opposition *(critique).* Ceci constitue une méthode expéditive pour considérer les hypothèses sous-jacentes tirées d'études particulières. Les modèles fondés sur le *consensus* assument que les travailleurs et les employeurs partagent des opinions comparables concernant le processus d'automation. Les tenants des modèles dits *critique* estiment qu'il existe un phénomène d'affrontement tendant de la part de la direction à centraliser et à contrôler l'exécution du travail. Même si la littérature traite de l'un et de l'autre modèles, le plus souvent soutenu est le modèle *critique.* Ceci est source de débats marquants qui masquent le jeu des divers facteurs relatifs à l'automation. L'objet principal de l'article porte, en conséquence, sur la nécessité d'une approche *critique* révisée, sensible à la nature même de l'automation.

Cet article est divisé en trois parties qui correspondent aux questions spécifiques ci-dessus indiquées. La première traite de l'emploi, sujet le plus controversé dans les discussions sur l'automation. Décrivant l'ampleur et la vitesse des déplacements de main-d'oeuvre, les tenants de l'approche *critique* dominent nettement et ils ont fait des prédictions pessimistes sur les pertes massives d'emplois et sur les bouleversements sociaux (Downing, 1981; McDermott, 1981; Booth et Plowright, 1981; Armstrong, 1984; Menzies, 1981). Cependant, ce type de recherche fait de l'extrapolation à partir d'études partielles sur l'automation et ignore la diversité des emplois de bureau et des applications des technologies nouvelles. Des études plus récentes, utilisant un modèle *critique* révisé (Osterman, 1986; Leontiff et Duchin, 1986; Conseil économique du Canada, 1987), suggèrent que les déplacements sont tempérés et circonscrits par la réorganisation des bureaux, l'adaptation de la main-d'oeuvre et la répartition inégale des technologies nouvelles. Ces travaux indiquent que les conséquences sur l'emploi varient selon les postes, l'entreprise et le secteur industriel. D'autres recherches, utilisant ce modèle *critique* révisé, seraient nécessaires pour déterminer les effets de l'automation sur l'emploi du personnel de bureau au Canada.

La deuxième section de l'article traite de l'impact sur la qualification. L'enjeu principal a trait à l'influence des technologies nouvelles sur la véritable complexité du contenu des tâches et le niveau possible d'autonomie pour le personnel de bureau. La majorité des chercheurs adoptent la thèse *critique* fondamentale énoncée par Braverman (1974) qui met l'accent sur la standardisation et le caractère routinié des tâches ainsi que sur l'utilisation des moniteurs et du rythme des machines. La recherche au Canada, même si elle se développe, suit cette voie; cependant, les débats sont fort abstraits et manquent d'assises empiriques. On considère les problèmes relatifs à la qualification d'un point de vue déterministe en supposant qu'ils résultent naturellement de l'utilisation de la technologie. On trouve des recherches plus valables, utilisant le modèle *critique* révisé qui explorent comment des facteurs tels la réorganisation du travail, le type de technologie utilisé, l'importance de l'entreprise et les coutumes peuvent tempérer le processus de déqualification (Evans, 1982; Glenn et Feldberg, 1983; Crompton et Reid, 1982; Crompton et Jones, 1984). Ces études laissent entendre que le travail de bureau n'est techniquement déqualifié que dans des conditions précises et que la technologie, alliée au sexe de l'employé, agit de façon à créer des postes tant «qualifiés» que «non qualifiés». La recherche canadienne de ce genre est fondamentale pour comprendre les conséquences possibles de l'automation sur la qualification.

Dans la troisième partie, l'auteur aborde le sujet de la qualité de la vie au travail et plus particulièrement les questions de la santé et de la sécurité au travail, des relations sociales et de la stabilité de l'emploi. Les études sur la santé et la sécurité au travail tiennent la première place chez les tenants du modèle *critique* (CLC, 1982; ILO, 1975). Elles confirment les dangers posés par le «monitoring», les déficiences ergonomiques et les aménagements du travail mal conçus. La recherche future doit faire la lumière sur ce point en se demandant si ces risques proviennent des nouvelles technologies mêmes ou de la réorganisation du travail qui les accompagne. La recherche sur les relations sociales porte sur l'isolement et la spécialisation de l'employé, mais elle est restée jusqu'ici théorique. Enfin, les travaux traitant de la stabilité des emplois explorent les questions du travail à temps partiel, du travail par quart et du travail à domicile. Les recherches basées sur le modèle *consensus* prévoient une flexibilité plus grande dans le travail de bureau, alors que celles fondées sur le modèle *critique* avancent une possible exploitation dans l'aménagement du travail. Sur ce dernier point, la recherche future devrait considérer comment les contextes législatif et socio-politique peuvent exercer une influence sur l'agencement du travail de bureau.

En conclusion, l'accent est mis sur l'avantage d'un modèle *critique* révisé. On discute également d'un manque important dans la littérature, en particulier en ce qui a trait au rôle que doivent jouer les travailleurs, les employeurs et les gouvernements par rapport aux effets de l'automation. On néglige ce dernier point, surtout chez les tenants du modèle *critique* qui estiment que l'environnement est statique. L'importance du climat des relations du travail, en ce qui concerne les conséquences de l'automation, est souligné avec références aux expériences d'autres pays (Lane, 1985; ILO, 1985). Enfin, l'article décrit brièvement la situation au Canada. On y indique que la façon dont les syndicats, les employeurs et les gouvernements vont relever le défi du phénomène de l'automation dans les bureaux est la prochaine question urgente à mettre au programme de recherche au Canada.

Office Automation
A Review of the Literature

Karen D. Hughes

The impact of new technologies on clerical workers has been intensely debated. This paper assesses current research on the key issues of employment, skill and quality of working life, drawing implications for Canadian clerical workers. The author argues that a reliance on deterministic research models has produced unduly pessimistic forecasts about the impact of new office technologies. Research which is sensitive to the mediated nature of automation is necessary for improving forecasts for the Canadian office. So too is the consideration of employer, union and state activity in influencing automation outcomes.

