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TECHNOLOGY AT WORK:

STRESS, WORK AND TECHNOLOGY ACROSS THE LIFE CYCLE

LITERATURE REVIEW

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A quiet revolution is taking place in our communities, workplaces and homes through the pervasive influence of digital technologies in our lives. The way we communicate, interact, learn, play and work are being transformed by rapidly evolving Information and Communication Technologies (ICTs). Workplaces are a key focal point for this transformation with most grounded in the use of a wide range of ICTs. Much is known about the productivity enhancing benefits of ICT and the power of new technologies to radically alter the way we undertake work. Much less is known however about the psycho-social and health and safety implications of technologically dense working lives and the impact of particular combinations and applications of ICTs on individuals under differing circumstances.

This literature review forms stage 1 of a project which examines the workplace health and wellbeing impacts of a rapidly evolving ICT landscape in Australia. It is designed to lay the conceptual foundations for a workplace survey in the finance sector that will provide insights into the relationship between stress, work and technology over the lifecycle.

1.1 INFORMATION COMMUNICATION TECHNOLOGIES IN A RAPIDLY CHANGING WORLD

The growth of ICTs over the past three decades has had a profound influence on how people relate to the world, and within family, friendship, work and interest networks. To a great extent, information is immediately available, and people are instantly within reach, around the clock, across any span of distance. These technologies have changed how people understand and organise their world, and how they communicate and coordinate across the myriad of social relations, both personal and professional, that intersect with their lives.

Uptake of ICTs in households and businesses has been underpinned by a powerful social, political and economic momentum driving Australia toward a technologically advanced future. In many ways this is embodied by the National Digital Economy Strategy (NDES) of the Australian Government (Australian Government Department of Broadband Communications and the Digital Economy, 2011). Recognising that Australia currently lags on the international digital stage, the strategy aims to reposition the nation among the world's leading digital economies by the year 2020. Broadly, the success of the NDES is to be judged by the extent to which 'the efficient use of digital technologies has become so interwoven with citizens' business, professional and personal lives, that they move seamlessly between the digital and physical world as appropriate' (p.13). More specifically, the strategy aims to increase online participation by Australian households, online engagement by Australian business and not-for-profit organisations, and the development of a range of other online environment and infrastructure, health, education and government service delivery applications. Underlying this push are industry-based figures indicating that 'the internet provides approximately $27 billion in productivity enhancements to businesses and government through improvements to the way they operate and deliver services... [and] the equivalent of $53 billion in benefits to households in the form of added convenience... and access to an increased variety of goods and services and information' (Deloitte Access Economics, 2011: 1).

The technological vision embodied in the NDES is the latest expression of a movement that is well established in Australia. Since the 1980s, the wider community has increasingly embraced ICTs such as computers, email and mobile communications, to the point that their influence 'has become so pervasive that we could no longer conceive what work and life would be without them' (Amichai-Hamburger, 2009: 4). This observation is born out in population-based ICT uptake data, which shows that in the last ten years alone, Australian household access to a computer increased from 44% to 78%, and internet access at home more than quadrupled, from 16% to 72%. In 2008-09, 58% of people reported using the internet at home every day, with

a further 36% using the internet at least weekly (Australian Bureau of Statistics, 2009b). Similarly, the number of mobile phone services operating in Australia almost trebled between 2000 and 2008, up to 22.12 million services, used by 83% of the adult population. Of these, 39% subscribed to a 3G service, signalling greater interest in mobile devices for internet applications as well as voice communications (Australian Communications and Media Authority, 2009).

An offshoot of increased computer, internet and mobile communication engagement is the community's emerging fascination with social media. Elefant (2011: 4) describes this as 'technology that facilitates interactive information, user-created content and collaboration'. It is argued that where email has evolved into a more formal way to communicate electronically, informal messages are more likely to be communicated via instant messaging in social networking sites or text messaging on mobile phones (Baron, 2009). Social networking media platforms have proliferated, but can be broadly categorised according to the following functions: directories (e.g. LinkedIn), communication (e.g. Blogs, Twitter), communities and product rating sites (e.g. Facebook, company fan pages), and archiving and sharing sites (e.g. YouTube) (Elefant, 2011). The 2010/2011 Nielsen Online Consumer Report indicated that nine million Australians aged 16 years and over were interacting via social networking sites, with the dominant social media activities in 2009 including looking at social networking profiles (73%), reading a wiki (72%), and posting pictures online (68%) (Nielsen, 2011). In a notable finding for Australian businesses, almost three quarters of online Australians read reviews, discussions, and comments on brands, products and services in the 12 months prior to the survey. Consumers are also engaging more directly with brands and companies via social media, with two in five interacting with businesses via social networking sites (Nielsen, 2010).

1.2   ICTS AND THE CHANGING NATURE OF WORK

In recent years, a substantial body of work has emerged on the impact of new organisational work practices in the transition to an 'information society' 'network society' or 'knowledge economy' (Castells, 2000, 2004; Florida, 2003b; Leadbeater, 1998; Webster, 1995). An important element in this transition has been the introduction and proliferation of ICTs in the workplace, in particular: computers and computer technologies (including personal computers, laptops, hand-held organisers, mobile libraries like Kindle and now the Ipad); mobile phones; the Internet; Intranets; email; video conferencing; and new mediums for social exchange (like Skype, Twitter and Facebook).

