Centre for
Construction Work Health and Safety

Health and Safety Culture

AUSTRALIAN CONSTRUCTORS ASSOCIATION

RMIT UNIVERSITY

This report was commissioned by the Australian Constructors Association.

Authors

Helen Lingard, Rita Zhang, James Harley, Nick Blismas, Ron Wakefield

About RMIT Centre for Construction Work Health and Safety Research

The RMIT Centre for Construction Work Health and Safety provides leading-edge, applied research to the construction and property industries. Our members are able to work with organisations to analyse health and safety (H&S) performance and identify opportunities for improvement. We can develop and evaluate innovative solutions, provide specialised H&S programs or undertake other research-based consulting activities. Our work addresses real-world H&S challenges and our strong international linkages provide a global perspective to our research.

Website: http://www.rmit.edu.au/research/health-safety-research

E-mail: constructionwhs@rmit.edu.au

Table of Contents

List of Figures

List of Tables

Executive summary

The construction industry performs relatively poorly in health and safety (H&S) and is identified as a priority industry for action in the Australian Work Health and Safety Strategy 2012-2022.

An organisation's prevailing culture can shape the priority placed on H&S and ultimately determine the effectiveness and performance of the organisation's H&S system.

Much has been written on the topic of safety culture, yet the concept remains poorly specified and inconsistently used. In particular, there is ongoing debate about whether the term 'safety culture' should be used at all as the term implies that a safety culture can be distinguished from aspects of the broader organisational culture that have consequences for H&S. Some argue it is better to talk about an organisational 'culture for safety' rather than safety culture.

Culture exists at multiple levels and organisational cultures are influenced by national and industry cultures within which they develop.

Culture can be described as a pattern of shared basic assumptions that are learned by members of a group over time. The system of shared meaning that comprises culture serve as a frame of reference that guides behaviour within a society, industry or organisation.

Various facets of national cultures have been identified, some of which have been linked to H&S. However, research suggests that the link between national culture and H&S is relatively weak, with H&S more strongly influenced by industry and organisational cultures.

The Australian construction industry is characterised by:

- a predominantly male workforce
- a multi-level system of contracting and subcontracting with associated economic pressures
- long work hours, and
- poor work-life balance.

These factors contribute to a cultural context that is challenging for H&S.

The culture of an organisation has been identified as a causal factor in many industrial accidents. Organisational culture is expressed at different layers. At the core of an organisation's culture is a set of basic underlying assumptions. These are taken-for-granted beliefs and values. They are often held unconsciously, and are very difficult to uncover and understand. More visible are espoused beliefs and values which are the ideas, goals and ideologies that underpin organisational activities. The outer and most visible layer of an organisational culture comprises the artefacts that are directly observable indicators or products of the culture.

The basic underlying assumptions that characterise an organisational culture may shape H&S outcomes, even if these assumptions are not directly concerned with H&S.

There are two approaches to safety culture. A functionalist approach regards a safety culture as an ideal state that can be achieved through managerial intervention. However, an interpretive view of safety culture regards it as a bottom-up phenomenon that develops within organisations (and organisational subunits).

Organisational safety cultures are believed to develop over time and researchers have attempted to plot their development using various maturity models. These maturity models reflect the fact that relatively immature cultures for safety can develop, over time, into mature cultures that strongly support positive H&S performance.

It is also acknowledged that organisational cultures for safety can be 'patchy' and the maturity of the culture can develop more slowly or quickly in different organisational subunits. Therefore, it is possible to observe projects or workgroups with varying levels of cultural maturity within a single organisation.

Safety culture is a complex and multi-layered phenomenon. It is important to distinguish safety culture from the concept of 'safety climate'. The key differences between definitions of safety culture and safety climate lie in:

- the depth of the concept – climate is believed to be a surface level expression of the culture at a given point in time
- the stability or lifespan of the concept – culture is believed to be relatively stable and slow to change, while climate can change more rapidly, and
- methods of inquiry used to assess each concept – climate is usually measured using a quantitative survey, while culture requires more in-depth qualitative evaluation.

Many models or theories about organisational safety culture have been developed. Different writers identify different components of a culture for safety. However, there is considerable overlap.

For this project, the Centre for Construction Work Health and Safety Research has developed an H&S Culture Framework. The Framework is described in Part 9 of this report. It comprises nine commonly cited components of a culture for safety. These are:

- Leadership
- Communication
- Organisational goals and values
- Supportive environment
- Responsibility
- Learning
- Trust in people and systems
- Resilience, and
- Engagement.

Each component is defined with detailed reference to the research literature.

In Parts 5, 6 and 7 of this report, the nine culture components are described using a five point organisational culture maturity spectrum ranging from 'pathological' to 'generative'. Based on this analysis, the Centre developed for this project the H&S Culture Maturity Model. For each of the nine components, the Model describes the progressive development of an organisational culture for safety.

The H&S Culture Framework developed by the Centre for this project also includes the H&S Climate Assessment Tool. Part 8 of this report describes how the Tool was derived and how it relates to the H&S Culture Maturity Model.

The Tool adopts a multi-level measurement approach enabling measurement of the prevailing safety climate at the organisation, project and workgroup levels. Based on the nine identified components of safety culture, the H&S Climate Assessment Tool will become an instrument for measuring the safety climate within construction organisations.

The H&S Culture Maturity Model and the H&S Climate Assessment Tool were developed following a comprehensive review of the research literature. **However, neither the Model nor the Tool has been validated in the Australian construction context.**

The Centre recommends that a robust validation of both the Model and the Tool is undertaken.

Validation of the H&S Culture Maturity Model would involve a panel of industry experts (drawn from ACA membership) who would be asked to:

- review the content of the H&S Culture Maturity Model
- determine whether the content accurately reflects the progressive development of maturity in relation to the nine components of H&S culture, and
- add or amend the descriptors, as appropriate, until consensus is reached.

At this point, a number of scenarios describing a range of managerial and organisational approaches to H&S would be developed to reflect different levels of cultural maturity (from pathological to generative) in relation to the nine components.

The industry experts would be provided with these scenarios and asked to rate the levels of maturity described according to the H&S Culture Maturity Model. The experts' ratings would be compared to determine the degree of agreement.

If an acceptable threshold level of agreement is attained, the content of the final H&S Culture Maturity Model would be confirmed. On this basis, it could be concluded that:

- the content of the H&S Culture Maturity Model is valid, and
- the gradations specified for developing cultural maturity are meaningful.

Validation of the H&S Climate Assessment Tool would take the form of a pilot study that would:

- enable an assessment of the extent to which construction workers understand and respond reliably to the questions in the Tool
- involve quantitative validation of the factor structure of the survey – the factor structure relates to the extent to which the grouping of questions reflects distinct components of the H&S climate, and
- ensure that instructions and questions are appropriate for the particular level of aggregation at which the H&S climate is measured (for example, the organisation, project and workgroup).

Part 1: Introduction

1.1 Background to the project

Preliminary data show that in the Australian construction industry during the year 2011-12, there were 13,735 serious workers' compensation claims. During the five years from 2007-08 to 2011-12, 211 Australian construction workers died from work-related injuries (Safe Work Australia, 2012a). The high number of injuries and fatalities in the construction industry results in both substantial economic costs and negative social impacts.

The *Australian Work Health and Safety Strategy 2012-2022* identifies construction as a priority industry for health and safety (H&S) improvement. The Strategy establishes as a key Action Area the development of H&S leadership and culture. The Strategy calls for H&S to be a priority in all work processes and decisions, and recognises the role of community values and attitudes in driving this priority.

> *Organisational cultures can be influenced by broader community values and attitudes. Community expectations can be powerful drivers of change and collectively influence the nation's health and safety culture. When the Australian community expects and demands that work be free from harm any failure to do so generates community pressure and action.*
>
> - Safe Work Australia, 2012b, p.9

1.2 Aim of the project

This report has been prepared in response to a request by the Australian Constructors Association. The project aimed to:

1. Conduct a comprehensive literature review to discuss the definition of culture and the operation of culture at the national, industry and organisational levels, and to discuss the impact on H&S performance of Australian national culture, the construction industry culture, and organisational culture.
2. Develop a Safety Culture Framework which specifies the attributes of a 'good' safety culture at the organisational, project and work group levels.
3. Develop a Safety Culture Assessment Tool, which will include a safety climate assessment instrument and a safety culture maturity model.

The opportunity to engage in cultural benchmarking

This project aimed to create a framework, and supporting assessment tool, that can support the measurement and benchmarking of cultural drivers of H&S in the Australian construction industry.

Previously, cultural drivers of H&S have been measured within different business units, projects and workgroups of a single organisation. This approach provided valid intra-organisational comparisons and identified opportunities to transfer good practice. However, to date, there have been few attempts to measure and compare cultural drivers of H&S between organisations. Clarke (2000) argues that it is potentially very useful to benchmark the 'safety health' of an organisation against other organisations operating in the same industrial sector. According to Clarke (2000), interorganisational comparisons of cultural drivers of H&S should provide a more sensitive indicator of an organisation's relative performance than would be revealed by comparing outcome measures such as reportable injuries, accidents or absenteeism.

1.3 The growing emphasis on safety culture

Improving the construction industry's H&S performance is an important challenge. Attempts to reduce workplace incidents, injuries and the occurrence of ill-health have progressed through discernible historical ages. Hale and Hovden (1998) summarise these ages as follows.

The 'technical' age	Spanning the 19th century until after the Second World War, the technical age focussed on technical measures for guarding machinery, stopping explosions and preventing structures from collapsing.
The 'human factors' age	Spanning the 1960s and 1970s, the human factors age considered that the main source of accidents was human error arising from the interaction between human and technical factors. The merging of two fields that influenced H&S – probabilistic risk analysis, and ergonomics – saw the focus shift to human error and human recovery or prevention.
The 'safety culture' age	From the 1980s onwards, the safety culture age developed as it became apparent that matching individuals to technology did not resolve all safety problems. The 1990s saw a growing emphasis on cultural determinants of safety. The main focus of H&S development and research shifted to organisational and social factors.

Hudson (2007) suggests slightly different stages in the evolution of H&S thinking. The focus of H&S improvement in large multinational organisations progressively moved through three stages:

- first, an emphasis on technology
- then, an emphasis on H&S management systems
- finally, an emphasis on cultural aspects of H&S.

Hudson (2007) describes how this progression occurred as improvements in H&S performance were achieved and then plateaued as each new approach was implemented (See Figure 1.1).

The focus on cultural aspects of H&S emerged from the recognition that the people within the organisation were the missing component in the organisation's H&S management processes. The emphasis on culture sought to engage their 'hearts and minds', whatever their roles or level.

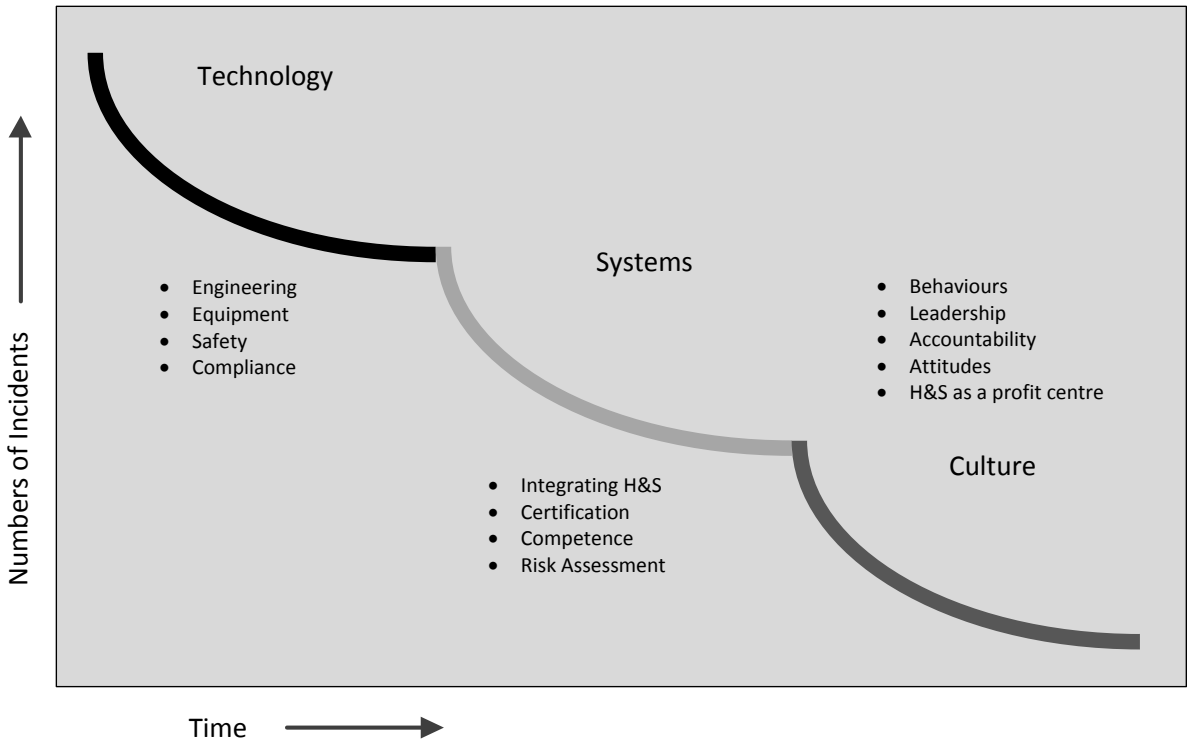

Figure 1.1: The progressive 'ages' of safety (Hudson, 2007)

An organisation's prevailing culture is understood as a fundamental influence in determining safety outcomes. The culture determines:

- the effectiveness of an organisation's safety management system
- the priority given to safety in the organisation
- the commitment to safety of the organisation's members
- the competence in safety of the organisation's employees, and
- the organisation's ability to achieve improvement through continual reflection and learning.

Reason describes culture as the 'engine' that drives the organisation towards the goal of sustaining the maximum resistance towards hazards (Reason, 1998).

Reason (2000) suggest that an emphasis on culture is particularly important when performance improvements have plateaued.

It is timely and useful for the Australian construction industry to:

- assess the current status of H&S culture within the industry
- develop a framework that establishes the elements of a culture that enables continued H&S improvement
- develop a roadmap that assists organisations in the industry to progress to a strong and positive H&S culture.

1.4 Challenges inherent in understanding the cultural drivers of H&S

There is an ongoing debate about whether safety culture is characterised by:

- the beliefs, attitudes, and values held about safety by organisational members, or
- the structures, practices, controls and policies implemented to enhance safety.

Safety culture has been inconsistently defined. Studies have identified different elements of an organisation's activities as being cultural drivers of H&S, such as safety management systems, leadership, management commitment, safety policies and procedures, safety training, and employee engagement in decision making. Without a consistent theoretical framework, these elements are often selected to suit the purpose of an individual research project. They may or may not reflect components of culture that are most strongly related to H&S performance.

Some writers suggest all organisations have a 'safety culture' that can either be positive or negative, strong or weak, good or bad. Other writers describe 'safety culture' as a state of having achieved a total and overriding commitment to safety, which few organisations may ever achieve (Hopkins, 2006).

To provide greater clarity, Hopkins (2006) distinguishes safety from culture by examining the way in which organisational cultures influence H&S. Each organisation has its own culture, and that culture is expected to influence H&S. Guldenmund (2000) identifies the need to better understand how cultural drivers of H&S are embedded in organisational systems and structures. A focus on organisational culture potentially reveals the extent to which H&S is integrated into organisational work processes and decision making.

There is much written about the differences between safety culture and safety climate. Confusion arises because these terms are often used interchangeably, yet there are conceptual differences:

- culture is understood to represent a deep, relatively stable system of underlying values.
- climate is a more superficial manifestation of a culture at a given point in time.

These differences tend to be related to academic disciplines: anthropology refers to 'culture', while social psychology refers to 'climate'. Guldenmund (2000) suggests the differences might be more semantic than substantive. Nonetheless, it is necessary to understand the relationship between safety climate and safety culture.

There is also a growing understanding that organisational cultures (including those aspects that impact on H&S) are rooted within community expectations and intersect with national cultures (see, for example, Koch, 2013). However, currently there is not a good understanding of the relationships between the Australian national culture, the culture of the construction industry, and the cultures of organisations operating within the industry.

1.5 Structure of the report

The report has nine parts. An overview of each part is provided in the table below.

Part 1: ***Introduction***	A growing emphasis on cultural aspects of H&S is described. Some important challenges inherent in understanding cultural drivers for H&S are identified. The background to the project is briefly explained and the project aims are defined.
Part 2: ***Definition of culture***	The concept of culture is defined and different perspectives on the study of culture are briefly discussed. The approach to culture adopted in the present study is explained. A discussion is provided of how culture is expressed at national, industry and organisational levels. The need to adopt a multi-level perspective in the analysis of culture is explained.