Advances in microelectronics have raised important questions about future prospects for Canadian workers. Such questions are particular pressing in relation to the office; for the office stands as a prime target area for technologicaly induced change. In Canada, 64% of all technological change between 1980-85 took place in the office. In addition, 50% of all planned change for 1985-90 will be office related (ECC, 1987). This suggests that clerical workers are being disproportionately affected by new technologies. A crucial footnote concerning this change is the fact that 78% of all clerical workers are women. Thus, at present, Canadian women are bearing the brunt of the microelectronics revolution (Abella, 1984, p. 163).

Precisely how new technologies are affecting clerical workers has been the subject of much debate. While there has been a substantial outpouring of research on this topic, little critical assessment has been made. Such assessment is vital, however, if we are to clarify the likely consequences of office automation and offer direction for future research. This paper pro-

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vides such assessment, paying particular attention to three central issues: employment, skill and the quality of working life. These issues warrant attention due to their prominence and contestation within the literature. With respect to employment, there is considerable debate over the extent and pace of displacement. While critics argue that automation will cause massive unemployment and social upheaval, proponents offer much more sanguine forecasts. The issue of skill is also highly contested and raises concerns as to whether automation will enhance office jobs or render them factory-like facsimiles. Finally, quality of working life issues broach questions about health and safety, social relations and job security.

Due to considerations of space, this assessment remains selective; the bibliography seeks to provide a comprehensive listing of research pertaining to office automation. Admittedly, the attempt to provide a concise assessment of this research is somewhat confounded by the sharp polarity of views and findings. Feldberg and Glenn (1983) attribute this antagonism to the use of two highly opposed research models. The first of these, *consensus research model,* assumes a shared interest between workers and management; automation decisions are seen to benefit both parties. The second approach, the *critical research model,* assumes a fundamental opposition between workers and management interests. Automation is seen to emulate traditional factory application in the aim to centralize and control the labour process. While we can identify both of these models in the literature, the critical model is clearly favoured. This leads to a preponderance of deterministic arguments which gloss over the interplay of factors involved in automation. A central thrust of this paper concerns the need for a modified critical approach which is sensitive to the mediated nature of automation. The increased utilization of such a framework is necessary if we are to improve our understanding of potential automation outcomes.

EMPLOYMENT

The issue of employment is the most widely contested of any relating to office automation. This is as much due to the precarious nature of forecasting as it is to the polarity of consensus and critical research models. Research here varies in approach, ranging from rigorous economic forecasts to general overviews, and emerges from diverse economic, political and social contexts. Such divergence admittedly limits direct comparison; however, regardless of these differences, it remains possible to gain some insight into the potential impact of automation on employment.

Within a consensus research model, Osborne (1979) offers optimistic forecasts on technological change generally. Concerning clerical occupa-

tions, he predicts change in the quality, not quantity, of jobs. Lower level positions will be eliminated and replaced by jobs which are more challenging for the worker; however, there will be no significant decline in job numbers (Osborne, 1979, p. 86). Osborne relies on consensus assumptions to carry his argument and offers little evidence on his own behalf. As a self admitted technological guru his interest is with technology itself and hence consideration of the social, economic and labour market factors, which mediate the impact on the clerical sector, is absent. Accordingly, the analysis is a fairly limited one which assumes, rather than investigates, the dynamic interplay of factors involved.

More substantive predictions in the consensus framework are provided, in the United States, by Rumberger and Levin (ILO, 1985, p. 266) and, in Canada, by Rinehart (1987). Using Bureau of Labour Statistics (U.S.), Rumberger and Levin rank clerical workers as a top ten growth occupation which, in terms of absolute job gains between 1982-95, is targeted for growth of 24% (ILO, 1985, p. 266). In Canada, Rinehart (1987) cites government projections from 1983-1992 for the thirty fastest growing occupations (p. 67). Within these thirty are six of the clerical occupations, with secretaries ranked first, bookkeepers second, general office clerks eighth, typists eleventh, and receptionists twelfth. Although Rinehart cites such projections, he does not support a consensus model; rather, he is highly critical of it. While it is difficult to evaluate the validity of these forecasts, due to a lack of detail on the models, it is important to note that these optimistic predictions do not fall squarely within a consensus model. Rather, researchers qualify favourable predictions by noting that, despite increased employment opportunities, the majority of new jobs will be routine, low skilled and poorly paid. Thus, while automation may not impair the number of jobs available, it will adversely affect the nature of the work itself. Given the already poor quality of many clerical jobs, this is a crucial consideration.

While a degree of optimism is found within the literature, a pessimistic tone resounds overall. Researchers such as Downing (1981) in Britain and McDermott (1981), Booth and Plowright (1982), Armstrong (1984) and Menzies (1981) in Canada, follow a critical model, arguing that automation will result in massive job loss. Downing (1981), for instance, studies specific cases of word processing in the U.K. Noting that this particular technology has the potential to increase productivity from 150-400%, she claims that its impact is likely to be substantial. Extrapolating from specific instances of systematic staff reduction, she predicts that future job loss will be dramatic. However, its extent will be largely obscured by job loss through attrition rather than direct layoff (pp. 275-276). Downing's argument is a pure version of the critical research model, with its emphasis on labour process con-

trol. The analysis views automation in isolation, disregarding the additional economic considerations underlying job loss in the time period of the study. As well, the empirical base is limited to a handful of examples which may not be indicative of a larger trend. However, while the conclusions are easily challenged, Downing does establish an important consideration by noting how attrition obscures technologically induced displacement in the clerical sector.

In Canada, McDermott (1981) also emphasizes the facilitation of job loss through attrition. In fact, she argues that the major threat to clerical workers is the attrition of job opportunities rather than direct job loss per se. High turnover within the clerical sector cloaks the impact of automation and undermines the potential for worker resistance and response. McDermott predicts that, though there is room for debate over time lines and numbers, overall job loss will be high (pp. 34-37). However, as with Downing, there is a tendency to extrapolate overall trends from limited cases and to ignore the role of the surrounding macro environment in determining employment levels.

Further Canadian research, by Booth and Plowright (1982), suggests that the majority of general clerical workers are vulnerable to automation because of the routine nature of their work. This includes workers positioned between clerks and knowledge workers, whose job consists of «some mix of routine paper handling plus thought work». Thus, secretarial jobs, which have been considered less vulnerable because of their non-routine nature, may be significantly affected. Accepting that job displacement will occur, Booth and Plowright challenge the argument that new 'high tech' jobs will be available to displaced workers. They question whether women can realistically move into such jobs and suggest that new technology may simply create a dual labour market within the information sector, expanding the already wide skill gap, and reducing mobility within the office (Booth and Plowright, 1982, pp. 21-24). Armstrong (1984) draws similar conclusions for Canadian workers arguing that, of possible outcomes, the most likely is an overall reduction in job opportunities, with a disproportionate increase in low skilled, dead end jobs (Armstrong, 1984, pp. 160-164).

