Women and Work in the Information Age

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Widespread social transformation and new class structures are predicted with the coming of the 'information age', but there is disagreement about the likely outcomes for work and employment patterns. Mainstream writing on the information age, both from the functionalist and Marxist traditions, tends not to consider likely consequences for women, but recent feminist research on gender and technology, treating technology as masculine culture, offers a useful framework for further research. This article argues that the information age may lead to some areas of convergence between the sexes in their experience of future work, but men may continue to defend areas of competence and to dominate the high status and powerful occupational positions of the future.

Introduction

There has been a flood of books, articles, and media coverage presaging the 'information age' (Gates 1995; Grenier and Metes 1995; Tapscott 1995), or variations such as the 'digital age' (Birt 1996), the 'information society' (European Commission 1996) or the 'network society' (Castells 1996). The convergence of information technology, computers and telecommunications (ICTs) to create a new 'heartland' technology (Freeman *et al.* 1982), is forecast to lead to a period of rapid innovation, creating new information-based products and services transforming work and creating new types and forms of employment.

The optimistic conception of the 'information age' has roots in the functionalist paradigm, most notably the post-industrial writings of Bell (1973, 1980) and shares with post-Fordist flexible specialization an emphasis on unilinearity of outcomes (Pollert 1991). Writers in this tradition tend to foresee a future where technologically-based revitalized service-based economies operate with re-skilled collaborative workers (Piore and Sabel 1984; Handy 1989; Barnatt 1996) and conflict is eliminated with the 'end of ideology' (Bell 1973, 1980). Failure to take up the new technology, or a slow take-up, is predicted to precipitate economic deterioration, higher unemployment and increased industrial strife. The last decade of the twentieth century is considered the decisive decade in the diffusion of this new technological paradigm (Freeman *et al.* 1982). This is predicted to be imminent with a critical mass created by the linking together of ICT networks within organizations (intranets), between suppliers and producers, and on a global scale (McLoughlin and Clark 1994). The information age, at its most ambitious, is predicted to lead to a society where unskilled, low productivity jobs will be almost eliminated by technology (Crouch 1997) and there is evidence that the globalization of some activities produces a shift to higher-skilled work undertaken by 'symbolic analysers' (Reich 1992) in advanced economies. The European Commission (1996) predicts a shift towards more knowledge work for a large number of workers, and emphasizes the job-creation possibilities of ICTs (Bangemann 1994).

Castells (1996) considers that the information age is not post-industrial but, rather, a further stage in capitalist evolution and outlines the common features of 'informational' societies. These include the phasing out of agricultural employment and a steady decline of manufacturing jobs accompanied by increasing productivity. Producer and social services, especially business and health, tend to increase in terms of job creation and retail jobs continue to be important. This is paralleled by the development of a white-collar proletariat. Job increases are clustered at the top and bottom of the occupational structure. Business firms, organizations and institutions move from hierarchy to network, blurring the traditional distinction between corporation and small business, with out-sourcing, sub-contraction, franchising and virtual enterprises all commonplace future adaptations to market conditions. Castells, along with many information age commentators, predicts that 'knowledge' workers,

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such as managers, technical workers and professionals, will hold the pivotal elite roles in the new social structure, and information will become the crucial economic commodity. However, other writers temper this with warnings that a relabelling of jobs rather than a process of genuine upskilling is taking place in some cases (Warhurst and Thompson 1998).

Touraine (1974) puts forward a much more pessimistic scenario of the future where class conflict becomes centred on the access to, control, and manipulation of, information, rather than property. Gorz (1982), Castells (1996), and Crouch (1997) also argue that labour market structures will polarize between a small, relatively secure 'core' workforce and a large periphery of poorly paid, low-skilled workers who may become increasingly servile. In contrast to the post-industrial writers, who tend to believe that ICTs will create jobs, these writers foresee that automation will lead to 'jobless growth' and a large, permanent pool of unemployed. Castells, while believing that ICTs will displace workers and eliminate some jobs, does not predict mass unemployment. Van den Besselaar (1997) predicts a long-run decline in jobs through process innovations, with expansion in the IT sector, and sectors applying IT, but not enough to counterbalance job losses in declining industries. He feels that political intervention will be necessary to redistribute work and to avoid unemployment by creating jobs in labour-intensive final services. Thus, despite disagreements about the outcomes of change, the common theme is that ICTs are enabling and driving social transformations, and creating new class structures in advanced economies (Farnham 1997).