Part 3: ***Cultural context of the Australian construction industry***	The cultural context of the Australian construction industry is examined. Research is presented relating to the Australian national culture and Australian construction industry culture. The role played by organisational cultures is described, with particular reference to the existence of sub-cultures within construction organisations (for example, distinct project or workgroup cultures). The implications of this cultural context for H&S performance are discussed.
Part 4: ***Cultural drivers of work health and safety***	Part 4 considers different approaches to understanding the cultural drivers of H&S, and the implications for developing a cultural improvement framework. An in-depth discussion is provided of characteristics of organisational cultures that enable high levels of H&S performance. The underpinning architecture of the H&S Culture Framework is presented. The relationship between the H&S Climate Assessment Tool and the H&S Culture Framework is presented with reference to previous discussions about the culture/climate relationship.
Part 5: ***The H&S Culture Framework***	A progressive developmental model of H&S culture is presented. This model proposes varying levels of cultural maturity relating to key elements developed specifically for the construction industry. The model defines the elements of a strong and positive H&S culture operating at organisational, workgroup and individual levels. Varying levels of cultural maturity for each element are defined in an H&S Culture Maturity Model. An H&S Climate Assessment Tool is presented which can be used by organisations to assess their H&S climate at a particular point in time.
Part 6: ***Conclusions and next steps***	Practical next steps are identified. They include recommendations about validating and testing the H&S Culture Framework before its widespread adoption. Ideally, validation will include: • content verification of the H&S Culture Maturity Model by industry representatives/experts, and • reliability and validity testing of the H&S Climate Assessment Tool.
Part 7: ***The H&S Culture Maturity Model – descriptors***	Descriptors for each component of the H&S Culture Maturity Model are presented. Validation of the Model is recommended to ascertain its applicability, relevance and usefulness in the Australian construction industry context.

Part 8: ***The ACA H&S Climate Assessment Tool***	The development of the ACA H&S Climate Assessment Tool is described. An H&S Climate Assessment Tool is presented which enables measurement and assessment of the H&S climate at a given point in time. The relationship between the Tool and the H&S Culture Maturity Model is described. It is recommended that the Tool should be subject to empirical testing to ensure it is reliable and valid in the Australian construction industry.
Part 9: ***Conclusions and recommendations***	An overview of the development of the ACA H&S Culture Framework components is provided. Next steps for testing and validating the H&S Culture Maturity Model and the H&S Climate Assessment Tool are identified. Recommendations are made for future implementation and use of the H&S Culture Framework.

Part 2: Culture at the national, industry and organisational levels

Part 2 presents and discusses two dominant perspectives on culture, and is organised as follows:

- the implications of each perspective for health and safety (H&S) are explored
- the multi-level nature of culture is then considered, and the way that culture is expressed at national, industry, organisation and workgroup levels is described
- the relationships between components of culture at different levels and H&S are discussed – where possible, research evidence is provided to support some of the multi-level cultural impacts on H&S
- finally, the ACA Safety Culture Framework is positioned with respect to previous studies of culture.

2.1 Defining culture

Culture is a broad and complex concept. There are many traditions or schools of thought about what culture is and how culture should be studied. Scholars of different disciplines have developed different approaches. Broadly speaking, culture can be viewed from two distinct (and contrasting) perspectives: these are known as the functionalist view and the interpretive view (Schultz & Hatch, 1996).

The functionalist view

A functionalist view assumes the social world is composed of concrete empirical artefacts and relationships which can be identified, studied and measured using a scientific approach. The functionalist view assumes social change can be achieved through 'social engineering', meaning culture is subject to manipulation by groups in positions of power or authority. In the functionalist view, considerable importance is placed on understanding order, equilibrium and stability in society and the way these attributes can be managed. The functionalist view is concerned with the effective 'regulation' and control of social affairs. Those who adopt a functionalist view see culture as being:

> … made up of those mechanisms by which an individual acquires mental characteristics (values, beliefs) and habits that fit him for participation in social life; it is a component of a social system which also includes social structures, to maintain an orderly social life, and adaptation mechanisms, to maintain society's equilibrium with its physical environment (Allaire & Firsirotu, 1984, p. 217).

The interpretive view

An opposing view of culture is the interpretive view. The interpretive view seeks to understand the world *as it is*, and to understand the fundamental nature of the social world through subjective experience (Burrell & Morgan, 1994). Those adopting an interpretive perspective see culture as developing through an emergent social process, created by individuals. Culture is regarded as a system of meanings and symbols shared between groups of individuals who participate in this social process (Allaire & Firsirotu, 1984). The interpretive view suggests culture cannot be shaped or manipulated easily, and cannot be studied easily using scientific methods. Culture does not reside in the attitudes and/or cognition of individuals. It resides in the 'meaning' shared by social actors (Allaire & Firsirotu, 1984). Consistent with this view, Geertz defines culture as 'the fabric of meaning in terms of which human beings interpret their experience and guide their actions' (Geertz, 1973, p. 145).

Geertz illustrated this interpretation as follows:

> Man is an animal suspended in webs of significance he himself has spun; I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning (Geertz, 1973, p. 5).

When defining and understanding cultural influences on H&S, it is important to consider these opposing views of culture. The view that is chosen will have relevance for:

- what aspects of culture should be considered important to H&S
- the type of interventions that might effectively enhance the culture for H&S, and
- the way H&S culture should be studied or assessed.

Why study culture?

Schein (2010) defines culture as:

> … a pattern of shared basic assumptions learned by a group as it solved its problems of external adaption and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems (Schein, 2010, p. 18).

Understanding culture is useful because '[culture] is a powerful, latent, and often unconscious set of forces that determine our individual and collective behaviour, ways of perceiving, thought patterns, and values' (Schein, 1999, p. 14).

Culture permeates all aspects of human lives: individuals experience and 'do' culture every moment – culture guides individuals' behaviours, and in turn, behaviours modify culture (Fellows & Liu, 2013). Culture also determines how people communicate and interact with each other, and how people interact with their environment. In an organisation, culture:

- guides decision making and activities at all levels in the organisation
- determines the effectiveness of the whole organisational system, and
- determines efficiency in achieving organisational objectives.

Thus, Schein argues that 'understanding culture can help to explain many of our puzzling and frustrating experiences in social and organizational life' (Schein, 2010, p. 7).

Culture is understood as a frame of reference that guides behaviour. This capacity to guide behaviour means culture is very important for developing an understanding of collective behaviour (including behaviour in relation to H&S) in societies, industries, organisations, projects and workgroups.

Levels of culture

Culture is also believed to manifest simultaneously in various forms, at different 'levels' (Sackmann, 1997). Individuals have more than one cultural identity because they can identify simultaneously with their ethnic background, their nationality, their profession/occupation, their industry sector, their employing organisation, their division, department or project, their workgroup, and so on. These potential cultural identities simultaneously create the cultural context in which individuals live and work, and they can combine in complex ways to influence behaviour.

These different levels of cultural influence are likely to be particularly relevant in multicultural societies such as Australia. A growing reliance on migrant workers in many industrialised nations further increases the cultural complexity within which H&S needs to be managed. Håvold et al. (2010) argue that it is useful for managers to understand the influence of national cultures and the likely

influence of these cultures in the composition of work teams. This understanding assists managers to ensure that differences in cultural characteristics are managed and the best possible H&S performance is achieved.

These sources of cultural identity broadly fall into four distinct levels of analysis, shown in Table 2.1.

Table 2.1: Categories of culture (adapted from Schein, 2010, p. 2)

Cultures	Categories
Macro-cultures	Nations, industry, ethnic and religious groups, occupations that exist globally
Organisational cultures	Private, public, non-profit, government organisations
Sub-cultures	Occupational groups and functional divisions within organisations
Micro-cultures	Work teams and groups

2.2 National culture

Hofstede (1991) defines national culture as 'the collective programming of the mind acquired by growing up in a particular country' (p.262). This mental programming shapes the values, beliefs, norms, and perceptions about what should be given priority within that national culture. It is believed that the values and beliefs underpinning national cultures influence individuals' behaviour through the values and beliefs they form about what type of behaviour is legitimate, acceptable and effective (Håvold, 2007).

Based on work conducted at a large multinational company (IBM), Hofstede (1991) identified a five dimensional framework for differentiating and positioning national culture.

Table 2.2: Dimensions of national culture (Hofstede, 1991)

Power Distance	Power distance concerns the extent to which power is unequally distributed between subordinates and superiors. In countries characterised by small power distance, the relationship between subordinates and superiors is much closer. The structure of organisations is less hierarchical and the working environment is more democratic. Subordinates are more involved in decision making. In countries characterised by high power distance, the structure of organisations tends to be much more hierarchical. The decision making process is more centralised, meaning decisions are mainly taken by superiors. Subordinates have fewer opportunities to voice their opinions and are expected to passively obey instructions from their superiors.
Uncertainty Avoidance	People in societies characterised by high uncertainty avoidance are more likely to seek strict rules to deal with uncertain situations. People in societies characterised by low uncertainty avoidance are more likely to resolve problems pragmatically without formal rules as they think that rules should only be established in case of absolute necessity.

Individualism vs. Collectivism	People in societies characterised by individualism are more concerned about their individual interests or the interests of their immediate family. People in societies characterised by collectivism are integrated into strong and cohesive in-groups. They place a higher priority on the collective interests of the group than their own individual interests.
Masculinity vs. Femininity	People in societies characterised by masculinity are concerned about the extent to which individuals are assertive, tough and focus on material success. People in societies characterised by femininity are likely to be more modest and tender, and have more concern with relationships.
Long-term vs. short-term orientation	Societies with long-term orientation tend to embrace forward-thinking values. Societies with short-term orientation tend to show high respect for traditional values.

Hofstede collected data using questionnaire surveys with 117,000 employees of IBM and its subsidiaries in 71 countries. The data were used to examine the existence of national cultural differences. Hofstede's national culture model has been employed extensively in organisational studies and it is used to explain the interaction between national culture and organisational behaviour.

Hofstede's framework has been used to explain H&S behaviour in various cultural contexts. For example, Mearns & Yule (2009) suggest a culture characterised by high power distance could result in a one-way flow of communication from superiors to subordinates. Potentially, this would prevent workers from actively participating in H&S processes and would reduce the opportunity for workers' H&S knowledge to inform decisions.

Extreme collectivism can produce a form of 'groupthink' (Janis, 1972) in which people are reluctant to speak up or offer a view that diverges from the group's collective view. Groupthink has been identified as a factor in major catastrophic events, including the Challenger disaster. It is critical that individuals can freely express safety concerns, even if these are at odds with the shared beliefs and values of the group. Individualism, on the other hand, fosters more open and direct communication and encourages individuals to voice their thoughts and concerns. This is likely to support organisational H&S efforts.

Cultures characterised by high levels of masculinity would tend to encourage the need for challenge, success and achievement of material benefit. Extreme levels of masculinity could reduce the quality of interpersonal relationships and communication and encourage risk-taking in pursuit of success.

Some empirical evidence also supports the link between national culture and H&S relevant-behaviours (see, for example, Hsu et al., 2010). Haukelid (2008) describes how, during the late 1960s and 1970s, oil rigs on the Norwegian continental shelf adopted an American culture. In this culture, a 'roughneck' identity developed in drilling crews. Such was the culture that involvement in minor accidents was a 'badge of honour' and many incidents were not reported to management. The overriding view was that workers had to take care of themselves and were personally to blame if they were injured. The 'Americanized' culture prompted Norwegian oil workers to nickname certain rigs 'Texas'. Haukelid (2008) describes how the values and norms on these oil rigs were at odds with the Norwegian national culture which valued collective and social responsibility for workers' health and safety.

Merrit and Helmreich (1996) conducted a survey among pilots and flights attendants of different nationalities. They reported that participants whose national culture was characterised by high power distance and collectivism were more likely to follow captain's orders, adhere to standard operating procedures, and monitor the crew's performance. Participants whose national culture was characterised by low power distance and individualism tended to be more self-reliant, to rely less on captain's authority to direct their behaviour, and to pay less emphasis to standard operating procedures and flight plans. Håvold (2007) reported on a survey of 2,558 predominantly male shipping industry workers, finding that high power distance, uncertainty avoidance and individualism were significantly related to a positive safety orientation. Similarly, Mearns and Yule (2009) analysed six national workforce groupings of 845 oil and gas workers. Significant differences were found between different national groups, and masculinity and power distance were both significant predictors of workers' risk taking behaviour. The higher the power distance and the higher the masculinity levels, the more likely workers were to take H&S risks.

In spite of these significant results, Mearns and Yule (2009) caution against overstating the role played by national culture in shaping H&S behaviour. Their analysis demonstrated that, though important, national cultures were a less significant factor in driving H&S behaviour than organisational characteristics, including management commitment to H&S. The role played by factors other than national culture in shaping H&S was also identified by Spangenberg et al. (2003). They investigated why Danish workers experienced almost four times the lost-time injury rate of Swedish workers in a joint venture construction project, despite the two countries sharing similar scores on Hofstede's cultural dimensions. The difference in H&S performance was attributed to national wage and workers' compensation practices, national educational programs, and aspects of the socioeconomic structure such as H&S and employment legislation. Spangenberg et al. (2003) conclude that a more comprehensive approach, incorporating national cultural values, and aspects of the social and institutional context, may be more helpful in understanding differences in H&S practices and performance between different national groups.

Hofstede's framework has received considerable criticism. The use of quantitative questionnaire surveys and inferential statistics has been questioned as useful method for analysing something as complex as national culture. The generalisability of Hofstede's dimensions has been questioned based on his reliance on data from a single organisation. Williamson (2002) argues that the five dimensions are insufficient to depict the richness of national cultures. Other concerns have focused on the risk of the over-generalisation implicit in equating culture with country and nationality. Critics, such as Tan (2002), maintain national cultures have converged due to globalisation, advances in information and communication technology, the internationalisation of business, and economic development.

Nevertheless, understanding the influence of national culture on H&S is important, especially in the context of globalisation and labour migration. Guldenmund et al. (2013) identify migrant workers as a vulnerable group at high risk of occupational injury in Europe. They attempt to analyse whether migrant workers' H&S is related to their country of origin and the safety values, assumptions and expectations they bring from those countries, or whether it is a matter of adjustment, language or other factors that are independent of their national culture. Guldenmund et al. (2013) report that national culture may influence certain behaviour among migrant workers. However, they found no substantive evidence that national culture plays a significant role in the incidence of work-related injury among migrant workers.

The trend towards the increasing use of migrant workers in developed economies can create new challenges for H&S management as effective H&S strategies might differ in culturally diverse workgroups. It is possible that certain characteristics of national cultures in combination (for example, power distance, individualism and masculinity) could interact with industry and

organisational or workgroup cultures to increase workers' propensity to take risks. However, the diversification of work crews (especially in industries with entrenched 'can do' masculine cultures) could also create opportunities to develop positive improvements in H&S culture and performance.

2.3 Industry culture

Specific industries have developed their own cultural characteristics. Phillips (1994) revealed important cultural differences by comparing the cultural assumptions held by employees of companies in different industry sectors (food production and hospitality). Chatman and Jehn (1994) compared the cultural characteristics of 15 companies engaged in different service sector industries (accounting, consulting, household goods, and postal service). They reported that cultural characteristics vary considerably between industries and explain industry differences in terms of structural attributes, such as growth rate and technology usage. Christensen and Gordon (1999) also explain cultural differences between industry sectors in terms of broader industry imperatives. For example, industries that require individuals or teams to 'bring in business' for their survival (such as consulting, accounting and construction) tend to be aggressive, reflecting the competitive nature of these industries. Gordon (1991) argues that organisational culture is deeply influenced by the characteristics of the industry in which the company operates. Companies in the same industry usually share some common cultural values and practices that are essential for survival in the industry. This is because the industry driven assumptions create industry-wide values systems, which lead the companies to develop strategies, structures and processes that are consistent with – and not 'antagonistic' towards – the prevailing industry culture (Gordon, 1991).

Researchers argue that the relationship between organisational and industry level cultures arises because organisations are embedded within the institutional relationships of their industry sectors (Dickson, BeShears & Gupta, 2004; Phillips, 1994). The institutional environment in which an organisation operates establishes the values, beliefs, rules, practices, and accepted requirements to which an organisation should conform to maintain its legitimacy and ensure its survival (Meyer & Rowan, 1977). Organisations that have the common characteristics of their industry sector are heavily influenced by institutional arrangements established by peak bodies, whose registration, accreditation and self-regulatory processes ensure conformity with industry norms, values and expected behaviours.

An industry also influences member organisations through the very nature of the industry, or through specific industry characteristics. For example, project based industries, including construction, emphasise the value of adherence to (often tight) project production schedules. Christensen and Gordon (1999) suggest that industry cultures 'regulate' the behaviour of member organisations regarding 'how things are done' in the industry.