Both Armstrong, and Booth and Plowright, base their arguments on the assumptions of the critical research model. Technology is viewed as a management control device; its application to the office, an attempt to emulate assembly line production (Armstrong, 1984, pp. 164-170). Under these assumptions, automation translates directly into job loss. However, the technological determinism within these arguments is questionable. There are important differences between the factory and the office which impede assembly line techniques in the office. As Lowe (1987, p. 136) notes,

office work is less tangible and less predictable and therefore more difficult to rationalize. As well, the hetereogeneity within the clerical sector frustrates a uniform technological assault on the full range of clerical occupations.

The most widely cited study on office automation in Canada is Menzies' *Women and the Chip* (1981). This work focuses on four case studies; the particular technology is that of 'informatics', a partnership between computer and telecommunications, which involves «the automation of all phases of information manipulation from gathering to dissemination» (Menzies, 1981, p. 1). On the basis of these case studies, Menzies concludes that the effect of automation will be overwhelming. Informatics generates additional employment but only in the specialist ranks. Few clerical workers are transferred into the expanding upper ranks and the overall demand for clerical workers is reduced. As previously discussed, such reductions are facilitated through attrition. Menzies utilizes these findings to construct four possible scenarios based on assumptions of: (1) increased office productivity (low increase of 33% / high increase of 50%) and (2) diffusion of technology (slow rate of 20 years / fast rate of 15 years)[1]. On the basis of these projections, she finds a mismatch between skills and jobs which translates into high rates of unemployment. On the high productivity-fast diffusion scenario, unemployment is projected at 26% by 1985 and 35% by 1990. On the low productivity-slow diffusion scenario, unemployment is estimated at 20% by 1985 and 25% by 1990 (Menzies, 1981, pp. 65-74).

Yet, despite these predictions, clerical occupations in Canada continue to experience growth (Statistics Canada, 1981). Clearly the inadequacies of Menzies analysis stems from the lack of sensitivity displayed towards the issue of technological diffusion. As well, the assumption of stable entrance into clerical occupations, and the use of atypical applications of automation, seriously weaken the conclusions which are drawn. Indeed, these inadequacies are common to research within the pure critical model which produces sweeping, pessimistic forecasts. Details concerning technological diffusion, range and diversity of clerical occupations and work tasks, specific organizational automation experience, and surrounding economic and social context are largely ignored. Yet, attention to these factors is crucial to a balanced asessment of anticipated outcomes.

It is within a modified critical research model then that the most useful analysis of employment is carried out. Here issues such as diffusion, productivity, differences in clerical occupations and types of office applications

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1   The four scenarios are: (1) low productivity increase-low diffusion; (2) low productivity increase-fast diffusion; (3) high productivity increase-low diffusion; (4) high productivity increase-high diffusion.

are considered. Research by Osterman (1986) investigates the relationship between organizational response and clerical displacement using data for specific installations in the U.S. (pp. 175-186). At the general level of analysis, Osterman finds a net reduction in employment; however, effects are cross cutting. While displacement occurs over the first two years, subsequent increases in employment occur after that period. Osterman attributes this rise to 'bureaucratic reorganization'; automation leads to increased employment by reducing labour costs, expanding production and inducing structural reorganization of the office. This thesis is supported by others who note the possibility of increased employment due to redefined structural arrangements and higher work volumes within the automated office (Eckart, 1982, p. 51; Marchant, 1979, p. 37). In Osterman's analysis, the subsequent increase does not offset initial employment loss, nor does it involve the same people. However, over the long term, it is conceivable that the initial employment loss could be offset or completely overtaken. This particular analysis illustrates the inadequacy of a purely determinist stance and underlines the need to introduce intervening factors, such as organization response, into analyses. As well, it sharply calls into question the underlying assumption of 'streamlining' which is characteristic of a pure critical thesis. Osterman's analysis suggests that it may be misleading to assume that the primary goal of automation is always reduced employment. Indeed, such a goal may be neither desirable, nor even attainable, by the organization.

Consideration of the heterogeneity of clerical occupations is also important as is shown by Leontiff and Duchin (1986) who provide forecasts for secretaries, typists, and other clerical workers in the United States. They differentiate between tasks which can, and cannot be, automated and utilize two projection scenarios: the first (S2) assumes slow diffusion of integrated office technology in the next 10-20 years and the second (S3) assumes maximum diffusion. The authors conclude that under both scenarios, stenography will be eliminated as an occupation by 1990. The impact on secretaries is somewhat less clear and depends on the mix of work tasks involved. For clerical jobs which involve the routine manipulation of data, between 25% (S2) and 65% (S3) will be fully automated by 1990, with the figure rising to 50% (S2) and 100% (S3) by 2000. However, because the majority of clerical workers perform activities which demand public interaction, this will restrict the impact of automation (Leontiff and Duchin, 1986, pp. 63-91). Hunt and Hunt (1986) have recently criticized this model for employing an artificially high rate of technological diffusion. Thus, it is possible that net job loss has been overestimated.

In terms of Canadian work, within a modified critical framework, there is a single publication: the recent report by the Economic Council of

Canada (1987). Using the Microelectronic Simulation Model (MESIM), the report predicts that clerical occupations will experience substantial net job loss to 1995 (p. 131). As an aggregate category, clerical occupations are targeted for 5% net job loss to 1995. In terms of specific occupations, predicted job loss is highest for file and correspondence clerks (15,1%) and lowest for general clerks (2,1%). However, while this report anticipates that clerical occupations will fare poorly, relative to other occupations, it is also assumes a high rate of technological diffusion. Thus, as with Leontiff and Duchin, it may be that net job loss has been overestimated.