Women, work and employment in the information age

Apart from the feminist contributions discussed later, issues of women's work and employment in the mainstream information age literature are rarely made explicit, or are touched upon only briefly. Toffler (1981) optimistically assumes that men and women will have equal access to employment opportunities through the return of high technology work into the home in the 'third wave', redressing the gendering of jobs which some believe followed the separation of work from home at the start of the Industrial Revolution (Wajcman 1991). There is also a view that telework at home will liberate women from male control in traditional work settings (Gutek 1983, quoted in Huws *et al.* 1996). Occasionally, there is an exhortation that a new army of low-paid, low-skilled women teleworkers should not be created (Handy 1985), or more commonly it is assumed that routine 'back office' women's jobs in Western countries will either move 'offshore' (i.e. move to cheaper labour markets), or will disappear altogether (McGrath and Houlihan 1996).

The rise of computers and ICTs in the information age is said to offer some distinctive opportunities for women in the labour market. Electronic technology eliminates heavy manual work, which converges with white-collar work providing reskilled, sedentary employment with no need for physical strength. A better balance between work and non-work activities is possible where work is uncoupled from the constraints of fixed time and location through the application of ICTs. Women can more easily combine paid work with child care, and will no longer be disqualified from jobs requiring geographical mobility. New small ICT-based businesses could be founded by women escaping the 'glass ceiling' of the bureaucratic male culture of the modern organization. The rise of horizontal corporations, built on electronically mediated networks and teamwork rather than hierarchy, may improve women's representation in management (Coyle 1993). The Internet is said to be free of gender (and race) bias because communication is impersonal and gender-neutral. Thus Internet-based trade and business (e-commerce) could be a fruitful source of new occupations for women on an equal basis with men.

In contrast, a more pessimistic scenario is that disadvantages currently facing women in the labour market could be recreated in the information age (Wajcman 1991). Despite the predominantly masculine culture of large organizations, the existence of bureaucratic rules and procedures to ensure fairness and equity, and employment protection measures, however flawed, may render this environment somewhat more conducive to women's advancement than delayered organizations, small businesses or own account self-employment. ICT-based work physically and contractually outside organizational boundaries is often isolated and exploitative for women especially where skills are low, easily replaceable or undervalued (Huws 1994).

Men may continue to defend areas of competence and succeed in occupying the more powerful organizational positions of the new age by excluding women, or abandoning occupational areas which begin to be colonized by

women, that often then become devalued, degraded and less well paid (Wajcman 1991; Cockburn 1992; Coyle 1993). Women may use computer-based technology at work, but their jobs may remain defined as women's work, low in status and reward (Kirkup 1992). Women may continue to be absent from the arena of technological innovation, which is shaped by masculine concerns. Remote work and trade via the Internet may not be gender-neutral for very long, with visual web pages supplemented by other communication media, rendering gender neutrality only temporary — a fruitful area for further research. Unskilled 'no-tech', low-paid work may not be eliminated by the technology (e.g. Crouch 1997; Reich 1992), with the new (mainly male) knowledge elite requiring more low-grade service work to satisfy their needs (Lovering 1990). Much of this work may continue to be carried out by women, defined as suitable because of their female interpersonal skills, a new stereotype to fit new circumstances (Lovering 1994).

The outcome depends upon processes of gendering around emergent technologies. Women's relationship to technology has in the past been manipulated to render them apparently incompetent, with technology defined and redefined as masculine (Grint and Gill 1995), or women's contribution to technological development has been hidden from view and undervalued (Wajcman 1991). Alternatively, the liberal feminist view is that women have been socialized away from involvement with technology (Grint and Gill 1995) resulting in an under-representation of women in technical and scientific fields of work. The next section explores approaches to women's relationship to technology in more detail.

Women and technology

Three approaches are discussed here: eco-feminism, liberal feminism and the social shaping approach treating technology as masculine culture. The eco-feminist view is that women are essentially close to nature, but it is men who dominate and control nature through their manipulation of technology, and thus also control women. The solution for eco-feminists is withdrawal and separatism, refusing to engage with patriarchal culture, or alternatively developing a uniquely feminist technology.

The liberal feminist view is characterized by the belief that technology is essentially neutral, and women have been socialized away from involvement with technology because they have adopted stereotyped notions of what is suitable work for women (Grint and Gill 1995). To combat this, programmes to help women overcome these stereotypes have been attempted, such as the government-sponsored Committee on Women in Science, Engineering and Technology (HMSO 1994) or the Women into Science and Engineering (WISE) initiative. Better teacher training, the implementation of equal opportunities policies in employment and more 'woman-friendly' policies have been recommended to enable women to achieve their potential, and change their attitude to technology. Such initiatives tend to emphasize the changes that women themselves have to make in order to relate more successfully to technology, and enjoy successful careers in technological work. 'The male is treated as the norm, and women are supposed to adopt masculine ways of relating to technology' (Grint and Gill 1995, p. 7). Nor have they been particularly successful judging by the continuing flight of women from technological subjects at 'A' level and in higher education, and the gross under-representation of women in technological work and careers.