Industry culture influences workforce behaviour and can impact on H&S performance. For example, a multi-level subcontracting system is a feature of the construction industry. This system operates on a payment-by-results basis – that is, payment is based on the amount of work completed rather than the time spent on work (Mayhew & Quinlan, 1997; Wadick, 2010). This arrangement can drive subcontractors to work excessively long hours, take 'shortcuts' in relation to H&S, and continue working in spite of injury. However, the relationship between industry cultures and H&S may be reciprocal. Mearns and Yule (2009) report that industries characterised by a male dominated, 'macho', 'can do' culture tend to attract, accept and retain workers who are inclined to take greater risks. They cite the example of the oil industry in the 1970s and 1980s in which workers were attracted to high rates of pay in an industry known to be high risk. They suggest that workers' behaviour at this time drove the industry's culture as much as the industry's culture drove risk taking behaviour.

2.4 Organisational culture

Reflecting the differing approaches to understanding culture described above, organisational cultures can be considered from either a functionalist view or an interpretive view.

A functionalist approach views organisational culture as the shared values and norms within the organisation, and emphasises leaders' roles in cultivating the culture through developing managerial ideology, goals and strategy (Schein, 2010). Organisational culture should be strategically managed to serve the purpose of the organisation (Waring, 1992). It is assumed that organisational cultures can be 'engineered' by identifying their essential components and formulating strategies to develop these components across the organisation. Organisations subscribing to a functionalist approach periodically assess their cultures using quantitative employee attitude/perception surveys. The data are used to identify cultural weaknesses, and strategic interventions are formulated and implemented to effect cultural improvement.

In contrast, an interpretive approach views organisational culture as an emergent property of the organisation. This view regards culture as comprising shared meanings and interpretations which are created (or recreated), collectively and continually, by the individuals involved (Demers, 2007). People who subscribe to the interpretive approach believe that organisational culture is created by all organisational members. Culture cannot be manipulated easily or created by senior managers, and it is not 'owned' by the organisation. The interpretive view represents a 'bottom-up' (rather than a 'top-down') approach to organisational culture. The interpretive approach also lends itself to using more qualitative assessment methods (such as in-depth interviews and field observations) to understand the cultural meanings underlying individuals' actions and interactions.

Smircich (1983, p. 347) distinguished the two approaches to organisational culture by whether they reflect:

- 'the view that culture is something an organization has' (functionalist), or
- 'the view that a culture is something the organization is' (interpretive).

According to Schein (2010), confusion about the best way to understand organisational culture arises as a result of the failure to recognise the different levels at which organisational culture operates. Schein (1985) developed a three-layer model of organisational culture. The differentiation between each layer is based on the 'degree to which the culture phenomenon is visible to the observer' (Schein, 2010, p. 23). Schein's three layers of culture are shown below in Table 2.3.

Table 2.3: The three layers of culture (Schein, 2010, p. 24)

Basic underlying assumptions	Usually unconscious, taken-for-granted beliefs and values. They are developed over a long period and shape the way that group members perceive, feel about and interpret the environment around them. They are the essence of any culture.
Espoused beliefs and values	The principles that guide group members in their behaviours. They include ideals, goals, values, aspirations and ideologies. Espoused beliefs and values are considered to be conscious and explicitly articulated because they guide group members in how to deal with certain key situations. They are used to train new members in how to behave.
Artefacts	Artefacts are symbols that reflect the basic underlying assumptions and espoused beliefs and values of an organisation. Artefacts include: • visible organisational structures (like organisational charters, formal responsibility descriptions, and organisational charts) • organisational processes, and • observed behaviour that accompanies organisational processes.

The second layer in Schein's model – espoused beliefs and values – aligns with the 'managerial ideology' emphasised by a functionalist approach to organisational culture. Espoused values and artefacts relate to what managers 'audibly say and visibly do' about organisational goals and aspirations. Schein's choice of terminology reflects the fact that what is seen and heard in an organisation is not always a true expression of the underlying culture (Guldenmund, 2000). Workers form perceptions of managerial actions over time and these perceptions are amenable to measurement by employee perception/attitude surveys. Artefacts are the tangible products of the organisation's espoused beliefs and values. They are observable directly and can be assessed readily using tools such as checklists and activity analyses.

However, the basic underlying assumptions, which form the core of an organisational culture, are more challenging to bring to light. Arguably, they are so deep, and their validity so self-evident to those who hold them, that they may be difficult to uncover or express in words. Understanding basic assumptions requires qualitative approaches to data collection. Such approaches rely on observing and interpreting organisational members' interactions and behaviours, from which basic assumptions can be inferred.

An organisation's deep cultural assumptions and beliefs influence all aspects of the organisation, including H&S-relevant behaviour (Guldenmund, 2000). This is well illustrated by the identification of organisational culture as a causal factor in major industrial catastrophes (Hopkins, 2006).

Characteristics of organisational H&S cultures are discussed in detail in Part 4 of this report.

Workgroup cultures

Modern organisations are large and complex. It is an over-simplification to assume that a single unifying organisational culture will develop. Consistent with an interpretive view of organisational culture, multiple cultures can co-exist. They may develop in organisational subunits or across professional, functional or departmental lines. There is a growing recognition that workgroups within an organisation often develop distinct sub-cultures that serve as strong drivers of H&S behaviour and performance (Zohar, 2000).

Several researchers have identified cultural differences in H&S orientation among groups of employees within the same organisation. For example, in the Norwegian oil industry, Tharaldsen et al. (2008) found cultural differences in the safety orientation of workers on different oil platforms and in different work areas. Differences were also observed between directly employed workers and those who were employed by contractors to the oil platform operators. Glendon and Litherland (2001) also report significant cultural differences between workers in different functional areas (maintenance and construction) within a road construction organisation.

There is compelling evidence that organisational cultures are inherently 'patchy' – they are subject to considerable variation.

The need for a multi-level/multi-layer approach to understanding culture

Earlier sections of the report have summarised what constitutes culture, how it can be understood, and how it is expressed at different levels within society. This summary provides a foundation for the direction to take in developing the ACA Safety Culture Framework.

The Framework will adopt a multi-level/multi-layer approach in which:

- the cultural drivers for H&S are understood to exist at national, industry, organisation and workgroup levels
- culture is understood to operate through basic underlying assumptions, espoused values and artefacts.

Consistent with an interpretive approach, culture is understood as an emergent phenomenon that is not easily manipulated, and unlikely to be uniform or aligned with the organisation's H&S goals.

It remains important to understand the cultural drivers of H&S within an organisational context because organisations can be influenced and changed for the better over time. It is unlikely that the 'ideal' of a unitary culture totally aligned with organisational strategy can ever be realised. However, the inherent 'patchiness' of organisational H&S performance can be reduced by developing local conditions that culturally support H&S.

It is acknowledged that basic underlying assumptions are very difficult to uncover. It is likely to be impossible when using worker perception/attitude surveys. Nevertheless, worker perception/attitude surveys can diagnose potential weaknesses in organisational cultures that impact on H&S at a given point in time. Survey data collected over time can also supplement a continuous monitoring system that tracks leading indicators of H&S performance.

Part 3: The cultural context of the Australian construction industry

3.1 Introduction

Part 3 describes the cultural context of the Australian construction industry. It is structured as follows:

- Part 3.2 provides an overview of research on the Australian national culture, including:
  - a review of Australia's national cultural traits, and
  - a discussion of the extent and impact of Australia's multicultural society.
- Part 3.3 describes characteristics of the Australian construction industry which influence (or are influenced by) the industry's culture, including:
  - the health status of Australian construction workers
  - the cultural diversity of the industry
  - the industry's masculine culture
  - the prevalence of subcontracting, self-employment, and small-to-medium sized businesses, and
  - the state of work-life balance in the construction industry.
- Part 3.4 draws conclusions about the way that the cultural context of the Australian construction industry is likely to shape the H&S culture of organisations operating within it.

3.2 Australian culture

Schein (2010) argues that a comprehensive understanding of organisational culture requires an understanding of the macro contexts in which the organisation is embedded. Similarly, Dickson et al. (2004) comment that:

> … national culture and industry are integral parts of the environment in which organisations function; organisational culture by implication should be influenced both by the broader societal culture and by the industry in which it operates.

National cultural values

Hofstede and Hofstede (2005) compared cultural differences between countries by calculating cultural dimension index scores. Table 3.1 lists the cultural dimension index scores for Australia as well as comparative rankings. Australia can be described as a nation with low power distance, low uncertainty avoidance, high individualism, high masculinity, and low long-term orientation. (See Part 2 of this report for definitions of these terms).

Table 3.1: Cultural dimension scores for Australia (source: Hofstede & Hofstede, 2005)

Cultural dimension	Index Score for Australia	Ranking	Categorisation
Power Distance	36	62 out of 74 countries	Low Power Distance
Uncertainty Avoidance	51	55-56 out of 74 countries	Low Uncertainty Avoidance
Individualism (Collectivism)	90	2 out of 74 countries	High Individualism
Masculinity (Femininity)	61	20 out of 74 counties	High Masculinity
Long-Term Orientation	31	25-27 out of 39 countries	Low Long-Term Orientation

Researchers have employed Hofstede and Hofstede's cultural dimension scores to study the influence of national culture on people's values and behaviour (especially in international comparative studies). However, recently researchers have questioned the magnitude of influence that national culture has on people's values and behaviour. Gerhart and Fang (2005) argue that national culture provides a very weak basis for individual values about management practices. They re-examined Hofstede and Hofstede's underlying assumption that national culture plays a substantially important role in international management, focusing on the amount of variance rather than on statistical significance. They found that cultural difference only explained a small amount of variance regarding workers' reaction to management practices. They also compared country and organisational differences, and discovered that organisational differences account for more variance than country differences. The conclusion is that national culture does have some influence on personal values – however, its role needs to be understood in the context of other important factors such as organisational culture.

Cultural diversity

Australia relies heavily on migration for population growth, making cultural diversity a remarkable characteristic of its national culture. In 2009-10, net overseas migration (NOM) added 215,600 people to Australia's population. This number accounted for 57.2% of total population growth during that period (DIMIA, 2011). By 30 June 2011, 27% of the resident population – approximately six million people (ABS, 2012) – was born overseas. Migrants make a significant contribution Australian society by increasing the size of the workforce, adding to productivity, and boosting economic growth (DIMIA, 2011).

Recently arrived skilled migrants earn more per year than the Australian average, suggesting that migrants substantially increase productivity and stimulate the Australian economy (DIMIA, 2011).

During the period 2005-10:

- the number of workers in Australia increased from 10 million at June 2005 to 11.21 million at June 2010
- the number of Australian-born workers increased modestly by 9.1% (681,000 workers), while the number of overseas-born workers increased by 21.2% (528,300 workers) (DIMIA, 2011).

Australian multiculturalism makes it difficult to identify a single Australian national identity. Further, this makes it difficult to apply Hofstede and Hofstede's cultural dimension scores to the Australian context, as these assume there is a single national identity. Also, the values are derived from the responses of a limited sample size in each country and the sample may not be representative of the whole country.

3.3 The culture of the Australian construction industry

The construction industry differs from other industries in a number of ways that are fundamentally important in shaping the construction 'cultural recipe' (Dainty et al., 2007).

The Australian construction industry is characterised by:

- a demanding, project based work environment
- a high proportion of migrant workers
- a male-dominated workforce, and
- a high percentage of subcontractors.

Many studies have indicated that the culture of the construction industry has significant implications for the H&S of construction workers. (See for example: Debrah and Ofori 2001; Mayhew et al., 1997.)

The health status of Australian construction workers

Construction workers are highly vulnerable to physical and mental illness, creating an urgent need for health promotion programs (Welch, 2009). Construction is a 'dirty, dangerous and demanding' industry in which chronic health-risk factors are prevalent. Health assessments of some 176,483 male construction workers in the state of Victoria (WorkHealth Victoria, 2013) revealed significant levels of:

- high blood pressure (33%)
- high cholesterol levels (26%)
- high risk of developing type 2 diabetes (26%)
- high blood-glucose levels (25%).

Unhealthy lifestyle behaviours were also evident, including:

- physical inactivity (57%)
- risky alcohol intake (63%)
- below recommended vegetable intake (93%)
- below recommended fruit intake (55%)
- smoking (29%).

International research indicates that the way construction work is organised has a greater impact on workers' health than lifestyle factors. In the Netherlands, for example, Alavinia et al. (2007) found work related factors were more significantly related to workers' health than individual factors. Work related factors include low levels of job control, high work demands, job strain, a lack of support at work, and ergonomic hazards. Similarly, in Sweden, Stattin and Järvholm (2005) found that individual factors had some influence. However, they found that physical and environmental hazards, work-life strain, lack of job control, work stress, and high work demands were stronger predictors of construction workers' experience of musculoskeletal, cardiovascular, psychiatric and respiratory diseases than were individual factors.

It also appears that the environmental conditions experienced by project based construction workers may contribute to unhealthy behaviour and lifestyle factors. Long work hours are typical of project based construction work, and work-family conflict (WFC) is high (Lingard & Francis, 2004). Work hours and WFC are linked consistently to chronic disease risk factors, including:

- poor diet (Devine et al., 2006)
- high cholesterol (Van Steenbergen & Ellemers, 2009)
- lack of physical exercise and low physical stamina (Burton & Turrell, 2000; Van Steenbergen & Ellemers, 2009)
- poor sleep quality (Williams et al., 2006)
- high body-mass index (Van Steenbergen & Ellemers, 2009)
- harmful levels of alcohol consumption (Frone et al., 1997; Roos et al., 2006)

Australian construction workers have themselves attributed their high levels of alcohol use to working long hours (MacKenzie, 2008). Construction workers also state that long hours, insufficient recovery opportunities, and exhaustion, prevent them from participating in healthy lifestyle activities such as sport and physical exercise (Lingard et al., 2010).

Thus, long-term and sustainable improvements to construction workers' health need a holistic and integrated approach that addresses environmental conditions, the culture of the industry, and workers' health related behaviour.

Cultural diversity in the Australian construction industry

The construction industry employs a large number of migrants in its workforce (Loosemore & Chau, 2002). Recent reforms to the skilled migration program have further contributed to the high level of migrants in the construction industry. In 2008-09, the government conducted a review of permanent skilled migration to address the economic challenges resulting from the global financial crisis (Phillips & Spinks, 2012). This review led to a shift from 'supply driven', independent skilled migration to a 'demand driven' migration strategy that targets the skills needed in the economy and ensures that migrants are employed in industries with the highest need. Construction was identified as an industry with a critical need for workers (Phillips & Spinks, 2012), and construction trades, together with medical and key IT professionals and engineers, became the main focus of the Critical Skills List (CSL). Migration reforms also introduced priority processing for people with these skills. In 2012, the highest share (13.4%) of temporary business (long stay) visas was granted to the construction industry. It is anticipated that more migrants with construction skills will be employed in the near future.

With high numbers of migrant workers, construction sites are considered one of Australia's most culturally diverse workplaces (Loosemore et al., 2010). Project managers in the Australian construction industry are facing new challenges in managing cultural diversity. Researchers claim that cultural diversity, if managed well, can positively affect work productivity, problem solving, creativity, and competitive advantage (Cox & Black, 1991; Hoecklin, 1994; cited by Loosemore et al., 2010). However, ineffective management of cultural diversity in project teams may lead to conflict, low morale, ineffective communication, and mental stress (Loosemore & Chau, 2002; Loosemore et al., 2010).

Cultural diversity on construction sites has a direct impact on H&S. Researchers have identified the existence of cultural and linguistic 'ghettos' on Australian construction sites, which present a significant challenge for managing communication and safety (Loosemore & Lee, 2002; Loosemore et al., 2010). For example, Loosemore et al. (2010) found that workers on Australian construction sites tend to identify socially with those who share a similar cultural background. Workers perceived that they were more likely to be understood and supported by coworkers from the same cultural group. Along with language barriers, this can lead to limited interaction, or even conflict, between workers of different cultural groups (Loosemore & Lee, 2002). Lack of communication between cultural groups directly impacts H&S as risk information is not communicated and shared effectively.

On Australian construction sites, low English proficiency is a major issue for some ethnic groups, especially for Asian workers (Loosemore & Lee, 2002; Loosemore et al., 2010). Low proficiency in English leads to difficulty in comprehending safety notes, instructions, and messages conveyed by others, which prevents workers from understanding safety risks (Loosemore et al., 2010; Trajkovski & Loosemore, 2006). Workers with low English proficiency also face challenges during induction and training sessions (Loosemore et al., 2010; Trajkovski & Loosemore, 2006). For example, Trajkovski and Loosemore (2006) investigated workers in New South Wales who were required to obtain WorkCover accreditation by completing the mandatory 'Green Card' safety induction course. Most respondents felt the training would be more effective if the induction course was delivered in their first language. More than half of the respondents reported that they had difficulty understanding the written or verbal material provided, and also experienced difficulty passing the final exam. Although most workers on construction sites have undertaken mandatory training, their safety knowledge may be limited due to language barriers.

