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NEW TECHNOLOGY AND WORK IN THE AUSTRALIAN TELECOMMUNICATIONS SECTOR: WHAT ROLE FOR TECHNICIANS?

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This paper examined the impact of rapid technological change on the role and employment practices of Telstra technicians. The ramifications of technological change for these workers included changed skill sets, electronic monitoring, job cuts and the outsourcing of some former core work. The paper concludes that technological determinism may assist in explaining some of the resulting changes to the roles of Telstra's in-house technicians, while the heightened use of electronic monitoring was in line with the 'control imperative' of labour process theory. However, new technology did not appear to be the major factor behind Telstra's shift towards a unitarist employment relations approach. Rather, this approach represented a strategic choice on the part of Telstra management, although new technologies provided support for some of their unitarist strategies.

THE TELECOMMUNICATIONS SECTOR provides the infrastructure for information and communications technologies (ICT) that are increasingly linked to the competitive advantage of firms and nations (Boreham et al 2008; Katz 1997; Lee and Chan-Olmsted 2004). It employs approximately 6 million workers worldwide, with global revenues from telecommunications services increasing from US\$644 billion in 1997 to US\$1.4 trillion in 2005; the latter being 4 per cent of global GDP (ILO 2007; WTO 1998). The telecommunications sector provides important potential areas for employment relations (ER) research from academic, public policy and practitioner perspectives, and an increasing number of researchers have been examining the impact of the deregulation of this sector on ER practices (Cowhey and Klimenko 1999; Darbishire 1993; Doellgast 2007; Katz 1997; Ross 2006, 2008).

Researchers have studied various interrelated factors that have influenced ER practices across the telecommunications sector, including the deregulation

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of labour and telecommunications markets, changing management strategic choices and the dichotomy between mobile and fixed line providers (Katz 1997; Doellgast 2007; Ross 2006, 2008). This paper does not discount these factors. Rather it considers that within the overall institutional context, the influence of technological change on ER practices in the telecommunications sector warrants closer examination. The paper builds on earlier research by focusing on the impact of technological change on Telstra technicians. The very nature of technical work means that new technologies – including the introduction of next generation networks (NGNs) – have a direct impact on how their work is performed, while a considerable portion of their former work has been outsourced. Technicians thus present an important and appropriate employee classification for the research and analysis of the influence of technological change on ER practices within the telecommunications sector. In this regard the paper addresses two main research questions. First, how has technological change affected the work practices of Telstra technicians? Second, what future role are Telstra technicians likely to play within this changed technological environment?

Research Methods

This paper forms part of a larger ongoing longitudinal study of Telstra. The data was collected between 1997 and 2007, when more than 40 semi-structured interviews were conducted with a range of stakeholders associated with Telstra. The interview questions focused on management decisions on organisational restructuring, downsizing, outsourcing and the introduction of technological change. The interviewees included Telstra board members, departmental heads, human resource managers, mid-level managers, former Telstra managers and Telstra consultants. Interviews with Telstra management were balanced by interviews with officials from the two main unions with members at the telco, the Communications, Electrical and Plumbers Union (CEPU), and the Community and Public Sector Union (CPSU).

Most interviews were taped and transcribed, with the remainder written up immediately following the interview. Many of these notes and transcriptions were analysed using the NVIVO qualitative data analysis software, which allowed for a rigorous analysis of the interview data. The data was segmented and coded into various themes and subthemes – for example, ‘technology’, ‘training’ and ‘privatisation’ themes – which could then be analysed across and between interviews.

The author also attended CEPU union meetings attended by Telstra technicians, where a range of issues related to organisational restructuring and institutional change were discussed. Being present at the meetings allowed the author to engage in in-depth discussions with technicians who were being directly affected by the above changes. Privacy concerns and assurances,

however, dictated that neither the names nor positions of the interviewees could be recorded publicly in this paper.

This data was supported and cross-checked by direct observations; external and internal company reports; union documents; and other publicly available sources. Discussions by email and telephone were also made with representatives of Union Network International (UNI, the peak international telecommunications union). The data was compared and cross-referenced with similar interviews that the author conducted with telco managers and telecommunications union representatives in Europe between 2004 and 2005 (see Ross 2006, 2008) and New Zealand between 1997 and 2008 (see Ross 2002, 2003). This work allowed the Telstra data to be compared and contrasted with international trends.

Technological Change and Employment Relations

Any discussion of ER and technological change begs the question ‘of what, if any, definitive independent influence technology has in shaping organisational behaviour and the organisational outcomes of technological change’ (McLoughlin 1999: 4). ‘Hard versions’ of technological determinism consider technology to be the pre-eminent factor that guides social behaviour (Adler 2008: 1537; Leonardi and Jackson 2004; Woodward 1980). Telecommunications research provides some qualified support for this argument. The introduction of new products and services across the telecommunications sector has required new skills and job classifications, while some former skills and job classifications have become obsolete (Barton and Teicher 1999a, 1999b; Doellgast 2007; Katz 1997; Ross 2003). The shift to internet protocol (IP) based NGNs and the concomitant demise of the copper wire network could be expected to hasten the process of technological change that has already influenced and in some cases transformed employment practices within and across the sector (Dwyer 2004; Katz 1997; Miozzo and Ramirez 2003; Ross 2003).