Cockburn (1985) and Wajcman (1991) reject the eco-feminist idea that there is some fundamental difference between the sexes, and also challenge the view that women's under-performance in science and technology jobs and careers is caused only by sex-role stereotyping or lack of education and training. Their approach treats technology as masculine culture, embodying a historical and dynamic framework, which tries to explain how the link between technology and manliness is created and recreated, using careful empirical investigation.

A number of studies of new technology and computers have broadly adopted this explanatory framework. Turkle (1988) found that boys and girls adopted different approaches to work with computers, but it was the male approach that was valued more highly. Faulkner and Arnold (1985) traced the differential use of microelectronics in men's and women's areas of work. Massey (1993) elaborated the dynamics of masculinity in the high-tech 'Cambridge phenomenon' constructed around reason and transcendence. Tierney (1995) traced how a group of male workers in a software company used informal networking to enhance their careers to the detriment of others, including women. Wajcman (1991) found that computer-mediated homework, rather than enhancing the position of women, led to outcomes that reinforced gender differences, with women still failing to gain their fair share of genuinely

innovative technical jobs such as software design and development.

In terms of the coming information age, where new occupations and jobs arising from the application of ICTs will be continually created, Grint and Gill's (1995) modification of the technology as masculine culture approach could be adopted. They argue that what counts as masculine, feminine or neutral technology lies in the interpretations that are made of it rather than any property of the technology itself. New occupations and divisions of labour could mean that there are arenas for emergent relationships between men and women, where power may be contested, not necessarily with predictable outcomes. Feminist writers such as Wajcman and Cockburn might counter that future outcomes, though not pre-determined, are bound to be influenced by what has gone before, and, despite accelerating technological change, there may be a continuance of oppression and discrimination against women in work and employment. The next section outlines future UK labour market trends and identifies a number of issues for further discussion.

Trends in the UK labour market

Projected UK labour market trends, using government data, tend to support the information age thesis that higher level jobs will expand. Two out of every five jobs in the year 2006 are predicted to be in managerial, professional and technical occupations (DfEE 1996). Of these, professional jobs are expected to show the fastest growth rates, and technical change is principal among the drivers for the shift towards 'knowledge' work. The proportion of service sector jobs is predicted to increase, accompanied by a rise in women's share of employment to 49% by 2006. The self-employed population is predicted to continue to increase, with 15% of the workforce in this category by 2006, mainly due to outsourcing decisions by large firms, rather than the intrinsic appeal of self-employment. This foresees the likely continuance of waves of restructuring within firms and organizations. Much of the increase in self-employment is expected among the own account self-employed, who employ no-one. Self-employment will still be predominantly male, but female participation is predicted to rise to just over a quarter of the self-employed workforce by 2006. Women will continue to be far more likely than their male counterparts to be involved in part-time self-employment (Court 1995; Stanworth *et al*. 1998).

More non-standard work, work which is not full-time and/or permanent, is predicted in the UK, to match the supply and demand for labour more closely as a reaction to competitive market conditions. For example, part-time work, where women predominate, is likely to continue to rise to 31% of the labour force in 2006 compared to its present level of 25% (DfEE 1996). Other forms of non-standard work, such as temporary work, are also expected to increase. Employed teleworkers identified from a national study in the early 1990s represented a very small proportion of the UK labour force, with an estimate of 650,000, around half of whom were in clerical and secretarial jobs (Huws 1993). This figure excluded self-employed teleworkers, dual location teleworkers who worked less than half of their time from home, and those working in remote offices. More recent Labour Force Survey figures show that just under a million people are teleworking, using a broader definition of those working at least two days a week at home through the use of ICTs (*The Teleworker* 1998). Telework appears to be growing slowly from a low base (Gillespie *et al*. 1995).

A basic capability to use information technology is now becoming accepted as a 'key' or 'core' employment skill, which commentators feel will be needed in almost any job in the future. Dearing (1997) identified this skill as critical to the emergence of the 'learning society' and underlined the importance of developing it in the UK higher education sector.

A number of issues emerge from this brief analysis of UK labour market trends. These include:

- a more highly qualified workforce;
- more self-employment;
- externalization of labour and organizational restructuring;
- more labour market transitions;
- the centrality of IT skills;
- more remote ICT-based work.

Each of these issues will now be discussed in turn, and analysed critically in terms of its treatment in the information age literature. The likely impact of each on women's future work and employment in the UK will also be discussed.