New approaches to managing health and safety are required to address ethnic diversity on Australian construction sites. Researchers have suggested initiatives such as translating health and safety materials, using interpreters, and adopting visual methods for communicating health and safety messages (Bust et al., 2008). Visuals can be very effective in communicating health and safety messages in a way that is meaningful and relevant to migrant workers, but these should be informed by the experiential knowledge and cultural narratives that construction workers use to aid their understanding of health and safety. Recently, Tutt et al. (2013) reported that to achieve safety at work, migrant workers sometimes develop 'hidden' communication channels to communicate tacit and unspoken H&S knowledge and practices. Through onsite observation of a gang of curtain wall workers, they found that workers of different ethnic groups develop safety languages (for example, specific gestures, verbal symbols) that are only understood by group members and which enable them to work effectively and safely. This study shows that it might be beneficial for construction companies to develop an understanding of special communication patterns for improved H&S management rather than focusing solely on developing workers' English language skills.

Masculine culture

The construction industry is well known as a male dominated industry with a strongly masculine culture (Gale & Cartwright, 1995; Loosemore & Galea, 2008). Due to the harsh working environment, and physically demanding nature of the work, it is taken for granted that male workers should dominate the construction industry. In the 2010-11 financial year, 88% of Australian construction employees were male, and the remaining 12% were female (ABS, 2013). The proportion of female construction industry employees varied by industry sector, but was lowest in the construction services area. Women made up only 10.1% of construction services employees, while 89.9% of construction services employees were male. Women comprised 15.4% and 15.2% of the employees in the civil/heavy engineering and building construction sectors respectively (ABS, 2010a). The impact of gender on safety related behaviour has been documented. For example, researchers have reported that males are more likely to engage in unsafe driving behaviours than females (Harré et al., 1996), and females have a lower propensity than males to engage in risky activities related to gambling, recreation and health (Harris et al., 2006).

Dainty and Lingard (2006) report that the need to comply with male oriented work practices, such as the expectation that workers will work long hours and work in disparate geographical locations, is an impediment to women's career advancement in the construction industry. For example, the researchers describe the policy of one UK construction company that required all junior managerial workers to gain a period of international experience and pursue further academic qualifications, which had to be achieved in addition to already demanding work schedules. The under-representation of women in the construction industry means that their behaviour is subject to even greater 'time scrutiny' than their male counterparts, increasing the pressures upon women to be available for work at all times. Indeed, in a work culture that 'glorifies' workers who work as though they have no personal life, it is extremely difficult for women with primary responsibility for caring for children or other family members to strike a work-life balance. A number of the women in the Australian survey reported by Dainty and Lingard (2006) expressed the need to 'choose' between their career and having a family because they believed they would be unable to perform satisfactorily in these two life domains simultaneously.

In the Australian construction industry, Iacuone (2005) conducted an ethnographic study to explore the influence of masculine culture on H&S. Through participant observation and interviews with male tradespeople on construction sites, Iacuone identified five dimensions underlying masculine culture in this particular context:

1. Gender identity and sexuality
2. Girl-watching
3. Risk and physical prowess
4. Horseplay and larrikinism, and
5. Alcohol consumption.

Iacuone further contended that gender based practices on construction sites create a hierarchy among male tradespeople that is established by the men's subscription to a particular configuration of male culture called 'hegemonic masculinity', which is an imagined construct depicting the way men should behave and the goals they should aspire to. The struggle for control and dominance is one characteristic of hegemonic masculinity. Iacuone use the term 'one-upmanship' to describe the way construction workers contest for status, recognition and self-assurance of their masculine attributes. Iacuone found that the type of one-upmanship that most frequently occurs on Australian construction sites is around contests of physical strength, such as lifting excessively heavy weights. The dominant masculine culture, which assumes that men should be tough and should not be afraid of danger, imposes negative influences on construction workers' attitude towards H&S. Iacuone found that some workers tend to view others' caution about safety as a subordinated gender construct ('femininity'), and engage in dangerous behaviours to show their attachment to the dominant masculine culture.

Recent researchers suggest that organisations should take initiative to 'undo' gender issues at work. Ely and Meyerson (2010) conducted a case study of two offshore oil platforms and found that organisational initiatives designed to enhance safety and effectiveness create a culture that releases workers from societal imperatives for 'manly behaviour'. These organisational initiatives motivate workers to let go of masculinity concerns and to behave in counter-stereotypical way. Workers on these two oil platforms were found to readily acknowledge their physical limitations, openly admit to their mistakes, and show concern for their own and others' feelings, instead of proving how tough, proficient and cool-headed they were.

Based on the case study, Ely and Meyerson (2010) proposed an organisational culture model to help men 'undo' gender at work. The model constitutes three mutually reinforcing components of organisational culture that direct men away from masculinity concerns:

- collective goals
- the alignment of definitions of competence with *bona fide* task requirements rather than with idealised images of masculinity, and
- a learning orientation toward work.

It is argued that consistent emphasis on collective goals directs men away from the goal of masculinity toward goals that benefit the collective good. Specifically, organisational norms and practices that give high priority to workers' safety, and emphasise the importance of community, indicate management's concern for workers and reinforce workers' shared responsibility for each other. Organisations can equip men with requisite skills and perspectives to undo gender by articulating a definition of competence that includes qualities required to perform work safely and effectively (for example, caring about fellow workers). The definition of competence can be communicated via rhetoric, role models and training. While collective goals and the definition of competence can motivate men to let go of masculine concerns, a learning orientation towards work supports men to recognise their own and others' limitations. Cultures that advocate learning provide men with a psychosocially safe zone to relax their guard and admit to mistakes, without being worried that fellow workers will humiliate them.

Subcontracting and self-employment in the Australian construction industry

The Australian construction industry is characterised by various forms of non-standard employment; in particular, high levels of (multi-level) subcontracting and self-employment.

In 2009, 72.5% (713,000) of people employed in the Australian construction industry were organisationally employed, compared to 88.6% for all industries. Some 218,000 workers operated on an 'Own Account' basis, making up 22.1% of the construction industry's workforce. This is significantly higher than the 8.6% of workers that operated on an 'Own Account' basis in all Australian industries (ABS, 2010b). Research shows that compared to their organisationally employed counterparts, self-employed workers in the UK construction industry work longer hours, experience higher levels of conflict between their work and personal life, and express more concern about their job security (Sang et al., 2008).

The Australian construction industry is also dominated by small-to-medium sized enterprises (SMEs). According to the Australian Bureau of Statistics, 93.8% of construction businesses have fewer than than five employees, and just over two-thirds of all people working within the industry (ABS, 1999) work for SMEs. Conversely, less than 1% of construction businesses employ 20 or more people, and companies of this size employ only 13.6% of the construction workforce. ABS data indicates that the average number of people employed by construction businesses in 2002-03 was 1.8 per business for residential building businesses, and 4.7 per business for the non-residential and non-building (that is, engineering, industrial and services) sectors (ABS, 2004). The ABS reports that during 2002-03, 64.7% (219,926) of construction businesses earned income less than $100,000, and a further 25.3% (86,035) earned income between $100,000 and $500,000. Further, small businesses (those with income less than $100,000) accounted for 72% (or 199,000 persons) of all working proprietors/partners, but only 6.2% (27,400) of all employees, which is indicative of high levels of self-employment in this sub-sector of the construction industry.

Subcontracting is also standard practice in the Australian construction industry. According to ABS data for the period 2002-03, a total of $125.7 billion was generated by the trade services, building and construction industry. Of this, contracting income comprised $83.0b (66% of the total), and subcontracting income accounted for $42.7b (34%). The proportion of income accounted for by subcontracting varied by asset type. For example, in the period 2002-03, income generated from subcontracting accounted for 36.8% of the total income generated in the housing sector, 36.6% of the total income generated in the non-residential construction sector, and 26.0% of income generated in constructing roads and bridges (ABS, 2004).

Although subcontracting can benefit principal contractors in terms of labour flexibility and the changing requirements of the market, it is also blamed for poor H&S performance (Mayhew & Quinlan, 1997). Subcontractors are located at the lower end of the hierarchical structure in the construction industry (Lingard & Holmes, 2001). They have the least influence on decision making in the construction process and have the highest exposure to hazards and risks.

Principal contractors play a critical role in managing subcontractors and maintaining a safe workplace (Wadick, 2010). Principal contractors should select subcontractors who provide them with best value rather than the lowest quote. Value in this context is a subcontractor's ability to fulfil the principal contractor's requirements through attributes such as technical and safety competencies (Teo et al., 2005), including the provision of adequate and appropriate health and safety plans. Importantly, principal contractors need to allocate sufficient resources to ensure that subcontractors can perform their jobs safely. A safe construction site is highly reliant on planning done by principal contractors, and

on their effective communication with all subcontractor groups about risks. Principal contractors are in the best position to foster positive interfacing between subcontractor groups through promoting and reinforcing effective communication and collaboration between groups (Wadick, 2010).

The negative influence that subcontracting has on H&S may be linked to the following factors:

- economic pressures
- ineffective coordination
- lack of consultation, and
- lack of entitlements.

Economic pressures

Subcontracting often operates on a payment-by-results basis; that is, payment is based on the amount of work completed rather than the time spent on work (Mayhew & Quinlan, 1997; Wadick, 2010). This results in subcontractors' inclination to complete work as quickly as possible to receive a quick financial return. Therefore, subcontractors sometimes work at the expense of H&S by taking shortcuts, working excessively long hours, and continuing to work despite injuries. In addition, the low profit margins that result from a competitive tendering system mean subcontractors are reluctant to invest in H&S. They claim that H&S compliance results in higher costs and slower progress, and they are unable to charge more to cover the costs (Wadick, 2010).

Ineffective coordination between subcontractors

Coordination and communication between trade groups on construction sites is often poor, which directly impacts on workers' H&S (Mayhew & Quinlan, 1997; Wadick, 2010). According to Wadick (2010), the culture of independence and individual resourcefulness in the Australian construction industry diminishes the importance of interdependence and consideration for others. Economic pressure leads subcontractors to complete work as quickly as possible, and to focus on their own interests without considering the potential impact of their performance on other people. This lack of thoughtfulness for others makes it possible for one subcontractor's actions to readily endanger another subcontractor. The fragmentation of trade groups usually leads to ambiguity about the boundaries of H&S responsibility (Mayhew & Quinlan, 1997). Subcontractors may shirk responsibilities and blame others, leaving H&S problems unresolved and elevating the risk of accidents.

Lack of consultation

Subcontracted workers are often not consulted when decisions are made that could affect their H&S. Many subcontracted workers do not believe that legislative requirements adequately address their particular safety concerns, including manual handling injuries and repetitive movement injuries (Wadick, 2010). There are few structured systems for H&S consultation with workers, though workers have developed substantial tacit safety knowledge from years of practical work 'on the tools'. Subcontractors are usually instructed to follow a structured safety programs and policies that privilege paper systems over practical safety knowledge (Wadick, 2010). Many workers distrust documented policies and procedures and consider this form of safety instruction irrelevant, costly and ineffective (Wadick, 2010). This tension results in a culture of 'enforcement' that does not necessarily create a safer workplace, and is at odds with organisational statements about the importance of worker 'engagement' (Sherratt et al., 2013).

Lack of entitlements

Depending on their employment arrangements, many subcontracted workers in construction may have limited compensation, holiday, sick leave, or superannuation entitlements (Mayhew & Quinlan, 1997; Mayhew et al., 1997). Difficult access to compensation, and financial pressures, usually cause them to continue working after injury instead of seeking medical treatment. Thus, chronic injuries have become common among employees of subcontractors in Australia, and research indicates that many workers have to take early retirement due to exhaustion (Mayhew & Quinlan, 1997).

Work-life balance

The working hours of Australians have increased steadily in recent decades (Campbell, 2002). Unlike countries in the European Union, Australia has porous statutory regulations limiting the hours that can be worked (van Wanrooy & Wilson, 2006), and most Australian workers have limited control over their work hours (Peetz, Townsend, Russell, Houghton, Fox & Allan, 2003). Research has highlighted a mismatch between people's actual and preferred work hours (Reynolds, 2005). Van Wanrooy and Wilson (2006) report that significant numbers of Australian workers who work long hours (45 hours per week or more) believe their hours are too long and would prefer to work less. Reynolds and Aletraris (2007) report that when work hours are perceived to interfere with family life, Australian workers (both male and female) express stronger preferences for reduced hours.

The Australian construction industry follows traditional work patterns (Lingard & Francis, 2005) and is characterised by a culture of long hours and weekend work, especially for site-based workers. Lingard and Francis (2004) report that on average site-based employees in direct construction activity work 63 hours a week, employees in site offices work 56 hours, and employees in the head offices of construction companies work 49 hours. Since 1985, the proportion of people in the Australian construction industry working more than 44 hours has increased by 11%, which is one of the biggest increases in any industry (Van Wanrooy & Wilson, 2006). In addition, due the project based nature of construction work and the uncertainty associated with competitive tendering systems, many workers experience a lack of job security, or suffer from frequent relocation as a means of ensuring continuity of employment (Lingard & Francis, 2004).

This demanding work environment impacts construction workers' H&S and non-work life in a negative way. Lingard and Francis (2004) found that project based construction workers experience high levels of work-family conflict, and emotional exhaustion, as a result of excessive job demands, including long and irregular work hours. In another study, Lingard et al. (2010) reported that Australian construction employees showed higher mean scores for time-based, strain-based and behaviour-based work-interference with family (WIF) compared with scores reported in other international studies. They found that those who work on site in direct construction activity had higher levels of time-based and strain-based WIF than salaried workers who work predominantly in office-based roles. This finding shows that long work hours and high work pressure interfere with construction workers' ability to fulfil family responsibilities.

3.4 Conclusions

The following conclusions can be drawn from this review of the cultural context of the Australian construction industry:

- The Australian national culture is high in individualism and low in power distance. These characteristics are alleged to be to be good for H&S as workers should feel comfortable holding and expressing their individual H&S concerns, and feel comfortable engaging in H&S related communication with managers.
- The Australian national culture is high in masculinity. This attribute is reported to have a negative impact on H&S because it is believed to encourage risk seeking, and to reduce the quality of relationships and communication.
- The culture of the Australian construction industry is very 'masculine', which is reflected in the industry's work practices, gender balance and work related behaviours.
- National cultures are believed to be related only weakly to H&S cultures and behaviour. Industry and organisational cultures are demonstrated to be much more influential.
- The Australian construction industry has certain characteristics that have a negative H&S impact, including:
    - long work hours and poor work-life balance
    - a heavy reliance on subcontracting
    - non-standard work arrangements, and
    - a prevalence of small-to-medium sized businesses, many of which work as subcontractors to larger companies.

Part 4: Safety Culture

Part 4 discusses different approaches to understanding organisational safety cultures, and is structured as follows:

- Section 4.1:
  - examines the role of culture in organisational accidents
  - discusses the relationship between safety culture and broader organisational cultures
- Section 4.2 describes the characteristics of a 'culture for safety'
- Section 4.3 presents a number of approaches to specifying the components of an organisational culture
- Section 4.4 draws conclusions about the characteristics and components of a safety culture.

4.1 Safety culture

Identifying culture as a causal factor in catastrophic accidents

The term 'safety culture' has gained prominence because of its use in reports that analyse major safety failures, including the Chernobyl nuclear accident (IAEA, 1986), the Piper Alpha oil platform explosion in the North Sea (Hidden, 1989), the Clapham Junction rail disaster (Cullen, 1990), and other catastrophic events. The inquiries into the causes of these major accidents identified problems inherent in the prevailing organisational cultures which, investigators argued, created the preconditions that allowed these accident scenarios to develop.

Culture is believed:

- to permeate all parts of an organisational system
- to be a powerful determinant of how organisational members enact H&S systems
- to influence H&S at different levels and through various mechanisms.

According to James Reason (2000), the cultural drivers for H&S become increasingly significant as health and safety performance improvements 'plateau' following the establishment of safety 'hardware' and 'software' (that is, technologies and systems). Indeed, Reason (2000) suggests a key component of a good safety culture is 'an abiding concern for failure' (p. 11). Organisations with a good safety culture are sensitive and responsive to signals of danger.

Hopkins (2011) describes the cultural deficiencies surrounding a 'VIP' visit to the Deepwater Horizon oil well just seven hours before it blew out. Two executive managers from BP, and two from the rig owner, Transocean, made the visit which formed part of the organisations' 'management visibility' agenda established to make managers visible to the workforce. Partly, the visit was to recognise seven years of operation without a lost time injury, and partly to remind workers about some H&S programs the two organisations were implementing; for example, one program focused on preventing injury from falling objects. The visitors observed the process of preparing to move the rig. A blowout had occurred with the same process on a Transocean rig in the North Sea just four months earlier. At the Deepwater Horizon rig, the task was not undertaken in accordance with proper and safe procedures, resulting in the massive blowout. The competency of the people performing this operation was later questioned.