While this brief summary does not do justice to the complexity of the employment literature, it does at least provide a flavour of the employment debate. In assessing the literature, it is clear that past research has favoured the determinism of a critical framework; hence, the tendency to gloss over factors such as labour market adjustments, types of applications, worker retraining and response and macroeconomic factors. The recent movement towards a modified critical framework is encouraging and shoud lead to improved forecasts. While it is difficult to draw firm numerical conclusions on employment outcomes, it does appear that automation may be more incremental than is generally assumed. As well, bureaucratic expansion, labour force adjustments and differential penetration of new technologies may circumvent clerical displacement. The most recent Canadian forecasts suggest 5% unemployment (ECC, 1987); however, there are reasons to believe this forecast overestimates displacement. Thus, further research within a modified critical framework is required before decisive conclusions can be drawn for Canadian clerical workers.

SKILL

Because Canadian women are already concentrated in occupations which are low paying and low skilled, the advent of automation raises important questions. What kinds of jobs will new office technologies create? Will the present situation be improved or exacerbated? Proponents claim that automation will improve the current situation, eliminating low skilled jobs and creating challenging and responsible positions. In many cases, it will create the need for a clerical 'para-principal', who shares in the knowledge work and decision making of the firm (Toffler, 1980, p. 192; Booth and Plowright, 1982, p. 58). Critics dismiss such claims outright, arguing that automation will result only in the routinization and deskilling of jobs. Clerical work, already monotonous and low-skilled, will be further eroded (Rinehart, 1987, p. 164; Armstrong, 1984, p. 161).

Delving into this debate does not yield firm conclusions. Research is this area, especially in Canada, is formative. Studies from other countries, while useful, differ markedly in approach and focus, thereby inhibiting comparison. The array of approaches range from empirical studies to purely theoretical accounts. The focus, while commonly on the lower office stratum, covers a spectrum of occupations (i.e. EDP operators, typists, secretaries). Most troublesome, however, is the varying usage of skill as a theoretical and empirical concept. Due to its differential conceptualization and measurement, it is often difficult to interpret results.

To avoid conceptual confusion on this last item, it should be established that skill is an attribute of a job which is both technically derived and socially constructed (Spenner, 1983, p. 827; Lee, 1981, p. 56). The technical component includes the substantive complexity of job tasks and the level of autonomy and discretion that is available to the worker. The social component simply refers to whether a job is defined as 'skilled' irregardless of job content (Spenner, 1983, p. 828; Crompton and Jones, 1984, p. 1). The social construction of skill is important in relation to clerical work due to the well documented tendency of 'female' work to be socially, and often technically, deskilled (Crompton and Jones, 1984; Lowe, 1987; Glenn and Feldberg, 1977; Downing, 1981). Changes in skill levels are measured either by changes in work content or occupational structure and are discussed in terms of upgrading, downgrading or little net change (Spenner, 1983, p. 826).

In the debate over office automation, the majority of literature emphasizes downgrading in relation to work content and the focus is on the lower office stratum (i.e. EDP operators, typists, secretaries). While upgrading is discussed to some extent, there is uncertainty about the number of upgraded jobs that will be created and the ability of women to move into them. Both Eckart (1982), and Kraft and Dubnoff (1986), suggest that education gaps and structural barries limit women's movement into upgraded jobs. In those cases where women do make inroads into new 'high tech' jobs, such as programming, they tend to be segregated into positions at the bottom of the occupational hierarchy. This suggests a cluster of 'women's work' similar to that found in traditional occupations (Kraft and Dubnoff, 1986, p. 195). While historical experience supports such a trend, detailed empirical research is required in order to determine to what extent gender undercuts upgrading in relation to office technologies.

In terms of downgrading, Braverman (1974) has provided the foundation for the critical research model (pp. 293-358). Arguing that office automation emulates principles of the assembly line, Braverman suggests that the substantive complexity and autonomy of clerical work is eroded by new technologies. Tasks are fragmented, standardized and subject to

machine control. Information is transferred from the mind of the clerk to the machine, thereby undercutting the traditional preserve of clerical skill. As unfluential as this thesis has been, it displays clear limitations. The argument is highly abstract and lacks empirical grounding. More important, it operates with an underlying determinism which ignores the dynamic nature of the labour process. Mediating factors, such as union or worker response, are absent. Yet, as many authors note, the labour process is always mediated and contested (Crompton and Jones, 1984, p. 215).

While research on deskilling in Canada is scarce, the majority follows Braverman. Armstrong (1984), Booth and Plowright (1982), Rinehart (1987), and Menzies (1981) all utilize a critical framework. Armstrong, for example, builds directly on Braverman, arguing that automation will uniformly deskill clerical jobs. Yet, while charging that substantive complexity and autonomy/control will be eroded, she offers little systematic evidence (Armstrong, 1984, p. 164). Booth and Plowright follow a similar tack. While predicting that select positions may demand more exacting skills, they suggest a general trend toward deskilling and polarization of office workers (Booth and Plowright, pp. 24-27). However, supporting evidence is slight. Menzies, though providing an empirical base, applies surprising little focus or rigor to the analysis of skill within her case studies. Acknowledge the possibility for some upgrading, she concludes that clerical work overall will become more 'factory like'. Work tasks will be standardized and fragmented and workers will experience greater machine control (Menzies, 1981, pp. 25-64). Yet, on the basis of her evidence, such conclusions represent more of a leap of faith than of sound reasoning. Rinehart offers a vigorous argument on deskilling, especially in relation to the erosion of autonomy/control through electronic monitoring and machine pacing. Yet, again the evidence is sketchy and does not confirm the extent to which such trends are the norm (Rinehart, 1987, p. 67). As with the bulk of Canadian research, the argument is theoretically committed yet lacks solid empirical grounding.

Further work within a critical model is provided by Gregory and Nussbaum (1982) and Glenn and Feldberg (1977) in the United States and Downing (1981) and Arnold (1981) in the United Kingdom. Gregory and Nussbaum (1982) present a general survey piece which looks at several examples of office automation. Refuting ILO laboratory research, which suggests skill upgrading, they note the role of managerial decisions in deskilling (pp. 207-223). Decisions ot streamline office procedures are seen as pivotal to the deskilling process. Unfortunately, the authors assume a constant motive for automation. Thus, the argument ignores the diversity of managerial motives and technologies involved in office automation and becomes exceedingly deterministic. A similar determinism is displayed by

Glenn and Feldberg (1977). Adopting a comparative strategy, Glenn and Feldberg focus on five U.S. companies, differing in size, technology and prevailing organizational goals. The authors find that deskilling is linked to the reorganization of work and is most pronounced in those organizations with highly advanced, centralized applications. While this comparative tack is potentially fruitful, it is subverted by an underlying determinism. The authors assume an evolutionary pattern towards centralized systems and the motives surrounding application decisions remain uninvestigated (i.e. cost, control, service). Further problematic is the tendency to move beyond the data in making grandiose conclusions about the larger proletarianization of clerical occupations.