The ICT revolution is reflected in business investment in ICT which has accelerated since the 1990s (Productivity Commission, 2004). According to 2009-10 Business Use of Information Technology (BUIT) data, 90% of Australian businesses have internet access and 40% have a website (Australian Bureau of Statistics, 2011). This compares with 56% of businesses with internet access and 16% with a website in 1999-2000 (Australian Bureau of Statistics, 2000).

A recent Australian Research Council funded study (Gregg, 2011) explored the extent to which ICTs are transforming work and family life, identifying a profound change in both spheres and a blurring of the boundaries between each. In particular, wireless connectivity while providing freedom of access within the family home was a double-edged sword that increased reliance on the use of ICTs, creating what the authors termed 'chronic connectivity'. A similar dependence was identified in the workplace, noting that many continue to work despite physically leaving their offices.

Business buy-in to ICTs has been supported by research showing a strong link between business use of ICT and innovative activity, in particular that 'businesses which use ICT more intensely develop more novel innovations, engage in multiple types of innovation and are more likely to develop these innovations internally' (Todhunter & Abello, 2011: i). Specific ICT benefits identified by businesses include more timely and

accurate management of information, improved communication and reporting, greater consistency of product quality and quality enhancement, and development of customised products and services (Productivity Commission, 2004). An Australian survey of 150 small to medium sized enterprises identified that many expected to benefit from increased access to new markets, cheaper advertising and marketing, and sourcing products from a larger range of suppliers via the internet (Deloitte Access Economics, 2011).

1.2.1   ICTS IN THE FINANCE AND INSURANCE SECTOR

The finance and insurance sector has been identified as an early business leader in investing in new ICTs (Productivity Commission, 2004). Frame and White (2009: 3) note that the 'primary function of a financial system is to facilitate the allocation and deployment of economic resources, both spatially and across time, in an uncertain environment'. To this end, considerable banking resources are expended in data collection and analysis, in order to understand and minimise costs and risks implicit within the terms of business. It is within this context that finance organisations understood early the opportunities provided by increased computer processing speeds and improved data storage capabilities.

Technological change has transformed both the securities and commercial banking industries (Frame & White, 2009; Vickery & Wunsch-Vincent, 2005; Werthamer & Raymond, 1997). International financial markets have become integrated and decentralised; operations run 24 hours per day; trading is comprehensive and instantaneous. Moreover, many of the trading functions once overseen by human specialists are now automated by computer software. Risk analysis, applicable to securities and banking systems, now depends on the systematic, instantaneous compilation of database information from linked divisions and lines of business. Within commercial banking, there has been rapid ICT-based innovation in product and service development, for example in payment systems, electronic commerce, and credit card security. All of these developments have taken place within a highly competitive context, where financial organisations are driven to be faster, broader, and more efficient in order to retain their markets. Werthamer and Raymond (1997: 51) note that 'within an individual firm, the major drivers for operational change are how new technology can increase efficiency, lower costs, and improve competitive advantage'.

Business Use of IT data collected by the ABS support the notion of the finance (in tandem with insurance) sector as a front runner in ICT use (Australian Bureau of Statistics, 2011). In 2009-10, 98% of finance and insurance businesses had internet access (second only behind the information media and telecommunication sector) and 56% had a web presence, which also placed them ahead of many business sectors. In 60% of cases, the internet was used to enable people to work from home and 50% to work from other locations. The financial and insurance sector led all other sectors in using online training and learning features (51% compared with 24% overall) and in using the internet for information sharing and data exchange with other business organisations (23% compared with 12% overall). Forty two percent of finance and insurance businesses used the internet to gather or research information for evaluating products, services, processes and methods, 31% to develop new ones, 33% to monitor competitors, and 23% to identify future market trends.

Ninety eight percent of finance and insurance businesses with a website used it to provide information about the business, which was slightly higher than all sectors overall; 88% used the website as an enquiry or contact facility, and 14% to provide account information. Of all business sectors, finance and insurance reported one of the lowest rates of 'no IT support provided'. Fifty seven percent hired contractors or consultants to provide IT support and 30% sourced support from IT specialists on staff. Compared with the finance and insurance sector, other business sectors were more likely to rely on in-house staff without specialist training for their IT support needs (Australian Bureau of Statistics, 2011).

1.2.2 ICTS IN THE WORKPLACE

Increasing engagement with ICTs brings both benefits and challenges to the workplace, and it is important to understand both. At this stage, the research literature provides limited insights on how best to balance the advantages and disadvantages involved. There is a growing body of evidence on the benefits of ICT. The proliferation of ICTs in the workforce has fostered positive changes in workplace culture including: enhanced global communication; increased productivity; increased workplace flexibility; and a reduction in the number of occupations which require menial work or manual labour (Florida, 2003a, 2003b). ICTs provide more employees with the ability to work from home, and at different times of the day, adjusting their work schedules to allow for more work-life balance (Bradley, 2000; Carayon, 2007; Mattila *et al,* 2007; W.C. Murray & Rosits, 2007). Some research has even argued that less contact with office employees creates better work relationships and improves communication, as it reduces distractions, making communication more purposeful and directed (Fonner & Roloff, 2010).