Hopkins (2011) describes how the executives failed to ask probing questions of the workers they observed, missing the opportunity to evaluate their competency. During the inquiry that followed the blowout, the VIPs explained they did not want to examine what people were doing too closely because they did not wish to undermine the authority of the managers at the rig. They also explained that they did not examine the work too closely because they did not want to disrupt the operation. Despite the fact that both BP and Transocean had implemented a program to encourage workers to 'stop the job' when it was dangerous, the well had never stopped operating for safety reasons.

Finally, Hopkins (2011) observes that the executives focused their observations on conditions that were safe or unsafe (for example, whether slip resistant flooring was installed and whether safety harnesses had inspection tags). They did not concern themselves with the safety of the behaviours they observed.

This case illustrates the dangers inherent in organisational cultures in which senior managers:

- develop an over-confident (even complacent) belief that a production system is so well defended that accidents cannot happen
- fail to heed and respond to early warning signs that things could go wrong
- focus solely on inspecting physical conditions without considering the human factors that could contribute to accidents
- are reluctant to question the safety competence and professionalism of people in positions of authority and responsibility within an organisation, and
- fail to monitor rigorously the safety of operations and verify that proper and safe work procedures are being followed consistently.

> *If an organisation is convinced it has achieved a safety culture, it almost certainly has not. Safety culture, like a state of grace, is a product of continual striving.*
>
> - Reason, 2000, p.4

What is safety culture?

One feature of safety culture research is the lack of a clear and consistent definition of the concept (Hale, 2000). Research into safety culture takes different perspectives and varies on points of emphasis. There is ongoing debate about the scope and meaning of 'safety culture'. Some writers even question whether there is such a thing as a safety culture. However, broadly speaking, the cultural drivers of H&S are understood to comprise the social forces within organisations that shape organisational members' assumptions, beliefs, values and actions.

Many definitions treat safety culture as an entity that an organisation either has or does not have (Hale, 2000). It is assumed that if an organisation has a safety culture then it will perform well in H&S, and if a safety culture does not exist then it will perform poorly in H&S. For example, the UK Health and Safety Executive's (HSE) Advisory Committee on the Safety of Nuclear Installations (ACSNI) offers a widely accepted definition of a safety culture as:

> … the product of individual and group values, attitudes, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management (ACSNI, 1993).

However, some argue that this definition of safety culture is too narrow because it may not adequately capture all the organisational and social factors that are important to the healthy and safe operation of a workplace (Sorensen, 2002). The wisdom has also been questioned of separating safety culture from the broader operating culture of an organisation. Guldenmund (2000) asks whether there is, in fact, a distinct object that we should call safety culture.

An alternative view of safety culture positions it as an outcome (rather than a subset) of the organisational culture. This view assumes that organisational cultures have characteristics that impact on the way H&S is prioritised and enacted. Guldenmund (2000) argues that the basic assumptions underlying the operation of an organisation have a profound impact on the effectiveness with which H&S is managed in that organisation. Accordingly, safety culture is defined as 'those aspects of the organisational culture which will impact on attitudes and behaviours related to increasing or decreasing risk' (Guldenmund, 2000, p.251).

Safety might be a core value in some organisations, but not in others. It is likely that H&S activities will be driven by all the basic assumptions that make up the organisation's underlying culture – whether these are specially concerned with H&S or not. Similarly, Antonsen (2009) writes: 'there is no such thing as a "safety culture" but rather there are different traits of larger organisational culture that can affect the organisations' safety levels' (p.184). He argues work related attitudes and behaviours should be analysed, and understood as being situated, in a wider organisational context in which the organisational culture provides a shared framework of reference for meaning and action.

Hale (2000) adopts this line of argument, stating that it is more appropriate to talk about the (organisational) cultural influences on safety, rather than the safety culture. Similarly Haukelid (2008, p.417) argues that 'safety culture should not be something separate from – or in addition to – an organisational culture, but constitute an integrated part of this culture.'

Hudson (1999) uses the term 'safety culture' but argues that it is appropriate to talk about a positive 'safety culture' only when an organisational culture has reached a 'generative' level of progressive development, and safety is sufficiently strongly embedded as a basic value. Prior to this, other basic values and core beliefs will drive organisational behaviour, such that poor H&S performance can arise as an unintended 'side effect' of the organisational culture.

This view is also advocated by Hopkins (2006), who further claims that safety culture research can be divided into two components:

- the study of organisational cultures, and
- the study of the impact of these cultures on safety.

Every organisation has a culture, which has the potential to impact on safety. However, the way and extent to which organisational cultures impact safety varies: organisational cultures can impact safety in positive or negative ways, and the level of the impact can be high or low.

Is culture a top-down or bottom-up phenomenon?

Writers on safety culture disagree about whether safety culture should be understood as a 'top-down' or 'bottom-up' phenomenon. This reflects the functionalist/interpretivist distinction inherent in the broader literature on organisational cultures (described in Part 2 of this report).

Functionalist view of safety culture

A functionalist approach regards a safety culture as an 'ideal state' that organisations should strive to achieve. In this view, a safety culture can be readily manipulated through management intervention and used to support organisational H&S strategies and systems (Glendon & Stanton, 2000). A common characteristic of the functionalist approach to safety culture is to understand it as shared patterns of behaviour, often expressed as 'the way we do things around here' (Cooper, 2000).

According to a functionalist view, safety culture is initiated by organisational leaders and amenable to top-down control. Implicit in the functionalist approach is the assumption that managers should develop a unitary organisational safety culture that is aligned with managerial ideology and strategy (Glendon & Stanton, 2000). This unitary approach has also been described as an 'integration' orientation towards safety culture (Richter & Koch 2004), in which it is assumed that, in an ideal culture, all members of the organisation will develop shared ideas and beliefs about H&S risks, accidents and ill-health.

An integration perspective on safety culture rarely recognises that different safety cultures can co-exist within a single organisation. If functionalist writers do recognise the existence of multiple cultures then they frame this diversity as a weakness because the 'ideal' situation is believed to be a strong and unitary culture in which every member of the organisation shares similar beliefs and ideas about what is safe and what is not. The functionalist perspective assigns one culture (usually that of management) as dominant. Other cultures, where they are recognised to exist, are subordinated.

The functionalist approach to safety culture has been embedded in the traditions of social and organisational psychology and favours quantitative methods. Safety culture is seen as an entity that can be measured using tools, such as perception and attitude surveys.

Problems inherent in the functionalist approach to safety culture have been identified as follows:

1. Managers may be able to change behaviour (for example, to encourage reporting of incidents and errors) using incentive and punishment schemes, but this change is likely to be short-lived. Research indicates that behaviour modification approaches only produce temporary behaviour change and fail to address unobservable but important organisational drivers of H&S performance (for example, corporate funding decisions) (Hopkins, 2006). While managers might be able to modify behaviour within an organisation fairly readily, it is much harder to manipulate underlying beliefs and values about H&S (Naevestad, 2009).
2. The role of managers as initiators of culture is overstated. Naevestad (2009) argues that workers resist managers' cultural influences and distinct cultures can develop as a result of face-to-face interaction between members of informal groups within organisations. Most workers have little contact with managers and are more likely to be influenced to a greater extent by those they interact with most (Christian, et al., 2009). Research shows the important influence of coworkers on shaping H&S safety cultures in organisations. Chiaburu and Harrison (2008) suggest that exchanges with coworkers help people to develop clear beliefs about what is expected of them. Tucker et al., (2008) argue that social impact is a function of the strength, proximity and number of sources of influence. Although supervisors and managers have formal power (that is, strength of influence), coworkers have a greater ability to influence as they are perceived to be work task 'experts'. Also, coworkers are physically closer to other workers and relatively larger in number than managers and supervisors. These factors combine to make coworkers an important source of cultural influence on H&S (Brondino et al., 2012, Lingard et al., 2011).

3. A great many empirical studies have revealed that different groups within an organisation develop distinct safety cultures/climates. These differences have been identified between:
   (i) occupants of different professional roles (see for example, Gherardi et al., 1998)
   (ii) people in various roles/levels within an organisational hierarchy (see for example, Clarke 1999), and
   (iii) workers in groups reporting to different supervisors within the same organisation (see for example: Zohar, 2000; Lingard et al., 2010).

These instances undermine the assumption that a single safety culture imposed by management is a viable approach to analysing organisational safety culture (Naevestad, 2009)

Interpretive view of safety culture

In contrast, an interpretive view regards safety culture as an emergent phenomenon reflecting the collective identity, beliefs and behaviours of social groupings (Glendon & Stanton, 2000). According to the interpretive view, safety culture is not 'owned' by the organisation but socially constructed by organisational members – that is, it grows from the bottom-up. Culture is understood as shared patterns of meaning developed by members of an organisation (or organisational subunit) and used to interpret their beliefs, behaviour and collective identity (Naevetsad, 2009).

The interpretive perspective acknowledges that multiple sub-cultures may develop within an organisation. For example, Gherardi and Nicolini (2002) describe how engineers and construction managers developed patterns of meaning about H&S through a dynamic process of interaction and negotiation. The acknowledgement that multiple sub-cultures can co-exist within a single organisation has also been described as a 'differentiation' orientation towards safety culture (Richter and Koch 2004). This approach emphasises a lack of consensus on interpretations, experiences and assignments of meaning in organisations (Richter and Koch, 2004).

In the interpretivist view, no culture dominates by default. Viewed from this perspective, non-leader centred sources of safety culture are recognised as important and influential. Various points of view can be brought together to deal effectively with problems, challenges, and daily organisational frustrations (Blewett et al., 2012). Differentiated cultures have been viewed as the product of various types of social grouping. For example, Parker (2000) describes cultures as forming around three types of social grouping (which can also overlap within an organisational context):

- spatial/functional (that is, buildings, sites or departments)
- generational, and
- occupational/professional.

An interpretivist view assumes that, within a social grouping, the safety culture:

- motivates and legitimises members' actions about H&S
- forms the basis for ascribing meaning to H&S phenomena, including interpreting warning signals and hazards, and
- forms the basis for identifying oneself as a member of the particular group.

The interpretivist approach to safety culture is embedded in the traditions of sociology and anthropology and favours qualitative rather than quantitative methods. It is argued that in-depth study, interviews, observations and document analysis can reveal the underlying and shared systems of meaning that members of an organisation have about H&S.

The interpretivist approach to safety culture avoids suggestions that a safety culture can be 'engineered' or managed. Naevestad (2009) suggests that the malleability of a safety culture depends very much on how it is assessed. Thus, if a measure of workers' perceptions of management commitment to H&S is used to assess the safety culture, it may be relatively easy to produce changes in this measure by, for example, encouraging managers to discuss H&S more frequently in their interactions with workers. It would be much more difficult to measure and/or change workers basic assumptions about safety. It is likely that different assessment methods might be required depending on the 'layer' of safety culture that is of interest (see below).

Layers of safety culture

In Part 2 of this report, Schein's three layer model of organisational culture was described. This model suggests that the basic assumptions at the deepest level shape the way that organisation members interpret and interact with the environment around them.

Based on Schein's model, safety culture is also considered to have three layers:

- the deepest layer (basic assumptions)
- an intermediate layer (beliefs and espoused values), and
- the surface layer (behaviours and artefacts).

Clarke (2000) provides examples of safety-related basic assumptions, beliefs and espoused values, and behaviours and artefacts. The examples are reproduced in Table 4.1.

Table 4.1: Aspects of organisational safety culture (Clarke, 2000)

Surface level (norms and artefacts)	**Intermediate level (beliefs and values)**	**Deepest level (core assumptions)**
Safety policy documents Safety information system Safety training Safety rules and procedures Quality and maintenance of equipment Accident reporting Near miss/incident reporting Safety representatives and committees Managers actions (e.g. setting an example on safety, encouraging safety suggestions, consistency between policy and practice) Supervisors' actions (e.g. safety discipline, elevating safety concerns to management)	Managers' attitudes (e.g. safety vs. production priority, blaming workers for accidents) Supervisors' attitudes (e.g. supervisors' fairness in dealing with safety complaints) Workers' safety attitudes Personal beliefs about risk/safety Personal involvement Individual responsibility Evaluation of safety measures Evaluation of work environment	Understanding that safety is the overriding priority

Guldenmund (2000) suggests that the outer layers of the safety culture – the beliefs and values, and artefacts and behaviours – logically flow from the basic assumptions at the core of the culture. For example, the way that H&S is understood and enacted within an organisation can be explained by basic assumptions about what causes accidents. Some of the basic assumptions that underpin an organisational culture might not be specifically concerned with safety but they might still have a safety impact. For example, Guldenmund (2000) suggests that a basic assumption that written rules and procedures are futile is not specifically related to safety but will influence the response of people within the organisation to safety rules and procedures.

Another example of multiple layers of culture is illustrated in recent research undertaken by Sherratt et al. (2013) in the UK construction industry. They analysed the way that H&S is written and spoken about at construction sites. Safety signage, safety related communication with workers, safety manuals and memos (artefacts in Schein's three layer model) reflected an 'enforcement' orientation to managing safety. These artefacts reflect a belief that a command and control management style is needed to ensure H&S compliance (an intermediate level belief in Schein's model). This belief, and the artefacts that flow from it, can be traced to a more basic assumption about the need for external rules and enforcement to regulate behaviour. Sherratt et al. (2013) highlight the ambiguities that arose because the enforcement oriented organisational culture was sometimes at odds with statements in corporate H&S policies about worker engagement in, and ownership of, H&S. They also note that modern H&S management theory suggests an engagement oriented culture may be a more effective way to produce positive organisational outcomes (see also Bakker & Schaufeli, 2008).

Guldenmund also argues that the basic assumptions reflect the broader organisational culture. The two outer 'layers' (beliefs and espoused values, and artefacts and behaviours) are more appropriately described as the safety climate.

Guldenmund's proposed three level model of safety culture helps to resolve the methodological debate about how safety culture should be assessed. Clarke (2000) notes that many writers acknowledge the complex and pluralistic nature of safety culture but continue to measure it using relatively simple methods, such as safety climate surveys. There is general consensus that climate surveys cannot reveal the basic assumptions underpinning a safety culture (Flin et al., 2000; Guldenmund, 2007). Alternative methods are recommended to explore and understand culture at its deepest level. Schein (2006, p.14) writes that 'culture is the deepest, often unconscious part of a group.' Basic assumptions are particularly difficult to identify, as people may not even recognise that they have these assumptions, or they appear to be so self-evident that they are not talked about. Recognising this, Fruhen et al. (2013) recently trialled a method for exposing the basic assumptions underpinning a safety culture by analysing managers' language as symbolic behaviour that transmits values, norms and meaning.

Following Guldenmund (2000), safety climate might usefully be viewed as the 'surface' expression of the safety culture. Unlike the basic assumptions that lie at the core of organisational culture, safety climate can be measured using questionnaire survey tools. The distinction between culture and climate as reflecting layers of varying depth in a culture model has been adopted by a number of safety culture/climate researchers (for example, Havold, 2010).

4.2 Characteristics of safety culture

Safety culture as a developmental phenomenon

Safety culture is understood to be amenable to change. Glendon and Stanton (2000) argue that safety culture is a dynamic concept that changes over time. Major organisational changes (like changes in leadership, or introduction of a new safety system) are likely to impact an organisation's safety culture. The International Atomic Energy Agency identifies three stages in developing a safety culture (IAEA, 2002b). These three stages, shown below, reflect a progressive engagement with the human elements of the organisational safety system.

Table 4.2: Stages in the development of a safety culture (IAEA, 2002b)

Stage 1	Safety is seen as an external requirement imposed by government and regulatory agencies. Safety is not seen as something that will enhance the business or operation of the organisation. Safety is seen as a technical issue and there is little awareness of the behavioural or attitudinal aspects of safety. The focus is on complying with rules and regulations.
Stage 2	Safety is seen as an important organisational goal, irrespective of externally imposed requirements. The safety management system generally concentrates on technical and procedural controls, although there is an emerging understanding of the importance of behavioural and attitudinal aspects of safety. Safety targets and goals are specified. However, it is common for the safety performance of Stage 2 organisations to improve rapidly and then to plateau.
Stage 3	The concept of continuous improvement of safety has been adopted. There is a strong emphasis on safety communication, training, managerial behaviour and improving safety system effectiveness. The impact on safety of cultural aspects of the organisation is well understood.

Hudson (2007) suggests that merely defining and describing the components of a safety culture is insufficient to help organisations become such cultures. He advocates understanding safety culture using an evolutionary model in which organisations are placed on a continuum from those with advanced safety cultures to those with safety cultures at less advanced stages of development. Hudson argues that defining intermediate stages can assist organisations to engage in culture change in manageable (and measurable) steps.

Hudson (2007) defines five levels in progressively developing a safety culture.