Amongst the British research, Downing (1981), focuses on the application of word processing, arguing that automation results in task fragmentation, increased control for worker polarization (pp. 283-287). Arguing from a pure critical model, automation is viewed as a means to replace patriarchal forms of control with more direct forms of machine control. Arnold et al. (1981) challenge this argument, noting that new work arrangements tend to reinforce, rather than replace, patriarchal control (p. 335). Jobs are deskilled not only through loss of substantive complexity but through the duplication of patriarchal control via machines (pp. 328-336). Yet, as West (1982) notes, these studies ignore the contestation and complexity of control. While automation may duplicate, or eliminate, forms of patriarchal control, it is also the case that personal patriarchal relations may protect some workers from downgrading (i.e. personal secretaries) (p. 78). Thus, the effect of automation on forms of control is fairly complex. Despite their reductionist nature, however, these arguments raise important questions: How does automation replicate, or complement, other forms of control and how does this effect skill levels?

With the exception of a handful of research, most work within a critical model lacks empirical grounding and is argued at a very abstract level. This is particularly true of Canadian research. More specifically, this approach ignores the hetereogeneity of clerical occupations, and office applications, and assumes that the effect of automation is constant across all cases. However, as Lowe (1987, p. 90) notes, this ignores a range of factors — such as particular industry, type of technology, organization size and traditions, and managerial decisions surrounding the reorganization of work — all which play a pivotal role in shaping skill outcomes.

It is within a modified critical approach that these factors begin to be considered. Evans (1982) and Glenn and Feldberg (1983), in the United States, and Crompton and Reid (1982) and Crompton and Jones (1984), in Britain, provide research on skill within this type of framework. Evans

(1982), focusing on typing and secretarial occupations, finds four predominant modes of reorganization: (1) centrally administered (typing only); (2) satellite centers (task mix); (3) back up/overload center (typing only); (4) decentralized departments (task variety) (pp. 166-167). He reports that deskilling, as measured by workers, is less common in work arrangements involving decentralization and task variety. Evans argues that reorganization decisions are pivotal in shaping skill outcomes and suggests that, with declining costs, organizations may gain flexibility in organizing automation, thus limiting downgrading effects. The discussion is brief and provides little detail on the factors which determine various modes of organization. However, it does challenge the assumption of uniform technological application and suggests the possibility of alternative skill outcomes.

Glenn and Feldberg (1983) study skill changes at the occupations, organization and work process level (pp. 59-78). At the level of occupational structure, the authors trace trends within the insurance industry and find that new technology results in narrower, more specialized and standardized jobs. At the organizational level, the authors investigate the interaction between automation, deskilling and gender, finding that technologically induced deskilling is gender specific. At the work process level, the customer service department of a utility company is studies. In this case, automation integrates tasks and leads to a partial increase in substantive complexity; however, workers are more closely supervised and machine controlled. The analysis is useful in distinguishing between levels of analysis and noting the differential impact of automation on men and women. However, the conception of skill lacks rigor and analysis is carried out in isolation. For example, the use of the insurance industry at the occupational level requires contextualization. Insurance processing, due to its repetitive nature, is easily automated and it is possible that automation will create great upheaval in the insurance industry (Marchant, 1979, p. 34). Yet, it is questionable whether insurance outcomes are representative of automation outcomes generally.

The most useful studies on deskilling are provided by Crompton and Reid (1982) and Crompton and Jones (1984). The first of these, a case study of a British treasurer's department, focuses on EDP processing. Here jobs are clearly deskilled in relation to substantive complexity and autonomy/control. Areas of discretion are heavily eroded and the computer increasingly takes over information previously held by the clerk. Accordingly, clerks experience a sense of subordination and dependence on the machine; their 'intermediary role' is diminished through the loss of customer knowledge and an incomplete understanding of the work process. Gender is found to interact with these changes; social deskilling occurs as recruitment increasingly focuses on women. While this argument emerges

from the critical model, it makes room for countervailing forces, such as worker resistance and technological application. The authors entertain the possibility that alternative technologies and applications (i.e. on-line systems) may reskill jobs by returning discretion and task unity to the worker. In addition, they investigate the deskilling process in both its technical and social forms, pointing to the important role played by gender.

Such carefully crafted research is replicated in a more recent study which focuses on three British firms: Lifeco, Cohall and Southbank (Crompton and Jones, 1984, pp. 42-77). A comparative case study method is used to investigate the impact of contrasting applications of technology and work organization. Skill changes are assessed through a comprehensive measure which combines elements of substantive complexity and autonomy/control. The authors find a marked difference in skill levels between the three companies, with the most centralized and sophisticated operation producing the greatest technical deskilling. The application of technology is found to enhance the substitutability of the workforce and to act, in concert with gender, in segregating women into low skilled jobs. Crompton and Jones produce a solid analysis of the deskilling process in terms of study design, skill measurement and the inclusion of mediating factors. While favouring a critical model, they incorporate variables, such as organizational constraints, economic climate and worker response into the causal model. The analysis itself is situated within the framework of a more encompassing argument concerning gender, class and stratification in relation to white collar work. The argument tests Braverman's proletarianization thesis and thus provides a detailed survey of white collar work in the U.K. It moves easily between empirical and theoretical issues and is highly contextualized in terms of the macro environment.

While drawing final conclusions on skill is difficult, given the underdevelopment of this research, it is possible to make some general observations. In terms of work content, it appears that automation, under particular configurations, further deskills clerical jobs in the technical sense. As well, technology continues to act with gender in socially constructing 'skilled' and 'unskilled' jobs. While it appears that deskilling may be avoided under certain conditions, little detail is available on the outcomes for alternative office applications. Consideration of work organization, and other factors which influence skill levels, is required in future research. So too, is the detailed study of compositional shifts within the clerical sector. As an overall assessment of the literature, it would appear that the heavy reliance on the determinism of the critical model has impeded the investigation of factors which mediate the deskilling process. The recent emergence of work such as Crompton and Jones (1984) is a hopeful sign that detailed

excavation has begun within an approach that is both empirically based and theoretically guided. In Canada, there is a need to generate such data. Organizational case studies, which are sensitive to dynamics, are crucial for understanding what the likely effect of automation will be.