Issues

A more highly qualified workforce

Commentators adopting the post-industrial viewpoint tend to believe that a high quality

labour force is essential for future labour market competitiveness, and this involves developing a 'learning society' where a much higher proportion of the workforce must be constantly retrained and reskilled to match the ever-changing technology and increased skill demands of the new millennium (for example, Jackson *et al.* 1996; Dearing 1997; Rajan *et al.* 1997). This means more investment within the economy in training and development, and from employers in particular, who understand the particular skill mix needed (Crouch 1997). Employers are willing to invest in those who already have higher qualifications, whom they wish to retain, and this is reflected in government figures which indicate that the higher qualified, and professional, technical and managerial employees receive higher than average amounts of training (DfEE 1996). By way of contrast, employers tend to invest less in the short-term and non-standard workforce, where many women are located (EOC 1991; CBI 1994). This could push the responsibility for training this segment of the workforce onto the state or onto workers themselves (Crouch 1997) leading to a more marked polarization of the workforce in the information age between privileged knowledge workers (mainly men) with high quality skills, and a mass of low-skilled workers (mainly women), who will perform the ICT-based routine, or no-tech, work in the economy (Allen and Massey 1988; Crouch 1997; Stanworth 1998).

Though the bulk of the female workforce is located in low-skilled work, a growing number of UK women are now becoming highly qualified. Recent trends show that women are increasingly investing in higher level qualifications, particularly younger women (Court 1995). Women now account for nearly half of all university enrolments, and medicine, law and accountancy are all professional areas where women are gaining ground (ibid.). This investment in human capital should benefit women, especially those now entering the labour market, enabling them (according to post-feminists) to compete for the knowledge work of the future on equal terms with men. Better qualified women are also less likely to leave the labour market when they have children, and less likely to suffer occupational downgrading than other groups. Some will have an uninterrupted career pattern similar to men (Brannen *et al.* 1994). However, there are cultural factors which may continue to militate against women's progress in managerial and professional occupations. These include the persistence of informal male-dominated networks, homosociability and its effects on internal labour market decisions, as well as the exclusion of women from positions of direct organizational authority which are stepping-stones into senior management (Coyle 1993; Crompton 1994; Crompton and Sanderson 1994). Another factor is the importance of maintaining and improving the value of women's jobs and preventing downgrading and the erection of barriers to vertical mobility which can emerge when new occupational areas are opened up to women (Rubery and Fagan 1994).

More self-employment

The theme of employment-by-self and the growth of 'enterprise' runs through both the European and the US information age literature. Technical work transforming information into knowledge, the archetypal work of the information age, is predicted to be carried out in 'virtual' organizations, described as dynamic coalitions of technical specialists linked by global computer networks. The diffusion of the 'virtual' organizational form is said to be driven both by the technological imperative and by the chaotic external environment. One form of virtuality is the sophisticated subcontracting chain, another is the lean hub of employed staff surrounded by a shifting army of own account self-employed workers. Negroponte (1995) and Barnatt (1997) foresee the predominance of 'free agent individuals' in future labour markets. Some of the literature of the information age goes much further than the current governmental predictions of the scale of self-employment in the future UK economy. A scenario of atomized individuals bearing the risk of generating a sufficient income flow and operating in a global environment is predicted for the majority of the workforce.

Though this forecast would seem a long way from the present make-up of the UK labour market, the position of the increasing numbers of women in the growing self-employed workforce of the future nevertheless merits analysis. Again, the information age literature often fails to address the issue of whether women will be able to compete on equal terms in this ultra-competitive and almost 'pre-industrial' labour market where a flow of work will be dependent as much on reputation as skills and knowledge, pay will be individually bargained, and labour laws to eliminate such things as unfair sex discrimination in selection and promotion within internal labour markets will no longer apply. Women will need not only equivalent

competencies but also access to social networks to enable them to build up a good reputation, in order to compete successfully in the market with men. Research in the area of female entrepreneurship presents women's current self-employment in the UK as less successful than men's, when judged on such (admittedly 'masculine') criteria as employing others, financial turnover and working full-time (Allen and Trueman 1993). There are gender-related inequalities experienced by women which make small business start-up more difficult and inhibit growth.

The difference between dependent and independent self-employment is also important, with self-employed homeworking and freelance occupations which over-represent women sometimes being closer to disguised wage labour than entrepreneurship (Huws 1994; Stanworth and Stanworth 1995). Employers can access a highly-skilled workforce at low cost by using own account, home-based workers using ICTs.

The entry of women into self-employment has been seen as a way of surmounting gender-related career blocks (the so-called 'glass ceiling' effect) in hierarchical organizations, though this is by no means the only motivation (Allen and Trueman 1993). It is not clear whether setting up a business is a better alternative for women, though there is no doubt that entrepreneurship can be liberating and genuinely empowering for some women. Self-employed women are generally more highly qualified than self-employed men in the UK, suggesting that the career profiles of female entrepreneurs may be somewhat different. Women's option for self-employment can also not be separated from their family and non-work responsibilities (ibid.), and this factor may not change radically in the future.