Table 4.3: Levels of safety culture maturity (Hudson, 2007)

1. Pathological	Who cares about safety as long as we are not caught?
2. Reactive	Safety is important: we do a lot every time we have an accident.
3. Calculative	We have systems in place to manage all hazards.
4. Proactive	We try to anticipate safety problems before they arise.
5. Generative	H&S is how we do business around here.

An organisation moving from a pathological safety culture towards a generative safety culture:

- is increasingly informed about H&S, and
- shows increasing levels of internal trust and accountability about H&S.

Parker et al. (2006) used these five levels to develop a framework that can be used by organisations in the oil and gas industry to understand their own safety culture. The framework emerged from interviews with senior managers in the oil and gas industry. They identified aspects of the organisation that they believed were important elements of a safety culture in the oil and gas sector, such as:

- concrete facets like incident/accident reporting and contractor management, and
- less tangible, abstract organisational concepts like the balance between H&S and profitability, or management and workforce commitment to H&S.

Interviewees were asked to describe how an oil company would function in relation to each element at each of the five levels of cultural maturity (that is, from pathological to generative). The framework reflects the multidimensional and dynamic nature of safety culture. It can be used by petrochemical companies to:

1. understand the status of their safety culture
2. explore differences in perceptions of the safety culture between different groups within the organisation (such as managers, supervisors and frontline workers), and
3. plan for and assess the level of change brought about by interventions designed to effect cultural change.

A variation of the five level culture model was developed for the UK healthcare sector. Ashcroft et al. (2005) report on the feasibility and face validity of a five level healthcare maturity model. More recently the five levels specified by Hudson, Parker and others was used to develop a safety culture maturity assessment tool for the oil and gas industry in Brazil (Filho et al., 2010). The analysis revealed the five level model worked well in the South American context.

A comprehensive safety culture maturity model has yet to be developed for the construction industry. However, Ayers et al. (2013) classified companies in the commercial and industrial construction sector in Victoria, Australia, using Hudson's five level model and Parker et al.'s descriptors of the H&S behaviour of organisations at different levels of maturity. Ayers classified each organisation at one of the five levels of safety culture maturity and then analysed each organisation's employer-worker consultation practices.

'Patchiness' of organisational safety cultures

One characteristic of safety culture is its inherent 'patchiness' in large organisations. An effective safety culture is understood to take some time to develop. Filho et al. (2010) describe how safety culture does not develop at the same pace in all organisations. Even within a single organisation, certain business units or functional or geographic areas may develop their safety cultures more quickly because actions to improve the safety culture might be more effective in some areas than others. The different components of a safety culture (such as leadership and communication) might also develop more rapidly than other components, and the patterns of development of cultural maturity might vary between organisations. For this reason a single safety culture 'index' is unlikely to be meaningful (Parker et al., 2006).

It is likely that the safety culture will vary within a single organisation. Zohar (2000) demonstrated that within a single organisation, variation in supervisors' responses to safety can create significant variation in safety expectations and actions in workgroups. Further, over a five month period these differences were linked to the experience of accidents requiring first aid or more significant treatment.

One safety culture or many?

There is considerable evidence to indicate that the majority of organisations, particularly large and complex ones, do not develop a single uniform culture of safety. According to Richter and Koch (2004), conflict can arise between three different perspectives adopted by people within an organisation.

Table 4.4: Differing perspectives that drive workers' responses to H&S (Richter and Koch, 2004)

The producers' perspective	This perspective drives organisational members to produce a product of quality that is consistent with their acquired professional or technical skills and values.
The wage workers' perspective	This perspective drives organisational members to pursue decent pay, co-determination and job security.
The safety perspective	This perspective drives workers to preserve their long term ability to work and cope with emotional aspects of risk taking.

Organisational cultures do not always establish clarity, shared orientations and consensus among constituent groups. In these situations, what is acceptable and what is not acceptable in a given situation may be ambiguous.

Research has revealed that people engaged at different hierarchical levels within an organisation can develop varying understandings of H&S. A number of studies have found that managerial employees perceive the safety climate within an organisation to be more positive than other employees. In offshore installations in the resources sector, Mearns et al. (1998) report the existence of fragmented safety subcultures based on levels of seniority and occupation. This led Mearns et al. to suggest that more in-depth analysis is needed of how social groups form and interact to develop unique beliefs about risk and safety. Other researchers have observed similar differences.

Table 4.5: Research evidence supporting the existence of safety subcultures within organisations

Researchers	Findings
Cox and Cheyne (2000)	Compared with production or drilling workers in the same organisation, managers in the offshore oil industry held significantly more positive views of: • safety involvement • the safety of the work environment, and • personal appreciation of risk.
Arboleda et al. (2003)	Managers and drivers in the trucking industry had different perceptions of top management commitment to safety – a core component of the safety climate.
Mearns et al. (1998)	Different safety climate perceptions among employee groups in the offshore oil industry could be explained by whether employees held supervisory or non-supervisory roles. In all cases, supervisors reported more positive perceptions of the safety climate.
Prussia et al. (2003)	Managers and workers in a steel manufacturing plant perceive the work environment in a similar way. However, managers view the safety climate more positively than workers.
Harvey et al. (2002)	Compared to managers in the nuclear power industry, workers have more negative perceptions of the organisational safety culture relating to: • communication • management commitment to safety, and • personal responsibility for safety.

The lack of a common inter-level understanding of the importance of H&S within an organisation can act as an impediment to the development of a culture for H&S. This can arise when two groups (for example, managers and workers):

- wrongly perceive agreement between their own safety values, beliefs or attitudes and the safety values, beliefs or attitudes of the other group
- hold negative stereotypes about each other's' safety values, beliefs or attitudes, and
- have inaccurate perceptions of the others' safety values, beliefs or attitudes (Lingard & Blismas, 2006).

Figure 4.1 depicts these (mis)perceptions.

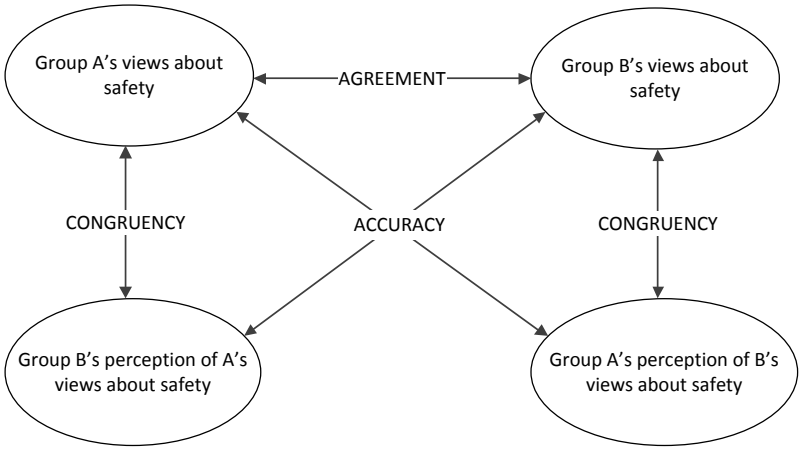

Figure 4.1: Agreement, congruency and accuracy in understanding different groups' H&S perceptions

In the UK rail industry, Clarke (1999) examined the safety beliefs and attitudes of senior managers, supervisors and train drivers. She asked each of these three groups to report on:

- their own safety beliefs and attitudes, and
- their understanding of the safety beliefs and attitudes of the other two groups.

The results revealed that managers believed they were effectively communicating the importance of safety messages to supervisors. However, supervisors perceived that the operational efficiency of the rail network was the primary concern of managers and that this was prioritised above safety. Believing this, supervisors communicated to the train drivers that, although they publicly stated that safety was the 'number one priority', in fact the efficient running of trains was what most concerned managers. These perceptions and mixed messages encouraged employee behaviour that was inconsistent with the organisation's espoused safety values.

Three points can be made about safety culture arising from Clarke's (1999) study:

- Supervisors play a critical role in communicating safety messages in organisations. It is supervisors who communicate 'what managers really want'.
- Managers' behaviour may sometimes be inconsistent with their espoused values about safety. This results in ambiguity about how safety should be treated.
- Employees will interpret what managers say and do over a period of time and form their own opinions about the relative priority of safety. These interpretations will become significant cultural drivers for safety related behaviour within an organisation.

Haukelid (2008) reports conflict and ambiguity inherent in communication concerning safety at a number of North Sea oil drilling platforms. Managers and workers were both found to engage in frequent 'double communication' in the way they spoke about safety. For example, managers issued directives like: 'Take your time – but be quick!', 'Report incidents – but don't do foolish things!', 'Don't break safety rules – but use your head!'

Workers comments also reflected the tension between safety and factors like production efficiency, and comfort. For example: 'Safety rules are ok – but it takes too long time if we always should follow them!', and 'Protective equipment is important – but unpleasant to wear!'

Organisational culture can reduce ambiguity by acting as a frame of reference that provides meaningful 'guidelines' about what is important and how to act. Consequently, behaviour becomes more predictable and anxiety associated with ambiguity is reduced (Guldenmund, 2000). Richter and Koch (2004) refer to culture as creating 'bounded ambiguity'. Alvesson (2002, p.166) describes culture as creating 'meta-meanings' that provide clues about how to deal with 'tricky' situations. Thus although ambiguity is a common feature of organisational life, bounded ambiguity (expressed through the culture) can create some broadly shared 'rules' about what is acceptable and what is not. Haukelid (2008) even argues that such rules are essential if the term 'culture' is to have any meaning at all.

Most studies of variation in safety culture/climate within organisations have focussed on existing hierarchies or functional units. These studies have investigated the similarities within organisational groups and the differences between them. However, a number of researchers caution against assuming that cultural differences will necessarily reflect existing social structures and groupings within organisations.

Richter and Koch (2004) conducted an in-depth ethnographic analysis of safety culture at a Danish manufacturing facility. They concluded that distinct sub-cultures were present but that these sub-cultures cut across professional, occupational and departmental boundaries. The implication is that facets of organisational safety culture link to higher order culture factors beyond the organisation itself, like industrial culture, socioeconomic status, ethnicity and national culture.

Sometimes, local manifestations of safety culture reflect pockets of good practice, as case study 4.1 illustrates. Any attempt to impose top-down control on these good, local safety cultures could, in some circumstances, have a negative impact on H&S.

Case study 4.1: Local safety cultures in the UK construction industry

It is often assumed that migrant workers are vulnerable in terms of H&S because they are unable to access and understand important H&S information in English. However, assumptions about the H&S capability of migrant workers can be wrong.

An ethnographic study of a group of curtain wall installers in the UK construction industry revealed that this group consistently won project level H&S awards and was recognised for its excellent H&S performance. The group comprised workers from several different Eastern European countries who did not share a common language, and were not proficient in English.

The research revealed that group members did not communicate in English but evolved their own unique 'language' for sharing important H&S information. This included a mix of different languages, gestures, simple hand signals and phone links which together helped coordinate a series of complex tasks.

The case reveals that English-speaking managers' attempts to exercise top-down cultural control could have potentially disrupted existing and highly effective work practices. Thus, rather than attempting to impose a culture of safe working from above, cultural change initiatives should identify, embrace and complement good, local practice.

Tutt et al. (2013)

Safety culture as a social phenomenon

Many definitions of safety culture reflect the fact that it is shared between members of a social grouping. Pidgeon (1991) describes safety culture as 'the constructed system of meanings through which a given people or group understand the hazards of the world' (p.135).

Richter and Koch (2004, p. 705) define safety culture as:

> … the shared and learned meanings, experiences and interpretations of work and safety – expressed particularly symbolically – which guide peoples' actions towards risk, accidents and prevention. Safety culture is shaped by people in the structures and social relations within and outside the organisation.

Safety culture as a multilevel phenomenon

Mearns (2009) argues that a single level perspective does not adequately reflect the state of H&S within an organisation because organisations are multilevel systems. Within a single organisation, there is significant variation in the quality of H&S implementation between organisational subunits (Sparer and Dennerlein, 2013). The inherent 'patchiness' of H&S within large organisations has already been noted. Thus, measuring H&S culture/climate at the whole organisation level can mask subtle but important differences that are relevant to organisational H&S performance. Therefore, it is useful to measure the safety culture/climate at different levels within organisations (Zohar, 2008).

Policies and processes at the organisation level establish the context within which H&S is enacted within organisational subunits (for example, in departments, projects or workgroups). However, there is considerable scope for subunits in an organisation to develop distinct cultural characteristics. Zohar (2000) proposed two levels of safety climate:

1. that arising from the formal organisation-wide policies and procedures established by top management, and
2. that arising from the safety practices associated with implementing company policies and procedures within workgroups.

Zohar tested this proposition in a manufacturing context and confirmed that workgroup members:

- develop a shared set of perceptions of supervisory safety practices, and
- discriminate between perceptions of the organisation's safety climate and the workgroup safety climate.

Zohar suggests that group level safety climates relate to patterns of supervisory safety practices, or ways in which organisation level policies are implemented within each workgroup or subunit.Group level safety climates are reported to influence workgroups' safety performance through shaping members' safety behaviour (Zohar, 2002b). Lingard et al. (2009) tested whether Australian construction workers discriminated between group level and organisational safety climates. They found that distinct workgroup safety climates were a feature of the Australian construction industry, and were driven by supervisors' and coworkers' actions and expectations. This research demonstrates that safety culture/climate can be expressed at different levels within an organisation. It is advisable to assess safety culture/climate at different levels. It is also possible for culture/climate to vary in strength and quality at different levels within the same organisation. For example, workers may perceive:

- their supervisors to be strongly committed to H&S (a group level expression of culture/climate), and
- senior managers to be less committed to H&S (an organisation level expression of culture/commitment).

> *The important role of supervisors as the tender of organisational culture in creating congruence by mixing organisation, group and individual interests into a meaningful whole cannot be overstated.*
>
> - Guldenmund, 2007

Construction projects are subsystems of an organisation's larger portfolio of work (Blismas et al., 2004a; Blismas et al, 2004b). Each project is delivered through a temporary organisational structure in which professional services are brought in under a variety of contractual arrangements, and construction work is outsourced to a general contractor and a multiplicity of trade contractors. Uniformity of H&S practices cannot be assumed within a single organisation – work is highly decentralised and local managers (project managers and workgroup supervisors) necessarily exercise discretion in deciding how to implement organisational policies and procedures (see Aritua et al., 2009). Consequently, to understand the state of the safety culture (or climate) in the 'projectised' construction industry consideration should be given to cultural aspects of the organisation, the project and local work groups.

Safety culture or safety climate?

> *The best and safest organisations have a culture of safety and safety climate is an indirect measure of how close an organisation approximates to that*.
>
> - Hudson, 2007, p. 698

Thus far in this report, the terms safety culture and climate have been used interchangeably. This is often the case in the published literature (see, for example Hopkins, 2006). Hopkins (2006) argues that in practical terms safety culture and climate are conceptually very similar. Guldenmund (2000) argues that although the two concepts stem from different disciplines (anthropology refers to 'culture', while psychology refers to 'climate'), the difference between them may be more apparent than real. Cox and Flin (1998) note, for example, that the components (or dimensions) of safety culture and safety climate are almost identical (Cox & Flin, 1998).

Mearns and Flin (1999) argue for a clearer distinction between the concepts of safety culture and safety climate, arguing that using the terms interchangeably causes misunderstanding and confusion. Glendon and Stanton (2000) suggest that while there is a relationship and some overlap between the terms safety culture and safety climate, the two terms can be distinguished from one another.

There appear to be three key differences between the concepts of safety culture and climate:

1. depth of the safety culture and climate concepts
2. stability (or lifespan) of safety culture and climate, and
3. methods of inquiry into safety culture and climate.

Each of these differences is now described.

1. Depth of the safety culture and climate concepts

Glendon and Stanton (2000) argue that that safety climate is a more superficial concept than safety culture (see Figure 4.2). Safety climate represents the 'surface features of the safety culture discerned from the workforce's attitudes and perceptions at a given point in time' (Flin et al., 2000, p178).

Schein's three layers of culture were described earlier. They are:

- the deepest layer (basic assumptions)
- an intermediate layer (beliefs and espoused values), and
- the surface layer (behaviours and artefacts).

The study of safety climate aims to measure workers' attitudes or perceptions concerning the intermediate and surface layers (Guldenmund, 2000). Guldenmund (2000) argues that basic assumptions are so deep rooted and the 'truth' about them is so self-evident that they are not easily recognised or expressed by the people who hold them. These basic assumptions provide the underlying meaning for the espoused values and beliefs, which can be measured using safety climate survey tools.

2. Stability of safety culture and climate

Safety climate is considered to be a 'snapshot' of the safety culture at a given point in time (see Figure 4.2). The safety climate is believed to be relatively unstable and subject to change. Wiegmann et al. (2004) suggest that the safety culture compares to the personality of the organisation, while the safety climate is compared to the mood of the organisation at a particular point in time.