Technological determinism suggests that these changes may foster the development and convergence of employment practices towards an employment system that best suits the emerging ICT technologies and the industry sector (Dunlop, 1993; McLoughlin and Clark 1992; Thomsin and Tremblay 2008). Katz discusses the emergence of a ‘telco restructuring model’, particularly across the incumbent ‘Anglo-American’ group of telcos – including Telstra – whose strategies were characterised by cost cutting and downsizing (Katz 1997; Ross 2003). Interestingly, later research has outlined the emergence of similar cost-cutting strategies in western European incumbent telcos that had formally been associated with more union friendly responses (Doellgast 2007).

But criticisms of technological determinism include its apparent failure to consider the roles that social and institutional factors play in the implementation of new technologies (McLoughlin and Clark 1992: 41). Mediating factors include

state policies and historical labour market processes (Marjoribanks 1997: 36). For example, the Austrian government pressured senior management at Telekom Austria to slow down the digitisation of its telephone network in order to reduce worker redundancies and associated social costs (Interview with Telekom Austria 2004). Such state intervention reflected the social partnership view of the Austrian government. Following 'privatisation' Deutsche Telekom was also required by law to continue to employ its former civil servant workers under their existing special terms and conditions of employment, which increased its labour costs vis-à-vis its competitors (Doellgast 2007: 7). 'Social constructivists' consider the role of technology to be subservient to such institutional and social factors (Adler 2008: 1539). Resource dependence and contingency theories provide some support for the social constructivist argument by suggesting that firms develop strategies and processes that best fit these changing external institutional constraints and opportunities (Katz et al 2003: 574).

A further criticism of a technologically deterministic approach is its failure to consider the role of independent strategic choice in management decision-making (McLoughlin and Clark 1992: 41). Strategic choice theories suggest that telcos have choices in the way that they introduce and use new ICT technologies. For example, firms make decisions over whether to either create their own high-value innovations or simply imitate the innovations of others (Clegg et al 2008: 547). Sako and Jackson (2006) also considered the question of strategic choice in the German and Japanese telecommunications sectors in their study of the impact of local ER institutions on management decision-making. They concluded that the former telco monopolies of each country had developed ER practices that were not consistent with the general institutional practices of the countries concerned, suggesting that there was scope for strategic choice (Sako and Jackson 2006).

Labour process theory (LPT) also disputes the idea of technological determinism. Rather it utilises Marxist ideas and concepts and considers the introduction of technology to be linked to capitalist relations of production (Alder et al 2007). Specifically, LPT associates the introduction of new technologies with the capitalist system's need for increased managerial control (Braverman 1974; Jaros 2001: 28). Braverman considered that the increased Taylorisation of the workplace combined with twentieth-century mass-production systems had segmented the labour production process into smaller low-skilled component parts. This segmentation had in turn led to the de-skilling and loss of autonomy of former craft workers, while a new class of supervisors and managers were then required to organise and control the segmented lower skilled workforce (McLoughlin and Clark 1992: 42–5).

Braverman's original work was criticised as overly simplistic and for failing to take broader social and institutional factors into account (Jaros 2001). But later qualifications and developments of LPT broadened its approach to better include

the wider and often complex environment within which firms operate (Edwards 1990; Thompson 1990). Thus, while some researchers query whether the original premises of LPT – based on Taylorist manufacturing practices – remain relevant for modern service sector workplaces (see Adler 2004), Braverman's ideas remain influential (see Carter et al 2002; Jaros 2001, 2006; Sewell 2005). Barker considered that the development of 'sophisticated' ER strategies such as 'employee empowerment' and 'self managed teams' did not contradict LPT notions of managerial control. Rather he saw these practices as coercive management tools that controlled the actions of workers 'more powerfully and completely than did the former system' (Barker 1993: 408). Russell considers LPT in his discussion of call centres (Russell 2008) – the Talyorised production lines of the twenty-first century – while new telecommunication technologies have led to the deskilling of some telco job classifications (Katz 1995; Barton and Teicher 1999a, 1999b; Ross 2003).

LPT has been used to explain the relationship between the status of skilled workers and political and social negotiations within the firm. Spinks discusses how lengthy apprenticeships and/or broad-based training may create the 'perception of exceptional skill requirements, whether such requirements exist or not' (Spinks 2008: 1416–17). This issue has relevance for older Telstra technicians, who received extensive broad-based training that was tied to an expected long-term career within the firm. As well, these workers in many respects saw themselves as the elite members of the field workforce. In contrast, researchers suggest that the rapid nature of the changes occurring in the information, communication and technology (ICT) field better supports the development of short-term project workers, rather than the traditional long-term careers previously enjoyed by Telstra technicians (Boreham et al 2008; Dif 2004; Tremblay 2003). Consequently, Cadin et al assert that an independent knowledge worker typology has developed within the telecommunications industry, with associated shifts towards 'nomadic careers' across the sector (in Dif 2004: 305).

