PRINCIPLES AND EVIDENCE FOR GOOD WORK THROUGH EFFECTIVE DESIGN

Report commissioned by Comcare (RFQ) 13/373
to inform the Safe Work Australia Members Collaborative Project
'Good Work Through Effective Design'.

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EXECUTIVE SUMMARY

This report, Principles and Evidence for Good Work Through Effective Design, has been commissioned by Comcare (RFQ) 13/373 to inform the Safe Work Australia Members' Collaborative Project 'Good Work Through Effective Design'.

The Safe Work Australia Members' project will contribute to the Australian Work Health and Safety Strategy 2012-2022 and particularly the national Action Area Healthy and Safe by Design. This Action Area has a strategic outcome referring to the "design and management of work, work processes and systems of work to eliminate or minimise hazards and risks".

This report will inform best practice to help those with design responsibilities or have a role in designing work, to create good work through effective design.

'Good work' is healthy and safe work where the hazards and risks created by the work are eliminated or minimised so far as is reasonably practical and where the work design optimises human performance, productivity and job satisfaction.

In Section 1 the report background and context are briefly outlined.

In Section 2, we define work design as 'the content and organisation of one's work tasks, activities, relationships, and responsibilities'. Carrying out work tasks, activities, and responsibilities requires physical, biomechanical, cognitive, and psychosocial elements. Good work is healthy and safe work in which physical, biomechanical, cognitive, and psychosocial hazards and risks of work are eliminated or minimised so far as is reasonably practicable. Good work also involves the presence of positive work elements that promote motivation and wellbeing. Considerable evidence shows that good work is most often 'good business'.

Section 3 of this report identifies principles to support the design of good work. Core principles, or overarching perspectives, include:

- Good work design will give the highest level of protection against harm that is reasonably practicable.
- Good work design will be holistic.
- Good work design is applicable at many stages in the supply chain and across operations, products and processes.
- Good work design will enhance protective factors that contribute to good health.
- Good work design will enhance business success.

Action principles for how to achieve good work design are:

- Apply a risk management approach, and monitor its effects.
- Ensure commitment of decision makers and leaders.
- Actively involve the people who do the work, including those in the supply chain and networks.
- Seek the best fit between the work environment, culture, systems of work, and the needs and capabilities of workers.
- Apply multi-disciplinary expertise and learn from evidence and experience.

The remainder of the report provides evidence for these principles and actions. Section 4 elaborates the 'what' of good work design, including evidence that the four elements of work (physical, biomechanical, cognitive, and psychosocial) are critical influences on individuals' health and safety, as well as other outcomes. We give examples of interventions that can change these elements.

Section 5 is concerned with the 'how' of work design. We review the key approaches to redesigning work and to enhancing work health and safety more generally. We review the key principles or 'lessons-learned' within each approach.

1. BACKGROUND

This report refers to the contracted project (RFQ) 13/373 entitled 'Good Work Through Effective Design' Collaborative Project. This is an approved Safe Work Australia Members' collaborative project led by Comcare and Work Health and Safety, Queensland.

This project contributes to the Australian Work Health and Safety Strategy 2012-2022 (Australian Strategy), which builds on the National OHS Strategy 2002-2012. The Australian Strategy was formally endorsed by the Workplace Relations Ministers, the ACTU, ACCI and the Ai Group.

1.1 AUSTRALIAN STRATEGY

The Australian Strategy vision is of "*healthy, safe and productive working lives"*. The Australian Strategy recognises that effective systematic management of risks will result in improved worker health and safety and productivity by:

- preventing and reducing the number and severity of injuries and illnesses and associated costs,
- promoting worker health, wellbeing and capacity to work, and
- fostering innovation, quality and efficiency through continuous improvement.

The most effective and durable means of creating a healthy and safe working environment is to eliminate hazards and risk during the design or redesign of work, structures, plant and substances. This is described under the Australian Strategy Action Area *Healthy and Safe by Design*.[1]

Under this Action Area, two strategic outcomes to strive to achieve by 2022 are: (1) structures, plant and substances are designed to eliminate or minimise hazards and risks before they are introduced into the workplace, and (2) work, work processes and systems of work are designed to eliminate or minimise hazards and risks. This report will contribute to this Action Area, placing greatest weighting on the second outcome whilst acknowledging the interrelationship with design of structures, plant and substances.

The design rationale underpinning the Australian Strategy is to prevent harm (a requirement under the work health and safety legislative framework) by "directing activities to where there is the greatest potential for reducing harm by eliminating or minimising exposure to serious hazards and risk according to the hierarchy of control". In addition to preventing exposure to risks leading to traumatic injury and death, the Australian Strategy lists six national priorities to focus prevention effects on both short and long latency work-related disorders. These were based on severity of consequences and the number of workers estimated to be affected: musculoskeletal disorders; mental disorders; cancers (including skin cancer); asthma; contact dermatitis; and noise induced hearing loss.

A key work health and safety principle is the use of a systematic risk management approach. This involves a four-step planned process involving actively thinking about what could go wrong at the workplace and what the consequences could be, and then doing whatever is 'reasonably practicable' to "eliminate or minimise health and safety risks arising from your business or undertaking". This approach is mandated in all Australian WHS legislation (see Appendix A, Model Work Health & Safety Act Risk Management Process).

Safe Work Australia Members recognised a need for more explanation on what constitutes 'good work' and how this might be achieved through an effective design process. In 2013 they agreed to a national project '*Good Work Through Effective Design*' to contribute to this outcome. The Safe Work Australia Members' collaborative project aims to:

a) produce national guidance on the key principles of good work and an effective design process,
b) promote this guidance to those with a role in work design, and
c) provide national resources and information to support design of good work.

[1] The remaining six areas include: supply chains and networks, health & safety capabilities, leadership and culture, research and evaluation, government, and responsive and effective regulatory framework.

Phase One of the Safe Work Australia Members' project is to develop the overarching principles of good work and effective design, and will be informed by the current report.

1.2 Report Goals, Scope, and Structure

As stated in the contract, the goals of this project were to produce a report to:

- Use existing knowledge and produce a report summarising the empirical evidence that identifies the core concepts of healthy and safe work (physical, biomechanical, psychosocial etc) (see Section 4).
- Use existing knowledge to produce a report summarising the empirical evidence that identifies the best practice approaches to effectively design work to be healthy and safe (see Section 5).

The contract notes a formal literature review is not required, but rather a collation of existing evidence into a synopsis. The ultimate goal of the project is to identify principles to guide work design, thus draft principles are also included in this report (see Section 3).

This report will inform guidance to encourage those with upstream design responsibilities, or who participate in the process of designing work, to go beyond meeting legislative responsibilities to strive to create 'good work'.

These principles are not intended to replace the technical design specifications of plant, substances and structures.

It is expected that the principles and subsequent guidance material will target two main groups who play an important role in designing good work:

- PCBUs who have specific design duties under the Work Health and Safety laws relating to the design of plant, substances and structures including the buildings in which people work, and
- persons who have responsibility for designing work processes and systems, such as shift rosters, organisational structures, computer systems, etc. They include, for example, health and safety officers, managers, human resources personnel, information technology designers and systems engineers.

'Guidance on the Principles of Safe Design For Work'[2] produced by the Australian Safety and Compensation Council in 2006 provides information and advice on eliminating hazards and controlling risks at the design stage to persons involved in the design or modification of products (including buildings, structures, equipment and vehicles) and processes used for work.

The next section of the report, Section 2, provides a brief overview of the meaning of work design. Following that, Section 3 suggests principles of good work design. After Section 3, the report provides the evidence base for these principles. Thus Section 4 reviews the core elements that constitute 'good work design', as well as the evidence underpinning these elements; and Section 5 focuses on the 'how' of work design, that is, evidence regarding processes for achieving good work design.

[2] http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/gm2006principlesofsafedesign

2. INTRODUCTION

Whenever an individual goes to work, that individual has a number of tasks, activities and responsibilities they need to carry out, usually in collaboration with others.

2.1 DEFINING WORK DESIGN

Work design refers to "content and organisation of one's work tasks, activities, relationships, and responsibilities" (Parker, 2014). Illustrative work design decisions include, for example:

- Which activities should be grouped together to form a meaningful job?
- Which decisions should be made by workers and which by their supervisors?
- Can the manual handling demands required in the job be reduced by redesigning work processes?
- Can one build in routine tasks amidst complex ones to ensure individuals' are not overwhelmed by the psychosocial and cognitive demands?
- Is the level of lighting appropriate given the duration of screen monitoring required?

These example work design decisions encompass physical, biomechanical, cognitive, and psychosocial elements of work (see Section 4).

2.2 CONCEPT OF GOOD WORK

'Good work' is healthy and safe work where the hazards and risks created by the work are eliminated or minimised so far as is reasonably practical and where the work design optimises human performance, productivity and job satisfaction. Work design seeks to manage the structure of tasks, demands, supports, and work processes to reduce hazards and enhance health and safety. Achieving good work through design represents a "primary intervention" which addresses the underlying causes of health and safety (see Table 1). Good work designs can be most effectively achieved through a consultative design process, as elaborated in Section 5.

TABLE 1: PRIMARY, SECONDARY, AND TERTIARY INTERVENTIONS (COMCARE)

LEVEL	ACTIONS
Primary intervention	Action which aims to **prevent** potential harm by addressing the source of the risk
Secondary intervention	Actions which aim to **limit the consequences** of harm including through support, knowledge, skills or resources to prevent long term disability or re-injury
Tertiary intervention	Actions that aim to **treat, compensate and rehabilitate** an injury or illness.

The duty to design and manage work to take reasonably practical measures to protect workers from harm is encompassed in all WHS legislative (see Section 2.4). But the potential for good work design to also *improve* worker health with associated potential benefits to the individual, the organisation and the broader Australian community is of increasing important to employers, unions, workers, and other stakeholders. For example, in July 2011 the Australian Government and key employer representatives and unions released a "Joint Statement of Commitment" identifying the importance of good health at work[3].

Thus, as well as good work design involving eliminating or mitigating risks that cause injury and illness, good work design also involves designing jobs in ways that enhance workers' health and wellbeing.

[3] In April 2013, over 50 NZ organisations and over 50 Australian organisations signed up to consensus statement released by the Australian Faculty of Occupational and Environmental Medicine (AFOEM) on the Health Benefits of Work (www.racp.edu.au/page/afoem-health-benefits-of-work); and the Australian Council of Trade Unions' (ACTU) decent work agenda recognises the ILO's focus on 'decent work'.

Principles of good work design are based on evidence from diverse fields such as psychology, medicine, law, ergonomics, engineering, biomechanics, and sociology (Campion & Thayer, 1985). The range of perspectives and the breadth of health concerns can make the application of good work design seem complex. Thus an important end goal of this report involved generating a relatively small set of work design principles that can be used to guide good practice.

2.3 Outcomes of Good Work Design

Work design decisions affect outcomes at multiple levels. Outcomes affected by work design include:

- the attitudes, behaviours, and health of *individual workers*, such as how motivated and engaged workers feel, their level of job strain, and their safety. For example, an Australian study reported design issues are probably or definitely indicated in 37% of work-related traumatic fatalities (Driscoll et al. 2008).
- *team* effectiveness, such as how effectively teams co-ordinate their activities; and
- the effectiveness of the *wider organisation*, such as whether the organisation achieves its productivity and efficiency targets (Parker, 2014).

Good work design can influence productivity in a number of ways.

- The motivational properties of good work design enhance productivity by developing a developing a committed and engaged workforce. Following Huselid's' (1995) influential study of human resource practices, a great deal of research supports the benefits for improving performance of implementing motivational work design in conjunction with other human resource practices (e.g., Tregaskis et al., 2013). Work design has traditionally been an underrated aspect of these practices but is receiving increasing attention in recent years (Becker & Huselid, 2010).
- Good work design makes better use of worker skills. The application of skills to work is an important source of productivity. For example, Morrison et al (2005) identified how work design translates into better application of skills. Other researchers have also shown how good work design, such as a reasonable level of job autonomy, promotes skill development, learning and the development of expertise (see Parker, 2014, for a review).
- Greater efficiency and effectiveness can be achieved when good work design principles are employed. Youndt et al. (1996) showed that practices that enhanced skills were related to more efficient procedures and higher productivity. Likewise research has shown that good work design can result in faster responses to problems, lowered costs associated with unnecessary supervision layers, and higher levels of worker creativity and innovation (Parker, 2014).
- Good work design has productivity benefits both in terms of reduced absence, turnover, and workers' compensation costs (e.g., Van den Heuvel et al. 2010).

2.4 THE LEGISLATIVE CONTEXT

The work health and safety legislative framework includes the Work Health and Safety (WHS) Act, Regulations, and approved codes of practice. All jurisdictions have similar work health and safety laws which set the minimum standard for compliance. Those with duties must comply with their obligations under the Act and Regulations. Suggestions on how duty holders can meet their obligations are included in approved codes of practice[4] and guidance material.

The model[5] WHS Act places the primary duty of care on persons conducting a business or undertaking (PCBU) to protect workers from risks to health and safety so far as is reasonably practicable. 'Health' is defined in the model WHS Act to mean both physical and psychological health.

If elimination is not reasonably practicable, the risks must be minimised so far as is reasonably practicable. The WHS Regulations require PCBUs to identify hazards, assess the risk is required, control the risk, monitor and review control measures.

Section 22 of the model WHS Act places further duties on designers to ensure that structures, plant or substances are designed without risks to health and safety. The model WHS Regulations clarifies the operation of this provision and defines designer duties by outlining procedures that must be followed to achieve a specific safety outcome. For example, regulation 61 outlines that designers must eliminate, or if it is not reasonably practicable to do so, minimise, the need for a hazardous manual task to be carried out in relation with the plant or structure when it is being designed and manufactured.

The design of good work is captured under the general duty of care under work health and safety legislation. People with design responsibilities must have regard to other relevant legislation when designing work for example industrial relations laws.

[4] These are approved by Parliament and provide practical guidance on how to meet the standards set out in the WHS Act and the WHS Regulations. Codes of Practice are admissible in proceedings as evidence of whether or not a duty under the WHS laws has been met. Codes of Practice can also be referred to by an inspector when issuing an improvement or prohibition notice. It is recognised that equivalent or better ways of achieving the required work health and safety outcomes might be possible. For that reason, compliance with Codes of Practice is not mandatory providing that any other method used provides an equivalent or higher standard of work health and safety than that suggested by the Code of Practice.

[5] The model Act and regulations have been used as a basis for the legislation in most Australian jurisdictions.

3. PRINCIPLES OF GOOD WORK DESIGN

This section suggests principles to guide the design and evaluation of work, work processes, and work systems. Principles for the design of broader structures, building, plant, equipment, vehicles, and substances are articulated in '*Guidance on the Principles of Safe Design For Work*' published in 2006 by the ASCC; a document that provides information and advice on eliminating hazards and controlling risks at the design stage to persons involved in the design or modification of products and processes used for work[6]. The principles proposed below are not intended to replace other guidance and standards relating to the design of buildings, structure and plant.

Principles are defined as "a fundamental truth or proposition that serves as the foundation for a system of belief or behaviour or for a chain of reasoning" (oxforddictionaries.com). In this context, a principle can be considered an evidence-based proposition that helps to achieve good work design.

Principles are useful for educating and informing key stakeholders to adopt, as far as possible, an evidence-based approach that is likely to achieve work design that is both good for workers (well-designed work affects worker health and safety) and good for employers (well-designed work affects organisational productivity and sustainability). Principles also provide a potential framework for evaluating the effectiveness of work design.

Our criteria for principles include:

- A principle should be evidence-based, with evidence suggesting better health and safety outcomes if the principle is applied.
- A principle should be easy to understand by, and relevant to multiple audiences.
- Principles should form a cohesive, interconnected set of ideas, rather than be conflicting or read in isolation.
- The number of principles should be limited.

We identify core principles and action principles for good design (drawing on Clegg, 2000):

- Core principles – concerned with an overarching world view, or perspective on work design
- Action principles –focused on the process of designing better work (or the 'how')

These principles derive from the evidence presented in this report regarding the content of work design, including key elements of work design and examples of interventions (Section 4) and the process of work design (Section 5).