Safety culture is viewed as a relatively enduring characteristic of an organisation that is reflected in a consistent manner of dealing with safety issues. However, the safety climate is a temporary state which is more subject to change (for example, as a result of factors in the operational environment). The state of a the safety climate provides important information about 'what' is happening in an organisation at a particular point in time, but understanding the culture can explain 'why' H&S is enacted in a particular way.

3. Methods of inquiry into safety culture and climate

Glendon and Stanton (2000) contrast the methods appropriate to investigating safety culture and climate. They suggest that the choice of research method indicates whether the focus of measurement is the safety culture or the safety climate.

Guldenmund (2000) states that culture is typically investigated using qualitative methods like field research or ethnography. Safety culture studies aim to describe or understand a culture rather than evaluate it. Culture research seeks to uncover deep assumptions (often arising from past events in an organisation) and provides rich information about an organisation's safety culture.

In contrast, the study of safety climate is more concerned with the state of the organisation at a given point in time. Measuring safety climate assumes that safety culture is expressed in different ways within an organisation. A questionnaire is typically developed to measure individuals' attitudes and perceptions relating to the identified components of safety culture. The resulting data is then analysed to confirm the safety culture components and determine the extent to which members of a particular social group share similar attitudes and perceptions. Examples of existing safety climate

survey tools include the 'Health and Safety Climate Survey Tool' (Health Safety Executive, 1997), the 'Safety Culture Assessment Toolkit' (S. J. Cox & Cheyne, 2000), and the Rail Safety and Standards Board's (RSSB) Safety Culture Tool (RSSB, 2003).

Critics of safety climate surveys suggest that they merely 'scratch the surface' of culture and that a broader suite of methods is needed to understand culture fully.

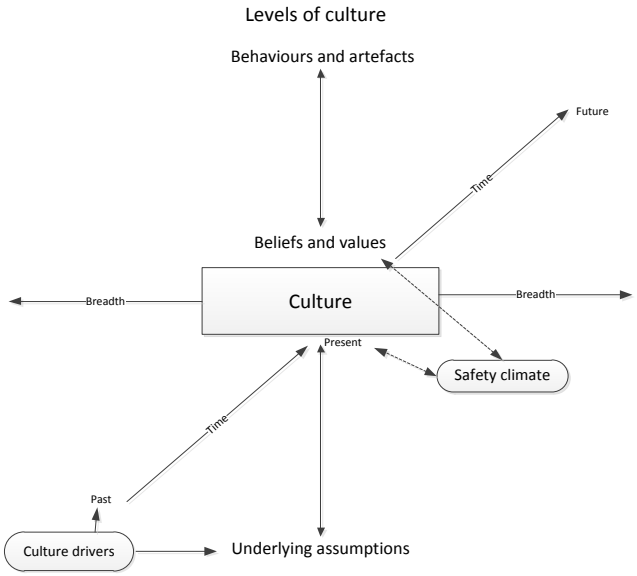

Figure 4.2: Safety culture and safety climate (adapted from Glendon & Stanton, 2000, p. 199)

Safety climate as a leading indicator of H&S

Zohar (1980) defined safety climate to be 'a summary of molar perceptions that employees share about their work environments … a frame of reference for behaviours' (Zohar, 1980, p96).

The measurement of safety climate is increasingly popular in safety research and practice. Cooper and Phillips (2004) suggest that the concept of safety climate is important insofar as it predicts safety performance at a future point in time. Researchers have empirically investigated the relationship between safety climate and various aspects of safety related behaviour and/or safety performance. Generally (but not always), the results have supported a link between safety climate and performance. For example, Tharaldsen et al. (2008) report a significant inverse correlation between safety climate perceptions and accident rates in offshore oil platforms. Varonen and Mattila (2000) similarly report that the accident rate in a sample of eight wood processing companies was lower when the safety climate measures were high for dimensions such as organisational responsibility and safety supervision. These studies suggest that safety climate can predict incident occurrence.

Some researchers have relied on self-reported measures of safety performance, again generally supporting a positive relationship between safety climate and performance. For example, Mearns et al. (2003) report that in the offshore oil industry, favourable safety climate scores are associated with installations that have a lower proportion of self-reported accident involvement. Griffin and Neal (2000) and Neal and Griffin (2002) examined the relationship between safety climate and two types of self-reported safety behaviour: safety compliance and participation. They report that safety climate is positively related to both self-reported compliance with safety procedures, and to self-reported voluntary participation in safety related activities, but that the strength of this relationship depends

upon workers' levels of safety knowledge and motivation. Safety climate has also been linked to an organisation's ability to appropriately attribute incident causes, and learn lessons from safety incidents (Hofmann & Stetzer, 1998).

Evidence from longitudinal studies is also emerging to indicate that safety climate is a valid leading indicator of OHS. That is, safety climate measured at one point in time statistically predicts the occurrence of accidents or injuries at a subsequent point in time (see, for example: Zohar 2000; Wallace et al., 2006).

4.3 Safety culture components

A number of authors have proposed varying models that identify the components of a safety culture. This section explores some of these contributions, particularly those of Pidgeon, Reason, Jeffcott et al., and Hale.

Pidgeon's three essential elements of a good safety culture

Pidgeon (1991) argues that three essential elements constitute a good safety culture.

Table 4.6: Pidgeon's elements of a good safety culture

Norms and rules for handling hazards	These include both explicit and tacit corporate guidelines which shape the perceptions and actions of employees in a specific way by defining what is and what is not a significant risk, and what is an appropriate response. Effective rules and norms specify procedures to deal with foreseeable hazards, and encourage alertness to unforeseeable hazards. Pidgeon suggests individuals and workgroups should be willing to monitor information sources for a variety of purposes, such as: • 'to research, and to accept uncertainty and incompleteness of knowledge as facts of life' • 'to be prepared both to solicit opinions about risk from outsiders and to institute positive reward structures for internal "whistle-blowers"', and • 'to exercise creativity and safety imagination in order to assess the available intelligence about hazards.'
Attitudes toward safety	Safety attitudes are concerned with individual and collective beliefs about hazards and the importance of safety, and the motivation to act on those beliefs. Such attitudes require that both employees and the organisation are concerned for the outcome of dealing with risks and care about the effect of their activities on people. Safety attitudes reflect individually and collectively held rules and norms relating to how to handle workplace hazards. Positive attitudes toward safety need to be developed by all organisational members and not imposed in a punitive manner by one group on another.

Reflection on safety practice	Reflection on current practices and beliefs is regarded as a learning process, and is also a search for new meaning in the case of facing uncertainty and ambiguity about risk. Reflection acts as 'a precaution against the overrigid application of existing rules to neglect of unanticipated hazards.' Reflection is facilitated by an effective feedback system at both industry and organisational levels – for example incident, accident and near miss reporting.

Reason's five characteristics of an effective safety culture

According to Reason (1997), a safety culture is characterised by a sense of 'chronic unease' – that is, 'not forgetting to be afraid' – and maintaining an awareness and vigilance about potential health and safety hazards. Reason proposed that an effective safety culture displays five characteristics.

Table 4.7: Reason's characteristics of an effective safety culture

1. Has a safety information system that collects, analyses and disseminates information from accidents, near misses and active safety monitoring systems.
2. Has a reporting culture in which people feel able to report errors, mistakes, violations, and safety problems.
3. Has a culture of trust in which people are encouraged to provide safety information but in which a clear line is drawn between acceptable and unacceptable behaviour.
4. Is flexible and characterised by an ability to change in response to changes in a dynamic and demanding task environment.
5. Is willing and able to analyse the performance of its safety system and make improvements to the system when required.

Jeffcott et al.'s four components of a positive safety culture

Jeffcott et al. (2006) identified four components of a positive safety culture.

Table 4.8: Jeffcott et al.'s components of a positive safety culture

Flexibility	Flexibility ensures that norms and rules allow for a flexible approach, expertise is recognised, and decision making is decentralised. 'Frontline' knowledge and expertise is valued and used, especially in abnormal situations, to inform appropriate protection decisions.
Commitment	Management commitment to safety concerns the extent to which top management considers safety as the core value of the organisation. Commitment is reflected in top management's enduring and positive attitude toward safety, which includes: • consistently emphasising the importance of safety • prioritising safety over production in all situations (even in adverse events) • providing adequate resources to support the implementation of safety activities • actively promoting safety across all levels within the organisation.
Learning	Learning concerns aspects such as ongoing reflection on practice, nourishing reporting cultures, and learning from mistakes and failures. Organisations characterised by learning: • are highly committed to gathering and analysing safety related information • disseminate safety related information to the whole organisation • are sensitive to vigilance and expertise among frontline staff in identifying and responding to errors.
Trust	Trust concerns individuals' attitudes and expectations about the organisational systems where they are embedded. Trust is important to safety culture because it affects safety related matters such as communication, collaboration, information sharing, incidents/near miss reporting. A positive safety culture may also support, encourage, and appropriately reward trusting behaviours and relationships.

Hale's four elements of a good safety culture

Hale (2000) defines four elements of a good safety culture.

Table 4.9: Hale's elements of a good safety culture

1. The importance given by all employees, but particularly top managers, to safety as a goal, even when safety conflicts with other organisational goals – for example, rewarding actions that favour safety even if they cost time and money.
2. A broad understanding of safety culture in which the aspects of organisational life that support workers in staying safe, healthy and well are valued, encouraged, and developed.
3. A sense of shared purpose about safety is reflected in the involvement felt by all parties in the organisation in the process of defining, prioritising and controlling risk.
4. People in the organisation have a creative mistrust in the risk control system, which means they are always expecting emergent problems and are never convinced that the safety culture or organisational H&S performance is ideal. In this culture, safety 'whistleblowers' are accepted and safety personnel constantly question, and seek to identify weaknesses in, the organisation's safety systems and culture.

Safety culture at the London Olympic Park

The UK Health and Safety Laboratory undertook a detailed analysis of the safety culture at the Olympic Park construction project in London. This analysis was commissioned by the UK Health and Safety Executive (HSE) and the Olympic Delivery Authority (ODA). Its purposes were to identify themes associated with a positive safety culture, and to identify good practices among the contractors involved. The objective was to ensure that good practices identified would provide the basis for developing a safety learning legacy for the construction industry.

The ODA was the public body responsible for building the Olympic Park, including new venues and infrastructure for the London 2012 Olympic Games and Paralympic Games. ODA appointed CLM Delivery Partner Ltd (CLM) to undertake much of the work on its behalf. CLM was responsible for managing the construction program to ensure that the construction works were delivered on time, within budget, and with specified quality. CLM acted as a principal contractor to construct part of the Park. However, the work was mainly contracted to primary contractors who took complete responsibility for individual projects. Primary contractors were designated Tier 1 contractors, their subcontractors Tier 2 contractors, their subcontractors Tier 3 contractors, and so on.

ODA and its delivery partner mandated the use of a safety climate assessment tool (SCT) among companies working on the Park. SCT surveys were conducted to reveal workers', supervisors' and managers' perceptions of health and safety issues which were considered to be indicative of the safety culture in each organisation. The SCT assessed eight components to the safety climate:

1. Organisational commitment
2. Health and safety oriented behaviours
3. Health and safety trust
4. Usability of procedures
5. Engagement in health and safety
6. Peer group attitude

7. Resources for health and safety, and
8. Accident and near miss reporting.

SCT scores were analysed to provide a statistical overview of safety performance (indicated by a mean score for each of the eight factors) of companies involved in the Olympic Park. The SCT scores across companies operating on the Olympic Park were much higher than the highest scores in the HSE's 'all industry' dataset, indicating a positive safety culture on the Park.

'Top performers' (that is, companies with the most positive or improved SCT scores) were identified for each of the eight SCT components. Seven companies were identified as 'top performers' and were selected to participate in developing a case study. A series of interviews and focus groups was conducted with the seven companies to collect qualitative data related to each of the eight SCT factors. The qualitative work aimed to understand how the 'top performers' achieved health and safety success and how their good practices could be promoted in the whole industry.

Table 4.10 summarises the main themes identified for each component of safety climate. These themes were believed to have contributed to the positive safety culture on the Olympic Park.

Table 4.10: Safety climate components and related themes

1. Organisational commitment	
Productivity vs. safety *Visibility and approachability*	Management should prioritise health and safety and provide support to workers where conflicting pressures may arise. Management should be frequently visible on site and demonstrate their commitment to safety, leading by example or questioning unsafe behaviours. They should be approachable so that workers feel comfortable raising safety issues without worrying about being criticised.
2. Health and safety oriented behaviours	
Making safety personal *Health and safety campaigns* *Safety observation/Focus on safe procedures*	Management should use campaigns and training courses that are relevant and appropriate to workers. Management use credible campaigns to enhance workers' commitment to healthy and safe behaviours, e.g. safety weeks. Management should maintain a focus on working to safe procedures on site, e.g. by using observation cards and regular inspections/site visits.
3. Health and safety trust	
Valuing the workforce *Reward and recognition* *'Just' consequences to actions*	Management should demonstrate that workers contributions through work and ideas are highly valued. Management should use incentive methods to recognise and reward their workers' contributions to health and safety, e.g. reporting incidents and near misses or making suggestions. Management should address unacceptable or unsafe behaviours by applying 'just' consequences to create a fair environment.

4. Usability of procedures	
Development of risk assessments as 'live' documents	Management should ensure risk assessment documentation is subject to ongoing review and revision and is accessible to workers.
Training	Management should use various types of training to ensure employees' understanding of risk assessment documents.
Monitoring	Management should use a number of systems for monitoring the ongoing relevance and appropriateness of the documents relating to work procedures or method statements.
5. Engagement in health and safety	
Ongoing engagement/communication mechanisms	Management should ensure effective two-way communication so that issues are raised and shared, allowing for appropriate measures to be identified.
Standardised communication mechanisms	Management should develop various formal communication mechanisms for safety related decision making.
Daily communication mechanisms	Management should also develop daily communication mechanisms to ensure communication occurs between workers and supervisors on an ongoing basis, e.g. toolbox talks, and daily activity briefs.
6. Peer group attitude	
Fostering a supportive environment	Management should allocate sufficient time and resources to enable workers to develop strong working relationships, and to take responsibility for their own and others health and safety.
Empowerment to stop work	Management should nourish an open and honest culture where workers feel confident to stop work when they feel unsafe.
7. Resources for health and safety	
Provision of resources and time spent planning	Management should allocate sufficient time and resources to ensure workers receive appropriate equipment and training, and works activities are undertaken appropriately.
Welfare	Management should invest in providing health and welfare facilities, to foster an environment in which workers feel cared for.
Training	Management should provide effective training to ensure the competence of all workers, supervisors and managers on sites.
8. Accident and near miss reporting	
Near miss reporting	Management should ensure that workers understand near misses, e.g. what should be reported, and how the information reported can be used to improve health and safety performance on sites.
Valuing reports	Management should take prompt and appropriate actions to respond to workers' reporting.

Source: Health and Safety Executive, 2012

4.4 Conclusions

Eight conclusions can be drawn from the foregoing review of the safety culture/safety climate literature:

1. Cultural factors play a significant role in shaping H&S outcomes in organisations.
2. Safety culture has three distinct 'layers'. At the core are basic assumptions, from which flow espoused values and beliefs, and observable artefacts and behaviours.
3. Safety culture and climate are closely related and overlapping concepts. However, they differ in terms of their depth, stability and the tools by which they can be investigated.
4. Safety climate can be measured using attitude and perception surveys. It represents a snapshot view of the surface features of the safety culture at a particular point in time.
5. Safety climate is linked to performance and represents a useful 'leading indicator' for H&S.
6. Safety culture and climate are multidimensional. They are made up of several different components. There is no consensus about what these components are. However, there is considerable overlap between the component parts of different safety culture/climate models.
7. Safety culture/climate may not be inherently uniform across organisations. Organisations are large and complex and the safety culture/climate is likely to be 'patchy'. Subcultures and climates may develop in the different parts of an organisation.
8. Safety culture/climate develops progressively over time. It can be described in terms of varying levels of development or maturity.

Part 5: The Work Health and Safety Culture Framework

5.1 Introduction

Part 5 presents an overview of how the H&S Culture Framework was developed, and an overview of the two elements of the Framework:

- The H&S Culture Maturity Model, and
- The H&S Climate Assessment Tool.

Part 6 explains the nine components of the H&S Culture Maturity Model.

Part 7 presents descriptors for each component of the H&S Culture Maturity Model.

Part 8 describes the ACA H&S Climate Assessment Tool, and explains the relationship between the Tool and the H&S Culture Maturity Model. Samples of the questions from the Tool are presented at Appendix A of this report.

5.2 The development of the H&S Culture Framework

The H&S Culture Framework is based on a comprehensive review of the research literature on safety culture and safety climate. The Framework was developed by following a sequence of five inter-related steps.