While the above alternative theories criticise technologically deterministic perspectives on ER processes, McLoughlin suggests that alternative views still often struggle to explain the role and scope of technology in shaping organisational processes (1999: 5). Marjoribanks attempts to address this problem by combining aspects of LPT and an institutional approach to formulate a 'Relational Model' of workplace reorganisation (1999). This model links the introduction of new technology into the workplace to 'the prevailing balance of power between trade unions and workers, management and employers, and the state, and ... the political, social and economic contexts in which the actors are situated' (Marjoribanks 1997: 40). This approach complements a softer form of technological determinism which sees technological change as playing an important role, albeit in conjunction with other factors (Adler 2008: 1537). This paper draws on the ideas of technological determinism, LPT, institutional

perspectives and strategic choice to assist in its analysis of Telstra's strategies in relation to its technical workforce.

Changing Product Markets and the Australian Telecommunications Sector

In 2000, Telstra's then CEO, Switkowski, stated that the company's move from a 'phone company' to an 'electronic-information-services company' was not simply succeeding, but accelerating (Wilhelm et al 2000:10). The latest personification of these changes is the shift towards IP- based NGNs. Dwyer defines NGNs as,

a highly reliable data network (of networks) that transports packets of data from anywhere to anywhere. All it requires is a standard format packet of data, prefaced with an address. It will deliver the packet to the destination address within certain time limits. It is immaterial whether the packet is carrying text, voice, images, video or combinations of these. (2004: 9)

This quote succinctly sums up the convergence that has been occurring between formerly separate services such as text, voice, photo images and video (Dwyer 2004: 9; OECD 2007b). The shift to NGNs supports technological deterministic arguments as the process is driven by new technologies that are in turn transforming product markers. Further, this section outlines how Telstra has little choice but to invest in these new products and services in order to remain competitive, as NGNs have the potential to neutralise its traditional competitive advantage in the copper wire, public switched telephone network (PSTN). These changes then alter the role of Telstra's technicians, who were largely trained on the PSTN.

Telstra has continued to dominate the Australian telecommunications sector, despite its full deregulation in 1997. Telstra's competitive advantage has to a large extent depended on its continued ownership of the PSTN, which has allowed it to retain most of this revenue stream. In 2004–05 Telstra received more than 75 per cent of the total PSTN revenue, including local, long distance, international and fixed to mobile calls (Australian Consumer and Competition Commission (ACCC) 2006: 6). This is Telstra's 'bread and butter' revenue which provided the firm with some of its highest profit margins. Australia's large land mass and relatively small population also discouraged Telstra's competitors from undertaking large-scale investments in new networks; the returns on investment often did not justify the relatively high roll-out costs. Consequently many of Telstra's competitors needed to access and use its PSTN network. The PSTN is also the network that Telstra's long-term technicians have trained on and are familiar with. The future of the PSTN is thus tied to the future of Telstra's long-term technicians.

Telstra's competitive advantage through its ownership and control of PSTN

traffic is, however, declining. Table 1 outlines Telstra's PSTN revenues between 2003 and 2007. It shows that revenue from local calls during this period almost halved from approximately A\$1.5 billion to A\$845 million, while national long distance and international calls also exhibited significant decreases in revenue. By 2007 revenues from fixed to mobile calls were almost double those of local calls. But the introduction of capped mobile telephone bills is likely to reduce future revenues from fixed to mobile calls as consumers become more accustomed to mobile to mobile rather than fixed line to mobile telephone conversations (Telstra 2007: 14). Between 2003 and 2007 Telstra's overall income from the PSTN declined from 37 per cent to 30 per cent of Telstra's total revenue; a pattern that is set to continue (Telstra 2007).

The reasons for this decline include changing consumer habits leading to the substitution effects of new products and technologies as voice traffic increasingly shifts from fixed to mobile services, along with the growth in the use of other communication mediums such as text messaging, email, voice over internet protocol (VoIP), international calling cards and wireless broadband services. Mobile revenues now account for approximately 40 per cent of all telecommunication revenues across the OECD countries (OECD 2007b: 71), with third generation mobile phones morphing into entertainment devices (Puddoo 2007). The internet has overtaken television as the most heavily used medium among teenage boys in Hong Kong while AOL advises that the internet has become the primary communication tool for US teenagers (Puddoo 2007). Such developments imply that PSTN-based systems worldwide will be progressively phased out and shut down over time as telcos shift towards fully integrated IP-based networks (Dwyer 2004: 3). Under this scenario the cost of making telephone calls becomes largely redundant as IP-based calls can be made over the network at a negligible cost. Billing systems can then be simplified, as customers will pay one monthly fee based on a bundle of services, rather than being billed separately for individual calls.