The specific application of the proposed principles should go hand in hand with workers' responsibility to take reasonable care of their own and others' health and safety, and to comply with reasonable policies, procedures, and instructions[7].

[6] http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/gm2006principlesofsafedesign

[7] Work Health and Safety Act 2011.

3.1 CORE PRINCIPLES OF GOOD WORK DESIGN

Core principles describe the fundamental assumptions that underlie the nature of good work. They represent an overall view of the most significant features of work design at a conceptual level, as evidenced in Section 3. Table 2 shows the core principles of good work design (see Appendix B, Table 4, for a more detailed version of this table).

TABLE 2: CORE PRINCIPLES OF GOOD WORK DESIGN

Core Principles	Elaboration
Good work design will give the highest level of protection against harm that is reasonably practicable	• All workers have the right to a healthy and safe working environment (Australian Strategy p 4) so workers should be given the highest level of protection against harm to their health, safety, and welfare from hazards and risks arising from work or from specified types of substances or plant as is reasonably practicable (model WHS Act 2011). • Prevention activities should be directed to where there is the greatest potential for reducing hazards (Australian Strategy, p. 8). The hierarchy of controls measures should be used to ensure that the highest level of protection reasonably practicable is achieved (model WHS Regulations 2011, and further explained in the relevant Code).
Good work design will be holistic	• When work is designed and redesigned, or the hazards and risks assessed, the physical, biomechanical, cognitive, and psychosocial requirements of work should be systematically considered as part of good work design (see Section 4), as should the person, and the wider work environment, systems and culture. • New initiatives, technologies, and change in organisations (e.g., new IT systems, downsizing, restructuring) have implications for work design, and work design should be assessed at these decision points.
Good work design is applicable at many stages in the supply chain and across operations, products and processes	• Work organisation should not be 'taken for granted': there are typically many options for improving the design of work, including at start up, maintenance, and downsizing/ closing down of an organisation. • Physical, biomechanical, cognitive, and psychosocial requirements of work should be considered in the conceptual design phase, build, manufacture, use, and handling stages of a product/ service cycle., maintenance or disposal phases.
Good work design will enhance protective factors that contribute to good health	• Designing good work can not only mitigate short term risks to prevent injury and illness, but can foster and support health over the longer term, such as by considering the long-term effect of work on musculoskeletal disorders, mental health and/or cardiovascular functioning. • Well-designed, healthy and safe work will allow workers in Australia to have more productive working lives and to experience higher wellbeing.
Good work design will enhance business success	• Good work health and safety improves long-term business productivity by preventing injuries/illnesses and associated costs; promoting health, wellbeing and capacity to work; and fostering innovation, quality, and efficiency through continuous improvement (Australian Strategy, p. 5). • Incidences of poor worker performance, and system failures (such as near misses, injuries and illnesses), are an important source of information about work design, and can often be symptoms of poor work design.

3.2 Action Principles For Good Work Design

Action principles for good design describe the fundamental assumptions that underlie the design, or redesign, of good work. These refer to 'how' good work can be designed or redesigned. Table 3 shows the action principles (see Appendix B, Table 5 for a detailed version of this table). Evidence for these principles comes primarily from Section 5 of the report.

Table 3: Action Principles for Work Design

Actions	Elaboration
Apply a risk management approach, and monitor its effects	• A systematic risk management approach should be applied in every work place that involves identifying hazards, assessing the risks if necessary, controlling the risks, and maintaining and reviewing control measures. Interventions should be evaluated. • Designing good work is not a one-off event. Designs or redesigns should be continually monitored and adjusted, and the focus should be on sustainability in the long-term.
Ensure the commitment of decision makers and leaders	• The implementation work design or redesign is most effective when there is high level support and endorsement, with this support being clearly visible to workers. • It takes time and resources to properly undertake an effective work design or redesign process, but evidence suggests there are long-term net benefits to such investment.
Actively involve the people who do the work, including those in the supply chain and networks	• The person conducting a business or undertaking must, so far as is reasonably practicable, consult … with workers who carry out work for the business or undertaking who are, or are likely to be, directly affected by a matter relating to health and safety... Consultation involves: sharing information, reasonable opportunities for people to express their views, raise issues, and contribute to decision making; taking into account views; advising workers of the outcomes of consultation in a timely manner; and involving any health and safety representatives in the consultation (model WHS Act 2011). • All levels of workers have a role to play, including relevant stakeholders in the supply chain. Involvement is advantageous because: of workers' local expertise about the work; it increases understanding of the impacts of good or poor design decisions on upstream and downstream participants; it increases ownership of the change; and because active involvement results in 'protective factors' for work stress, such as support, feelings of control, and perceptions of fairness.
Seek the best fit between the work environment, culture, systems of work, and the needs and capabilities of workers	• Work design should recognise the fit between human physical and mental capabilities and the work people are required to perform. For example, creating good work requires that work be designed to accommodate workforce diversity including the abilities, and vulnerabilities of workers, and those returning to work following injury or illness (Australian Strategy, p. 8). • Good work design is 'fit for purpose', and should reflect the needs of the organisation including owners/ managers and workers. Failure to take broader organisational factors into account (e.g., training, recruitment/selection, payment, information systems, work layout, and work health and safety processes) can result in poor work design.
Apply multi-disciplinary expertise and learn from evidence and experience	• Experts in work design should be sought if required, such as human resource personnel, engineers, managers, users, system designers, psychologists, human factors and ergonomics specialists. • Different people involved in work design (as relevant) need to work together to as they can provide different views and insights about the issues and are then able to learn from each other. Continued improvement in work health and safety requires ongoing collaboration amongst multiple parties involved in work design (Australian Strategy, p. 8).

4. ELEMENTS OF GOOD WORK DESIGN

This part of the report concerns the contracted goal "use existing knowledge to produce a report summarising the empirical evidence that identifies the core concepts of healthy and safe work (physical, biomechanical, psychological)".

When making decisions about work tasks, activities, and responsibilities, there are typically four elements to think about which interact together. These are:

- Physical Elements: Aspects of the work environment or context that creates physical or physiological demands on the human body.
- Biomechanical Elements: Aspects of the work that include hazardous manual tasks and the biomechanical risk factors that leads to musculoskeletal disorders.
- Cognitive Elements: Aspects of the work that create demands on the human mental capacity.
- Psychosocial Elements[8]. Social, psychological, and organisational aspects of work that place demands on human capacities.

These elements of work, summarised in Figure 1, have consistently been shown to have a substantial impact on workers in terms of mental health, safety, wellbeing, and performance.

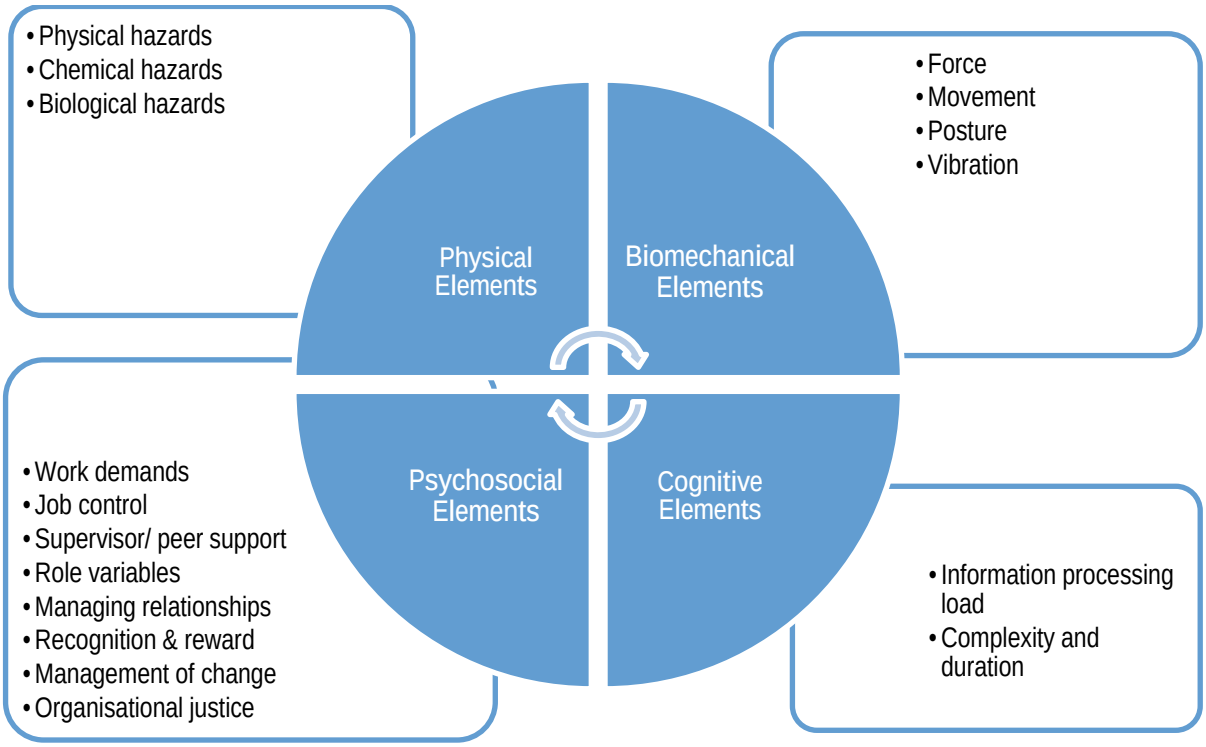

FIGURE 1. KEY ELEMENTS OF WORK INCLUDING PHYSICAL, BIOMECHANICAL, PSYCHOSOCIAL, AND COGNITIVE.

These elements of work design (physical, biomechanical, cognitive, and psychosocial) align with hazards and risks identified in the Model WHS Act. The Act covers the need to reduce exposure and control risks in relation to physical, biological, chemical or psychological hazards. These different elements of work design relate to, and reflect, different disciplinary and historical perspectives (Campion & Thayer, 1988), and often have distinct evidence bases and intervention implications.

[8] We focused on this categorisation rather than physical, biomechanical, and psychological (suggested in the tender document) in order to better map onto existing models.

In the subsequent sections, we address each of the key elements of work separately. It is important to note that, although we address them separately, it is often the interactions amongst physical, biomechanical, cognitive, and psychosocial aspects that cause risks (for example, when an individual operates a potentially dangerous machine, but lacks sufficient job control to change the speed of operation to suit the situation).

Moreover, hazards and risks often co-occur. The same work design choice can affect both physical load patterns (such as work pace, repetitiveness) and psychosocial factors such as job demands and low job control. For example, forms of work organisation such as piece rate working or just-in-time production imply rapid working without rest breaks and consequently can sometimes be negative from both a physical/ biomechanical perspective as well as a psychosocial perspective.

The interaction amongst elements, and their co-occurrence, means that a holistic approach should be adopted when evaluating work, and when designing solutions. Risk factors are interrelated and interdependent so focusing on one or two factors in isolation will likely be ineffective as a strategy.

4.1 PHYSICAL ELEMENTS

All work takes place within a physical work environment. Physical elements make up the physical context of the work.

The Australian Strategy sets targets relating to reducing traumatic injury and death which will be achieved in part if physical work factors are improved. In addition, four national priority occupational disorders are especially likely to be affected by poor physical work factors: cancers, asthma, contact dermatitis, and noise-induced hearing loss. Although individual differences affect responses to physical factors to some degree, physical factors mostly have fairly universal health effects.

The main physical elements which have been studied in relation to health and safety at work include: physical hazards, chemical hazards, and biological hazards.

PHYSICAL HAZARDS

The Comcare definition of a physical hazard is “a factor within the environment that can harm the body without necessarily touching it”. Reviews of research into these factors have demonstrated how important it is to create a work environment which is maintained at an acceptable level of physical comfort (Campion & Thayer, 1988), and which eliminates or minimises the risks from physical hazards so far as is reasonably practicable.

There are specific legislative requirements to ensure physical hazards from plant and structures do not present a risk to health and safety. Physical hazards that need to be eliminated or risk managed include light, heat, cold, electricity, noise, vibration, pressure, ionising and non-ionising radiation, falls from working at heights and slips, trips and falls at level. Non-ionising radiation in the form of UV is a concern in Australia. Comcare has an extensive list of physical hazards that occur in the workplace (for example: http://www.comcare.gov.au/preventing/hazards/physical_hazards). All work health and safety regulators have relevant guidance material.

There are specific legislative requirements for many of the physical hazards and risks, however all the physical aspects of work should be considered during the design process.

Researchers have also studied physical hazards including the range noise, temperature and lighting should be kept within to provide comfortable working environments for workers that optimise performance and job satisfaction. For example, excessive noise can cause noise induced hearing loss in the long term and temporary hearing impairment, interfering with performance on complex tasks, inhibiting the hearing of safety warnings and instructions, negatively affecting social behaviour and creating annoyance amongst workers (Stansfeld & Matheson, 2003). Employees working in extreme temperatures can become hypothermic, develop hyperthermia, heat stress or heat related illnesses with the associated risks to health and decrements to safety behaviour (Ramsey, Burford, Beshir & Jensen, 1983) and performance (Pilcher, Nadler & Busch, 2002). If lighting is inadequate, this can lead to serious safety incidents (eg falls and trips over obstacles), failure to detect critical task information, eyestrain, or disrupt circadian rhythms (Boyce, 2010).

Chemical Hazards

Chemical hazards or agents are substances, mixtures and materials that can be classified according to their risks and dangers. The Work Health and Safety Regulations defines hazardous chemicals as a substance, mixture or article that satisfies the criteria for a hazard class in the Globally Harmonised System (GHS). Chemical types include which should be considered include gases, vapours, solids, fibres, liquids, dusts, mists and fumes.

Hazardous chemical are common in a wide variety of workplaces. Work involving exposure to hazardous chemicals has health and safety risks that may cause, cancers, respiratory diseases or cause skin irritation. Chemical hazards also arise through any failure of production processes releasing chemicals or from major events such as fires and explosions.

Airborne contaminants can be released from a material that may be in a form that is hazardous or non-hazardous and the process that is applied to it releases an airborne contaminant that is harmful to health. This can occur for example, where a kitchen bench top manufacturer produces stone bench tops, the stone bench top is not a hazardous chemical but when it is cut or grinding is carried out a large amount of dust is generated. This dust will contain crystalline silica that is harmful to health and a well-known occupational health hazard. Another example is welding, where heat is applied to metal object (not a hazardous chemical) and welding consumables and a mixture of harmful gases and fume is generated.

The design of work is also very important for the physicochemical hazards presented by chemicals. For example, chemicals with certain physical properties, such as flammable liquids, must be stored appropriately to, among other things, prevent the interaction of incompatible chemicals. The inappropriate storage and handling of chemicals can result in such things as fires or the release of toxic gas.

The design, manufacture, supply and use of hazardous chemicals are covered by specific Australian and international jurisdictional laws. This report will not explicitly cover the 'design of chemicals' but acknowledges the importance of good work design to help eliminate or minimise chemical hazards and risks in the workplace.

Biological Hazards

Biological hazards are organisms, or products of organisms, that pose a threat to the health of humans and other living things. Biological hazards include bacteria, viruses, fungi and parasites and other biological substances that may cause infection, allergy, toxicity or otherwise create a hazard to human health (Control of Substances Hazardous to Health Regulations[9]).

Work-related exposure to biological hazards includes for example:

- Contact with human blood and body substances (e.g.healthcare workers, emergency service workers)
- Contact with animals, animal products and waste (e.g. abattoir workers, veterinarians)
- Contact with the environment (e.g. construction workers, forestry workers)
- Contact with organic material (e.g. agriculture workers, waste industry workers)
- Contact with venomous wildlife, insects, poisonous plants and other such hazards.

Salmon & Parry (2002) reported the need for more comprehensive evidence to understand exactly whether and how exposure to biohazards can translate into chronic illness (see http://www.hse.gov.uk/research/rrpdf/rr006.pdf). Improved understanding of how exposure to biological agents occurs can inform work design.