There is some evidence that ICTs promote stronger social capital and social relationships at work, leading to better job satisfaction. The Work Foundation (2009) in the UK found that people who used ICTs at work had greater trust in their colleagues to do their work properly, and people with access to new technologies in their workplace were more likely to feel their organization had a culture of mutual trust and loyalty. Attitudes toward technology at work were generally positive, with 74% of employees agreeing that technologies made it easier to do their job well. However, 13% of employees felt that technologies made their work more complicated.

It is important to recognise that negative as well as positive impacts can flow from the use of technologies in the workplace. Key concerns that have been identified include loss of face-to-face contact, social isolation and difficulties with supervision and teamwork associated with increased work from home; the erosion of boundaries that separate work and home; and an expectation that workers are always available – a trend that has been termed 'technologically tethered workers' (William C. Murray & Rostis, 2007). Household Use of IT data show that 46% of Australians used the internet at home for work or business related purposes, with this activity peaking at 58% for people aged 35 to 44 years, and being more prevalent among men (50%) than women (42%) (Australian Bureau of Statistics, 2009b). Given these high rates, there is a clear need to understand the implications brought for work-related stress and to identify strategies to manage this.

2 STRESS, WORK AND NEW INFORMATION AND COMMUNICATION TECHNOLOGIES

Workplaces are constantly evolving as social and economic conditions change and new technologies are introduced. These changes are accompanied by shifts in expectations about the role of work and the workplace, and about the relationship between work, family and leisure. ICTs often permeate our lives in all of these dimensions generating both benefits and costs for employers and employees.

2.1 THE COST OF STRESS IN THE WORKPLACE

Epidemiological evidence indicates that job stress is rapidly emerging as the single greatest cause of work-related disease and injury (Blewett *et al* 2006: 4).

Stress in the workplace occurs when an individual is presented with a task or situation they believe is beyond their capabilities to complete and/or where failure to complete the task is perceived to have negative

consequences (Tarafdar *et al* , 2010). Stress is often experienced as depression, anxiety, frustration, feelings of being overwhelmed, or feelings of dissatisfaction with one's job. In organisational psychology, the term *stressor* refers to the task, factor, or situation that creates the stress while *strain* is a consequence of stress (Blewett *et al* 2006: 10). Within the literature, the terms 'mental stress', 'psychological illness', 'psychological stress/injury' are often used interchangeably. In this review, *stress in the workplace* is used to describe any psychological distress, psychological illness, mental illness, anxiety, depression, psychosocial stress, or psychosocial illness resulting from stressors in the workplace.

Substantial evidence has emerged in recent years linking stress with a number of other physiological conditions including: gastrointestinal disorders, diabetes, musculoskeletal disorders, cardiovascular disease, immune system issues, cancer, and other mental health issues (see Grimshaw, 1999). According to Williams (2003) the *Journal of Occupational and Environmental Medicine* reports that health care expenditures are nearly 50% greater for workers who report high levels of stress. Research has also established that working in a stressful environment increases the likelihood of workplace accidents (Clarke & Cooper, 2004). The presence of multiple variables, and their interactive effect, makes it difficult to quantify the true impact of workplace stress on the health and well-being of employees, as occupational stress may serve to prolong recovery from, contribute to the development of, or even directly cause injuries and ill health.

The research literature identifies the significant impact of stress in the workplace, and there are clear global trends indicating a rise in rates of psychosocial illness in the workplace (Dollard, Skinner, Tuckey, & Bailey, 2007). According to these researchers, data from the Office of the Australian Safety and Compensation Council (2006) shows that compensation claims due to work stress increased by 62 per cent during the periods from 1996-97 and 2002-03 (while all other types of claims decreased over the same period) and that these involve the highest direct cost per claim and are associated with the longest time lost from work. Similarly, a recent report from *Safe Work Australia* (2011) suggests that although mental stress was only the fifth most prevalent cause of serious injury or diseases, it was associated with the longest time off work and was the most expensive condition. Between 2003-04 and 2007-08, there was little change in median time lost for serious claims in any category except for mental stress claims which had increased from 9.6 to 11.0 weeks. This compares with a median of 4.0 weeks off for all serious claims. The median payment for mental stress in 2007-08 ($16,500) had increased more than claims for any other serious condition over the previous 5-years, and was twice as costly as the median claim of $6,900 for all serious injuries and diseases.

2.1.1 STRESS-RELATED WORKERS' COMPENSATION CLAIMS IN SOUTH AUSTRALIA

In reviewing data from WorkCover SA's latest Statistical Review (WorkCover SA, 2010b), it seems reasonable to conclude that an extremely large proportion of claims for mental disorders result from mental stress. The following patterns can be discerned:

⇒ 'mental disorders' comprised three per cent of all registered claims by 'type of injury/disease' and 5.7 percent of all self-insured claims in South Australia between the years of 2008 and 2009.