To counter the continued decline in traditional PSTN revenues Telstra must cut costs and place greater emphasis and investments in new and emerging products and services. But these are often more competitive markets that do not usually provide the same profit margins as traditional PSTN services. By 2006 Telstra's share of the mobile phone market had dropped to 44 per cent, followed by Optus with 33 per cent (ACCC 2007: 11). While Telstra remains Australia's largest retail mobile service provider, it faces more competition in this sector which is also showing signs of having reached market saturation (ACCC 2006: 10). In 2006 Telstra launched its third generation mobile telephone network – subsequently branded by Telstra as 'Next G' – that supported IP-based products and services. But rather than build the network in-house, Telstra's outsourced the construction to the multinational enterprise (MNE) Ericsson (Interviews with Telstra 2007). This project was essentially a 'turnkey' contract, with Ericsson

Table 1: Telstra's PSTN revenue, 2003–07

PSTN products	2003		2004		2005		2006		2007	
	A\$m	% of total revenue	A\$m	% of total revenue	A\$m	% of total revenue	A\$m	% of total revenue	A\$m	% of total revenue
Basic access ¹	3 083	14	3 237	15	3 362	15	3 318	14.5	3 333	14
Local calls	1 567	7	1 504	7	1 284	6	1 023	4.5	845	3.5
PSTN value added services ²	280	1	259	1	250	1	246	1	257	1
National long distance calls	1 162	6	1 121	5	1 013	4	913	4	808	3.5
Fixed to mobile	1 517	7	1 597	8	1 566	7	1 491	6.5	1 491	6
International	307	2	266	1	234	1	201	1	184	1
Fixed interconnection ³	N/A	N/A	N/A	N/A	N/A	N/A	286	1	276	1
Total PSTN revenue	7 916	37	7 984	37	7 709	34	7 478	32.5	7 190	30
Total revenue	21 616		21 280		22 657		23 062		23 960	

Notes: 1. Basic Access service includes installing, renting and maintaining connections between customers' premises and the Public Switched Telephone Network.

2. Includes, voicemail, call waiting, call forwarding, call conferencing and call return.

3. Fixed interconnection is made up of local and non local PSTN/ISDN access interconnection services provided to other carriers.

Sources: Telstra annual reports

engaging local and overseas workers on short-term contracts. As outlined in more detail below, this strategy reduced the role of Telstra technicians, who had formerly been responsible for much of the new network construction.

Despite the reduction of traditional PSTN revenues the introduction of ADSL and ADSL2 broadband technologies that operate over the copper wire network allowed Telstra to extend the PSTN's operations to cover these new products and services. In addition, it provided continued employment for the current cohort of Telstra technicians who were trained on the PSTN. The OECD estimated that by 2007 almost 81 per cent of Australian broadband connections were through ADSL technology, which was well above the OECD average of 62 per cent (OECD 2007a). Despite this apparent positive outlook for Telstra, interviews suggest that profit margins on ADSL services remain relatively low in comparison to traditional PSTN products (Interview with CEPU 2007). ADSL technologies also lack the broadband capacities that are required to exploit the full range of potential new internet-based products and services including high-speed video on demand and internet-based high definition television (HDTV) program services. This means that Telstra must introduce technologies which operate at far greater speeds than ADSL, such as a high-speed fibre network, if it wishes take advantage of these new products and services. Telstra had announced plans to roll out a fibre to the node (FTTN) network¹ but the strategy was shelved when it failed to come to an agreement with the Australian Consumer and Competition Council (ACCC) over access pricing for Telstra's competitors. Critics suggested that Telstra was trying to create a monopoly over the supply of future high-speed internet-based services, similar to its current control over the PSTN. But Telstra claimed that the ACCC's proposed access price for competitors was too low, making the investment uneconomic (Interviews with Telstra 2007).

In late 2008 the government rejected Telstra's bid to be involved in a public/private partnership to build a high-speed national broadband network (NBN) network across Australia, which was a A\$5 billion project the government had committed to during the 2007 election. The reason given was that Telstra's proposal did not meet the government bidding process requirements (Warne 2008), though the confrontational approach employed by then Telstra CEO, Trujillo, in his dealings with the government may not have helped Telstra's case (Durie and Hewett 2009). In the end the government did not award the contract to any of the prospective tenders and instead opted to change the FTTN strategy to a higher speed A\$48 billion fibre to the premises (FTTP)²

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1. Fibre to the node (FTTN) provides optical fibre to a local street corner node but then uses copper wire for the relatively short distance from the node to the premises (ACCC 2006:2).
 2. A fibre to the premises (FTTP) network differs from a FTTN in that it provides optical fibre directly to the home or premises (i.e. it completely bypasses the copper wire network).