> *In summary, good work design eliminates or minimises exposure to physical, biological, and chemical hazards and risks.*

4.2 Biomechanical Elements

[9] http://www.legislation.gov.uk/uksi/2002/2677/pdfs/uksi_20022677_en.pdf

Biomechanical elements of work include the possibility of hazardous manual tasks which cause work-related musculoskeletal disorders (WMSDs). These remain the most common compensable condition and are one of the priority disorders in the Australian Strategy. WMSDs are primarily caused by carrying out hazardous manual tasks (although they can also be caused by psychosocial factors[10]). Designing and/or redesigning work to reduce exposure to hazardous manual tasks risk factors will help to reduce the incidence of WMSDs.

The model WHS Regulation 2011, Schedule 19 defines hazardous manual tasks as "a task that requires a person to lift, lower, push, pull, carry or otherwise move, hold or restrain any person, animal or thing" that involves one or more of the following-

a) repetitive or sustained force;
b) high or sudden force;
c) repetitive movement;
d) sustained or awkward posture;
e) exposure to vibration."

Biomechanical hazards "may be single or repetitive movements and forces imposing stress on the body with a potential to cause or contribute to injury or disease affecting the musculoskeletal or neurological systems".[11] Burgess-Limerick states that "biomechanical Injuries occur when the forces on a body tissue (e.g. muscle, tendon, ligament, bone) are greater than the tissue can withstand. These injuries can occur suddenly as a consequence of a single exposure to a high force; they can also arise gradually as a consequence of repeated or long-duration exposure to lower levels of force … if the rate of damage is greater than the rate at which repair can occur a musculoskeletal disorder may result."

All work imposes some biomechanical demands. Good work design should minimise the exposure to the hazardous manual tasks.

As identified in the model WHS Regulation 2011, Part 4.2 Hazardous Manual Tasks and the Hazardous Manual Tasks Code of Practice 2011, the biomechanical risk factors which cause WMSDs are force, movement, posture, and vibration. We elaborate these next.

FORCE

Force refers to the amount of muscular effort required to perform a movement or task. Forceful muscular exertions overload muscles, tendons, joints and discs and are associated with most WMSDs. Force which includes one or more of the following is likely to be a risk.

- Repetitive – using force repeatedly over a period of time to move or support an object
- Sustained - applying force continually over a period of time
- High – exerting a high force such as when a worker describes the task as physically demanding, requires assistance due to the effort required, requires two or more people to perform the task and/or a "stronger" worker.
- Sudden – involves jerky, unexpected movements and/or with speed

MOVEMENT

[10] Australian Government, Australian Safety and Compensation Council, Research on the Prevention of work-related musculoskeletal disorders Stage 1 – Literature Review, 2006; and Burgess-Limerick, 2012

[11] Robin Burgess-Limerick (2012) Biomechanical Hazards, *Core Body of Knowledge for the Generalist OHS Professional*

Ideally tasks should involve slow to moderately paced and varied patterns of movement. Tasks that involve little or no movement of a body part or repeated performance of identical patterns of movement with a short cycle time are likely to pose a risk of injury, especially if combined with exposure to the other risk factors (Burgess-Limerick, 2012).

- Repetitive movement – using the same parts of the body to repeat similar movements over a period of time

POSTURE

Posture results from the task demands and the work area design and it influences the likelihood of injury form biomechanical hazards. Postures that are awkward and sustained are particularly hazardous.

- Sustained – part of or the whole body is kept in the same position for a prolonged period
- Awkward – part of the body is in an uncomfortable or unnatural position i.e. postures that are unbalanced or asymmetrical and/or postures that require extreme joint angles.

VIBRATION

There are two major types of exposure to vibration. They are whole body vibration and hand arm vibration. In both cases, the vibration exposure impacts on the risk of injury (Burgess-Limerick, 2012).

- Whole body vibration – occurs when vibration is transmitted through the whole body such as when driving a heavy machinery.
- Hand-arm – occurs when vibration is transferred to the hand and arm such as when using a vibrating tool

These risk factors often co-occur. That is, overload of the biomechanical system usually stems from a combination of factors (repetition, posture, force,). The seriousness of the above biomechanical risk depends on three key factors, and their combination (Simoneau et al., 1996):

- *Intensity*: most of the time the more intense the risk factor, the higher the risk.
- *Frequency*, or how often the risk occurs within a given time period.
- *Duration* can mean several things, including the amount of time in a shift that a person is exposed to a risk or the number of years an individual is exposed.

There is extensive evidence for these biomechanical risk factors as causing harm. For example:

- A US Congress report from the National Research Council and the Institute of Medicine (see Punnett & Wegman, 2004) concluded after an extensive review of more than 2500 articles that there is sufficient evidence to conclude that exposure to work-related risk factors such as those above cause WMSDs, even after accounting for age, gender, body mass index, recreational activities, disease, and other such factors. The AF (estimated proportion of disease that would be reduced in the exposed population if exposure was eliminated) statistics were (for example): manual material handling (AF = 11%-66%), frequent bending and twisting (AF = 19%-57%), heavy physical load (AF = 31%-58%), static work posture (AF = 14%-32%), whole body vibration (18%-89%), monotonous work (AF = 23%), high work pace (21%-48%), few rest break opportunities (AF = 33%-67%).
- The Musculoskeletal Committee of the International Commission for Occupational Health (Kilbom et al., 1996); the US National Institute for Occupational Safety and Health (Bernard, 1997), the European Agency for Safety and Health at Work (Grieco et al., 1998), and the SALSTSA Joint Program for Working Life in Europe (Sluiter et al., 2000) have identified that, despite some methodological weaknesses of individual studies, there is overall generally consistent evidence that workplace exposure to biomechanical (and psychosocial) factors affect the development of WMSDs. In the words of Punnett & Wegman (2004, p. 19). *"there is an international near-consensus that musculoskeletal disorders are causally related to occupational ergonomic stressors such as repetitive and stereotyped motions, forceful exertion, non-neutral postures, vibration, and combinations of these exposures".*
- Jobs that involve manual handling tend to have the highest risk of musculoskeletal disorders, strains and sprains (Khanzode, Vivek, Maiti & Ray, 2012).

- da Costa and Vieira (2010) undertook a systematic review to evaluate the evidence currently available for the many suggested risk factors for work-related musculoskeletal disorders. They concluded that the most commonly reported biomechanical risks factors with at least reasonable evidence for causing WMSDs included excessive repetition, awkward postures, and heavy lifting. In addition, risk factors with reasonable evidence of a causal relationship with WMSD include high biomechanical and psychosocial demands smoking, high body mass index, high psychosocial work demands and the presence of co-morbidities.

An exposure study by Safe Work Australia (2011[12]) reported that, from a survey of 4500 Australian workers, "*almost all workers reported some level of exposure to the biomechanical demands surveyed and 22 per cent were deemed to have high overall (composite) biomechanical demand exposure. In particular, young workers, male workers, night workers and lower skilled workers were most likely to report exposure and had the highest overall biomechanical demand exposure*".

In summary, good work design includes the prevention and/or minimisation of biomechanical risks associated with force, movement, posture and vibration (such as the risks caused by heavy lifting or excessive repetition). Such work design will be associated with lower musculoskeletal disorders.

4.3 Cognitive Elements

Cognitive elements of work are aspects of work that affect, and are affected by, the mind (Hollnagel, 1997) p. 1170). The topic of cognitive ergonomics considers these elements, and is concerned with ensuring "that people's mental capabilities and limitations are not exceeded" (Campion & Thayer, 1988, p. 73).

More specifically, the Human Factors and Ergonomics Society of Australia[13] states that cognitive ergonomics "is concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system. The relevant topics include mental workload, decision-making, skilled performance, human-computer interaction, human reliability, work stress and training as these may relate to human-system design". Within these areas of study, there are subtopics which are important to consider when designing work. For example, human-computer interaction involves taking into account things like "display formats, display elements, and display devices, as well as alarms and warnings, error detection and correction, information management, information integration (across tasks), support systems, training, degree of automation, etc" (Hollnagel, 1997, p. 1181).

Considering cognitive elements of work is becoming more important as physical tasks are increasingly being mechanised. In many occupations, information processing requirements are becoming more complex as a result of technological change, globalization, and other such factors that result in dynamic change.

The key cognitive processes that are important for understanding the way humans use information are attention, perception, and memory (Attwood, Deeb et al. 2004).

Attention describes the way individuals become aware of information and maintain awareness over time. Different types of attention might be required in different circumstances:

- *Selective attention* involves awareness of the most important information and directing cognitive resources to that particular source.
- *Focused attention* further requires the ability to filter out unwanted or unimportant information.

[12] http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/nhews-biomechanical

[13] (http://www.ergonomics.org.au/resource_library/definitions.aspx)

- *Divided attention* requires awareness of information from different inputs, modes, systems.
- *Sustained attention* requires vigilance and effortful awareness over sustained periods of time.

When designing tasks, it is important to consider what kinds attentional resources are demanded of workers and understand the human limitations associated with these demands.

The second process is perception which goes beyond attention and requires the active integration of information. Perception involves the interpretation of information patterns through knowledge, experience, feelings, and expectations. Perception involves the recognition of problems as well as the decision making to respond to problems.

The third process involves memory, or the ongoing storing and retrieval of information. The memory capacity of humans provides an important resource for problem solving but also sets some limits on how information can be effectively absorbed and acted upon. Three aspects of memory are important to consider in job design: sensory, short-term, and long-term memory capacity. Each form of memory entails advantages and limitations that influence the way information is processed. For example, sensory memory might limit the number of controls and warming signals that can be scanned by an individual. Short-term memory is critically important because it limits the number of elements that can processed at any one time. This processing limit suggests upper boundaries on information that should be presented to individuals as well as the kinds of supports that will be most helpful to aid the recall of information and decisions about information. Long-term memory determines the background resources that an individual can bring to operations conducted in short-term memory.

Risk arising from cognitive elements of work can be considered from two related perspectives: workload and complexity. Both of these aspects can influence attention, perception, and memory demands.

Mental Workload

Mental workload is the demand on the individual's cognitive resources. The impact can be assessed by the time required to attend to information, the mental effort required, or the psychological stress created through experiences of conflict, frustration and anxiety. There can also be risks associated when the demands are too low, such as during highly monotonous tasks, as boredom can impair attention and thereby contribute to accidents or poor performance.

Complexity

Wood (1988) defined four aspects of complexity: dynamism, connected parts, uncertainty, and risk. Each aspect of complexity can increase the cognitive demands of a task or set of tasks. Dynamism describes the speed at which information is conveyed and changes over time. Complexity also arises from the interconnections among information elements so the more linkages and dependencies between elements of information the greater the complexity. Uncertainty creates cognitive complexity because resources must be allocated to scanning and anticipating unexpected events. More serious consequences of a task also create complexity because workers must devote resources to understanding and preparing for greater risk. Complexity of tasks relative to worker capacity should be considered when designed work.

> *In summary, good work has mental requirements that do not exceed individuals' cognitive capabilities, highlighting the importance of designing work and work systems with reasonable levels of cognitive work load and complexity. Good cognitive work design should also ensure work is challenging and interesting, using peoples' skills and minimising monotonous tasks.*

4.4 Psychosocial Elements

Psychosocial elements concern the social, psychological, and organisational characteristics of the work that affect workers' motivation, stress-mediated psychological and physical ill-health, and wellbeing.

When considered from a health perspective, psychosocial elements are variously referred to as 'work stressors', 'psychosocial hazards', or 'psychological/ organisational risks'. For example, Cox and Griffiths (1995) defined psychosocial hazards as "*those aspects of work design and the organisation and management of work, and their social and environmental contexts, which have the potential for causing psychological, social, and physical harm*". From this stress perspective, risks associated with poor psychosocial hazards need to be removed, reduced, or ameliorated.

When considered from a motivational work design perspective, these aspects are referred to as 'motivational aspects of work design' (Humphrey, Nahrgang & Morgeson, 2007), 'intrinsic job quality', or sometimes 'job enrichment'. From this perspective, good work design involves actively building in particular work characteristics (such as job autonomy, task variety) into jobs and roles to increase worker motivation and engagement.

Multiple frameworks and syntheses of 'key' psychosocial elements abound. There is reasonable consensus across these frameworks and syntheses. Almost all frameworks identify as key elements: (1) job demands (such as work load, time pressure, and work pace); (2) job control/ autonomy; and (3) social support. These three elements are the core features of the extensively investigated demand-control theory of job strain (Karasek, 1979; Karasek & Theorell, 1990).

Almost all models and frameworks also cover the classic concept of job enrichment (Hackman & Oldham, 1976) via their inclusion of positive types of job content, such as task variety, autonomy, and skill utilisation; as well as evidence from the well-established model of role stress (Kahn, 1964), which includes role conflict, role clarity, and role stress

Increasingly models and frameworks encompass social aspects over and above social support, such as the provision of feedback, positive interpersonal relations, the quality of communication, and the absence of conflict.

Beyond these 'core' elements of job content and work roles, additional psychosocial elements have been identified, such as work schedules, environment and equipment, organisational culture and function, career development, payment factors, and the home-work interface. A sample of experts identified as emerging psychosocial hazards (European Agency for Safety and Health at Work, EU-OSHA, 2007):

- new forms of employment contracts and job insecurity (e.g. precarious contracts);
- the ageing workforce;
- work intensification (long working hours, work intensification);
- high emotional demands at work; and
- poor work-life balance.

To summarise the key psychosocial factors, Table 6 in Appendix C shows the eight psychosocial factors identified as risk factors for stress mediated ill-health by the Workplace Health and Safety Queensland[14], mapped against illustrative academic evidence (primarily meta analyses and reviews) and other policy-oriented evidence (such as the inclusion of these factors in other key frameworks). The eight psychosocial factors are:

1. Work demands, including aspects such as time pressure and mental/physical/emotional demands.
2. Job control, including worker choice and self-direction, input into decision making, consultation and communication, and having appropriate supervision.
3. Supervisor/ peer support, including having an organisational structure with clear reporting lines, and the provision of practical and emotional support.
4. Role variables, including role clarity, a lack of role conflict, and the demands caused by responsibility for others.
5. Managing relationships, including a lack of task / relationship conflict, and avoiding worker social isolation, bullying, harassment, and violence.
6. Recognition and reward, including elements such as feedback, performance reviews, opportunities for development, rewards program, low or unfair pay, lack of promotion prospects and under/over promotion, and work of low social value.

[14] http://www.deir.qld.gov.au/workplace/hazards/bullying-fatigue-stress-violence/resources/index.htm#.U48Vt_m1YqI

7. Management of change, including communication, consultation and participation, the review of roles, and provision of support.
8. Organisational justice, including distributive justice (fair outcomes), procedural justice (fair processes), and interactional justice (how people are treated when procedures are implemented).

Table7 in Appendix C summarises other psychosocial factors, beyond those identified in the Work Safe model, that have been linked to health and wellbeing outcomes.

Many reviews (e.g, Kelloway & Day, 2005), meta analyses (e.g., Humphrey, et al. 2007), and reports (e.g., Leka et al., 2008; WHO; EU-OSHA,2002b, 2007; 2009a; Eurofound, 2007; NIOSH 2002) have documented evidence that these various psychosocial factors affect a range of physical outcomes (e.g., cardiovascular functioning; musculoskeletal strain) and mental outcomes (e.g., psychological strain, depression, anxiety) amongst individuals. For example:

- Hauke et al., (2011; Work & Stress) summarised the results of 54 longitudinal studies as well as a range of meta-analyses investigating the effect of psychosocial factors on musculoskeletal disorders (MSDs). These authors concluded: "*the meta analyses showed statistically significant small to medium pooled effect sizes, indicating that the risk of onset of MSDs in all body regions is 15 to 59% elevated amongst employees exposed to adverse psychosocial working conditions*" (p. 251). Examples of adverse psychosocial factors for which there were significant associations with MSDs include: low social support, high job demands, low job control, low decision authority, low skill discretion, low job satisfaction, high job strain, and psychological stress.
- Landsbergis et al. (2011) reviewed the vast literature on cardiovascular disease (CVD), and summarised evidence for the following work factors as influences on CVD: high demand/low control work, effort-reward imbalances, jobs that involve a high level of vigilance to avoid disaster, long work hours, shift-work, downsizing, and a lack of organisational justice.
- Based on a comprehensive review, Kelloway & Day (2005; see also Burton, 2010) concluded there is solid scientific evidence that mental health is negatively affected by overwork, role stressors (role conflict, role ambiguity), working nights and overtime, poor quality leadership, aggression and bullying, and low job control. On the other hand, positive aspects of work such as job control and social support can enhance mental health.