⇒ These figures increase when looking at the *proportion* of income claims, with mental disorders comprising seven per cent of all registered income claims by type of injury/disease' and 13.5 percent of all self-insured income claims in South Australia between the years of 2008 and 2009 (WorkCover SA, 2010b).

⇒ A total of 553 (317 registered and 236 self-insured) claims for income maintenance where mental disorder was listed as the primary injury/illness, were lodged in the 2008-09 period at a cost of $14,071,000. As such mental disorders were the second most common cause of primary income claim

for self insurers by 'type of injury/disease' after sprains and strains, and the fourth most common type of primary income claim for registered employers.

⇒ 'Mental stress' comprised 3.1 per cent of all registered claims when disaggregated by 'mechanism, body location and agency', and 5.8 percent of all self-insured claims, in South Australia between the years of 2008 and 2009.

⇒ These figures increase when looking at the *proportion* of income claims, with mental stress comprising 6.9 per cent of all registered income claims by 'mechanism, body location and agency', and 14 percent of all self-insured income claims in South Australia between the years of 2008 and 2009 (WorkCover SA, 2010b).

However, it is important to note that the figures provided above can be misleading, as data are only collected for the statistical reviews on the **main type** of injury/disease for primary claims. A large proportion of psychological claims are in fact **secondary** claims, which may be lodged during or after the resolution of the physical illness/injury which has motivated the lodging of the primary claim. These secondary claims are not included in the figures provided in WorkCover's statistical reviews and WorkCover has advised that information about secondary psychological claims is not publicly available at this stage. Furthermore, the report states that 'Mental disorder income claims for 2008-2009 are understated due to reporting lags for income claims and mental disorders' (WorkCover SA, 2010: 75).

2.2   IMPACTS OF NEW ICTS ON STRESS

The psychosocial aspects of work that have the potential to lead to stress include workload and work pace, work schedule, career security factors, role in the organisation, interpersonal relations, and job content and design (Grimshaw, 1999). ICTs have the potential to exacerbate many of these aspects of work in both positive and negative ways. For instance, the use of social networking sites (such as Facebook and Twitter) at work may improve interpersonal relations with colleagues but may also provides a medium for bullying and harassment at work. Emails can be a more rapid form of communication that telephoning, but can increase overall workload (Derks & Bakker 2010). Frequent changes to software (e.g. Microsoft Outlook, Mozilla Firefox) may lead to an increase in workload as employees are forced to spend time adapting to the new technologies but may also improve productivity once the new technology is mastered.

However, there has been relatively little research undertaken on the way in which these new technologies affect workplace stress, or on the benefits which they can bring. However, this field is emerging and can be expected to grow over the next few years.

The negative psychological effects associated with the introduction of ICTs, are often summarised under the term 'technostress' which has been defined by as "an inability to cope with the demands of organisational computer usage" (Tarafdar *et al,* 2010: 304). Technostress also encompasses stress caused by mobile phones, Kindles, Ipads, video conferencing and social networking mediums such as Facebook and Twitter. The negative psychological effects associated with new ICTs include:

o   addiction to SMS texting, and to internet surfing, gaming or other entertainment aspects of ICTs;
o   increased workload;
o   information overload;
o   increased pressure to multi-task;
o   higher productivity expectations;
o   erosion of work-life balance; information overload;

- frustrations with hardware/software and time delays due to breakdown or equipment failure;
- constant demands to upskill/keep pace with rapidly evolving technology; and
- the depersonalisation of communication/loss of social capital (Putnam, 2000).
- The introduction of ICT in the workplace has also been associated with an increase in cognitive demands (attention, concentration and mental effort) and a decrease in the level of specialised knowledge required to carry out work tasks (Aronsson, 1989).

Tarafdar *et al* (2007) surveyed 233 ICT users in two US organisations about technostress at work. Structural equation modelling identified five specific types of stressors that lead to technostress (see Table 1 below). These five stressors provide a useful theoretical basis on which to study the impact of ICTs on work place stress. It is possible that specific groups (age, gender) may be more vulnerable to some of these stressors than others. For employees in their 20s and 30s with young families, techno-invasion may be the most problematic stressor as they try to maintain a satisfactory work-life balance. For older workers, techno-overload may present more of a concern as slowing processing speed that can be associated with ageing presents additional challenges when needing to work faster. This issue is discussed in more depth in Section 2.3. Gaining an understanding of the importance of these different stressors for specific groups of employees aids the development of strategies to ameliorate techno stress in the workplace.

Table 1: Five key stressors leading to technostress in the workplace

Stressors	Description
Techno-overload	ICTs force employees to work faster and longer. Workers feel that they are forced to do more work than they can handle, work to tighter schedules and change their work habits to adapt to the ICTs.
Techno-invasion	Employees feel their privacy is invaded because ICTs allow them to be reached anywhere at any time. Employees often feel an obligation to be available or connected at all times, which can lead to difficulties in maintaining a satisfactory work-life balance.
Techno-complexity	The complexity of new ICTs leads to stress about one's ability to use the technology and keep up with changes to technology. Employees often feel they have to spend lots of time learning and updating their knowledge about new ICTs to be able to work efficiently.
Techno-insecurity	Employees feel that new ICTs threaten their job security because they will be replaced by someone with a better understanding of technology or their position may become redundant due to technological advancements
Techno-uncertainty	When an organisation engages in frequent changes and upgrades to ICTs leading to uncertainty on the part of employees. Employees feel they must continuously update their knowledge of ICTs and educate themselves to be able to complete their work, which can lead to anxiety and stress and a sense that the work environment is unsettled.