national broadband network (Conroy 2009). The government set up a public firm to operate the proposed new network although private sector firms may be minority shareholders. By connecting directly to the home the government strategy effectively bypassed Telstra's PSTN network, thus potentially excluding Telstra from the new network's operation. Realistically, however, Telstra is the only Australian telco with the skills and capital to engage in such a large public/private partnership. Nevertheless the government's actions to date suggest that any involvement by Telstra in this project will be on the government's terms. Further, the government is considering a legislated structural separation of Telstra's wholesale and retail arms; at the time of writing the details of this policy have yet to be finalised. These changes could have significant repercussions for Telstra technicians. Once established an FTTP network requires significantly less maintenance than the copper wire network, along with different skills sets. The telco unions are against the government's structural separation plan, which they see as damaging for Telstra's long-term viability and their members.

Telstra's Employment Relations Strategies and Technicians

During the 1990s Telstra shifted towards a unitarist approach to ER. Management excluded unions from the decision-making process and shifted away from collective bargaining towards individual Australian Workplace Agreements (AWAs) (Ross 2003). By 2007 more than 50 per cent of Telstra workers were covered by individual AWAs, which was well above the national average of less than 8 per cent (van Wanrooy et al 2007: 35; Ross and Bamber 2009). These strategies reflected the changing ideology of senior Telstra managers and were facilitated by the deregulation of the Australian labour and telecommunication markets by the conservative government between 1996 and 2007 (Ross 2003; Ross and Bamber 2009).

These more aggressive Telstra management tactics combined with less institutional support for union activities reduced the unions' ability to counter many of these changes. The situation was compounded by workers being shifted onto AWAs and extensive downsizing strategies that reduced union membership and resources. Table 2 shows that in 2005 Telstra remained by far the largest employer within the Australian telecommunications sector, but its workforce was far smaller than it had been prior to the deregulation of the sector; between 1989 and 2007 Telstra cut its permanent workforce from 84,000 to around 36,000 employees (Telstra annual reports).

Staff reductions were achieved in part through the introduction of new technologies. For example, the digitisation of the network required fewer exchanges and less maintenance than the previous analogue systems. Former Telstra managers advised that associated reductions in labour costs were also built into Telstra's early FTTN plan.

Table 2: Workers employed by Australia's five largest telcos, 2005

<i>Company</i>	<i>Employees</i>
Telstra	39 406 (domestic full time)
Singtel Optus	9 865
Vodafone	1 300
Hutchison	1 200
AAPT	147
Total	51 918

Source: Eason (2006)

Changing Skills Sets and Training

Telstra managers advised that the skills sets that the firm required changed, as some technical skills became redundant. For example, a Telstra technician no longer needed to be able to read a meter to detect and locate a fault. While this type of work was previously a skilled and time-consuming job, a centralised computer now provided an electronic readout stating the problem and location of the fault. Similarly, many routine faults could now be fixed by utilising relatively simple skills such as the replacement of 'plug and play' devices and circuit boards. The shift towards a 'plug and play' technology model in some instances also reduced the need for customer support. For example, when a new customer subscribes to a Telstra internet service they receive a modem in the mail and instructions on how to connect up to the provider. If necessary they can get advice from a call centre representative – potentially based offshore – who talks the customer through the process. Software problems are usually fixed online, and faulty hardware is replaced rather than fixed. These processes have deskilled some technical jobs.

Are these examples of a twenty-first century application of LPT, with management utilising new technologies to deskill former autonomous highly skilled craft workers – in this case the technicians – in order to increase management control? In this case the evidence suggests not. Rather the changes appear more closely related to technological determinism, with new technologies changing how products and services are delivered, which then impacts on employee skill sets.

The shift to NGNs has other significant repercussions for Telstra technicians. Dwyer notes that NGNs – such as the proposed FTTP – are characterised by dumb networks and smart terminals, the opposite of the current PSTN network. As outlined above, FTTP networks require significantly less maintenance than the traditional copper wire network, and much of the equipment is software controlled and configured remotely via a computer terminal rather than in the

field, thus allowing for job cuts (Dwyer 2004: 19). The ability to transfer digitised information quickly and cheaply also makes it easier for firms to shift such IT functions offshore. In 2004 Telstra announced that its IT outsourcing partner, IBM, would move a significant portion of its Telstra IT work to India, to access cheaper IT labour costs; about 450 IBM Australia workers were expected to lose their jobs (Crowe and Conners 2004: 3). Telstra also formed direct relationships with Indian IT firms including the Bangalore-based Satyam Computer Services, which set up a Telstra-branded internal unit (CEPU 2004: 11).