A great deal of evidence has also documented performance and productivity consequences of psychosocial work elements, suggesting that what is very often good work from an individual health perspective also is good from an economic perspective. For example:

- Sickness absence, presenteeism, workplace harm, workers' compensation claims as well as the impact of early retirement are a cost to business (see Burton, 2010 for a review).
- Workers are taking 8.93 days sick and carers leave each per year, according to an Australian Survey[15]— Workforce loss due to mental illness is significant. Stress-related absenteeism from work and presenteeism costs employers in Australia around $10.1 billion per year, while the cost to the economy is around $14.8 billion per year[16].
- Several studies have shown that psychosocial work factors affect the likelihood of accidents and injuries (see Burton, 2010, for a review). Meantime, evidence also shows that accidents and injuries have significant costs (insurance increases, interrupted work, legal costs, return to work costs, etc). SMEs are particularly vulnerable to the costs of accidents and injuries because the latter have a relatively higher impact. In fact, 60% of SMEs having a disruption greater than 9 days go out of business (Gervais, et al., 2009). Evidence also shows the safest organisations are also the most competitive (Hamaleinan et al., 2006).
- Ill or injured workers, or those with mental ill health, have lowered productivity, including reduced creativity and innovation; increased absence; and greater likelihood of turnover (see Burton, 2010 for a review).
- As well as the extensive evidence identifying the positive health and wellbeing effects of a job in which workers can influence their day to day decisions, many studies have shown that job autonomy enhances job performance (because, for example, workers put more effort in to their work if they feel some ownership over decisions), especially behaviours such as creativity and innovation (see Parker, 2014).

[15] Direct Health Solutions, The *2013 Absence Management & Wellbeing* survey

[16] The Cost of Workplace Stress in Australia, Prepared for Medibank Private, August 2008, Canberra.

More broadly, recommendations for what constitutes 'good management' or 'effective leadership' frequently dovetail with the presence of positive psychosocial work factors. For example, the leadership style of 'transactional leadership' (identified as promoting good job performance) involves clarifying roles and providing feedback, and the leadership style of transformational leadership involves providing 'individualised consideration', thereby addressing elements such as support and career development.

In summary, good work design involves designing work tasks and systems to as to achieve as much as possible: reasonable work demands, job control, social support, clear and non-conflicting roles, positive relationships, appropriate levels of recognition and reward, effective management of change, and organisational justice. Other psychosocial factors beyond these eight might also be important to consider in particular situations.

5. PROCESSES OF WORK DESIGN

It is not enough to just understand what constitutes good work design. Nor is it sufficient to know that it is possible to change work to improve work design. One needs to understand how good work design is achieved, or the process of work design. In this section, selected key literature and evidence relevant to work design processes is noted. Key approaches and perspectives that we review here include:

- work design-specific approaches (including job enrichment, teamwork, sociotechnical systems approaches),
- risk management approaches,
- continual improvement process model approaches (plan, do, check, act),
- health promotion approaches,
- change management approaches, and
- human-centred design approaches.

5.1 WORK DESIGN-SPECIFIC APPROACHES

In the literature, work design-specific approaches have tended to focus on improving the design of work or work processes, primarily with the aim of enhancing the motivation and performance of workers, although health and wellbeing are often assessed as outcomes of these approaches.

SOCIOTECHNICAL SYSTEMS APPROACH TO WORK DESIGN

The sociotechnical systems approach to work design originated from Tavistock in the UK in the 1960s. The key philosophy of this important approach is that the technical and social aspects of the work should be designed simultaneously (Cherns, 1987), in contrast to the more typical approach of designing work with solely technical criteria in mind. In practical terms, this approach resulted in the introduction of self-managed teams (autonomous work groups) in which groups of workers with moderate to high levels of job control and high task variety work collectively to carry out an identifiable piece of the work.

Clegg (2000) argued that work design still tends to be techno-centric, with engineers playing the pre-dominant role. Consequently Clegg (2000) expanded Cherns' sociotechnical systems principles in order to balance this techno-centric perspective, and to better incorporate social, human, and organisational factors (including psychosocial elements of work) into the design process, including the design of work as well as the design of systems more broadly. Table 8 in Appendix D shows these key principles of sociotechnical system design.

Our proposed core and action principles for work design (Section 3) are strongly underpinned by the sociotechnical systems principles (the specific links are also shown in Appendix B, Tables 6,7, column 3). For example:

- Our core principle that "*good work design will be holistic*" encapsulates the sociotechnical systems principle that design is systemic (all aspects of a system are interconnected, so they should be designed jointly), and the core principle that 'good work design is applicable at many stages in the supply chain and across operations, products and processes' encapsulates the sociotechnical systems principles that 'design involves making choices' (existing work designs shouldn't just be taken for granted) and that 'design is an extended social process'.
- Likewise, the action principle "*actively involve the people who do the work, including those in the supply chain and networks*" is underpinned by the sociotechnical systems principle that 'systems and their design should be owned by their managers and users', and the action principle *"seek the best fit between the work environment, culture, systems of work, and the needs and capabilities of workers*" is congruent with the sociotechnical systems principle that 'system components should be congruent'.

JOB ENRICHMENT AND TEAMWORKING

There is a long history of designing work to enhance worker motivation and performance. Scholars have identified evidence-based principles for enhancing motivation at work through design. Table 9 in Appendix D shows principles for

job enrichment (which primarily apply to individual jobs) and principles for autonomous group working (which is job enrichment applied to team work).

Job enrichment involves creating more meaningful and autonomous work. Principles for job enrichment include, for example, "arrange work in a way which allows the individual worker to influence their own working situation, work methods, and pace" and "provide a sufficient variety of tasks within the job, and include tasks that offer some degree of worker responsibility and make use of the skills and knowledge valued by the individual". As can be seen, these principles primarily pertain to designing good work from a psychosocial perspective, and therefore are relevant to our core principle that "*good work design will be holistic*" (including psychosocial aspects, as well as other aspects).

With increased interdependence in the workplace, it has become more important to consider how to group individual jobs into teams. Table 10 in Appendix D shows questions to ask when designing work teams, with a positive response suggesting the appropriateness of teamworking (Medsker & Campion, 1997). Table 11 in Appendix D shows a similar set of principles from West (1996). Beyond these generic principles, principles have been designed to support teamworking within specific safety-critical contexts, such as within healthcare (e.g., TeamSTEPPS, Baker et al., 2006) and within the airline industry (Crew Resource Management, e.g., see Helmreich & Foushee, 1993).

Several of these principles for teamworking highlight the importance of introducing teams only when it 'makes sense' for the situation (when there is interdependence amongst tasks), which pertains to our action principle to "*seek the best fit between the work environment, culture, systems of work, and the needs and capabilities of workers*". Also relevant to this action principle, the teamworking principles highlight that changes in broader systems are often needed to ensure the success of teamwork, such as the importance of aligning performance management systems, information flows, training, and payment systems with the team structure (see Tables 10 and 11, Appendix D). As a further example, the teamworking principles highlight the importance of managerial support for the effective implementation of teams, which is relevant to the action principle "*ensure the commitment of decision makers and leaders*".

In contrast to the risk management approach (which is focused on reducing or ameliorating health and safety risks; see next), these work design-specific approaches focus on designing work that is motivating (as well as healthy and safe), thereby placing a strong emphasis on achieving better worker performance and organisational effectiveness through work design, relevant to our core principle "*good work design will enhance business success*".

5.2 Risk Management Approaches

The risk management approach is well established in work health and safety. It is a broader approach than the work design approaches described above, and is concerned with multiple methods and strategies to achieve the minimum requirements for healthy and safe work (including work design). Our action principle "a*pply a risk management approach, and monitor its effects*" explicitly links to this well-established approach.

The risk management approach "is a systematic evidence-based problem solving strategy… that starts with the identification of problems and an assessment of the risk that they pose, [and] then uses that information to suggest ways of reducing that risk at the source". Once the assessment of problems and risks is complete, and actions implemented, the whole process is then evaluated. Overall, risk management comprises risk assessment and risk reduction.

Work health and safety frameworks in Australia use a risk management paradigm (see, for example, *How to Manage Work Health and Safety Risks*: model Code of Practice, December, 2011, and see also Appendix A)[17]. The risk management approach is also frequently used in Europe (e.g., Leka et al., 2008b, Leka & Cox, 2010; Cox, 1993), and

[17] http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/633/How_to_Manage_Work_Health_and_Safety_Risks.pdf

is an approach endorsed by the UK Health and Safety Executive[18], the INRS in France (INRS, 2004), the European Commission (EC, 1996), and the International Labour Organisation (ILO, 2001).

The steps to undertake a risk management approach are described in detail in the model Code of Practice, and are summarised in Appendix A.

5.3 Continual Improvement Process Models involving Plan, Do, Check, Act

Burton (2012) summarised several approaches to the question of 'how' to get a healthy workplace, collectively referring to these approaches as Continual Improvement Process Models involving Plan, Do, Check, Act processes. These approaches are similar to the risk management model, but they derive from Deming's principles of quality improvement.

Many organisations use variations of Plan Do Check Act models (PDCA, Deming), which propose iterative processes in which a plan is made (Plan), implemented (Do), evaluated (Check), improved (Act), and then a new plan is made, and so on. Examples of health and safety management systems designed according to this process include the Canadian Centre for Occupational Health & Safety (CCOHS) and the WHO Regional Office for the West Pacific.

A systematic review of the continual improvement approach to health and safety was conducted in 2007 by the Institute for Work and Health. Results of studies that met the criteria for rigour were either positive or neutral, leading the authors to conclude that this is a promising approach. Nevertheless the authors cautioned that the body of evidence was insufficient to clearly advocate for or against such systems, and recommended further research. Subsequently the WHO proposed an elaborated model that went beyond systems theory to include principles from knowledge transfer theory and action research. This model identifies five core features (see Appendix D, Table 12) that underpin successful continual improvement processes. Table 13 in this Appendix provides a more detailed set of core steps involved in these approaches, with examples of how the steps can be applied within a small and a large enterprise.

One of the core features of effective continual improvement process models (Table 12) is 'leadership engagement', which is reflected in our action principle "*ensure the commitment of decision makers and leaders*". The core feature of 'involvement' is reflected in our action principle "*actively involve the people who do the work, including those in the supply chain and networks*". The core feature 'learn from others' is directly relevant to our action principle "*apply multi-disciplinary expertise and learn from evidence and experience*" and the core feature 'sustainability' is congruent with our action principle "*seek the best fit between the work environment, culture, systems of work, and the needs and capabilities of workers*".

5.4 Health Promotion Approaches

Rather than a primary focus on preventing ill-health or injury, a Health Promotion Approach focuses on interventions to promote positive health and wellbeing (Hassard et al., 2011; Jane-Llopis et al., 2007). The World Health Organisation also emphasizes the importance of health promotion[19], and has as a goal to "improve equity in health, reduce health risks, promote healthy lifestyles and settings, and respond to the underlying determinants of health".

Health promotion interventions concern "the process of enhancing protective factors that contribute to good health" (Pollett, 2007). In other words, these interventions concern developing conditions that enable 'optimal' health and functioning. Such interventions are argued to boost worker performance and productivity. Some mental health promotion interventions concern work design (e.g., the introduction of flexible work hours), whereas other mental health promotion interventions focus on secondary and tertiary interventions such as providing free counselling. The

[18] http://www.hse.gov.uk/risk/index.htm

[19] http://www.who.int/healthpromotion/en/

promotion approach is congruent with our core principle "*good work design will enhance protective factors that contribute to good health*".

Table 14 (Appendix D) shows "good practice principles" identified by Hassard et al., (2011) that support effective health promotion initiatives. Hassard et al., (2011) also provide short case examples from across Europe to illustrate each principle. Almost all of these good practice principles have been incorporated into our principles. For example, the good practice principle of a health promotion approach 'a holistic intervention approach' (e.g., considering physical, mental and social wellbeing) dovetails with our core principle "*good work design will be holistic*", and the good practice principle of "on-going and continuous" (rather than interventions being a 'one-off') relates to our core principle that
"good work design will be applicable at many stages in the supply chain and across operations, products and processes".

5.5 Change Management Principles

It is relatively rare that work can be designed 'from scratch' in a greenfield site. Much more common is that work needs to be 'redesigned' in existing work places. Consequently, work design is often a process that involves change. A great deal of knowledge and expertise has accumulated as to how to design and implement change effectively, resulting in widely accepted principles of change management. For example, a classic model of managing change is Kotter and Rathbeger's (2006) eight step model of change. The eight steps are[20]:

Step 1. Establishing a Sense of Urgency	Help others see the need for change and they will be convinced of the importance of acting immediately.
Step 2. Creating the Guiding Coalition	Assemble a group with enough power to lead the change effort, and encourage the group to work as a team.
Step 3. Developing a Change Vision	Create a vision to help direct the change effort, and develop strategies for achieving that vision.
Step 4: Communicating the Vision for Buy-in	Make sure as many as possible understand and accept the vision and the strategy.
Step 5: Empowering Broad-based Action	Remove obstacles to change, change systems or structures that seriously undermine the vision, and encourage risk-taking and nontraditional ideas, activities, and actions
Step 6: Generating Short-term Wins	Plan for achievements that can easily be made visible, follow-through with those achievements and recognize and reward employees who were involved.
Step 7. Never Letting Up	Use increased credibility to change systems, structures, and policies that don't fit the vision, also hire, promote, and develop employees who can implement the vision, and finally reinvigorate the process with new projects, themes, and change agents.
Step 8. Incorporating Changes into the Culture	Articulate the connections between the new behaviors and organizational success, and develop the means to ensure leadership development and succession.

Because the process of work design often involves change, change management principles can be a useful consideration. Appendix D (Table 15) shows an elaborated set of change management principles (in this case, change management applied to conducting field research).

Our action principles are underpinned by change management theory and research. For example, our action principle of "*ensure the commitment of decision makers and leaders*" is consistent with the change management principle (above) of 'creating the guiding coalition' and, from Table 13, Appendix D, change principle 10 'identify a competent, dynamic change leader' and change principles 27/28 regarding the need to ensure appropriate resources to support the change and the need for securing management support. Our action principle "*actively involve the people who do the work, including those in the supply chain*" is consistent with the change principle of 'empowering broad-based action' (above) and (from Table 13, Appendix) principle 13 'involve workers'. As a final example, our action principle "*seek the best fit between the work environment, culture, systems of work, and the needs and capabilities of workers*"

[20] http://www.kotterinternational.com/our-principles/changesteps

is reflective of change management principle 5 (Table 13) about tailoring change to fit different units as well as step 8 above 'incorporate changes into the culture'.

Our core principles are also underpinned by change management theory and research. For example, our core principle that "good work design will be holistic" maps on to change management principle 1 (Table 13, Appendix D) advocating 'a holistic, systems approach' to change.

5.6 Human-Centred Design/ Human Factors Engineering Approaches

Human factors engineering refers to the application of human factors principles to the design of technology.

Human-centred design (also referred to as user-centred design) refers to an approach that involves putting users views' at the forefront of design, such as when designing new technologies or new systems. In human-centred design, diverse experts (such as designers, researchers) work together with potential users, who are considered 'experts of their experiences' to bring together ideas into innovations and solutions to problems (see, for example, Steen, 2102).

Human-centred design involves approaches such as participatory design, empathic design, iterative design, ethnography, co-design, and the currently fashionable 'design thinking' (see Brown, 2008, and for a contemporary application, see http://www.betterbydesign.org.nz/). Human-centred design is closely related to the sociotechnical systems approach to work design referred to above, but it is more specifically focused on the design of new systems and products.

Human-centred design is based on four principles:

1. Involving users to better understand their preferences, needs, and practices.
2. Searching for an appropriate allocation of function between people and technology.
3. Organizing project iterations in conducting the research and in generating and evaluating solutions.
4. Organizing multidisciplinary team-work.