2.2.1 LINKS BETWEEN ICT INDUCED STRESS AND PHYSIOLOGICAL CONDITIONS

In recent years a number of more unusual physiological conditions have also emerged in workplaces associated with high usage of ICT. For example, Acoustic Shock Injury (ASI), also known as Acoustic Shock Syndrome (ASS) and simply Acoustic Shock; is a fairly recent phenomenon which is associated with the use of ICTs in call centres. This condition first appeared in international medical literature in the early 2000s and is well documented in the literature in Australia and the United Kingdom (McFerran & Baguley, 2007; Westcott, 2006). The condition is often precipitated by the call centre worker experiencing a sudden noise in their headset the shock of which may lead to physical injury, including stiff neck, shoulders or jaw, or tinnitus.

However the condition is also associated with a number of psychological responses including fear of hearing loss, hyperacousis (heightened sensitivity to all sound), phonophobia (fear of using telephones or headsets), and other reactions akin to post-traumatic stress disorder (including trauma, anxiety and depression).

Another area of concern is the effects that electromagnetic radiation from mobile phones and computers may have on the brain. Several studies have found that radiofrequency released from mobile phones and video display terminals may cause headaches, difficulties in concentration and insomnia (Al-Khlaiwi & Meo, 2004; Higuchi e*t al*, 2003; Huber *et al,* 2002). There have also been persistent concerns that there may be a link between mobile phones and cancer (Khurana *et al* 2009). Similarly, a report from the World Health Organisation (update in July 2011), concluded that radio frequency electromagnetic fields are "possibly carcinogenic to humans based on an increased risk for glioma, a malignant type of brain cancer associated with wireless phone use".

Links have also been found between stress, ICT usage and a number of physiological conditions, such as, RSI (Repetitive Strain Injury) and other musculoskeletal disorders. The general consensus is that an individual under stress is more vulnerable to illness (both physical and psychological), and is likely to take longer to recover from such illness than an someone who is not under stress (Goldman & Lewis, 2005).

2.3 WHICH GROUPS ARE MOST VULNERABLE TO STRESS CLAIMS?

It is important that we understand how ICTs shape work conditions, particularly on an age, occupation and industry basis, in order to better design workplaces so that the potential benefits of ICTs are maximised, their potential negative impacts are minimised and occupational injury and illness are prevented.

Despite the issues associated with missing or unrecorded data regarding stress-related claims, WorkCover SA's (2010b) latest statistical review report shows different patterns of stress-related claims based on gender, occupation and industry type. Age-based patterns are less straightforward.

2.3.1 AGE AND STRESS CLAIMS

WorkCover SA statistics do not provide age-specific information regarding vulnerability to psychological/stress claims (WorkCover SA, 2010b). However, past research conducted by the Australian Institute for Social Research into the impacts of an ageing workforce on the South Australian Worker's Compensation system, concluded from a detailed review of research that there are some forms of decline associated with the ageing process, but most of these can be prevented, minimised, reversed or accommodated. The likelihood of liability arising from workplace illness or injury is not easily determined on the basis of chronological age because age is one variable that is mediated by a range of workplace factors, by the individual health and fitness of workers, and the interactive effect between individual worker and their work environment (Barnett, Spoehr & Parnis 2008).

Ageing brings functional decline in a number of areas, including musculoskeletal functioning and sensory abilities. However, appropriate training and workplace design can prevent or minimise these changes causing injury or reduced productivity (Barnett Spoehr & Parnis 2008: 60). Research by Ilmarinen (2005) shows that of the three areas of physical, mental and social functional capacity, only physical function decreases with age– with individual variation, while social functional capacity improves with age. Mental function is mediated by individual differences and subject to cognitive training and practice. Critical to preventing or minimising any of these forms of decline are compensatory workplace design and training (Barnett Spoehr & Parnis 2008: 60).

Coughlin (2010: 64) argues, the ethos of 'more and smaller' which characterises the development of ICTs, does not necessarily work in favour of older workers, who are required to engage in 'an ever-shrinking interface' with technology. The rapidly decreasing size of high tech devices works against the factors of declining vision

and dexterity which usually accompany the ageing process. Again, workplace design can be used to great effect to support older workers' changing sensory capabilities.

Ageing can bring greater susceptibility to a range of psychological issues including stress, but much depends on individual circumstances and on workplace factors. Individual health and education critically affects age-related functional change. Longitudinal research in Finland, measured by the *Work Ability Index* (Ilmarinen: 1995) identified three groups of risk factors which affect the decline in ability to work –

1   excessive physical demand, for example, repetitive movements;

2   stressful and dangerous work environments; and

3   poorly organised work, including lack of control or discretion over the way in which work tasks are performed.