The above changes have implications for employee training. As a government-owned corporation Telstra had been one of Australia's largest technical trainers, with extensive in-house training facilities; training was extensive and broad based. During the 1990s Telstra reduced technical training to assist in reducing costs. Between 1989 and 1996 the number of Telstra technical trainee appointments was cut from 1353 to 5 employees, with in-house technical traineeships being completely phased out the following year (Telstra EEO reports 1989–98). The reduction in Telstra's broad-based technical training led to concerns about possible future skills shortages, and union officials alleged that Telstra was relying too much on the skills of its current cohort of skilled technicians (Interviews with CEPU 1998–99). In 2007 a union representative advised that training had

‘really become very narrowly focused ... people with very broad levels of training and experience have been disappearing out of the workforce. And those are the people, I think, that when you're in trouble, the manual doesn't work, that's when those people come to the fore and we realise that they need a core of people like that.’
(Interview with CEPU 2007)

By 2007 the average age of a Telstra technician was between 45 and 50 years of age and Telstra managers concurred that there could be serious skills shortages in the future.

But, as outlined above, the skill sets that Telstra requires have changed, with some skills becoming redundant as processes were automated and/or were no longer required. Such changes led Telstra to shift towards more specific limited training in new off-the-shelf technologies. New workers tended to receive narrow training in a number of specific areas – i.e. focused on specific jobs and/or tasks – rather than the broad-based training that was received by older technicians (Interviews with Telstra technicians and CEPU 2000–07). These changes also made it easier to employ subcontractors to perform what was essentially deskilled work (Interview with former CEPU 2007). Deskilling coupled with short-term job-specific training programs arguably supports Telstra's unitarist strategies as it becomes easier to downsize its unionised technical workforce and supplement the smaller workforce with external non-unionised subcontractors.

Telstra advised that they have committed to spending A\$200 million over a

five-year period – from 2006 to 2011 – on staff training (Interviews with Telstra 2007). This sum includes A\$67 million which will be spent specifically on Telstra field services staff, including technicians (Telstra 2006). But in contrast to its former in-house technical training programs, this program was outsourced to an external provider, Accenture, which has created the ‘Telstra Learning Academy’ (Accenture 2007). Telstra advises that it is ‘undergoing a major transformation with the introduction of many new products and advanced technologies. The new Telstra Learning Academy will help ensure field staff have the skills to build, run and maintain these technologies’ (Telstra 2006). Union officials respond that Telstra already had world-class in-house training facilities that were allowed to be run down, while the Accenture agreement will lead to excessive payments to an American-based MNC (CEPU 2006).

Telstra’s decision to outsource the construction of its third generation mobile telephone network to Ericsson further reduced its need to provide extensive in-house training (Interviews with Telstra 2007). During interviews a general theme among Telstra managers was that future large-scale capital investments were also likely to be one-off contracts with external providers. This implies that Telstra technicians are unlikely to be engaged in future large-scale network construction. Rather they will be trained to the specific requirements of maintaining a network after it has been built. When the PSTN is eventually phased out/shut down it is also likely that many former broad-based technical skills will no longer be required. As outlined above, NGNs generally require less maintenance than the PSTN, while work becomes more software/computer terminal-based, in contrast to traditional technical fieldwork. These changes suggest that Telstra will require fewer field technicians over time, with concomitant changes in the way they perform their work.

Work Allocation and Monitoring

Telstra used new technologies to tighten its control over its technical work allocation and monitoring processes. A typical Telstra field technician operates from a van, with work assigned by emails from a centralised dispatch centre that the worker receives via a laptop computer. The van is parked at the technician’s home where technicians log on to the Telstra network and receive their first jobs for the day. They also have keys to numerous supply depots where they can pick up parts and/or products that they may require.

In 2007 Telstra installed satellite navigation systems in their field technicians’ work vans, allowing the firm to monitor their whereabouts 24 hours a day. One CEPU union official considered that Telstra’s strategy was ‘monitoring gone mad’, with concern for the bottom line overriding concerns such as job enjoyment and satisfaction (Interview with CEPU 2007). This strategy does accord with a LPT approach including the ‘control imperative’ outlined by Jaros (2001: 28). Tighter monitoring was associated with higher stress levels, with

union officials claiming there was little consultation during the GPS installation process (Interview with CEPU 2007). In addition, GPS monitoring was seen as an invasion of privacy, with Telstra citing technical reasons for refusing to turn off the GPS tracking devices during lunch breaks or after work, when some technicians were allowed limited private use of the vans. Telstra management countered that the GPS system provided added safety for technicians, as the firm knew exactly where they were in the field. Telstra managers also noted that as the technicians' employer they had every right to know where they were operating while in Telstra's employ.

Researchers suggest that using electronic devices for this type of 'surveillance' role creates an atmosphere of distrust that may heighten worker stress levels, decrease morale and increase feelings of job insecurity (Carroll and Buchholtz 2006: 272 and 547; Vaught et al 2000: 108). Despite these negative attributes, other research claims that electronic monitoring may increase productivity, although such outcomes tend to be predicated on worker perceptions of the fairness or otherwise of the monitoring system (Vaught et al 2000: 108–09). Telstra managers argued that 'good' workers have nothing to fear, as it is only lower performing workers who are likely to have issues with their work and whereabouts.