These principles are incorporated into our principles of good work design. Principle 1 above regarding involving users is part of our action principle "*actively involve the people who do the work, including those in the supply chain and networks*". Principle 2 regarding searching for an appropriate allocation of function between people and technology relates to our core principle that "good work design will be holistic" because a holistic approach to work design includes actively considering work design and people issues alongside technical aspects (i.e., the sociotechnical systems principle above of joint consideration of social and technical factors). Principle 3 regarding project iterations and the need for generating and evaluating solutions relates to our action principle "*apply a risk management approach, and monitor its effects*". Finally Principle 4 regarding multidisciplinary team work supports our action principle of "*apply multi-disciplinary expertise and learn from evidence and experience*".

5.7 Summary

There are well-established approaches for: designing work and work systems, managing risk in the workplace, continuously improving work processes, designing work and organisations to promote health, effectively managing change, and designing technology with a human-centred perspective. The theory, principles and evidence from all of these approaches has been integrated and analysed to inform our core and action principles identified in Section 3.

6 LINKS AND RESOURCES

AFOEM Position Statement Improving Workforce Health and Workplace Productivity
http://www.racp.edu.au/page/racp-faculties/australasian-faculty-of-occupational-and-environmental-medicine/realising-the-health-benefits-of-work/latest-news/

AFOEM Position Statement Good Work
http://www.racp.edu.au/page/racp-faculties/australasian-faculty-of-occupational-and-environmental-medicine/realising-the-health-benefits-of-work/latest-news/

Australian Safety and Compensation Council, Guidance on the Principles of Safe Design for Work
http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/gm2006principlesofsafedesign
http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/154/GuidanceOnThePrinciplesOfSafeDesign_2006_PDF.pdf

Australian Faculty of Occupational and Environmental Medicine (AFOEM) Consensus Statement
www.racp.edu.au/page/afoem-health-benefits-of-work

Australian Faculty of Occupational and Environmental Medicine (AFOEM) on the Health Benefits of Work
www.racp.edu.au/page/afoem-health-benefits-of-work

Canadian Centre for Occupational Health and Safety
http://www.ccohs.ca/oshanswers/hsprograms/job_design.html

Canadian OHS Interventions to Address Physical Risks
http://www.ccohs.ca/oshanswers/hsprograms/hazard_control.html

Center for Chemical Process Safety, 2010
https://www.aiche.org/ccps

Cochrane Occupational Health Field
http://osh.cochrane.org/osh-reviews

Comcare list of physical hazards in the workplace
http://www.comcare.gov.au/preventing/managing_risks_in_the_workplace
http://www.comcare.gov.au/preventing/hazards/physical_hazards

Control of Substances Hazardous to Health Regulations
http://www.legislation.gov.uk/uksi/2002/2677/pdfs/uksi_20022677_en.pdf

European Agency for Safety and Health at Work
http://osha.europa.eu/publications/reports/7807118

Health and Safety Executive Management Standards for Stress
http://www.hse.gov.uk/stress/standards/
https://www.healthy-workplaces.eu/en/tools-and-resources/practical-tools

Health and Safety Executive Management report on biological hazards at work
http://www.hse.gov.uk/biosafety/biologagents.pdf
http://www.hse.gov.uk/research/rrpdf/rr006.pdf
http://www.hse.gov.uk/offshore/biological-hazards.htm

Health and Safety Executive Management guidance on effective design of display screen equipment
http://www.hse.gov.uk/research/rrpdf/rr045.pdf
http://www.hse.gov.uk/pubns/indg36.pdf)

Health and Safety Executive Management related to Musculoskeletal Disorders (MSDs)

http://www.hse.gov.uk/msd/msds.htm

Health and Safety Executive Management to risk management
http://www.hse.gov.uk/pubns/indg163.pdf

Human Factors and Ergonomics Society of Australia
http://www.ergonomics.org.au
http://www.ergonomics.org.au/resource_library/definitions.aspx

National Academy of Science
http://www.nasonline.org/

NIOSH's Prevention Through Design
http://www.cdc.gov/niosh /programs/ptdesign/
http://www.cdc.gov/niosh/docs/97-141/pdfs/97-141.pdf

Safe Work Australia
http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/gm2006principlesofsafedesign
http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/key-whs-stats-2014
http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/119/WorkRelatedMusculoskeltalDisorders_2006Australia_2006_ArchivePDF.pdf

Workplace Health and Safety Queensland
http://www.deir.qld.gov.au/workplace/hazards/bullying-fatigue-stress-violence/resources/index.htm#.U48Vt_m1YqI
http://www.deir.qld.gov.au/workplace/zeroharm/index.htm#.U48NiPm1YqI

World Health Organization
http://www.who.int/en/

World Health Organization Healthy Workplace Framework and Model
http://www.who.int/occupational_health/healthy_workplace_framework.pdf

WHS Act & Code of Practice 2011
http://www.comcare.gov.au/the_scheme/the_whs_act/codes_of_practice

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8 About the Authors

8.1 Winthrop Professor Sharon K. Parker

Sharon K. Parker is a Winthrop Professor in Management & Organisations at the University of Western Australia's Business School. She is currently one of only two Australian Research Council Future Fellow's in the field of Business, and she is an Associate Editor for one of the most prestigious and highly-ranked journals in the field (Journal of Applied Psychology). She is a Fellow of the Society for Industrial/Organisational Psychology (US), chair/ co-founder of the Society for Organisational Behaviour in Australia, and is the co-founder and co-director of the Accelerated Learning Laboratory@UWA (ALL@UWA).

Professor Parker has 111 publications (including 61 refereed journal articles, many in A/A* journals; and 7 books/special issues). Her work has been cited more than 6500 times, and is cited across management, psychology, sociology, and engineering. Her h,g citation indices are 34, 75, respectively. Recognition of her research standing and impact is shown by her high profile journal editorships, prestigious roles in the discipline, regular invitations for book chapters and key note addresses, and the award of an ARC Future Fellowship. Several of her publications have been recognised for their excellence.

Professor Parker is recognised as a world leader in the field of work design, as shown by a recent invitation to publish an article on this topic in the *Annual Review of Psychology* (Parker, 2014), one of the most high impact (IF > 15) outlets in our field. This invitation builds on her efforts to develop and test innovative work design theory. For example, she developed an elaborated theory of work design that reflects the changes in today's context, as well as addresses other limitations of traditional theories (see Parker, Wall & Cordery, 2001; Parker & Wall, 1998). Almost all text books and reviews of work design cite this expanded work design theory. Professor Parker has also carried out numerous empirical studies testing elements of this model. For example, one of her specific and most innovative contributions concerns showing that work design can affect workers in fundamental and enduring ways, such as affecting their proactivity, self-confidence, empathy, and aspiration.

Professor Parker's ability to translate scientific and technical material to suit multiple audiences is shown by her frequent engagement in local business activities, and her contribution to practice through executive teaching, consulting, and expert-witness work. For example: she was the key note speaker at the 2011 WA Chamber of Minerals & Energy safety conference; she presented to over 200 managers and executives at a UWA Business Breakfast; she was the key note speaker at the 2013 Department of Corrective Services Senior Leadership Development Day; and she was an invited speaker at the 2014 (Feb.) Australian Oil & Gas Convention. The impact of Professor Parker's work is shown by invitations to participate in policy-oriented forums. For example, she participated in the MacLeod Review of Employee Engagement (UK Department for Business Enterprise and Regulatory Reform), which reported to UK Ministers in late 2009. Her work has also contributed to the development of work-stress policy by the UK government (for example, her Health and Safety Executive funded work has been used to develop good work guidelines; she was an expert for a systematic review funded by the HSE on work design), and she has been an invited participant in NIOSH-funded policy-oriented discussions about work design.

8.2 WINTHROP PROFESSOR MARK A. GRIFFIN

Mark Griffin is Winthrop Professor of Organisational Psychology and Director of the Centre for Safety at the University of Western Australia. He is Associate Editor for leading international journals in the area of work psychology (Journal of Applied Psychology) and organisational management (Journal of Management). He is a fellow of the Society of Industrial/Organisational Psychology and past Chair of the Research Methods Division of the Academy of Management.

Professor Griffin has contributed extensively to knowledge of safety and health at work. He has published studies in leading journals on the nature of safety culture and climate (Griffin & Neal, 2000), the impact of work on accident rates (Neal & Griffin, 2006), and the link between safety climate and driving accidents at work (Newman, Griffin, & Mason, 2008). He is familiar with the regulatory context of safety and recently designed new guidelines for assessing the safety of offshore oil and gas facilities for Australia's off-shore regulator (Griffin et al., 2014).

Professor Griffin has methodological expertise appropriate for conducting and evaluating complex research projects particularly multilevel and longitudinal research design. He published an influential chapter in the leading of book on multilevel theory for management researchers (Hofmann, Griffin, & Gavin, 2000) that has been cited over 500 times. He has published one of the few papers specifying analyses to test bottom-up processes in organisations to explain the implications of individual performance on aggregate outcomes (Griffin, 1997).

Professor Griffin has managed large-scale projects in related areas of leadership, safety, work performance, organisational climate, and work stress. Professor Griffin has developed a range of assessment tools related to safety and leadership. These measures have been used by companies in Australia, Europe, UK, US, and Asia.

APPENDIX A: MODEL WORK HEALTH & SAFETY ACT RISK MANAGEMENT PROCESS

The WHS Code of Practice and its 'Risk Management Process'[21] involves a four-step planned process involving actively thinking about what could go wrong at the workplace and what the consequences could be, and then doing whatever is 'reasonably practicable' to "eliminate or minimise health and safety risks arising from your business or undertaking". The four steps are:

1. identify hazards – find out what could cause harm
2. assess risks if necessary – understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening
3. control risks – implement the most effective control measure that is reasonably practicable in the circumstances
4. review control measures to ensure they are working as planned.

The risk management process (depicted in the figure below) highlights the importance for effective risk management of the commitment to health and safety from those who operate and manage the business or undertaking, and reiterates the importance of consultation for each of the four steps.

FIGURE: RISK MANAGEMENT PROCESS (MODEL RISK MANAGEMENT CODE OF PRACTICE)

21 http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/633/How_to_Manage_Work_Health_and_Safety_Risks.pdf

APPENDIX B: ELABORATED EVIDENCE FOR PRINCIPLES (SECTION 3)

TABLE 4: CORE PRINCIPLES OF GOOD WORK DESIGN WITH ELABORATION, LINKS, AND EVIDENCE

Core Principles	Elaboration and Link To Australian Strategy/ Model Legislation	Evidence and Further Guidance
Good work design will give the highest level of protection against harm that is reasonably practicable	• Work tasks and systems should be designed to eliminate or minimise exposure to physical, biomechanical, cognitive, & psychosocial hazards & risks. • All workers regardless of their occupation or how they are employed have the right to a healthy and safe working environment (Australian Strategy p 4). • Workers and other persons should be given the highest level of protection against harm to their health, safety, and welfare from hazards and risks arising from work or from specified types of substances or plant as is reasonably practicable (model WHS Act 2011). • Prevention activities should be directed to where there is the greatest potential for reducing hazards (Australian Strategy, p. 8). Hazards and risks are most effectively controlled at the source (Australian Strategy, p. 8). • The hierarchy of controls measures should be used as a means to ensure that the highest level of protection reasonably practicable is achieved (model WHS Regulations 2011, and further explained in the relevant Code). • Where the hazard associated with new technology exists but the level of risk is not certain, the risk should be assumed to be high and managed accordingly until the actual level of risk is known (Australian Strategy, page 8) • Unanticipated risks can emerge from the complex interaction of people, tasks, equipment/ tools, and the organisation. This means it is essential to design and support systems to ensure review and monitoring, as well as rapid reporting, of potential or emerging hazards by all workers.	• Controlling hazards at the source relates to Clegg's (2000) sociotechnical principle 12 that 'variance should be controlled at the source' (Appendix D, Table 8). • NIOSH's Prevention Through Design program highlights the importance of a prevention-focused approachhttp://www.cdc.gov/niosh/programs/ptdesign/. • How to Manage Work Health & Safety Risks Code of Practice, Safe Work Australia (Dec., 2011) provides guidance. • Section 4 of this report summarises information about the hazard areas of physical, biological, chemical, biomechanical, cognitive, and psychosocial hazards.
Good work design will be holistic	• When work is designed, redesigned or the hazards and risks assessed, the physical, biomechanical, cognitive, and psychosocial requirements of work should be systematically considered as part of good work design, as should the person, and the wider work environment, systems and tasks. • New initiatives, technologies, and change in organisations (e.g., new IT systems, downsizing, restructuring) have implications for work design, and work design should be assessed at these decision points.	• Section 4 of this report reviews evidence for the need to consider each of these elements when designing healthy and safe work. • Clegg (2000) sociotechnical principle 2 is that people matter, and humans should be seen as assets not costs or error to be designed out of the system (see Table 8, Appendix D). • EU guidance highlights importance of a holistic approach (e.g. see Hassard et al., 2011)

TABLE 5 (CONTINUED)

Core Principles	Elaboration and Link To Australian Strategy/ Model Legislation	Evidence and Further Guidance
Good work design is applicable at many stages in the supply chain and across operations, products and processes	• Work organisation should not be 'taken for granted': there are typically many options for improving the design of work. Approaches need to be context specific. • Physical, biomechanical, cognitive, and psychosocial requirements of work should be considered in the conceptual design phase, build, manufacture, use, and handling stages of a product/ service cycle., maintenance or disposal phases. • Work design issues are relevant at start up, maintenance, and downsizing/ closing down of an organisation.	• How to Manage Work Health & Safety Risks Code of Practice, Safe Work Australia (Dec., 2011) provides guidance as to when health and safety hazards should be considered (p. 6). • Clegg (2000) sociotechnical system principle 3 concerns how there are many choices for work design but these are often not considered (Table 8, Appendix D). • Campion & Thayer (1988) discussed how poor performance is usually erroneously attributed to the individual rather than the work design.
Good work design will enhance protective factors that contribute to good health	• As defined by the World Health Organisation, health is a "state of complete physical, mental, and social wellbeing, not merely the absence of disease or infirmity". • Designing good work can not only mitigate short term risks to prevent injury and illness, but can foster and support health over the longer term, such as by considering the long-term effect of work on musculoskeletal disorders, mental health and/or cardiovascular functioning. • Well-designed, healthy and safe work will allow workers in Australia to have more productive working lives.	• Many models and scholars highlight the importance of efforts to enhance and maintain good health, beyond avoidance of harm (e.g., Hassard et al., 2011; Jane-Llopis et al., 2007; Pollett, 2007; Parker & Wall, 1998). • As noted in the report (Section 4), there is evidence that work affects health over the long-term (for example, low job control and high job demands can cause cardiovascular disease). • Work design is often initiated to improve performance, and seeks to promote positive worker outcomes such as commitment, motivation, and wellbeing. Section 5 details a health promotion approach which explicitly focuses on achieving good health.
Good work design will enhance business success	• Good work health and safety improves long-term business productivity by preventing injuries/illnesses and associated costs; promoting health, wellbeing and capacity to work; and fostering innovation, quality, efficiency through continuous improvement (Australian Strategy, p. 5). • Well-designed work should help manage risks to business sustainability and profitability by making work processes more efficient and effective and by improving product and service quality.	• As reported in Section 2.1, there is considerable evidence that good health and the design of good work has economic and financial benefits for organisations (see also Burton, 2010).