Both physical and functional changes experienced by older workers have been found to not necessarily be correlated with chronological age, as many individual and environmental factors influence individual capacity to manage stress. However, a number of research studies have found that older workers are more susceptible to depression than other age groups (Harper & Marcus: 2006 in a detailed literature review). Furthermore, numerous studies have found an elevated risk of adverse psycho-social health due to workplace stress (Pikhart *et al:* 2004; Godin *et al*: 2005; Weyers *et al:* 2006; Muntaner *et al*: 2006).

However, stress can be a significant issue for older workers with particular triggers/causes of stress that include the fear of redundancy, lack of opportunities for career development, financial insecurity heading into retirement, and the capacity to adapt to changing technologies (Hansson *et al*: 2001). Ageist assumptions often underpin these triggers, and there are a number of research studies that have documented these among employers (Selby-Smith *et al:* 2007; Taylor & Walker: 1998). Analysis of data regarding the Canadian workforce's participation in an Employee Assistance Program (EAP)[1] found that older workers were more likely than younger workers to report more grief due to loss of family members and friends, less likely to report relationship problems, slightly more likely to report work relationship and conflict and workplace stress issues, slightly more likely to report personal stress, and more likely to access financial planning and eldercare support services (Barnett Spoehr & Parnis 2008: 53-54; WarrenShepell: 2004).

Research on work place stress undertaken elsewhere in Australia and also in Europe identify different patterns of reported workplace stress that are age-specific. The *European Agency for Safety and Health at Work* (2009) reports on the prevalence of stress and the trends in workplace stress for all countries in the European Union, finding that stress is most prevalent in workers aged 40 to 54 years (24%), followed closely by workers aged 25 to 39 years (23%). Stress levels were significantly lower in younger workers (< 24 years) and workers aged over 55 years. These findings indicate that stress is low in younger workers, increases through the late 20s and 30s, peaks during mid-life and then decreases as people move into their 50s and approach retirement.

Also identifying mid-life as the most vulnerable time to experience workplace stress, Jackson and Clements (2006) reviewed 400assessments undertaken for Australia's Centre for Corporate Health (which assesses workplace stress claims) and found that the average age of claimants for psychological injury was 41-45 years. This group was also the most likely to lodge a claim for psychological injury with the second most likely age

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[1] A national strategy designed to address and reduce psychological problems in the workplace. An EAP is a confidential, performance. EAP services are provided by clinical and registered psychologists through a centralised phone system. The issues that may be addressed through the use of an Employee Assistance Program can be Personal (eg anxiety or depression, grief and loss, emotional or physical abuse), Family (financial, legal, relationship issues, work-life-balance issues) or Work (eg relationships with co-workers, managing conflict).

group being 50 and over. The review attributes the propensity of individuals 'in the second halves of their careers' to psychological injury, to 'burnout and vocational discontent' associated with organisational change.

The research literature indicates that cognitive functioning shows a gradual deterioration with age, but with considerable variation from one individual to another. Decline is reversible and usually due to lack of use of cognitive abilities. It can also be prevented through active usage and practice. Some cognitive functions eg problem solving, complex reasoning, use of language, improve with age. Cognitive changes do not mean that older workers are unable to learn new information but the way in which they learn is likely to be different. The way in which training is delivered is critical. Older workers respond well to self-paced learning and collaborative (eg with peers) learning. They usually require more time to learn and to practice new learning (Barnett Spoehr & Parnis 2008: 62-64).

The respected *Seattle Longitudinal Study*, (Schaie: 1996) found that among the variables associated with a reduced risk of cognitive decline with age are absence of cardiovascular and other chronic illness, and participation in an environment marked by complex and stimulating activities. More importantly, decline was found to be reversible and likely to be a function of disuse. Approximately two-thirds of those studied showing significant improvement following cognitive training, and some 40% of those who had declined significantly over a 14 year period were returned to their pre-decline level (Seattle Longitudinal Study web site)[2].

Importantly, cognitive impacts need to be differentiated from learning capacity. Ilmarinen (2001) asserts that actual functions of information processing change very little in the course of one's career and that moreover, some cognitive functions, such as control of use of language, complex reasoning skills and the ability to problem solve, improve with age. Further, even though the speed of learning may slow with age, the actual learning process is not dependent on a person's age. Ilmarinen's review of the literature found that some mental characteristics can also strengthen with age.

Decline in cognitive functioning that can be associated with ageing may make adaption to new technologies more difficult for older workers. One of the most pronounced changes in cognitive functioning with older age is slowing in processing speed (Salthouse, 1996). As ICTs require that employees work faster (*techno-overload*), this is likely to have a more prounounced impact on older workers than their younger colleagues if it is not managed appropriately in the workplace. One advantage that older workers have is that they tend to have a wealth of knowledge and vast experience gleaned from working in an organisation for a long-period of time. However, within organisations that make frequent changes and upgrades to their ICTs and other systems, the value of this knowledge and experience may be reduced, so that new ICTs might mitigate the advantages that older workers once enjoyed

Researchers have studied the appropriateness of new technologies in training older people, challenging the perception that older people do not respond well to learning modes that incorporate new technologies. For example, Wallen & Mulloy (2006) showed that computer-based training incorporating text, graphics and audio narration is most appropriate for workers over the age of 45 while Van Gerven *et al* (2003) found that multi-media learning tools are suitable and effective for older learners (Barnett Spoehr & Parnis 2008: 58).