QUALITY OF WORKING LIFE

'Quality of working life' is an encompassing, often subjective, concept which serves as a catch all for items which comprise the sum total of the work experience (Evans, 1982; Lowe & Northcott, 1986, p. 31). Evans suggests it includes job content, learning opportunities, working environment, job security, social contact, job rewards and job meaning (p. 158). With respect office automation, quality of working life is most commonly identified with issues of health and safety, social relations and job security. Health and safety concerns focus predominantly on VDT technologies and the hazards posed by monitoring, ergonomic deficiencies and ill conceived work arrangements. The issue of social contact centers on relations amongst office workers and the threat for worker isolation and polarization. The final issue, of job security, relates to newly spun job options resulting from automation. Part-time work, shift work and home work promise to alter working life, either through improved, more flexible, work arrangements or through demanding, unprotected jobs. Literature addressing these issues comes from a variety of sources: unions, governments, scholars and business. While the specific queries are varied and complex, the larger question is constant. Its essence is whether automation will negatively or positively affect the quality of working life and what can be done to ensure the latter.

Due to their practical nature, issues of health and safety have generated a near overload of information. Research has focused on VDT, and related, technologies and the threat to physical and mental health by machine monitoring, ergonomic factors and radiation emissions. While work within a consensus framework is scarce, both Northcott (1985) and Ostberg (1984) cite studies which disclaim hazards from VDT technologies. Northcott, in a publication by the Policy Studies Institute, cites two studies which reject health risks: first, the British Health and Safety Executive Report, which claims that VDT radiation emissions are well below accepted standards; and second, the U.S. National Council, which proffers that health risks are minimal (pp. 73-75). Ostberg, in a critique of recent publications, cites two I.B.M. studies which claim that health hazards have been overestimated (pp. 133-134). However, as Ostberg notes, these studies apply a superficial and 'individualistic' approach to health and safety. The implication is that many problems are illusory or worker related; a fact which is negated by a preponderance of conflicting evidence.

The more rigorous studies which address health and safety fall within a critical framework. In Canada, a solid study is provided by the Canadian Labour Congress (1982). Utilizing an interdisciplinary research team, the study surveyed 2,336 workers in 15 different Canadian worksites. The study included both VDT, and non VDT, operators, and focused on three health related concerns: eye strain, muscular strain and stress. The investigation revealed that those involved in intense VDT use reported a greater number, and degree, of problems. On the basis of its findings, recommendations are made for minimum use period (4 hours), rest periods (15 minutes), eye testing, governement standards for equipement and improved job content and work design. These recommendations are echoed by the 1982 Canadian Task Force on Microelectronics which also recommends legislation banning electronic monitoring. The Task Force also encourages further research to facilitate sound policy on issues of health and safety (Labour Canada, 1982, p. 13).

International studies, with a critical framework, are summarized in a very useful publication by the International Labour Organization entitled *Technological Change* (ILO, 1985, pp. 275-300). The publication reports on a variety of issues relating to technological applications: technological agreements, data protection/privacy, new technologies and the Third World and so forth. In the section 'Video Display Units (VDU) and Office Automation', abstracts are presented for studies from Australia, Austria, Canada, Denmark, Germany, Ireland, Japan, Sweden and Switzerland. All studies confirm the risks commonly associated with VDT technologies. Of particular interest are the proceedings from the 1984 International Trade Union Conference on VDTs (ILO, 1985, p. 298) which aim at establishing international standards for the estimated 50 million VDT operators worldwide. The following recommendations are reported: no more than 50% of worker time VDT related; 2 hour work periods with 15 minute breaks; prohibition of electronic monitoring; worker control of machines; union and worker access to equipment specifications; and ergonomic workstations. The publication combines government, union and scholarly research into a comprehensive survey of health related concerns. Most research is carried out within a modified critical framework which seeks to integrate critiques of negative applications with recommendations for positive alternatives.

In terms of its rigor and pure volume, research within the critical model is convincing. However, one qualification is in order. Many negative aspects of VDT work result from particular types of work reorganization rather than technology per se. As one ILO (1985) abstract states: «[...] VDTs are not alone. Other pieces of office equipment such as typewriters, telephone and microfiche scanners give rise to the same stresses» (p. 296).

Indeed, a historical survey of the Canadian office reveals the stress related to early typing pools (Lowe, 1987, p. 125). Comparisons between past and present technological applications pinpoint health and safety issues more specifically to the organization of work. In order to parcel out the direct effects of technology, comparative studies between automated, and non-automated, workers are essential (Lowe and Northcott, 1986, pp. 65-78; CLC, 1982). As well, studies which cover a range of industries, occupations and work organization may clarify the precise contribution of office automation to health related problems.

Social relations is another quality of working life issue which is closely related to work organization within the office. This issue is most frequently raised within the critical model concerned as it is with the mechanization of office work. Armstrong (1984), Menzies (1981), Downing (1981), Arnold (1981) and West (1982) all suggest that office automation regiments and restricts social interaction within the office. Workers are machine supervised, and increasingly tied to work stations, thereby limiting social exchange. In the office hierarchy, skill gaps develop and polarize upper and lower level workers. Thus, automation transforms office relations. Mirroring larger societal relations, workers are isolated from fellow workers, capitalists and themselves (Braverman, 1974, pp. 17-21, 293-356). This isolation is most noticeable along lines of gender and class (Armstrong, 1984).

In terms of the literature, there is general support for this thesis. Only a handful of authors suggest that automation may improve working relations within the office (Osborne, 1979; Spinard, 1982). Yet, in both cases, the arguments remain at a fundamentally general level of analysis. So too, they remain largely deterministic by failing to consider social relations vis a vis alternative form of work organization. Thus, while questions of social relations are important, existing research is largely speculative. At best, these questions can only be viewed as potentially fruitful hypotheses awaiting further investigation and debate.