TABLE 6: ACTION PRINCIPLES FOR WORK DESIGN WITH ELABORATION, LINKS, AND EVIDENCE

Actions	Elaboration and Link To Australian Strategy/ Code	Evidence and Further Guidance
Apply a risk management approach, and monitor its effects	• A systematic risk management approach should be applied in every work place that involves identifying hazards, assessing the risks if necessary, controlling the risks, and maintaining and reviewing control measures. • After implementation of work design initiatives, an employer should monitor and assess whether the intervention/s met the objectives. Both the content and process of work design should be assessed. • Designing good work is not a one-off event. Designs or redesigns should be continually monitored and adjusted, and the focus should be on sustainability in the long-term.	• See Section 5.2 of the report and Appendix A. • The HSE (Leka & Cox, 2010) and EU-OSHA (Van Stolk et al., 2012) identify steps of risk management/ continuous improvement similar to the Australian Model WHS Act. • The HSE Sensible Risk Management Principles highlight the importance of focusing on the most serious and frequent risks. • Many scholars have identified the importance of continuous monitoring and evaluation of work designs (e.g., Clegg 2000, principle 16; Cox et al., 2005; Parker & Wall, 1998, principle 17; Holden et al., principle 30; Hassard et al., 2011, principle 7).
Ensure the commitment of decision makers and leaders	• The implementation work design or redesign is most effective when there is high level support and endorsement. • Workers need to observe management's visible commitment and engagement to good work. • It takes time and resources to properly undertake an effective work design or redesign process. • Evidence suggests there are long-term net benefits to such investment.	• Most models of risk management/ continuous improvement/ change highlight the importance of leadership commitment (e.g., WHO Burton (2010) feature 1 ; EU-OSHA Mental Health Promotion Good Practice 4; Hassard et al., 2011, EU-OSHA; Holden et al., 2008, change principle 3). • As noted by Clegg (2000) principle 18, good design requires resources. Design is also often political (principle 19), hence the importance of support at the highest level (Appendix D, Table 8). • Considerable research has shown that effective work design can result in performance and productivity benefits for organisations (e.g., Burton, 2010; Parker & Wall, 1998).

TABLE 5 (CONTINUED)

Actions	Elaboration and Link To Australian Strategy/ Code	Evidence and Further Guidance
Actively involve the people who do the work, including those in the supply chain and networks	• The person conducting a business or undertaking must, so far as is reasonably practicable, consult, in accordance with this division and the regulation, with workers who carry out work for the business or undertaking who are, or are likely to be, directly affected by a matter relating to health and safety (model WHS Act 2011). • Consultation involves: sharing information, reasonable opportunities for people to express their views, raise issues, and contribute to decision making; taking into account views; advising workers of the outcomes of consultation in a timely manner; and involving any health and safety representatives in the consultation (model WHS Act 2011). • All levels of workers have a role to play. • Relevant stakeholders in the supply chain should be included in the work design process. Involvement is advantageous because: of their local expertise about the work; it increases understanding of the impacts of good or poor design decisions on upstream and downstream participants; it increases ownership of the change; and because active involvement results in 'protective factors' for work stress, such as support, feelings of control, and perceptions of fairness.	• Most models and scholars argue for the need to go beyond consultation to the active engagement of those who do the work in any design process, e.g., Clegg (2000) sociotechnical principle 5, 15. Leka et al., 2008 identified involvement as a key factor for success in work-stress interventions. See also WHO Healthy Workplace Framework & Model, Burton, 2010); Hassard et al., 2011, EU-OSHA. • Lamontagne et al., (2007) found that worker participation was integral to systems approach to work stress interventions, with systems approaches being overall most effective in improving both individual and organisational outcomes.

TABLE 5 (CONTINUED)

Actions	Elaboration and Link To Australian Strategy/ Code	Evidence and Further Guidance
Seek the best fit between the work environment, culture, systems of work, and the needs and capabilities of workers	• Work design should recognise the fit between human capabilities and the work people are required to perform. Human physical and mental capacity need to be accommodated to minimise harm 'as far as reasonably practicable'. • Creating good work requires that jobs and tasks be designed to accommodate workforce diversity including the abilities, and vulnerabilities of workers, and those returning to work following injury or illness (Australian Strategy, p. 8). • Poor work design can be the root cause of performance issues and should be assessed and managed accordingly (Campion & Thayer, 1998). • Which work design is best depends on multiple factors including technology, people, strategy, occupation, etc. What is good for one situation cannot be assumed to be good for another, so off-the-shelf solutions will rarely be an appropriate option. Good work design is 'fit for purpose', and should reflect the needs of the organisation including owners/ managers and workers. • Failure to take broader organisational factors into account can result in poor work design. Example structures/ systems that need to be considered include training, recruitment/selection, payment, information systems, work layout, and work health and safety processes.	• The need for a context-specific approach that focuses on 'fit for purpose' is inherent in the risk management approach. • Clegg (2000) sociotechnical principle 7 is that design is contingent, with no 'one best way'. The approach should be to achieve a fit between work design, individuals and the context. Principle 4 is that design should meet the needs of the business, users, and their managers. Principle 6 cautions against allowing fads and fashion to dictate work design choices. Principle 2 highlights that work practices and technology should support humans meeting their goals. • The Canadian Centre for Occupational Health and Safety highlights importance of accommodating workers' mental and physical characteristics, see http://www.ccohs.ca/oshanswers/hsprograms/job_design.html • Simon's (1957) idea of bounded rationality refers to the idea that humans do not always behave rationally due to limitations in information processing capabilities. • Clegg (2000) principle 10 is that system components need to be congruent for an effective work design. Similar guidance occurs in Parker & Wall's (1998) work design principle 16; West (1996) principle 15; Holden et al., (2008) principle 1 (see Appendix D). • Systems theory approaches to organisation design argue for the importance of alignment of all elements of an organisational system (e.g., Galbraith's 2008, STAR model of organisational design), as do bundle approaches to strategic human resource management (e.g., Guest & Conway, 2011).

TABLE 5 (CONTINUED)

Actions	Elaboration and Link To Australian Strategy/ Code	Evidence and Further Guidance
Apply multi-disciplinary expertise and learn from evidence and experience	• Experts in work design should be sought if required, for example human resource, engineers, managers, users, system designers, psychologists, human factors and ergonomics specialists. • Different people involved in work design (as relevant) need to work together to as they can provide different views and insights about the issues and are then able to learn from each other. • Expertise about improving the design of cognitive work in complex systems or high risk work may need to sought. • Continued improvement in work health and safety requires ongoing collaboration amongst multiple parties involved in work design (Australian Strategy, p. 8). • Failures, such as near misses, injuries and illnesses, are an important source of information about design failures or potential failures.	• Clegg's (2000) principle 17 (Appendix D, Table 8) states that design is too often dominated by one perspective (those with technical expertise), which constrains the work design choices that are considered, to the detriment of work effectiveness. • Burton (2010), point 4, argues for the importance when improving health of workers of: involving individuals with the right expertise, accessing relevant information, and visiting other organisations doing similar things. • Learning from experience, including from accidents and incidents, promotes increased safety (see, for example, Haunschild & Sullian, 2002) as well as outcomes like productivity and service quality (e.g., Argote et al., 1990).

APPENDIX C: ELABORATED EVIDENCE FOR PSYCHOSOCIAL WORK ELEMENTS (SECTION 4.4)

TABLE 7: PSYCHOSOCIAL WORK FACTORS[22] MAPPED AGAINST EVIDENCE

Psychosocial Work Element	Illustrative Academic Evidence	Other Evidence
1. Work demands • Time pressure • Mental demands • Physical demands • Emotional demands	• Rick et al., (2002) systematic review: work load factors linked to job strain & other subjective stress outcomes as well as work injury & absence. • Lee & Ashforth (1996) meta analysis: work load linked to depersonalisation. • Houtman et al (1994): work pace affects musculoskeletal problems. • Eurofound (2010) identified link between work intensity and workers' health and wellbeing, as well as evidence of increased work intensity.	• Present in the ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety & Health at Work, 2012). • European Agency for Safety & Health at Work (2007) identified long working hours, work intensification as an emerging psychosocial hazard due to changes in the workplace. • European Agency for Safety & Health at Work (2007) identified high emotional demands at work as an emerging psychosocial hazard due to changes in the workplace. • Work load/ work pace in World Health Organisation Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008).
2. Job control • Choice/ self-direction • Input into decision making • Consultation & communication • Appropriate supervision	• Rick et al., (2002) systematic review: job control/ decision authority linked to job strain, job satisfaction, motivation, turnover intention and to lesser extent objective strain indicators such as sickness and absence. • Spector (1986) meta analysis: positive links decision authority with motivation, commitment etc, and lower intention to quit, absenteeism & turnover. • Lee & Ashforth (1996) meta analysis: low participation association emotional exhaustion. • Allebeck & Mastekaasa (2004) systematic review: low control associated more sickness absence • Humphrey et al.'s (2007) meta analysis showed that a lack of job control was associated with turnover intentions, lower performance effectiveness, job dissatisfaction, and a lack of commitment. • Loher et al., (1985) meta analysis: autonomy predicts job satisfaction	• Present in the ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety and Health at Work, 2012) • Present in World Health Organisation Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008). • Identified as key factor in almost all major models of work design, such as the Job Characteristics Model and the Demand-Control Model of job strain (see Parker, 2014).

[22] Source: Risk factors for work-related stress identified by Workplace Health and Safety Queensland, http://www.deir.qld.gov.au/workplace/hazards/bullying-fatigue-stress-violence/resources/index.htm#.U48Vt_m1YqI

TABLE 6 (CONTINUED)

Psychosocial Work Element	Illustrative Academic Evidence	Other Evidence
3. Supervisor/ peer support • Organisational structure (clear reporting lines) • Provision of practical support (information provision, training and development, constructive feedback) • Emotional support	• Chiaburu & Harrison (2008) showed from a meta analysis of 161 studies that *co support* and *co antagonism*, were linked to important worker-related outcomes (role perceptions, work attitudes, withdrawal, and effectiveness). • Blegen (1993) meta analysis: higher communication from peers/supervisors predicted nurses job satisfaction. • Rick et al., (2002) identified lack of support as predicting job dissatisfaction, depersonalisation, intention to leave, and sickness absence. • Viswesvaran et al., 1999 meta analysis: social support reduced strain, mitigated stressors, and moderated link between stressors and strain. • A meta analysis of 85 studies by Kossek et al., (2011) highlighted the importance of work–family-specific support in reducing workers' work–family conflict experiences.	• Part of 'interpersonal relationships' in ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety and Health at Work, 2012) • Part of WHO Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008). • Identified as key element in major models of work design, e.g., demand-control-support model (Karasek & Theorell, 1990).
4. Role variables • Role clarity (lack of ambiguity) • Role conflict • Responsibility for others	• Jackson & Schuler (1985); Abramis (1994); Fisher & Gitelson (1983) meta analysis show role ambiguity and conflict linked to job dissatisfaction and tension, also reduced performance. • EU-OSHA (2000); Cooper et al., 1982; and other reviews have identified that responsibility for others is another source of role stress.	• Present in the ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety & Health at Work, 2012) • Present in World Health Organisation's Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008).
5. Managing relationships • Task conflict (role clarity; communication) • Relationship conflict (e.g, teamwork) • Social isolation, bullying, harassment, violence, etc	• A meta analysis by Bowling & Beehr (2006) showed that harassment was negatively related to the wellbeing of individual workers and their employing organisations, even after controlling for commonly studied occupational stressors, role ambiguity and role conflict. • Willness et al., meta-analysed data from 41 studies, with nearly 70,000 respondents. Sexual harassment was associated with negative outcomes such as decreased job satisfaction, lower organisational commitment, withdrawing from work, ill physical and mental health, and even symptoms of post-traumatic stress disorder. • De Dreu et al., (2003) showed in a meta-analysis that relationship conflict and task conflict were negatively associated with team performance, and team member satisfaction, especially for complex tasks.	• Present in the ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety & Health at Work, 2012) • Present in World Health Organisation's Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008).

TABLE 6 (CONTINUED)

Psychosocial Work Element	Illustrative Academic Evidence	Other Evidence
6. Recognition & reward • Feedback • Performance reviews • Opportunities for development • Rewards program • Low/ unfair pay • Lack of promotion prospects; under/over promotion • Work of low social value	• Loher et al., (1985) meta analysis: more feedback associated with higher job satisfaction. • Leka et al., (2003) identified low/ unfair pay as a potential work stressor. • Leka et al., (2003) review: identified lack of career development as potential stressors.	• Career development is included in ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety & Health at Work, 2012)
7. Management of change • Communication • Consultation and participation • Review roles • Provide support	• McHugh (1997) showed how change in organisations can be stressful. • Dahl (2010) analysed a panel data set of all stress-related medicine prescriptions for 92,860 workers working in 1,517 of the largest Danish organisations. • Findings suggest that the risk of receiving stress-related medication increases significantly for workers at organisations that change, especially those that undergo broad simultaneous changes along several dimensions.	• Communication included in culture in the ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety & Health at Work, 2012) • Part of the UK Health & Safety Executive's Management Standards of Stress (see Mackay et al., 2004).
8. Organisational justice • Distributive • Procedural • Interactional	• Cohen-Charash & Spector (2002) conducted a meta analysis with 190 studies. Distributive, procedural, and interactional justice were all associated with job satisfaction, job performance and (negatively) with counterproductive work behaviours. Procedural justice also affected commitment and trust. • Cropanzano & Wright (2011) summarised evidence showing that low justice is associated with ill health, absenteeism, lowered commitment, and burnout, although most studies focus on distributive justice.	• Included in the Canadian's Centre for Applied Research in Mental Health and Addiction (CARMHA) "Guarding Minds at Work" framework, which highlights having a culture of fairness.

TABLE 8. ADDITIONAL PSYCHOSOCIAL WORK FACTORS

Psychosocial Work Element	Illustrative Research Evidence	Other Evidence
Skill variety and use • Lack of task variety; monotonous work • Under-use of skills • Meaningless work	• Lee & Ashforth (1996) meta analysis: skill use related to lower emotional exhaustion; monotonous work correlated with depersonalisation (element of burnout) • Loher et al. (1985) meta analysis: skill variety predicts job satisfaction • Identified as important in Cox 1993.	• Eurofound (2010) reported increase in number people doing monotonous work between 1995-2010 of 40%-45% • Present in the ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety & Health at Work, 2012) • Present in WHO Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008).
Job security • Fear of job loss • Outsourcing • Uncertain contracts	• Sverke et al., (2002) meta analysis: job insecurity negative effects on job satisfaction, commitment, trust, etc, as well as to some extend job performance • Ashford et al., (1989) meta analysis: job insecurity linked to job dissatisfaction • Leka et al., (2003) review: identified these elements are potential stressors	• Eurofound (2010): increased sense of job insecurity from 2005 -2010. • Identified by European Agency for Safety & Health at Work (2007) as an 'emerging psychosocial risk' because of new forms of employment contracts, outsourcing, etc
Home-work interface • Dual career problems • Conflicting demands of work • Low support at home • Negative interference between home and work	• Allen et al., (2000) showed that work-to-family conflict had widespread and serious consequences, such as burnout and job dissatisfaction. • In a review, Greenhaus and Allen (2011) summarised evidence that work-family conflict has negative links with health-related behaviours such as diet and exercise, alcohol consumption, and lower safety compliance. Longitudinal studies show that work-family conflict predicts work stress, depression, and other strain outcomes.	• Present in the ESENER Taxonomy of Psychosocial Work Risks (European Agency for Safety & Health at Work, 2012). • Present in WHO Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008). • European Agency for Safety & Health at Work (2007) identified poor work-life balance as an emerging psychosocial hazard due to increased numbers of women in the workplace
Work schedules • Long work hours • Shift work • Amount of nightwork	• Multiple reviews show negative effects for job satisfaction of long work hours and shift work (e.g., EU-OSHA 2000; Rick et al., 2002; Monk & Tepas, 1985; Waterhouse et al., 1992) • Parkes et al., (1997) review showed shift patterns have negative effects on mood and emotional exhaustion. • Baltes et al., 1999 meta analysis showed flexitime and compressed work week positively predict job satisfaction and lower absenteeism • In a review, Smith et al., (2011) summarised evidence that shiftwork adversely affects sleep, fatigue, and is associated with more accidents and injuries. It has also been related to the development of psychological, gastrointestinal, metabolic, cardiovascular and (for women) reproductive disorders, although the data is not strong enough to show causality. The amount of nightwork is the most destructive element, and its negative effect increases with age.	• Present in the ESENER Taxonomy of Psychosocial Work Risks (European Agency S&H at Work, 2012) • European Agency for Safety & Health at Work (2007) identified work intensification (long working hours, work intensification) as an emerging psychosocial hazard due to changes in the workplace. • Work schedule Present in World Health Organisation's Psychosocial Risk Management Model (Burton, 2010; Leka & Cox, 2008).