It might be expected that younger workers, in particular those from Generation Y who have spent their lives immersed in rapidly changing technology, would be less susceptible to potentially negative psychological impacts of ICTs. However, Murray and Rostis (2007) point out that it is often young entry-level workers, who lack the professional and organisational credibility to dictate their terms of employment and are eager to work their way up the corporate ladder, who are most vulnerable to becoming *technologically tethered*. Moderate and high levels of psychological distress have been found to be more prevalent for Australians aged 18 to 34 years (Dorrian *et al* 2011: 14, citing ABS 2009 data) while longitudinal research undertaken using the Australian

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[2] www.geron.psu.edu/sls/researchers/index.htm

Work and Life Index has found the work-life strain is most intense for people in their 30s and 40s, compared to younger and older workers (Pocock *et al* 2010).

While it is difficult to directly compare the stress experience of younger and older workers due to the great number of variables that may impact on coping ability, there is some evidence to suggest that older workers experience significantly fewer problems with personal control on the job that might trigger stress, as well as less job tension, less generalized stress, less depression, and fewer stress-related disruptions of job performance (Hansson *et al*: 2001). This suggests that techno-invasion might be a greater problem for younger workers than their older counterparts.

These studies demonstrate that mental stress at work is more prevalent in middle age, and that age alone will not predict the likelihood of this or the likelihood of its impact. However, there is a lack of direct evidence of how technostress affects workers at different ages and this is a significant gap in the existing literature.

2.3.2 GENDER AND STRESS CLAIMS

The research literature over the past two decades has produced equivocal findings on gender differences and gender-based trends in occupational stress (Galanakis *et al* (2009). A likely explanation for the lack of agreement in findings is that a number of other variables interact with gender (for example, parental status and marital status), making it difficult to isolate the specific influence of gender. A detailed research study by Galanakis *et al* (2009) examined gender differences in occupational stress, in a sample of 2,775 professionals, finding initial gender-based differences that identified significantly higher levels of occupational stress for women than for men. However, these differences disappeared once age, marital status, and educational status were controlled.

A research study funded by Safework SA (Dorrian *et al* 2011) has studied the ways in which paid work impacts on health and wellbeing, in the process examining the influence of the broader context in which people work and live. Its authors note the significant gender differences in many aspects of paid work, and that women spend more time in unpaid care and domestic work, being more likely to experience work-family strain than men. Citing the findings from four years of research from the Australian Work and Life Index, consistent patterns of gender differences have been found in work-life strains, even when controlling for the number of hours spent in paid work. Reducing the number of hours of paid work was found to have little impact on women reporting that they felt rushed for time. Citing previous research findings, the authors note that the strain arising from work-family conflict is related to feelings of anxiety, depression, fatigue and irritability and other indicators of stress (Dorrian *et al* 2011: 13). These findings highlight the need to relate gender-based differences to the social context in which they occur.

A number of studies exploring gender differences in attitudes towards and usage of technology suggest that women may be more susceptible to technostress than their male counterparts (Schumacher and Morahan-Martin (2001)Durnell and Hagg (2002). However, these were undertaken in the early 2000s, and it is not clear if other variables- such as, age - were taken into account in the analysis of findings. Given the rapid increase in ICTs in schools, universities and the workplace over the past decade, it is likely that gender differences in attitudes relating to ICT are diminishing over time Rice and Katz (2003). Schumacher and Morahan-Martin (2001) found that many significant gender differences in computer experiences and attitudes of incoming college students measured in 1989/90 had diminished by 1997.

2.3.2.1 GENDER AND STRESS CLAIMS IN SOUTH AUSTRALIA

Recent *WorkCover SA* data for 2008-2009 show that –

⇒ 6.1 per cent of all registered primary claims by 'main type of injury/disease' lodged by females were for mental disorders, compared with 1.8 per cent of all registered primary claims lodged by males.

⇒ The figures are similar for self-insured claims with claims for mental disorders comprising 7.5 per cent of all primary self-insured claims lodged by females, compared with 4.5 per cent of all self-insured primary claims lodged by males.

⇒ Similarly, 13.3 per cent of all registered primary income claims by 'mechanism, body location and agency' lodged by females were for mental stress, compared with 4 per cent of all registered primary claims lodged by males. Again, the figures are similar for self-insured income claims (WorkCover SA, 2010b).

The figures provided above indicate that, for a number of reasons, females in South Australia are more likely to lodge claims for mental stress or mental disorders than their male counterparts. This gendered trend is repeated in relation to the number of claims for males and females in the same occupation, with the proportion of females who have lodged claims for 'mental disorders (mainly stress)' being consistently (and usually significantly) higher than their male colleagues.