Externalization of labour and organizational restructuring

Some well-publicized information age writing implicitly or explicitly foresees the disappearance of 'clear-cut and stable jobs' (Bridges 1995, p. ix) characteristic of the mass production era in large bureaucratic organizations. Technology is seen as the driver for this transformation, informating or automating existing jobs (Zuboff 1988), and destabilizing and destroying the internal labour market (ILM) system which provided secure jobs for life (at least for some) in the past. Cappelli, using US data, offers a more reasoned argument, that ILMs are breaking down, replaced by arrangements 'that rely much more heavily on outside market forces to manage employees' (1995, p. 563). Though he cites a number of factors besides computer technology which have driven the externalization of employment, he feels that computers have triggered restructuring, and in particular downsizing within middle management ranks. This 'hollowing-out' accords with Drucker's and Castells's view that middle-ranking managers will disappear in the organizations of the future (Drucker 1992; Castells 1996). Similar trends are discernible in the UK, with outsourcing and downsizing resulting from a combination of product market competition, recessions and technical change (Hendry 1995). Information age writers tend to assume that the trend to externalization is a permanent change in work organizations, though fluctuations in this long-term trend could be caused by economic or ideological factors.

Coupled with externalization is work of a more insecure nature, where jobs are impermanent, and come and go with fluctuations in the fortunes of the organization. Technology is predicted to both transform the structure of organizations and to intensify competition, which also becomes more globalized (Castells 1996). As a result, the traditional form of work based on full-time employment, clear-cut assignments and a unilinear career pattern over the life-cycle, according to Castells, is slowly eroding away (1996). The future prediction is that individuals will have to take much more responsibility for managing their 'careers' and deal with job insecurity (Cappelli 1995), and research shows that there are few compensating advantages (Herriot and Pemberton 1997). This breakdown of the old 'psychological contract' between employers and workers is predicted to be replaced by the concept of 'employability' whereby employers will ensure that workers are well equipped by means of training and development to compete in volatile labour markets and cope with multiple transitions during their working lives. Evidence for the development of this 'new deal' is scarce (Hendry and Jenkins 1996) and 'learning organizations' may be limited to a few large exemplar companies.

Non-standard workers, such as part-time, temporary and short-term contract staff have rarely enjoyed 'relational' contracts, where workers are treated as long-term assets of the firm, and the now defunct system of lifetime employment in the banks, for example, never included women (Hendry and Jenkins 1996). Currently, as UK figures show, non-standard forms of work tend to over-represent women, who make up 80% of part-timers, and over half of all temporary

workers, though the number and proportion of male part-timers have grown in recent years. National figures show that involuntary male part-time work in particular has increased. The labour market disadvantages of 'non-standard' working patterns are well documented, including segregation into low-skilled and low-paid work, a lack of promotion prospects, and a training deficit (for example, see CBI 1994; Rubery and Fagan 1994; TUC 1994; Webb 1994; Wilson 1994; Court 1995). Wilson (1994) foresees little change in the future: for example, most of the growing number of part-time jobs will continue to be filled by women, will be of relatively low status with basic pay levels, and women's choices will continue to be made with the needs for child care, other care and domestic responsibilities in mind.

There are signs that a new era of more 'equal rights' in non-standard jobs is emerging, which could, partially at least, compensate for their typical low status. A number of European and domestic legislative changes affect part-time workers in particular. These include the European Court of Justice (ECJ) ruling on pension rights for part-time workers, and the Lords Ruling implemented in 1995 which removed hours and length of service discrimination against part-timers in terms of employment protection. Now that the 'New' Labour government has signed up to the Social Chapter, the Directive on part-time work and fixed-term contracts will progress towards implementation, giving rights to pro rata fringe benefits such as sick and holiday pay from which many non-standard workers are currently excluded (Dickens 1992; Dex and McCulloch 1995). The minimum wage, though not an equality measure, may increase basic pay in occupations where women part-time workers are found in large numbers: cleaning, catering and hairdressing, for example. New Labour's 'Fairness at Work' proposals include measures whereby marginalized workers enjoy employee rights.

The system of labour law, social protection and employment benefits in the UK has been built around the standard or male 'breadwinner' model of full-time, relatively stable employment, (which was never universal) which is in a process of decline (Lindley 1994; Stanworth 1996). Where these standard conditions are present, workers enjoy entitlements to a series of guarantees and benefits, and the law imposes obligations on employers and the state (Cordova 1986). Because of the changes over a long period of time in the composition of the labour force, this system is becoming increasingly out of step with current trends, and a strategic reappraisal is needed to bring it into line with the more insecure and diverse labour market (Lindley 1994) of the information age. As Lindley comments:

> the notion of a dominant 'normal' pattern of work is gradually being eroded. This means that a period of transition could arise where the labour market structure goes through an orientation which seeks to accommodate diversity rather than treat one particular working pattern as the norm and other patterns as marginal. (1994, p. 114)

In future a larger number of men (not just the early-retired) may experience short-term jobs and interrupted careers which will be much more like the pattern which previously applied mainly to women. The male 'breadwinner', female homemaker model of the household is already becoming rare (but persists strongly at an ideological level), and has been superseded by more diverse patterns of employment between partners. Multiple earners in a household are now commonplace because the single male wage is no longer adequate to maintain an acceptable standard of living, and over a million people in the UK now have more than one part-time job. This trend, compounded by the more widespread absence of regular work and income in future may have important effects on society, as middle-class life in particular is based on home ownership and other regular payments and investments dependent upon a steady stream of income (Cappelli 1995). Aspects of modern life beyond the employment relationship may be profoundly changed, including, possibly, the sexual division of labour within households, though change to date has been painfully slow (Wajcman 1993).