TABLE 7 (CONTINUED)

Psychosocial Work Element	Illustrative Research Evidence	Other Evidence
Management of team work	• The ability and motivation of team members to work together, and to co-ordinate their activities, has been identified as essential for preventing accidents and error within safety-critical contexts, such as medical care (e.g., Baker et al., 2006), and the airline industry (e.g., Helmreich & Foushee, 1993).	• n/a

APPENDIX D: ELABORATED ANALYSIS OF APPROACHES TO WORK DESIGN (SECTION 5)

TABLE 9: PRINCIPLES OF SOCIOTECHNICAL DESIGN[23]

Principle	Elaboration of Principle
Overarching	*World views/ perspectives about work design.*
1. Design is systemic.	All aspects of a system are interconnected, so they should be designed jointly. For example, solely considering technical issues when introducing a new work method, without considering its implications for individuals' job content (such as the opportunity for individuals to use or develop their skills), will be sub-optimal. Sometimes the unintended consequences of a new design don't became clear until later, so designers need to try to anticipate the possible impacts of design choices, across as broad a range of system performance characteristics as is viable. They also need to be willing to review and alter designs.
2. *Values and mindsets are central to design. ("People matter'").	Humans should be seen as assets, not costs; technologies (and techniques) are tools to support humans in meeting their goals; and humans and machines have complementary skills and abilities. Trying to 'design out' error-prone, 'unreliable humans' is counter to this perspective, as is trying to command and control humans via Tayloristic systems. Clegg et al. (2000) argued that such attitudes are still common, and should be challenged by asking questions such as: `Why are we using technology to undertake this task?' `What are the roles of the humans in this system?' `What alternative ways are there of configuring the work?' `What are the costs and benefits of the different design choices?'
3. *Design involves making choices.	There are choices in the design of sociotechnical arrangements, such as how the work will be managed and organised, what form of technology will be required to support this work, and what other organisational systems are required (see also principles 9 and 10). There are also choices about how the design will be achieved, such as how design and implementation processes are managed (see principle 15). Often managers and others involved in work do not recognise that there are choices in the way that things are done, and existing technologically-oriented ways are 'taken for granted'. An example from Clegg (2000) is that, to improve the quality and speed of information flow from its customers, the national sales manager of a confectionary company thought a system involving the use of hand-held computers by the drivers would improve speed and accuracy. However, rather than simply select what appeared to be the best technical product, he discussed with drivers, depot managers, sales staff, IT specialists, finance people, administrators, to design how the work would be organised. An example decision was whether the drivers would work in a delivery role only, or as salespeople, or as franchise holders.
4. Design should reflect the needs of the business, its users and their managers.	A system needs to be useful, to meet some articulated purpose, to meet the current or future needs of the business, its users, and their managers. Unfortunately, systems are often designed which do not meet the needs of the business, or of the users (e.g. change is introduced as a fad; technological dominance of solutions results in them not being useful; etc).
5. Design is an extended social process.	Design and implementation should not be a one-off with a clear end, but should continue throughout use as people use the system. Systems should be (re-)configured over time, either formally or in practice as people adjust the system to meet their needs. For example, if teamwork is introduced, it would be expected that team members will amend its operation as they go along. It also means that stakeholders will interpret designs in different ways, and should be allowed to put forth their views: As an example, when a new information technology system is used to allocate time to projects, the accountants might see this change as enhancing financial control whereas the users of the system might see this as a way of having their time monitored by managers.
6. Design is socially shaped. (Work design can be affected by fashion and fads).	Design is affected by fashion. Wider social factors and trends can affect designs, such as innovations driven by technologists; consultants pushing particular products/ services; business agencies advocating particular approaches; or current trends in the industry. Such factors, for example, can affect the uptake of techniques and ways of working such as lean manufacturing, BPR, JIT, computer-supported collaborative work, and – currently – the internet.

[23] As identified by Clegg (2000)

TABLE 8 (CONTINUED)

Principle		Elaboration of Principle
7.	Design is contingent. (There is no 'one best way').	There is no `one best way'. For example, teamworking may be a good form of work organisation when the tasks are interdependent, when people need to interact to resolve problems as they arise, where a range of skills is needed, and where the work can be organised such that the team is responsible for the provision of a complete product or service. It can be a bad choice when interdependence is low (Sprigg, Parker, Jackson, 2000). Example factors that affect what will be good work design in the situation include: the market, the product mix, the sector, the size of the organisation, the organisation culture, the local labour market, the skills and capabilities of staff, the style of management, the levels of uncertainty, national culture. In many cases, it is unlikely to be clear what represents an optimal design choice.
Content principles		*Content of work*
8.	Core processes should be integrated*.	Organisations contain core processes that typically cut laterally across different functions. Ideally, processes should be designed to be integrated rather than fragmented (e.g., a split between production and packing, or between design and manufacture, or between the design of a new IT system and its use), with individuals responsible for supervising and managing complete processes, and with individuals having the requisite authority and resources. Processes should be simplified to take out unnecessary activities, duplications, and delays. The processes should be designed first; the structure second (rather than designing the processes to fit the structure). A job should incorporate a whole task, rather than a fragmented part. Example from Clegg (2000): Leicester Royal Infirmary used a process perspective to redesign the processes by which patients were examined, tested and treated to cut down delays and the number of required visits to the hospital. This approach allowed patients in some departments (for example, neurology and hearing) to be examined, have tests, receive the results, have a consultation and begin treatment all within a single visit to the hospital (Bevan, 1996).
9.	Design entails multiple task allocations between and amongst humans and machine.	Decisions about how to allocate tasks between humans and machines should be carefully made, with criteria including aspects such as the feasibility and cost of automation, the health and safety implications of allocation decisions, the operational requirements of the system, and the characteristics of the task itself. As an example, Clegg (2000) suggests that, if a task is critical to system performance but highly unpredictable and requiring judgement, it should be allocated to a human rather than a computer. When a task is less critical or more predictable, it might be better to be automated. Many design projects focus excessively on technical issues, ignoring these sorts of allocation choices.
10.	System components should be congruent*.	Work should be designed to be congruent with surrounding broader systems and practices, including, for example, systems for payment, selection, work measurement, performance assessment, and so on. In some cases, this means that the new system needs to be modified to fit the broader situation; in other case, it can mean that the broader systems need to be changed to fit the new design. Information and control systems are especially important because these systems shape and influence the way work is managed and undertaken. As an example, when teamworking is introduced, it will be necessary to ensure that the information system allows the team to understand the goals being pursued, to monitor progress against these goals, and to manage itself in real-time. Team members need to receive the right information at the right time to support their effective decision making. In this way, the work design is congruent with the information system.
11.	Systems should be simple in design and problems made visible.	Designs should be simple, resulting in work and technologies that are easy to use, easy to understand, and learnable. This partly relates to the initial design (including, for example the design of human–computer interfaces and interactions), but also to the broad concept. Problems should be made visible by the system. For example, Canon, the Japanese manufacturing company, uses a common set of simple, easy to communicate, systems and techniques throughout all its factories, such as simple systems for production planning, and for communicating targets and giving feedback. Problems are made visible via a `stop and fix it' system on their assembly lines in which an operator pulls a chime when there is a problem, and a roving `trouble-shooter' has 30 s to solve the problem. If the problem is not solved, the whole line stops. Under no circumstances is the faulty product is passed on to the next stage, or pulled off the line for rework later, and hence resources get allocated to problem solution.

TABLE 8 (CONTINUED)

Principle	Elaboration of Principle
12. Problems should be controlled at source*.	This principle comes from one of Cherns' most important principle: that variances (unprogramed events) should be controlled at source. This principle has multiple benefits: motivational (people like to have control over the problems they face); cognitive (people learn to perform better through exerting control and by anticipating and solving problems); logistical (it is quicker to solve a problem locally than to wait for an `expert' to visit); and, resource-based (the company can use the 'experts' elsewhere). Controlling variances at the source is central to practices like job enrichment, self-managing teams, and empowerment. Research suggests that this principle is most important under conditions of uncertainty because, when work systems are more certain, then problems are relatively predictable and then may be handled through other organisational mechanisms. Nevertheless, even when systems are certain, even though resolving problems at source will be no more or less effective than are other design strategies, the benefits from a psychological perspective remain.
13. The means of undertaking tasks should be flexibly specified (this draws on Cherns' ideas of minimal critical specification).	Cherns (1987) also proposed that one should not over-specify how a system will work ("minimal critical specification"). In other words, whilst the ends should be agreed and specified, the means should not. This allows for users, who can be seen as local experts, to solve their own problems (see principle 12), have job control, and enhance their chance for learning and innovation. This will be a challenge in relatively bureaucratic organisations with a strong emphasis on work standardisation, such as many call centres or lean production. From a technological perspective, this can also be a challenge as complex systems often have tightly prescribed procedures for operation. Clegg (2000) argues that in practice there is likely to be more variability than system designers intend. As far as possible, systems should allow for some flexibility in their operation, for example through local tailorability or by having different modes of operation. In this way, operation can depend somewhat on the situation or the skill and expertise of the operator. As an example, in the case of the shopfloor production scheduling system described earlier (see principle 2), under some situations such as when users were too busy to work out their own schedule, the users had the option of letting the computer system suggest an `optimal' schedule if they so wished. Clegg warned "Substantial conflicts can arise here" because such local tailorability might be desirable for operators but also costly.
Process principles	
14. Design practice is itself a sociotechnical system*.	Sociotechnical systems thinking applies to design systems, or teams that design processes. This principle matters because design processes are becoming increasingly standardised due to the introduction of computer-based methods and tools (e.g. structured methods) and new forms of working (eg virtual teamworking).
15. Systems and their design should be owned by their managers and users.	Users should be involved in, and have ownership of, design. When systems are designed, the different activities (e.g. strategy, feasibility, conceptual design, detailed design, programming, implementation, use, and maintenance) are often poorly integrated, with ownership diffuse. Clegg (2000) argues that "ownership of the new system and of its design, should be appropriated by the people who will be responsible for its management, use and support". Thus instead of 'user participation', Clegg argued a reversal in mindset is required in which managers and users of a new system bring in experts to help with the design. For example, one large manufacturing company changed the approach to designing mew manufacturing technologies. Before the change, a technical project manager would oversee the design, development and implementation of the new system, and then the new system would be handed over to the line manager and end-users, often with poor results. After the change, the same person was responsible for the design, implementation and use of the new system, with substantially better results. Either the project manager during design became the line manager responsible for the new system when it was operating, or the existing line manager was put in charge of managing project design.
16. Evaluation is an essential aspect of design*.	Investments in new technology and new working practices often fail or have disappointing results. And yet organisations so rarely evaluate systematically their investments against their original goals. Many reasons underpin this lack of attention to evaluation, including the fact that things have 'moved on' and there are new projects to think about. Yet evaluation is essential for learning. More learning occurs when evaluations are pluralistic, considering a wide range of criteria and from different viewpoints (e.g. social, technical, operational and financial criteria).

TABLE 8 (CONTINUED)

Principle		Elaboration of Principle
17.	Design involves multidisciplinary education.	The design process should bring together people from different roles and disciplines who have different skills, experience and expertise. Most design processes are dominated by people with partial forms of expertise, such as the design of technology being dominated by engineers and other technical experts. Those responsible for managing design projects are usually not expected to consider their social aspects, and may not be rewarded/ trained for doing so. Consideration of people / human/ organisational issues is neglected, which means that the full range of organisation and job design choices that may be possible are typically under-represented. Having systems designed by people and processes which incorporate partial knowledge of the systems is likely to be only partly effective. Learning and innovation is also inhibited because a multidisciplinary approach to design is more likely to foster creative and innovative solutions.
18.	Resources and support are required for design.	Designing new systems needs resources and support, including money, time, and effort; knowledge, expertise and skill (including of people issues); methods, tools and techniques; and teamwork structures and mechanisms that allow these principles to be enacted. In particular, "expertise in how to adopt a more holistic and systemic view is critical". For example, people need to have the time and expertise to consider the social aspects of system design. Many of the principles described above are complex, and ideally need to be supported by methods and tools, and structures and mechanisms, that incorporate social aspects.
19.	System design involves political processes.	Change is political. Design invokes issues of values, choices, ownership, processes, task allocation, evaluation, and resources, which are political issues. Thus for the sociotechnical system approach to be sustained, leaders need to be actively involved and committed to a human-oriented approach. For example, if managers simply leave technological changes to the 'experts', then they are abdicating responsibilities for a holistic approach. Processes and mechanisms need to be put in place to allow discussions about such issues.

*An asterisk indicates that this principle also at least partly covered by Cherns (1987).

TABLE 10: PRINCIPLES FOR MOTIVATIONAL WORK DESIGN INCLUDING JOB ENRICHMENT AND SELF-MANAGING TEAMS[24]

Principles for Motivational Work Design	
Job enrichment principles	
1.	Arrange work in a way which allows the individual worker to influence their own working situation, work methods, and pace. Devise methods to eliminate or minimise pacing.
2.	Where possible, combine interdependent tasks into a job.
3.	Aim to group tasks into a meaningful job that allows for an overview and understanding of the work process as a whole. Workers should be able to perceive the end product or service as contributing to some part of the organisation's objectives.
4.	Provide a sufficient variety of tasks within the job, and include tasks that offer some degree of worker responsibility and make use of the skills and knowledge valued by the individual.
5.	Arrange work in a way that makes it possible for the individual worker to satisfy time claims from roles and obligations outside work (e.g. family commitments).
6.	Provide opportunities for a worker to achieve outcomes which s/he perceives as desirable (e.g. personal advancement in the form of increased salary, scope for development of expertise, improved status within a work group, and a more challenging job).
7.	Ensure workers get feedback on their performance, ideally from the task as well as from the supervisor. Provide internal and external customer feedback direct to workers
8.	Provide workers with the information they need to make decisions.
Principles for self-managing teams	
9.	Group interdependent tasks to make a meaningful set and to involve a balance between less popular and desirable tasks.
10.	Provide clear performance criteria for the team as a whole.
11.	Provide clear feedback on group performance.
12.	As far as possible, leave methods of working to the discretion of the worker (i.e. minimal specification).
13.	Allow workers to control variances at the source, but ensure they have the necessary knowledge, skills and information to intervene.
14.	Allow the group to control equipment, materials, and other resources, making them responsible for their prudent use.
15.	Increase the skill level of workers to allow flexible responses to uncertainties (but note that complete multiskilling might result in redundancy of skills).
16.	Ensure that selection, training, payment systems, etc., are congruent with the work design.
17.	Regularly review and evaluate the work design.

[24] From Parker and Wall, 1998

TABLE 11: PRINCIPLES FOR DESIGNING WORK TEAMS (A) [25]

Principles for Designing Work Teams (A Positive Response Supports the Use of Teams	
1.	Are workers' tasks highly interdependent, or could they be made to be so? Would this interdependence enhance efficiency or quality?
2.	Do the tasks require a variety of knowledge, skills, and abilities such that combining individuals with different backgrounds would make a difference in performance?
3.	Is cross-training desired? Would breadth of skills and workforce flexibility be essential to the organisation?
4.	Could increased arousal, motivation, and effort to perform make a difference in effectiveness?
5.	Can social support help s deal with job stresses?
6.	Could increased communication and information exchange improve performance rather than interfere?
7.	Could increased cooperation aid performance?
8.	Are individual evaluation and rewards difficult or impossible to make or are they mistrusted by staff?
9.	Could common measures of performance be developed and used?
10.	Is it technically possible to group tasks in a meaningful, efficient way?
11.	Would individuals be willing to work in teams?
12.	Does the labour force have the interpersonal skills needed to work in teams?
13.	Would team members have the capacity and willingness to be trained in interpersonal and technical skills required for teamwork?
14.	Would teamwork be compatible with cultural norms, organisational policies, and leadership styles?
15.	Would labour–management relations be favourable to team job design?
16.	Would the amount of time taken to reach decisions, consensus, and coordination not be detrimental to performance?
17.	Can turnover be kept to a minimum?
18.	Can teams be defined as a meaningful unit of the organisation with identifiable inputs, outputs, and buffer areas, which give them a separate identity from other teams?
19.	Would members share common resources, facilities, or equipment?
20.	Would top management support team job design?