Telstra has used these technologies to support its performance management strategies based on group and individual points performance management systems. One Telstra manager commented that performance management systems had previously been reactive, in that a worker's performance could only be measured and tabulated after the fact. Now, with the use of computer-generated and recorded job assignments and on-the-job continuous reports from technicians' completions, worker performance could be assessed during 'real time'. From an LPT perspective one could argue that this development is essentially an updated 'scientific' management strategy, with Telstra technicians being monitored and controlled by a very sophisticated stopwatch. This management strategy does, however, raise a number of issues. Many jobs tend to be idiosyncratic in nature, meaning that a simple addition of total daily job completions does not reflect the differing complexities of the jobs nor the different travelling time involved in driving to different job locations. It also raises the issue of quality control, as a 'piecework' system may induce workers to complete jobs as quickly as possible without regard to the long term – i.e. a 'bandaid' solution. This problem was encountered by Telecom New Zealand when it outsourced its technical work to subcontractors who were paid on a piecework rate (Ross 2003).

Technical Workgroups

Table 3 divides Telstra's technical work into four worker sub-groups and considers the effects of new technologies on the employment practices of each group. The first group, the Telstra in-house technicians, are the oldest group

in terms of their history. But since 1996 they have been split between those employed under a collective agreement and those more recently engaged on individual AWAs. The technicians employed under the collective agreement tend to be older unionised workers and in 2007 they made up around 60 to 70 per cent of Telstra's technical workforce (Interview with CEPU and Telstra 2007). As outlined above they were the recipients of broad-based in-house training linked to the copper wire network. Many of these workers began their employment in a government-owned corporation with the expectation of long-term careers within the firm.

By 2008, despite the introduction of new technologies and associated automated monitoring and performance management systems, these workers retained many former work practices and conditions. For example they retained a 36¼-hour week – technicians on AWAs worked 38 hours per week – a relatively generous redundancy agreement and collectively bargained conditions of employment. In many respects they operated under a hybrid employment system with new tasks and employment practices grafted onto existing collective agreements. But a large number of these workers have already retired and/or have been made redundant (see Ross 2003), while many of the remainder are due to retire within the next five to 10 years. Thus the percentage of Telstra technicians operating within this hybrid system is diminishing. As outlined above this process is likely to be accentuated with the shift to IP-based NGNs that will decrease the value of these older broad-based skills, particularly given the likelihood that the PSTN will eventually be shut down.

In contrast the technicians on individual AWA contracts – approximately 30–40 per cent of all Telstra technicians in 2007 (Interview with Telstra 2007) – exhibit a higher degree of transformation towards a new employment system. Weakening revenue growth brought about by the decline of traditional PSTN revenues, coupled with lower profit margins on newer products and services, induced Telstra to continue reducing labour costs and to improve labour productivity. The AWA technicians were generally younger, more recently employed non-union workers, whose pay was tied more closely to individual performance-based incentives. The individual contracts offered less job security than the collective agreement, and Telstra's former CEO, Switkowski, openly stated that he no longer wished or expected all Telstra workers to have long-term careers within the firm (Ross 2003).

The AWA technicians tend to lack the broad-based skills of their predecessors, instead relying on generic external training coupled with limited in-house job and/or product-specific training. This change in Telstra's approach to technical training was facilitated by the deskilling of some former highly skilled jobs and the concomitant growth in 'plug and play' technology. In 2007, while pledging to eliminate individual AWAs, the incoming ALP government provided a relatively long transition period, and Telstra induced as many workers as possible to

Table 3: Telstra technical work groups

Telstra technicians		Subcontractors	
<i>Collective agreement</i>	<i>AWAs</i>	<i>General fieldworkers</i>	<i>NGN subcontractors</i>
Union members	Non-union member	Non-union members	Generally non-union members
Permanent employee; Long-term job orientation	Permanent employee Reduced job security Shorter term job orientation	Project-based work; Short-term job orientation	Project-based work; Short-term job orientation
Hybrid of new employment practices grafted onto existing practices	Higher degree of transformation towards a new employment system	Subcontractor employees	Externally based 'nomadic' and/or 'knowledge workers'
Older workers: average age late 40s to early 50s – many will retire over next 5–10 years	Younger more recently employed workers	External workers – but includes some ex-Telstra workers	External workers – includes some overseas-based workers
Public sector heritage	Private sector orientation	Private sector orientation	Private sector orientation
Trained in-house	Generic external training coupled with limited in-house job specific training	Generic external training coupled with limited in-house job-specific training	Training and skills gained elsewhere – both in Australia and overseas
Broad-based technical skills	Relatively narrow job- and/or product-specific skills	Often generic and/or semi-skilled; Some job-specific higher skills	Externally based NGN training and skills
Trained on PSTN; some deskilling; more recent training on newer technologies (e.g. mobile phone and ADSL)	Trained on specific roles associated with PSTN and newer technologies	Training generally limited to lower skilled work but shifts to higher skilled job-specific training over time	Training linked to NGN technologies
Orientation shifting from network building to network maintenance	Orientation shifting from network building to network maintenance	Support role for network building and network maintenance	NGN building

shift onto individual AWAs before the new ER legislation became law. This classification of technician will therefore continue to form a significant part of Telstra's technical workforce for the foreseeable future.