2.3.3   INDUSTRY SECTORS AND STRESS CLAIMS

Several studies on technostress has suggested that high work-related usage of ICT has traditionally been associated with occupations whose profiles are characterised by higher levels of education and higher levels of income (Johnson *et al,* 2005; Losh, 2009). While increasing the likelihood of exposure to occupational technostress, these two factors are also known to reduce the incidence of psychological injury (Baum, Garofalo, & Yalie, 1999; Johnson *et al*, 2005). In contrast, lower social economic status (SES) has been associated with conditions that contribute to ill-health and a chronic stress burden (Fuchs, 2008). However, as ICTs continue to rapidly proliferate in both working and non-working lives, the relationship between occupation, income, education and occupational stress (particularly in relation to technostress) may be partially destabilised (Losh, 2009).

2.3.3.1   INDUSTRY SECTORS AND STRESS CLAIMS IN SOUTH AUSTRALIA

WorkCover SA's statistical review (WorkCover SA, 2010b) shows that the five industries in which the highest number of income claims for mental disorders were lodged by *registered* employers were:

o   community services,
o   wholesale and retail trade,
o   recreation, personal and other services;
o   finance, property and other business services, and
o   manufacturing.

The three industries in which the highest income claims for mental disorders were lodged by *self-insured* employers were (in order of frequency):

o   community services,
o   public administration and defence, and
o   wholesale and retail trade.

The self-insured sector has a larger **proportion** of psychological claims than its registered counterpart (WorkCover SA, 2010a). This may be due to the fact that the self-insured sector includes government agencies in which workers have particularly high rates of exposure to high risk, stressful situations, for example - police, ambulance workers and fire fighters. This hypothesis is supported by the results of the review undertaken by the Centre for Corporate Health which found that those most vulnerable to psychological injury were working in occupations requiring high levels of 'emotional labour'- including ambulance workers, teachers, social services, customer service roles, call centre operators, prison officers and police (Johnson et al., 2005). Factors found to increase the likelihood of work-related stress include: performance investigations, complaints and management; exposure to aggressive clients; conflict with colleagues; high workloads; supervisors with poor management skills; frequent transfers; and poor person-job-fit (Jackson & Clements, 2006).

Table 2 summarises the findings based on an analysis of available *WorkCover SA* data, showing high levels of claim by gender, occupation and whether or not employers are registered or self-insured (WorkCover SA, 2010b).

Table 2: Claims for mental disorders in SA, by gender, occupation and industry type

Employer Type	Occupations with highest claims*(in order)		Industries with highest claims*(in order)	
	Males	**Females**	**Males**	**Females**
Registered	heavy truck driver	personal care assistant	finance	transport
	security officer	commercial cleaner	recreational, personal & other services	other industries
	hotel or motel manager	general clerk	wholesale and retail trade	finance
Self-insured	police officer	primary school teacher	finance	finance
	secondary school teacher	secondary school teacher	community services	agriculture and other industries
	project/program administrator	general clerk	public administration & defence	public administration & defence
	store person	registered nurse	construction	community services

*Highest number of primary claims for 'mental disorders (mainly stress)'

Table 2 shows that for *registered* employees, there is very little overlap between the occupations and industries with the highest stress claims for men and women. Men working as heavy truck drivers, security officers or hotel managers have the highest stress claims. For women, personal care assistants, commercial cleaners and general clerks have the highest stress claims. There is some overlap when looking at industry, with men and women working in the finance industry both having high mental stress claims.

However, for *self-insured* employees there is significant overlap with several occupations and industries having a high number of stress claims for both men and women. For *self-insured* employees, male and female teachers have the highest stress claims, as well as male police officers. By industry, the finance industry, community services and public administration, and defence industries have the highest claims for mental stress for both men and women. Men working in the construction industry and women in the agriculture industry also report high stress claims.

2.3.3.2   STRESS AND THE FINANCE INDUSTRY

Analysis of WorkCover SA data has identified the finance sector as one of several industries with high stress claim levels, for both women and men (WorkCover SA 2010b). In addition, working in the finance industry

involves higher ICT use. Recent data from the Australian Bureau of Statistics shows that the proportion of businesses with internet access is substantially higher in the financial and insurance services sector (98%) compared to the average across all industries (87%) (Australian Bureau of Statistics, 2009a).

3 MANAGING TECHNOSTRESS IN THE WORKPLACE

It is clear that information and communication technologies are playing an ever increasing role in the way people live and work. Impacts are being seen across a range of human domains, in how people interrelate and communicate, in how they access information for diverse purposes, and in the way work environments are evolving. A wide range of ICTs have been embraced in an increasingly technologically dense environment that both excites and challenges.

As the technological revolution accelerates, it is wise to take pause and consider some of the implications for human health and well-being. Emerging evidence has shown that technologies, for all their promise, are not without attendant risks. However, research into what these risks are, how they are mediated by contextual factors, and how they can be managed is still embryonic, indicating a significant gap as research lags behind technology-driven changes in the way people live and work. From a workplace perspective, a vital question is how we can maximise productive human and economic return from ICTs, while avoiding potential ICT-induced physiological and mental stress-related harm.

The research for which this literature review represents the first stage, addresses these questions in the context of the finance sector, which is considered a leader in ICT uptake. In particular, the study will examine variations across age and gender in how ICTs are perceived and used in the workplace, and their potential to manifest in harm. More importantly however, the study will examine adaptive strategies that harness strengths within the workforce (for example, intergenerational knowledge) to create a supportive ICT work environment that minimises potential harm.

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