[25] Medsker & Campion, 2007

TABLE 12: PRINCIPLES FOR DESIGNING WORK TEAMS (B) [26]

Conditions for Successful Teamworking	
1.	The team should be a `logical' task grouping: it should be an intact group with clear boundaries; it should have interdependent members and differentiated roles, and it should be congruent with workers' mental models about how work should be done.
2.	Workers should be involved in the design of the work organisation.
3.	The size of the team will vary according to the exact nature of the work, but it should always be of a manageable size. As a guide, there should not be more than 10 or 12 members.
4.	The team should be empowered as far as possible to plan and manage all aspects of its own work. This includes taking responsibility for planning and scheduling the work, organising rest breaks, and ensuring that quality standards are achieved.
5.	The team should have clear, specific and challenging performance goals, in order to foster maximum motivation. These goals should cover the full range of required outcomes, rather than just one measure such as short-term output.
6.	The actual methods by which the work is done should be minimally specified, allowing team members to choose the particular working methods they feel most comfortable with. The only constraints should be the need to meet performance targets, and the need to adhere to codes of conduct regarding discipline, health and safety.
7.	The team needs to have all the basic skills necessary to perform each task. To facilitate the rotation of unpopular tasks, it is necessary to ensure that each team member is capable of a number of different tasks.
8.	Significant training will be required in new skills. A common pitfall in implementing teams is the assumption that workers will be competent in the new way of working. Training will be required in technical skills, planning skills, and team/ interpersonal skills.
9.	The transition from traditional working methods to teamworking should be carefully planned and designed in its own right.
10.	A vital support for teamworking is the provision of an effective information system, as team members should have access to relevant information to enable them to make decisions. Separate principles exist for the design of information and control systems.
11.	If workers are working as a team, they should receive feedback at the team performance level. However, individual team members may at times face problems with which they need help, and the feedback system should include a way of identifying such occasions in a way that is not threatening to individuals.
12.	First-line supervision will require major restructuring to support teamworking. Since the team takes on many of the responsibilities traditionally allocated to supervisors, the role of first-line supervisors will change quite radically, moving from a controlling role to one facilitating effective team performance.
13.	This will involve `boundary management', such as liaising with other teams or other parts of the organisation and procuring resources from the organisation for the team. This means that supervisors will need extensive training in these skills, which will be quite different from the skills used in a traditional supervisory role. Supervisors may feel that their authority is being removed, or that their jobs are under threat, and they may find their new role quite stressful or frustrating. This can lead to resistance or inappropriate actions, which may adversely affect team performance.
14.	Other groups may also feel threatened by expanded operator roles. For example, engineers and quality inspectors may feel that their jobs are being taken away. However, they may be reassured by the fact that the new work organisation may help them to be more proactive in their work. For instance, engineers could spend more time on planned projects and preventative work, rather than routine maintenance and cleaning.
15.	Wider organisational structures and systems also need to be congruent with a team-based work organisation, and failure to take these into account is a frequent reason for a lack of success of teamworking. For example, many team-based organisations find it necessary to change the payment structure from seniority-based to skill-based and team-based pay, which will motivate workers to become multi-skilled and counteract the de-motivating effects of `topping out' of careers.

[26] West 1996

TABLE 13: KEY FEATURES OF THE CONTINUAL IMPROVEMENT PROCESS IN HEALTH AND SAFETY [27]

Feature	Elaboration
1. Leadership engagement	Leaders and other key stakeholders need to genuinely buy into the process if it is to succeed. Securing this commitment before starting a health and safety improvement process is important. This engagement often can result in the development of a high level policy stating the importance of health and safety.
2. Involvement	Anyone affected by the program, or their representatives, must be involved in a meaningful way at every step in the process. The involvement must be more than consultation – rather it needs to be active involvement. Unions, or other systems of worker representation, should be involved.
3. Gap analysis	A gap analysis is about comparing the current reality against the ideal, and then making decisions as to what to do. This means: assess the current situation such as by collective baseline data; do a needs analysis; identify hazards (eg via site inspections, surveys, collection of baseline data); and then determine the desired future by talking with people and reviewing the evidence as to what will have most impact. A good needs analysis takes into account local conditions.
4. Learn from others	Involve individuals with the right expertise (eg researchers, safety experts, etc), access relevant information (e.g., from WHO, HSE, etc), and visit other organisations doing similar things.
5. Sustainability	Ensure health and safety initiatives are integrated into the business plan. Evaluate initiatives and continually improve. Assess what works and what does not. Ways to ensure sustainability include: - Build health and safety issues into strategic planning (like the Balanced Scorecard notion); - Have health and safety as a criterion for managerial decision making; - Break down silos between different groups within the organisation; - Recruit people with interpersonal skills; - Build health and safety into performance management / reward systems; - Use cross functional teams where possible, or cross-membership approaches to teams - Ensure health and safety is integrated into leadership/ supervision selection, assessment, and performance management processes.

[27] WHO Healthy Workplace Framework & Model, Burton, 2010

TABLE 14: KEY STEPS FOR CONTINUAL IMPROVEMENT PROCESS APPLIED TO A LARGE CORPORATION AND A SMALL ENTERPRISE [28]

Step	Applied to a Large Corporation	Applied to a Small Enterprise
Mobilise	• Get buy-in from the senior management team & trades union leaders or other representatives. • Ensure that a comprehensive health, safety and wellbeing policy is in place. • Ensure that health and wellbeing is mentioned in the mission or vision of the corporation. • Ensure that resources and an annual budget have been allocated for healthy workplace activities	• Explain the healthy workplace concept to the owner or operator and get permission to proceed. • Get permission to hold short meetings with the staff/workers to determine needs and ideas for solutions. • Get a commitment for enough time to plan and implement programs. • Help the owner/operator to develop a short health and safety/wellbeing policy statement that can be signed and posted in the workplace.
Assemble	• Set up a committee of 10-15 people representing different departments and work locations. • Develop terms of reference. • Set up regional subcommittees if the corporation has many sites. • Ensure cross-representation with the joint management labour occupational health and safety committee.	• Ask for 2-3 volunteers to help with the work (the Healthy Workplace Working Group). • If there are very different types of jobs in the company (e.g., drivers and labourers) try to get one of each to help. • If you can, include experts from larger enterprises or community associations willing to help. • Find a space to meet and gather together any materials you will need.
Assess	• Gather demographic data about the workforce, baseline data on absenteeism, short and long-term disability, and turnover. • Conduct a confidential comprehensive survey of all staff asking about their health status, their health, safety and wellbeing concerns, sources of stress in the workplace or at home, leadership, worker engagement, etc. • In the survey, ask what they would like to do as individuals to improve their health, and how they think the employer could help. • Do a comprehensive audit to assess all hazards and risks in the workplace; or review results of regular workplace inspection reports.	• If possible, find a way for the Working Group to learn about health, safety and wellbeing as it relates to your industry. • Obtain a checklist from WHO, ILO, EU-OSHA, or make one up yourself, and do a walk-through of your workplace, looking for hazards. Determine local good practice and consult outside experts. • Hold a meeting of all stakeholders. Ask the owner or operator to start the meeting by assuring them of their commitment to the healthy workplace concept. • Lead a discussion with stakeholders about their health, safety and wellbeing concerns. Include family and community concerns as they relate to work. • Brainstorm ideas on what the workers and the employer could do to make things better.Ask about stress-related and physical concerns. • Have the Working Group meet with the owner/ operator separately to ask for their ideas on the same topics

[28] Ibid.

TABLE 13 (CONTINUED)

Step	Applied to a Large Corporation	Applied to a Small Enterprise
Prioritise	• Analyse the results of the survey and audit/inspection results. • Prioritise by pairing high need areas with high "want" areas from workers	• Do this at the same time as the initial meeting if possible or at a subsequent meeting. • List problems and solutions and ask people to choose their top 3-5.
Plan	• Develop a broad 3-5 year plan. • Develop annual plans with detailed action plans for each specific activity, program or new policy. • Base action plans on stages of change when appropriate. • Include activities addressing awareness, knowledge and skill-building, behaviour change, and environmental/organisational adjustments. • In each specific action plan, include process and outcome goals as well as evaluation plans, timelines, budgets and maintenance plans.	• Plan some short-term activities to address smaller projects or immediate high priority needs. Again, local good practice can be a guide. • Develop a long-term plan to accomplish bigger projects. • Use ideas from the Working Group as well as other workers or other enterprises. • Write out the plan and list what you'll need to accomplish each activity, and present to the owner/operator for approval or negotiation. • Plan to do one thing at a time.
Do	• Divide responsibilities among those on the committee. • Hold monthly or bimonthly meetings to assess progress	• Carry out the action plans with assistance from the owner/operator and the Working Group.
Evaluate	• Measure the process and outcome of each activity against the evaluation plans.	• At a pre-determined time after beginning a project or initiative, repeat the walk-through inspection to see if previous deficiencies have improved. • Ask s if they think the project worked, why or why not, and what could be improved.
Improve	• On at least an annual basis, re-evaluate the 3-5 year plan and update it. • Repeat the survey every two years and monitor changes over time. • Develop annual plans on the basis of the evaluations from the previous year.	• Based on what you see and hear from s, change the program to improve it. • Begin on another project, based on your list of priorities.

TABLE 15: GOOD PRACTICE PRINCIPLES IN HEALTH PROMOTION INTERVENTIONS, AND BARRIERS TO SUCCESS [29]

Principles	Elaboration
1. A holistic intervention approach	Approach to health that targets not only individuals but also the workplace/ wider organisation, and that considers physical, mental, and social wellbeing.
2. Strategic planning and monitoring of the action	Systematic, evidence-based, and practical approach to action planning should be adopted after a systematic needs analysis. Both protective and risk factors should be addressed.
3. Active involvement of stakeholders	All key actors across all levels should be consulted because removing work stress involves the design and management of work. The commitment and support of s is crucial for success. Workers need to believe in the relevance of the initiative for it to work. Active involvement promotes ownership of the initiative, which is crucial for success.
4. Commitment and involvement of management	Both formal official commitment, and active engagement, is needed from management for the initiative to be successful. Workers need to observe management's visible commitment.
5. Assignment of responsibility for the program	Having an individual or group responsible for the program increases the chance of success, such as a steering group or project team. Such a individual group can answer questions, market the intervention, gather feedback, and keep management up to date.
6. Evaluation of the action	The program must be evaluated to determine whether objectives are met, the problems are resolved, and to promote organisational learning for the future.
7. On-going and continuous future	The program should not be a one-off event but should be designed as a long-term program with continual creation of new activities and strategies. This is about establishing a sustainable culture focused on health.
8. Communication	Multiple forms of communication should be employed to communicate to workers and other stakeholders throughout the process, such as flyers, discussions, intra-net.
BARRIERS	
1. Challenges changing mindsets	Managers and workers often have fixed mindsets that are difficult to change. All involved need to clearly understand the purpose of the intervention via active communication.
2. Budget constraints	SMEs in particular often lack financial resources for implementing work health promotion. Cases and anecdotal evidence suggest that investment pays off in the long term.
3. Time constraints	Time is often a barrier, which some organisations overcome by allocating responsibility to one person or team to take charge of the program.
4. Low worker awareness	Workers often lack an understanding of why health programs are important, highlighting the need for active and continual communication.

[29] based on Hassard et al., 2011

TABLE 16. CHANGE MANAGEMENT PRINCIPLES[30]

Change management principle	Applied to the topic of field research management
A systemic, dynamic, and political process	
Principle 1: A holistic, systems approach	A systems approach requires the study of phenomena at all levels of analysis and attention to macro-level elements, such as organisational culture and management, that will interact with the research implementation.
Principle 2: Change is dynamic	Consider how the research project evolves over time; adopt different approaches or strategies at the different phases of the research.
Principle 3: Change is cultural and political	Be aware of the political, social, and cultural barriers and opportunities at the target research organisation.
Preliminary considerations: scanning, benchmarking, and readiness	
Principle 4: Scan the system internally	Identify the key individuals, management systems, organisational policies, existing technologies, products, and workflow at the host organisation.
Principle 5: Tailor implementation to different units	Prepare different implementation plans for gaining buy-in and participation for different units, as needed.
Principle 6: Scan the external environment	Identify the external (e.g. regulatory, market, public opinion) forces that will promote or constrain the research.
Principle 7: Benchmark successful changes at other organisations	Benchmark the research implementation approach against previous studies within the same domain or those using similar methods/theories.
Principle 8: Gauge/establish readiness for change	Determine whether management and workers are ready to engage with research in general and the project in particular; target those who are ready, or else establish a readiness.
Personnel: teams, leaders, champions, and 'end user' involvement	
Principle 9: Form a powerful change team	Form a research team; have team members with different 'powers' in terms of familiarity with and influence within the research site, scientific expertise, and interpersonal skills.
Principle 10: Identify a competent, dynamic change leader	Select a research team leader who will be competent in scientific and interpersonal domains and available to lead, manage, coordinate, and consult for the project.
Principle 11: Identify change champions	Identify well-respected individuals who already 'buy into' the research project; work through them to actively convince others to buy in.
Principle 12: Identify opinion leaders	Identify opinion leaders, whose view on the project may strongly bias others. Gain their buy-in, or address their concerns about the research in a fair and just manner.
Principle 13: Involve workers	Involve workers throughout the design and implementation of the research. Carefully manage the participation process to end up with both a good product and worker commitment to the project.
Expected and unexpected events	
Principle 14: Prepare to cope with the unexpected	Prepare to cope with and improvise when delays, errors, resource limitations, and other challenges arise in the research process.
Principle 15: Follow a structured plan	Prepare a structured research implementation plan, including timelines, purpose, vision statement, desired outcomes, and contingency plans.
Principle 16: Anticipate specific, achievable, measurable outcomes	Establish specific, achievable and measurable desired outcomes for the research for the purposes of evaluation and continuous improvement.
Principle 17: Create an agreed-upon vision statement	Develop a vision statement for the research implementation, alone or with management input. This vision statement should be clear, concise, and specific enough to provide direction for the project.

[30] from Holden et al., 2008

TABLE 15 (CONTINUED)

Change management principle	Applied to the topic of field research management
Buy-in and resistance	
Principle 18: Make a positive first impression	Researchers must make a positive first impression in front of management and potential participants.
Principle 19: Maximise perceived benefits, minimise perceived costs	Build perceptions of high-benefit and low-cost of participating in the research. Particularly address costs and benefits that are most important to potential participants, such as the usefulness and ease of participation.
Principle 20: Have important groups/individuals appear to encourage participating in the change	Emphasise the support and encouragement of groups (e.g. agencies, management, regulators) or individuals (e.g. clients, supervisors, colleagues) who are important to targeted managers or workers. Involve influential individuals when publicising the study.
Principle 21: Create perceptions of control and self-efficacy	Create a sense of control by allowing management and participants to make decisions regarding the content and conduct of research; consider making participation voluntary. Convince individuals that they have the ability and information necessary to participate successfully.
Principle 22: Create perceptions of the positive characteristics of the change	Create perceptions of the positive aspects of the research, including relative advantage, compatibility, trialability, and low complexity.
Principle 23: Communicate both positive and negative aspects of the change	Use all possible communication channels to inform management/participants of the study, addressing both positive and negative aspects of the research.
Principle 24: The *actual* change and its implementation must be well designed	The research content and process must be designed in a way that ensures actual usefulness, ease, compatibility, and so on.
Principle 25: Conduct implementation in a just way	Treat everyone fairly—equally or equitably—and with respect. Ensure perceptions of fairness by openly and honestly communicating with management and participants about the study and, if possible, being transparent about what is being done and why.
Principle 26: Manage individuals' stress responses	Reduce research participants' discomfort and stress by being open and honest, providing information, showing gratitude, and generally conveying an impression of psychological safety.
Training, resources, and top management support	
Principle 27: Provide workers with skills, training, freedom, information, financial support, and tools for the change	Determine what resources will be needed to properly participate, and make sure that these are provided. Remove any actual or perceived barriers to participation.
Principle 28: Secure management support	Obtain management's permission, support, and encouragement for the study.
Sustaining and adjusting	
Principle 29: Sustain the change over the long term	To achieve long-term goals, efforts should not be relaxed after initial victories (e.g. the first few site visits, the first wave of data collection).
Principle 30: Evaluate and continuously refine the change	Continue to make changes to the research project and the implementation process based on feedback from those involved.