More labour market transitions

The more volatile labour market in the future has led some to predict the death of the job as we know it (e.g. Bridges 1995) and the emergence of a new quid pro quo based only on 'market discipline' (Rajan *et al.* 1997, p. 3) where all individuals will have to acquire the skills for personal career development: that is 'job-search, networking and related skills' (Jackson *et al*. 1996, p. 22). Handy (1985) foresees a future of 'portfolio' careers where job moves are planned and individuals constantly refresh their transferable skills, keeping pace with rapid change.

These views, often based on conjecture rather than serious research, are contested by those who use recent labour market statistics to refute this thesis (e.g. Dex and McCulloch

1997). However, changes in the pattern of jobs and recurring waves of restructuring and outsourcing in firms and organizations make it likely that there will be more transitions between jobs, employment statuses, organizations and work settings in future. Personal competencies based on the attributes and capacities of individual workers may also become more important (Castells 1996). The growth of self-employment and small business means that business management skills will need to be developed by a larger number of individuals. Transitions will not only occur in the early years of working life, but will continue throughout it, driven by changing technology which will continually create new work opportunities as well as destroying old ones. Many workers with redundant skills will be at a disadvantage, where they are pushed into more casualized employment relationships, or into self-employment. They may have erratic, unplanned careers as a result. This career pattern is also associated with many of the women in the labour force (Jackson *et al*. 1996).

The principal source of skills development for society as a whole in the past has been business firms, but in the future the collective goal of economic policy to produce a highly-skilled, mobile labour force for the information age will depend on private firms who may no longer have the incentive to fulfil that role (Crouch 1997). With more sub-contracting, self-employment and uncertain market conditions, the incentive is for firms to reduce their costs and not to invest in vocational education and training for the workforce. Crouch also discusses the ability of multinational companies (MNCs) to act on a global scale. ICTs may offer economic regeneration to Western economies, but at one and the same time they facilitate a more global marketplace where there are enhanced opportunities to move both manufacturing and service operations to more favourable (i.e. low labour cost) locations (FIET 1996).

If firms cannot or will not train the workforce to adapt to career transitions, then public agencies may have to fill the role. Crouch advocates public agencies which move away from finding low-wage jobs for the unemployed towards upgrading the skills of the workforce to the levels of the best. He stresses the importance of increased funding of the general education system in the 'learning society' of the future (1997). Concentrating guidance on careers at the initial transition point to employment is no longer adequate, as work decisions will continue to be made throughout working life, and must cater for those with periods of unemployment, to women returners, and so on. Jackson *et al*. (1996) feel that a national strategy for adult guidance should be developed, which would offer independent advice, and would be partially publicly funded to ensure that those without the ability to pay, would be able to benefit.

The labour market of the future presents a number of paradoxes, not least for women. Responsibility for career development could be pushed increasingly onto the individual which could intensify gender and social class divisions. Individuals will need financial and time resources to invest in self-development if outside a firm's internal labour market. A greater proportion of women than men are economically disadvantaged and do not have access to these resources. Public provision for career guidance is limited and underfunded, and concentrated on the initial transition from education to work, neglecting the needs of women returners. The conclusion must be that for many women the future labour market will be one which adds to their disadvantage, unless there is an increased investment in supporting their needs.

The centrality of IT skills

Some information age literature assumes that ICTs will almost eliminate low-tech or no-tech work, and the wide adoption of IT skills will be crucial to the creation of added value work and future economic vitality. New job creation is predicted in certain sectors and occupations, including the IT sector, telecommunications, the media, and professions and technical jobs. Crouch (1997) criticizes these assumptions, arguing that knowledge work may not be as plentiful as promised, and the bulk of future job creation may be in low-grade personal service jobs. Knowledge work based on IT skills may in fact decline in the long run, as professional expertise is itself initially informated but ultimately automated. The popular literature is generally 'gender-blind' with little or no discussion of the sexual division of labour in IT-based work.