In relation to the third issue of job security, there is much discussion. Consensus research suggests that automation will present greater flexibility to workers by offering a choice of working hours and location. Research within a critical framework argues that such choices promise only to erode job security and improve managerial control. In Canada, research is closely aligned with the critical research model and is distinguished by a strong sense of foreboding (Labour Canada, 1982, p. 56; Armstrong, 1984, p. 167; Booth and Plowright, 1982, pp. 52-79; McDermott, 1981, pp. 36-37). It assumes that automation proceeds, in all cases, according to a dictum of increased control and productivity. Management is assumed to adopt exploitative techniques in order to minimize labour costs, maximize produc-

tivity and recover investment costs of new technologies. Shift work, continuous office operations and part-time job reclassification are such techniques (Armstrong, 1984, p. 167). Homework, as well, is viewed as a potentially exploitive work arrangement (Turoff, 1984, p. 170; ILO, 1985, p. 288; Northcott, 1985, p. 75; Armstrong, 1984, p. 167). Researchers suggest that homework creates social isolation and stress due to its piece rate nature. Employee benefits are likely to be non-existent and protection of workers rights and policing of violations is impaired. Such arrangements also limit advancement by removing workers from the office stream (ILO, 1985, p. 288; Turoff, 1984, p. 170; Northcott, 1985, p. 75).

While these studies raise important considerations, several points require qualification. First, to argue that automation impedes career advancement is to ignore that career paths are largely non-existent in the lower office stream. Thus, researchers must remain cognizant of the present realities of the office, tracing the declines and upswings in job security which are related to technology. Second, to argue deterministically for the erosion of job security denies that beneficial outcomes can be fashioned. Homework, for instance, given adequate legislation and worker protection, may present an attractive work alternative for Canadian clerical workers. Research within a modified critical framework, which compares how different legislative and socio political environments influence the viability and impact of new work arrangements, could provide considerable insight on issues of job security.

To summarize, research on quality of working life issues does indicate that automation seriously threatens to erode the quality of working life within the office. This is particularly well documented in relation to issues of health and safety. Threats posed to social relations and job security, while implied, are not at present empirically supported in either direction. On the basis of logical argument, or historical experience, we may draw conclusions on these two issues; however, the need to clearly identify patterns and relationships specific to current automation is evident. Future research should aim at embellishing data on these latter issues; as well, it should pursue additional issues of job satisfaction, job meaning and reward.

CONCLUSIONS

On the basis of the literature, we can make several broad conclusions. The impact on employment is likely to be less severe than anticipated. Diffusion will be less rapid than expected; the process more likely one of incremental progression than one of dramatic upheaval. As well, the 'process'

will be plural, varying by occupational group and sector, with those workers engaged in routine, repetitive work being most vulnerable. Effects on skill are unclear; suffice to say that skill outcomes are largely a function of the reorganization of work. In Canada, research within a modified critical framework is required to determine the extent of downgrading for the range of clerical occupations. Finally, quality of working life does appear to be threatened, particularly in relation to health and safety for lower stratum office workers. The impact on social relations and job security, however, is less clear and there is a need for further research in these areas.

A final issue, often only cursorily broached in the literature, concerns the role of workers, employers and the state in shaping the outcomes of automation. This oversight stems, in large part, from the reliance on a critical model which assumes a static and determined macro environment. Yet, both Lane (1985) and Bamber and Lansbury (ILO, 1985, p. 183) emphasize the enormous influence of these three parties in determining technological outcomes. Bamber and Lansbury report that countries with an adversarial industrial relations tradition (i.e. Australia, Britain) are experiencing greater difficulty in coping with technogical change than countries with a consensual environment (i.e. Sweden, Norway). This leads them to reject a deterministic critical thesis in favour of one which considers the strong influence of the industrial relations environment.

Research on union, state and worker activity has predominantly focused on the Scandinavian countries which are regarded as prototypical alternatives to laissez faire technological change (ILO, 1985, pp. 190-213; 275-300; ECC, 1987, pp. 126-127; Gill, 1985, pp. 141-158). Indeed, the way in which these countries have minimized social upheaval with regard to new technologies has lead many researchers to argue that industrial democracy must be an integral part of technological change (Crockfort, 1980, p. 700). Yet, despite the emphasis on these issues, Canadian research has not yet extensively addressed the tripartite question in relation to office automation. Concerning technological change generally, the Economic Council of Canada (1987) notes that Canadian firms appear hesitant to allow genuine participatory schemes. As well, Betcherman and McMullen (1986) indicate that less than 25% of innovating establishments have involved workers or their representatives in the automation process. Instead, input in Canada is solicited more frequently from vendors and consultants (ECC, 1987, p. 112). Thus, while unions, in protecting workers and pushing for joint consultation, have played a pivotal role in fashioning outcomes in other countries, this is not the case in Canada.

Similarly, despite active state intervention in other countries, both levels of government in Canada appear reluctant to become involved in

facilitating technological change (Jecchinis, 1982, p. 19). This reluctance has left Canadian workers with relatively ineffectual technological legislation. The Economic Council of Canada (1987) finds Canadian technological legislation deficient due to vague language concerning 'technological change' and 'significant numbers' and an opt out clause which has produced low rates of technological provisions in collective agreements. Consequently, the Canadian Labour Congress (ILO, 1985, p. 143) suggests that improved labour legislation is the first step to ensuring smooth adjustment to new technologies. Beyond this is a need for broader government policy which aims at assisting all workers who are vulnerable to technological change.

While questions of state and union response remain largely unexplored in relation to the automation of Canadian offices, one caution against optimistic forecasts is the low level of unionization among Canadian office workers. While the union movement has been characterized as perhaps the «best vehicle for shaping constructive responses to the challenges posed by technology» (Lowe, 1984, p. 90), this may be a mute point in relation to the office. As Lowe points out, clerical jobs, marked by apathy and high turnover, are unconducive to unionization; in the past, union drives have largely ignored women in the office (Lowe, 1987). Thus, many Canadian office workers fall outside the collective bargaining process and remain particularly vulnerable to ill conceived applications of technology. Yet, despite these facts, there is cause for optimism. First, unionization is highest in the public sector (Lowe, 1984, p. 13) which stands to be most affected by automation (Friedrichs, 1982, pp. 194-195). As well, overall union growth among women has been strong in recent years (Lowe, 1984, p. 16) and it has been suggested that automation itself will trigger further growth (Armstrong, 1984, p. 171). Whether or not this will occur remains to be seen. In fact, precisely how unions, employers and the state are meeting the challenge of office automation is the next pressing question on the research agenda.