Telstra's technical subcontractor workers can be split into general fieldworkers and those more recently employed on building NGNs. Telstra has employed subcontracted fieldworkers since the early 1990s. During this period it steadily increased their role from basic generic 'pick and pipe' ditch-digging type work to more highly skilled jobs (see Ross 2003). Many of these subcontractors now compete head to head with Telstra technicians where they perform somewhere between 30 per cent and 60 per cent of Telstra's fieldwork, depending on how 'technical' work is defined; if you include unskilled and semiskilled work then the proportion is closer to 60 per cent (Interviews with CEPU and Telstra 2007). Subcontractors are engaged on project work which leads to a short-term job-specific time orientation. They employ externally based workers, whose generic skills are sometimes coupled with limited job-specific training. Their general responsibility is to provide a supporting role for network building and maintenance.

In contrast, the Ericsson subcontractors who were brought in to build Telstra's third generation mobile network – and included both Australian and international subcontractors – came with new NGN skills that Telstra did not possess. The very nature of their skills meant they were gained externally to the firm. Once the network was completed, they moved on to new projects elsewhere. Of all the four groups profiled in Table 4 the high-skilled short-term project work performed by the NGN subcontractors presents the closest fit to the independent knowledge worker typology and the associated moves towards 'nomadic careers' across the telecommunications industry identified by Dif (2004: 305). Given that Telstra plans to continue its strategy of outsourcing the building of future NGNs to external specialist providers, NGN technical workers will continue to build new networks, while Telstra's in-house technicians will shift towards an ongoing maintenance role.

Conclusion

This research shows that new telecommunications technologies are transforming the Australian telecommunications sector. But to what extent have these technological changes, as distinct from other institutional factors, influenced Telstra's ER strategies? In response to this question, this research examined a number of areas that supported a 'soft version' of technological determinism. These included the rapid decline of Telstra's competitive advantage in its ownership of the PSTN network. This decline required Telstra to invest in new networks that required less maintenance. These new networks were also

associated with some deskilling of technical work. While the increased ability to employ subcontractors to perform such lower skilled work may have assisted Telstra's unitarist strategies, it does not appear to have been the primary reason for these strategies. Rather Telstra's investments in new networks and associated products and services were largely driven by changing product markets and financial imperatives. Many of the ensuing changes that occurred to the role of the technicians were directly related to the introduction of these new technologies.

Telstra's decision to outsource the construction of its Next G network to a specialist MNC provider shifted its in-house technicians towards a supporting/maintenance role. NGNs also require fewer workers to maintain them. The shift to IP-based networks is likely to lead to an increase in fixed-term subcontracted employment contracts, with a concurrent reduction in the number of traditional long-term Telstra technicians. This potential for additional job cuts will impact on Telstra's unionised technicians. These are generally older long-term workers who were trained on the copper wire PSTN, and some of these skills are becoming redundant. This research also suggested that the emergence of an independent 'nomadic' knowledge worker was most closely associated with the external subcontractors engaged to build NGNs.

New technologies are reducing the autonomy of Telstra technicians through intensive electronic monitoring and performance controls. These measures aim to increase productivity but appear to have led to work intensification and increased stress levels among Telstra workers. This control imperative accords with LPT. Perhaps one of the most significant aspects of this strategy was Telstra's ability to measure the performance of its fieldworkers in 'real time'; a capacity that was formerly possible only with in-house workers. This strategy then significantly extends management control.

Despite the above influences that technology has had on Telstra's ER practices, it does not seem to have been a major factor in Telstra's shift to a unitarist perspective. Rather, this management strategy appears to have been a management choice facilitated by changing institutional factors that included the deregulation of labour and telecommunications markets; including the privatisation of Telstra. However, one could presume that Telstra's senior management would probably view any reduction in the power of the unionised in-house technical workforce brought about by technological change as a positive externality.

The above changes point to a continued decline in the number of Telstra in-house technicians. The consequent decline in union membership suggests challenging times ahead for the telecommunication unions. The Australian government's decision to construct a FTTP network, along with its contemplation of a structural separation of Telstra's wholesale and retail arms provide added uncertainty for Telstra's technical workforce. Given the rapid changes occurring in the telecommunications sector – both in Australia and worldwide – this paper

points to the need for more research in this area in order to keep abreast of these developments and their impact on employment practices across the sector.

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