There is some agreement that the IT sector itself will be a net job producer, at least in the short run, in the information age (van den Besselaar 1997), but research in the UK indicates that women are severely disadvantaged in terms of IT occupations. Men dominate professional and technical occupations, with women constituting only 10% of members of institutions such as the British Computer Society. There is evidence of the exclusion or devaluing of women in IT-based jobs, and the ghettoizing of women within

enclaves which limit their aspirations (Larkin 1996; Bierne *et al.* 1998). Women are deterred from gaining computer skills at school, mainly because the subject has become 'masculinized' into 'laboratories' and women teachers have felt less confident about use of the technology. ICT products and services tend to be marketed to males, with few leisure games for young women (unless they want to dress Barbie!). Leisure computing is predominantly a male pursuit, with women tending to be involved through their male peers (Kirkup 1992).

As a result of the interplay of these factors, women are under-represented in technological subjects at 'A' level, and the gap widens in higher education, with women representing less than one in seven of those studying Computer Science subjects. Women have lost ground in this occupational area since the late 1970s when just under one in four graduates in Computer Science was female (Rubery and Fagan 1994). They explain the increasing segregation of women as possibly due to the male-dominance of computer professional work, with its long working hours and individualized employment contracts (ibid., pp. 38, 39). Massey (1993) in a study of male, high-tech knowledge workers, found little explicit sexism, but excessive hours, an encroachment of work into non-work time and an exploitation by capital of the masculine character and obsessive interest of the jobs which embodied scientific rationality and logic. Tierney (1995) described an informal 'lad's network' in a software company, which became a powerful means of gaining preferment at the expense of others, including women.

In terms of access to information technology in the UK population, the evidence available appears to show that women are disadvantaged. Women are less likely to have access to computer hardware and software at home, with 40% of men, but only 32% of women having access. A recent survey (Motorola 1996) found that 50% of men felt they were knowledgeable about IT compared with only 31% of women. In a recent *Guardian* survey of its readership, women reported feeling confident at work in all areas except IT, where only one in seven women considered themselves computer-literate compared to one in four men (*The Guardian* 1996). This is an interesting finding, given that women, as much as, or more than, men, use computers extensively not only in administrative and secretarial work but also increasingly in professional, technical and managerial work. Differential subjective assessments of proficiency in basic IT skills between the sexes underline the gendered nature of our relationships to these skills.

In terms of technical change at work, women tend to be disproportionately affected by decisions to use IT to deskill or displace jobs. In clerical work and word processing the tendency has been to bring in machine-pacing, repetitive work and increased monitoring (Faulkner and Arnold 1985; Barker and Downing 1985). There has been a trend for women to colonize jobs affected by IT which turn out to be temporary and rapidly automated by further technological development (Faulkner and Arnold 1985). Studies highlight women's exclusion from the more technical areas of computer work, or other work utilizing the technology, through male manipulation of the definition of skilled work and appropriation of the more skilled work, often resulting in the reinforcement of gender divisions (Crompton and Sanderson 1994; Wajcman 1991; Cockburn 1986). This socially generated shaping of decisions around ICTs questions the gender-free, rational and deterministic outcomes predicted by post-industrial writers.

More remote ICT work

The archetypal worker of the 'information age' is the teleworker, who works using ICTs at a place other than where the results of the work are needed (Bertin and Denbigh 1996), and much of the literature describes or prescribes the changes in working practices which are facilitated by the technology. Popular writing tends to emphasize the freedom which the technology allows to workers to determine how, when and where they work. They may be 'portfolio' workers (Handy 1985) with a variety of highly-paid jobs, or privileged 'core' employees with autonomy to organize their own time and location of work, enjoying high trust relationships (Handy 1995), and discretion to manipulate the hardware and software (McGrath and Houlihan 1996). The literature is mainly concerned with 'knowledge' workers. However, in reality, women teleworkers predominate in routine white-collar occupations but are severely under-represented in better-paid professional and technical jobs. Women in the UK make up 90% of secretarial and administrative teleworkers, but only 16% of consultants and 14% of computer professionals (Huws 1993). If teleworkers have a strong bargaining position, for example where skills are in short supply, they may have their preferences taken into account by employers, but where workers have a more vulnerable position, such as in routine white-collar work, and trade unions

are weak, employers may cut costs and degrade work (Stanworth 1996). Women are much more likely to be found in the latter category. Huws *et al*. presented two 'models' of teleworking — the 'exploitation' model and the 'new opportunities for flexibility' model (1996).

Research has identified well-qualified women with scarce skills undertaking jobs requiring high education levels, where telework can be well paid and rewarding, (Fothergill 1996). This supports the 'new opportunities for flexibility' model, and through telework women may be able to take advantage of the forecast growth in technical and professional occupations using ICTs. However, there are disadvantages to telework, especially the totally home-based kind, for both sexes. Teleworkers may be excluded from aspects of the internal labour market such as access to promotion because of their lack of visibility. Social isolation is common to nearly all teleworkers except those with a sustained office presence.