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L'automation des bureaux: perspectives canadiennes

Au cours des dernières années, les bureaux sont devenus le lieu principal des changements technologiques, ce qui a soulevé d'importantes interrogations touchant les perspectives d'avenir des employés de bureau au Canada. Même s'il y a eu beaucoup de recherches sur le sujet, on n'en a guère fait l'analyse critique. Cet article s'efforce de combler cette lacune en se préoccupant surtout de trois points: l'emploi, la qualification et la qualité de vie au travail. La présente recherche utilise la distinction établie par Glenn et Feldberg (1983) entre les modèles de recherche suivants: l'acceptation par consentement *(consensus)* et l'attitude d'opposition *(critique)*. Ceci constitue une méthode expéditive pour considérer les hypothèses sous-jacentes tirées d'études particulières. Les modèles fondés sur le *consensus* assument que les travailleurs et les employeurs partagent des opinions comparables concernant le processus d'automation. Les tenants des modèles dits *critique* estiment qu'il existe un phénomène d'affrontement tendant de la part de la direction à centraliser et à contrôler l'exécution du travail. Même si la littérature traite de l'un et de l'autre modèles, le plus souvent soutenu est le modèle *critique*. Ceci est source de débats marquants qui masquent le jeu des divers facteurs relatifs à l'automation. L'objet principal de l'article porte, en conséquence, sur la nécessité d'une approche *critique* révisée, sensible à la nature même de l'automation.

Cet article est divisé en trois parties qui correspondent aux questions spécifiques ci-dessus indiquées. La première traite de l'emploi, sujet le plus controversé dans les discussions sur l'automation. Décrivant l'ampleur et la vitesse des déplacements de main-d'oeuvre, les tenants de l'approche *critique* dominent nettement et ils ont fait

des prédictions pessimistes sur les pertes massives d'emplois et sur les bouleversements sociaux (Downing, 1981; McDermott, 1981; Booth et Plowright, 1981; Armstrong, 1984; Menzies, 1981). Cependant, ce type de recherche fait de l'extrapolation à partir d'études partielles sur l'automation et ignore la diversité des emplois de bureau et des applications des technologies nouvelles. Des études plus récentes, utilisant un modèle *critique* révisé (Osterman, 1986; Leontiff et Duchin, 1986; Conseil économique du Canada, 1987), suggèrent que les déplacements sont tempérés et circonscrits par la réorganisation des bureaux, l'adaptation de la main-d'oeuvre et la répartition inégale des technologies nouvelles. Ces travaux indiquent que les conséquences sur l'emploi varient selon les postes, l'entreprise et le secteur industriel. D'autres recherches, utilisant ce modèle *critique* révisé, seraient nécessaires pour déterminer les effets de l'automation sur l'emploi du personnel de bureau au Canada.

La deuxième section de l'article traite de l'impact sur la qualification. L'enjeu principal a trait à l'influence des technologies nouvelles sur la véritable complexité du contenu des tâches et le niveau possible d'autonomie pour le personnel de bureau. La majorité des chercheurs adoptent la thèse *critique* fondamentale énoncée par Braverman (1974) qui met l'accent sur la standardisation et le caractère routinié des tâches ainsi que sur la perte d'autonomie résultant de l'utilisation des moniteurs et du rythme des machines. La recherche au Canada, même si elle se développe, suit cette voie; cependant, les débats sont fort abstraits et manquent d'assises empiriques. On considère les problèmes relatifs à la qualification d'un point de vue déterministe en supposant qu'ils résultent naturellement de l'utilisation de la technologie. On trouve des recherches plus valables, utilisant le modèle *critique* révisé qui explorent comment des facteurs tels la réorganisation du travail, le type de technologie utilisé, l'importance de l'entreprise et les coutumes peuvent tempérer le processus de déqualification (Evans, 1982; Glenn et Feldberg, 1983; Crompton et Reid, 1982; Crompton et Jones, 1984). Ces études laissent entendre que le travail de bureau n'est techniquement déqualifié que dans des conditions précises et que la technologie, alliée au sexe de l'employé, agit de façon à créer des postes tant «qualifiés» que «non qualifiés». La recherche canadienne de ce genre est fondamentale pour comprendre les conséquences possibles de l'automation sur la qualification.

Dans la troisième partie, l'auteur aborde le sujet de la qualité de la vie au travail et plus particulièrement les questions de la santé et de la sécurité au travail, des relations sociales et de la stabilité de l'emploi. Les études sur la santé et la sécurité au travail tiennent la première place chez les tenants du modèle *critique* (CLC, 1982; ILO, 1975). Elles confirment les dangers posés par le «monitoring», les déficiences ergonomiques et les aménagements du travail mal conçus. La recherche future doit faire la lumière sur ce point en se demandant si ces risques proviennent des nouvelles technologies mêmes ou de la réorganisation du travail qui les accompagne. La recherche sur les relations sociales porte sur l'isolement et la spécialisation de l'employé, mais elle est restée jusqu'ici théorique. Enfin, les travaux traitant de la stabilité des emplois explorent les questions du travail à temps partiel, du travail par quart et du travail à domicile. Les recherches basées sur le modèle de *consensus* prévoient une flexibilité plus grande dans le travail de bureau, alors que celles fondées sur le modèle *critique* avancent une possible exploitation dans l'aménagement du travail.

Sur ce dernier point, la recherche future devrait considérer comment les contextes législatif et socio-politique peuvent exercer une influence sur l'agencement du travail de bureau.

En conclusion, l'accent est mis sur l'avantage d'un modèle *critique* révisé. On discute également d'un manque important dans la littérature, en particulier en ce qui a trait au rôle que doivent jouer les travailleurs, les employeurs et les gouvernements par rapport aux effets de l'automation. On néglige ce dernier point, surtout chez les tenants du modèle *critique* qui estiment que l'environnement est statique. L'importance du climat des relations du travail, en ce qui concerne les conséquences de l'automation, est souligné avec références aux expériences d'autres pays (Lane, 1985; ILO, 1985). Enfin, l'article décrit brièvement la situation au Canada. On y indique que la façon dont les syndicats, les employeurs et les gouvernements vont relever le défi du phénomène de l'automation dans les bureaux est la prochaine question urgente à mettre au programme de recherche au Canada.