The most significant current expansion of telework in terms of job creation involves 'call centre' or back office work in remote offices, which tends to support the 'exploitation' model. It is estimated that these jobs are expanding by 40% a year (*The Teleworker* 1996), and by the year 2000 two workers in every hundred will be working in such centres (*People Management* 1997). There are thousands of people, predominantly in low cost employment areas in the UK, mostly women, working shifts and nights, doing direct banking, insurance and help-line work, but also dealing with correspondence, mortgage applications or credit card bills. Some of this work is targeted at married women, and in banking such work has replaced work in branches, which enjoyed better working conditions and prospects (Stanworth 1996). Here the technology (Automatic Call Distribution or ACD, allied to networked computers) is often used to create deskilled Tayloristic factory conditions. There is no longer a need for qualifications, and direct banking staff can be trained in three weeks (BBC 2 1995). There is a high intensity of work, and the work rate is closely controlled by the technology. The work is relatively 'careerless' and stressful with high turnover rates (Taylor and Bain 1998). In the long term, call centre work in the UK may disappear, because it is vulnerable to geographical displacement, and may be moved to cheaper labour markets. It may eventually be automated, with customers accessing financial or other information through their personal computers or interactive digital TV sets, rather than the telephone. It could follow the typical pattern of occupational areas opened up to women, that is deskilling followed by automation (Wajcman 1991).

Telework at home has been seen as a way for women to combine paid work with child care. It was considered as a best compromise for women (Huws *et al.* 1996), but is often at best a constrained choice, given the low pay and low status of most of the work carried out at home, and the high cost of paid child care (Webster 1996). Working in the home does not break down existing gender roles as Toffler (1981) predicted, to any great extent, with women still bearing the greatest proportion of the responsibility for child care (Huws *et al*. 1996). Women working at home tend to have inferior working space, and often work unsocial hours because the domestic routine takes priority (Haddon and Silverstone 1993; Fothergill 1994). The potential of home-based telework has never been fulfilled, and corporate managers often resist the use of this working pattern for their staff.

Conclusion

The information age is characterized by accelerating change and capitalist restructuring around emerging information and communications technologies. The path of change is socially shaped around class, gender and race, and the outcomes cannot be neatly read-off as necessarily beneficial, uni-directional or gender-neutral. What technology makes possible should not be confused with material change, and some much-hyped technological inventions will fall by the wayside, while others will flourish. In a period of rapid technological development predictions are fraught with risk. There is, however, no doubt that information technology redefines work processes and workers, and therefore employment and occupational structures will continue to change. Detailed sectoral and occupational studies are required to trace the historical precedents and explain the outcomes for different groups of workers. The social shaping approach to gender and technology offers a fruitful framework for studying future work and labour market change.

Some patterns are already emerging from studies of ICT-based work and sectors. In some cases jobs are being upgraded in terms of skill, but if occupied by women still tend to be low in esteem and pay. A large number of jobs are phased out by automation, and these are often 'women's' jobs. In sectors using IT, such as financial services, where the technology has led to radical restructuring and

the reintegration of formerly discrete tasks, the new high status jobs requiring extensive education, in selling, marketing and analysis, are still occupied predominantly by men. New types of work, such as in call centres, designed for women, ethnic minorities or young workers, are downgraded and concentrated in service factories, and are susceptible to future automation.

New pivotal work-roles and skills are emerging in terms of the IT cutting-edge, such as the software developer, Internet trader or Web designer. Evidence so far indicates that women are losing out in these areas, with sex-typing of these roles centred around male 'rationality', but new opportunities continue to be created, and further research into novel occupations is needed as they emerge. Home-based teleworking has not developed to the extent predicted, and is polarized between the professional and technical, and low-grade routine tasks where women predominate. Despite the opportunities opened up by ICTs, most work is still co-located, using traditional control and communication methods, and the spatial and temporal flexibility offered by telework which could assist women in their careers is underused by employers.

It is also a mistake to assume that all future jobs will directly utilize the new and changing technology. Low-skill, low-paid jobs at the bottom of the status hierarchy in service areas such as leisure and tourism, often seasonal, temporary or part-time, may expand alongside 'knowledge' jobs. If women continue to retain the major responsibility for housework, child care and caring, they are likely to still occupy the bulk of these positions.

Nevertheless, the continuance of oppression and discrimination against women in the information age is not inevitable. The upcoming generation of women, better educated, with higher expectations of work and career, may be more successful in contesting the way technology develops and the process of sex-typing around emergent jobs and occupations. They may be more attuned to the subtleties of sexism, and the ways that groups of men appropriate different aspects of jobs at different times to retain their dominance.

The more common experience of insecurity and interrupted careers might be a point of convergence between the sexes, and, coupled with legislation improving the position of non-standard workers, could mean that the flexible career or working pattern is no longer considered deviant and thus devalued. A period of transformational change, which we may be entering, could bring women opportunities to shape significant technological developments, rather than simply being affected by them, or allowing men to continue to dominate and exclude women from the technical arena. This is the real, and daunting, challenge of the information age.

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