Table 5.1: Development of the H&S Culture Framework

Step 1	Documented models of safety culture were analysed robustly to identify characteristics of a positive H&S culture that are common to the different models. Facets of a positive H&S culture common to multiple models were grouped by theme. Nine broad components of H&S culture were identified.
Step 2	A detailed definition for each of the nine components of a positive H&S culture was developed, based on the descriptions of these components in the research literature.
Step 3	The detailed definitions were used to develop descriptions of the way that each component of a positive H&S culture would express itself in the construction industry at organisation, project and workgroup levels.
Step 4	For each component of a positive H&S culture, descriptors were framed to reflect the progressive development of an H&S Culture from a pathological culture to a generative culture. The descriptors were framed at the organisation, project and workgroup levels. The descriptors are presented in a matrix that constitutes the H&S Culture Maturity Model.
Step 5	H&S climate survey questions were developed for each component of H&S culture included in the H&S Culture Framework. The climate survey questions capture climate at the organisation, project and workgroup levels.

5.3 Overview of the H&S Culture Maturity Model

The Maturity Model is a matrix that describes the development of an H&S culture. The matrix specifies nine components of a positive H&S culture.

The evolution of each H&S culture component is described using five progressive levels of cultural maturity (Parker et al., 2006, p.555).

Table 5.2: Parker's levels of H&S culture maturity

Level 1 – Pathological	Who cares about safety as long as we are not caught?
Level 2 – Reactive	Safety is important: we do a lot every time we have an accident.
Level 3 – Calculative	We have systems in place to manage all hazards.
Level 4 – Proactive	We try to anticipate safety problems before they arise.
Level 5 – Generative	H&S is how we do business around here

The H&S Culture Maturity Model reflects:

- the developmental nature of organisational H&S cultures that are understood to evolve over time, and
- the hierarchical multi-level structure of the construction industry in which workgroups are 'nested' in project organisations and projects are 'nested' in organisational cultures.

The Model can be used by organisations to understand their level of H&S cultural maturity and, if necessary, to plot a course for improvement. It is possible, indeed likely, that:

- projects within a contracting organisation will develop specific and unique subcultures within a single contracting organisation, and
- workgroups may vary in their levels of maturity about different components of H&S culture.

5.4 Overview of the H&S Climate Assessment Tool

The H&S Climate Assessment Tool is a survey instrument developed to measure the state of the safety culture at a given point in time. As described in Part 2 of this report:

- culture consists of the underlying values, beliefs and assumptions concerning H&S which shape 'the way we do things around here' (Shannon and Norman, 2009, p. 327), and
- safety climate refers to perceptions about what is actually done.

Climate can be regarded as the check of whether the behaviour of people in an organisation matches the rhetoric.

Zohar and Tenne-Gazit (2008) describe how, in measuring safety climate, individual climate scores are aggregated to the unit of analysis that is of interest. This can be the entire organisation or organisational subunits, such as projects and workgroups. The ACA H&S Climate Assessment Tool will measure climate at the levels of the organisation, project and workgroup.

It is very important that any climate assessment tool is specific about the level at which climate is being measured.

Some previously used safety climate measures often include items relating to the organisation (that is, top management and company policy) and subunit supervision. For example, in a safety climate survey of container terminal operators in Taiwan, Lu and Shang (2005) incorporate perceptions of supervisors' safety leadership, but aggregate survey scores to the level of the entire organisation. Similarly, the safety climate instrument developed by Jorgensen et al. (2007), and tested among a sample of English and Spanish speaking construction workers, combines questions about the general work environment (a useful indicator of the organisation-level climate) with specific questions about workers' immediate supervisors (a group level characteristic).

Melia et al. (2008) argue that subcontracted workers are only loosely connected with the principal contractor and may work in a manner that is relatively isolated from their own company. They suggest this will affect the development and impact of the safety climate, increasing the importance

of measuring climate as a workgroup level phenomenon. This is borne out by research in high risk industries. Both Findley et al. (2007) and Tharaldsen et al. (2008) report that in nuclear decommissioning and in the offshore oil industries respectively, contracted workers have lower perceptions of safety climate compared to directly employed workers.

The multilevel approach taken in developing the ACA Safety Climate Assessment Tool reflects the fact that the H&S climate in construction has been demonstrated to vary significantly between projects and workgroups within the same construction organisation (Lingard et al., 2009).

Consequently, H&S climate will be measured by assessing workers' perceptions of each element of H&S Culture included in the Framework. These perceptions can be aggregated to the levels of workgroup, project and organisation. This approach will provide organisations with:

- a comprehensive assessment of the prevailing H&S climate with respect to the components of H&S Culture included in the ACA Framework, and
- an understanding of variations in the strength and level of the H&S climate within the organisation.

Part 6: The H&S Culture Maturity Model – components

6.1 Introduction

Part 6 explains the nine components of the H&S Culture Maturity Model.

The H&S Culture Maturity Model was derived following a comprehensive review of research literature about H&S culture/climate. The literature was analysed to identify the most prevalent themes in studies of H&S culture/climate. Following this review, nine components were distilled.

The nine components are:

1. Leadership
2. Communication
3. Organisational goals and values
4. Supportive environment
5. Responsibility
6. Learning
7. Trust in people and systems
8. Resilience
9. Engagement.

Each component is defined and explained below.

Component 1: Leadership

Managers at all levels (including senior managers) are genuine in their concern for H&S and consistent in the way that they talk about and behave in relation to H&S.

*H&S is an organisational imperative in **every** situation. H&S is not seen as being contingent on other aspects of organisational performance, such as work being 'on schedule'.*

Managers (at all levels) actively demonstrate their commitment to H&S and consistently model good H&S behaviours.

Relationships between managers, workers and contractors are built on open communication and trust. Managers welcome constructive criticism and respond positively to operational feedback (whether good or bad) about H&S.

Managerial behaviour is recognised as a key aspect of organisational culture in general and H&S culture specifically. The underlying values and observable behaviours of managers are influential in shaping organisational cultures and H&S performance. Managers act as powerful role models (Maierhofer et al., 2000). When managers clearly and explicitly express their strong H&S values and reinforce these values with consistent behaviour, H&S is more likely to be regarded as an unconditional 'way of doing things' in the workplace.

Managerial behaviour has been demonstrated to be a key driver of workplace H&S climates that, in turn, drive positive H&S performance (Wu et al., 2008). Flin et al. (2000) undertook a comprehensive review of H&S climate studies and identified management commitment to H&S as a 'core' component of a positive H&S climate. Management commitment to H&S is also perceived as an important cultural driver of H&S performance by all employees, irrespective of their level of seniority in an organisational hierarchy (Arboleda et al., 2003).

Assessments of organisational H&S cultures or climates frequently measure management actions and attitudes towards H&S, which is evidence of their importance (see, for example, Cox & Cheyne,

2000; O'Toole, 2002; Cheyne et al., 2002). Management actions and attitudes are the facet of H&S safety culture/climate that most consistently predicts objective measures of H&S performance.

O'Dea and Flin (2001) identify participative management as particularly important in developing a positive H&S culture. There are four facets of participative management.

Table 6.1: The four facets of participative management

1. Visibility	Effective leaders: • are visible • participate in H&S activities at the workplace • consistently apply H&S policies and rules • model good H&S practices, and • lead by example.
2. Relationships	Effective leaders: • form open, honest relationships with the workforce by engaging in two-way communication, and • listen & respond to workers' suggestions for H&S improvements.
3. Workforce involvement	Effective leaders: • actively involve workers in work planning and decision making.
4. Proactive behaviour	Effective leaders: • proactively seek to improve H&S • promote an environment in which hazards and incidents can be reported without fear of reprisal.

A transformational leadership style has also been linked to both positive safety climates and reduced levels of work related injury (Barling et al., 2002; Kelloway et al., 2006; Zohar, 2002a).

Transformational leaders are believed to demonstrate the following characteristics:

- idealised influence
- inspirational motivation
- intellectual stimulation, and
- individualised consideration (Kelloway et al., 2006).

Zacharatos et al. (2005, p. 80) suggest four ways in which transformational leadership would enhance H&S performance. These are summarised in Table 6.2.

Table 6.2: The influence of transformational leadership on H&S

1.	Leaders high in idealised influence convey the value of safety through their personal experience.
2.	Leaders high in inspirational motivation convince their followers that they could attain levels of safety not previously considered possible.
3.	Intellectually stimulating leaders help followers think about H&S and develop new ways to achieve high H&S levels.
4.	Individualised consideration is evident through leaders' real concern about their followers' safety at work.

Mullen and Kelloway (2009) provide evidence that developing safety-specific transformational leadership capability in managers enhances workers' H&S climate perceptions and H&S outcomes. In contrast to the positive effect of transformational leadership, Kelloway et al. (2006) report negative impacts on safety climate and performance when H&S leadership style is passive or 'laissez-faire' – for example, failing to intervene until problems become serious enough to require attention, and delaying decision making.

Zohar (2002a) also differentiates between transactional and transformational leadership, suggesting:

- transactional leadership provides reliability and predictability ('expected performance'), and
- transformational leadership provides heightened motivation and development orientation ('performance beyond expectations').

Inness et al. (2010) reported that transformational leadership is associated with workers' participation in H&S activities, but not to their levels of H&S compliance.

Zohar (2002a) argues that both transformational and transactional leadership are probably important to ensure optimal H&S performance. However, leadership that reflected a greater concern for workers' welfare and closer, individualised relationships created stronger and more positive group safety climates, and reduced incidence of accidental injury.

Consistency is an important characteristic of managerial leadership behaviour in relation to H&S. This is highlighted by Mullen et al. (2011) who report that managers do not always demonstrate the same style of leadership in relation to H&S. However, when managers alternate between transformational and passive H&S leadership behaviours, any positive effects of the transformational leadership behaviour are minimised. The key messages are that:

- to promote H&S occasionally is insufficient, and
- to produce a positive H&S climate and influence H&S performance, transformational leadership in H&S needs to be consistent.

Recent research highlights the need to evaluate the quality of H&S leadership at different levels within an organisation. Transformational leadership is likely to be important at all managerial levels. However, Flin and Yule (2004) suggest that managers at different levels should engage in different types of H&S leadership behaviour.

Table 6.3: Different levels of managerial influence on H&S

Senior Managers	Senior Managers effectively set the 'tone' of H&S activity within an organisation. They should continuously (and visibly) demonstrate their commitment to H&S. Flin and Yule suggest this is best demonstrated by devoting time to H&S matters within the organisation.
Middle Managers	Middle Managers should focus on ensuring effective H&S communication and compliance with organisational H&S systems. They should provide supervisors with a degree of autonomy in managing local H&S issues.
Supervisors	At a supervisory level, transactional leadership styles are likely to be effective when they focus on monitoring compliance and reinforcing H&S practices.

There are practical reasons for evaluating H&S managerial leadership behaviour at different levels within an organisation. Senior managers play a key role in establishing an organisation's H&S policy, setting strategic objectives for H&S, and allocating organisational resources to the overall

management of H&S. However, workers 'at the coalface' have little direct contact with senior management. Consequently, the role played by middle managers and supervisors is critical (Zohar, 2002a). This is particularly the case in decentralised, project based industries like construction. Supervisors are particularly influential because they 'filter' organisational H&S messages. Put simply, supervisors communicate what 'management really wants'. Research (see Simard & Marchand 1994, 1995, 1997) shows us that:

- senior managers play a very important role in the H&S process
- supervisors have very strong, direct influence on local H&S performance behaviour.

Zohar (2000) reports that workgroups develop distinct H&S climates that are driven by supervisors' actions and attitudes. In a manufacturing context, Zohar demonstrated that workers develop shared perceptions about the relative priority of H&S based on regular interactions with their supervisors. These shared perceptions (or group H&S climates) varied considerably between workgroups and were positively linked to the occurrence of injuries within workgroups (Zohar, 2002b). Zohar (2000) suggests that the development of group level climates can explain why some workgroups perform consistently better in H&S compared to other workgroups, even when they work with the same set of organisational H&S policies and procedures and have similar H&S risk profiles.

Component 2: Communication

Open and good communication in relation to H&S occurs throughout the organisation.

Effective communication occurs vertically (between hierarchical levels within the organisation) and horizontally (between functional departments/divisions).

Managers provide workers and contractors with relevant information on H&S hazards and risks associated with the organisation's operations.

Managers listen to and act on H&S concerns raised by workers and contractors.

Different methods are used to communicate H&S information including formal and informal methods.

Communication is tailored to the needs of constituent worker groups: for example, the communication needs of people from non-English speaking backgrounds are considered and addressed.

Messages about the organisation's commitment to H&S are always clear and consistent.

Open and frequent communication about H&S is identified as an important component of a positive H&S culture. H&S communication serves to:

- inform workers about H&S hazards, risks and ways of working safely
- elicit important information about workers' experiences and concerns, and
- elicit suggestions for ways to improve H&S.

One feature of positive H&S culture is the presence of multidirectional communication (HSE, 2005a; HSE, 2005b). The UK Health and Safety Executive (2005a) suggests that effective H&S communication within an organisation occurs in three directions:

- top-down – management to frontline
- bottom-up – frontline to management, and
- horizontal – between peers or functional groups.

Top-down communication ensures that safety goals and objectives are understood by workers and safety related information is transmitted to employees in a timely way. It is mainly concerned with:

- passing on health and safety policies and statements
- disseminating information related to risks and safety such as hazard analysis and preventive measures, and
- providing feedback to respond to workers' reporting and raising of H&S concerns.

Bottom-up communication is mainly concerned with safety reporting, by which workers' report H&S issues and concerns to management for action and improvement. Olive et al. (2006) suggest that organisations should develop an atmosphere (and supporting structures) that allows workers to feel comfortable to raise H&S issues and encourage them to ask questions. They argue that this can help to minimise latent shortcomings of a system by challenging 'potentially unsafe practices and identifying deficiencies wherever and whenever they are encountered' (IAEA, 2002a).

Horizontal communication is related to the transfer of H&S information between peers, departments and functional units. Olive et al. (2006) claim that extensive communication between functional areas is important to maintain a good H&S culture as there is close interdependence between technical safety and organisational processes. Without effective communication, the two elements cannot be coordinated to appropriately manage H&S issues when they arise.

Richness of safety communication is highly reliant on the coexistence of formal and informal communication channels.

Formal channels may include safety information systems and formal reporting systems. These systems ensure that information is collected, analysed and disseminated in a structured way.

Informal communication channels enable managers to verbally communicate the importance of safety and to listen to workers' concerns. Examples include conducting management tours and 'walking the job, talking to people, listening to people' (HSC, 2001, page 67). This direct communication conveys managers' commitment to and concern for workers' H&S (Cheyne et al., 2002). Similarly, Olive et al. (2006) suggest that 'management by walking around' (MBWA) is a key indicator of a company with good communication between different levels. MBWA emphasises the importance of managers' physical presence in a workplace, observing work procedures and processes. Managers can develop a deeper understanding of H&S issues by actively discussing H&S challenges and issues with workers. Meaningful face-to-face communication can help to cultivate trust, which enhances workers' willingness to voice H&S concerns and problems.

The extent to which H&S communication works well depends on the quality of relationships between workers and managers. It is most effective when a focus on problem solving and learning prevails. Hofmann and Morgeson (1999) report that the quality of the relationships between group members and their managers (Leader-Member Exchange) predicted safety communication, safety commitment and accidents. Kath et al. (2010) found that good supervisor-employee relationships are conducive to workers' bottom-up H&S communication – that is, raising safety concerns with supervisors. Where relationships are good, workers are:

- more likely to raise legitimate H&S concerns and internalise the organisation's H&S values, and
- less likely to be involved in a work related accident (Kath et al. 2010).

Similarly, Mullen (2005) reports that workers' willingness to voluntarily raise H&S concerns is greater when managers are perceived as supportive and willing to listen.

The UK's Health and Safety Commission (HSC, 1993) suggests that organisations should develop a positive safety culture characterised by 'communication founded on mutual trust'. Previous studies show that developing mutual trust relies on open communication (Conchie & Burns, 2008; Conchie, Donald & Taylor, 2006). Open communication is characterised by:

> … a relationship in which both parties perceive the other to be a willing and receptive listener, and one who refrains from responses that might be seen as negative or nonaccepting (Redding, 1972, and Jablin, 1985, cited in Conchie & Burns, 2008).

Eisenberg and Witten (1987) suggested that organisational activities with potential H&S implications require clear, complete communication, and that 'concealing information would lead to the worsening of some problems over time, making them less manageable if confronted in the future' (p. 423).

Recently, Conchie and Burns (2008) investigated the effects of open communication on workers' belief and trust in an organisation's risk management processes. They report that open communication about H&S risks significantly contributes to workers' trust in risk management processes and decisions.

It is important that safety communication is conducted in a clear and meaningful way so that managers and workers can develop a clear and unbiased understanding of each others' interests and priorities. Research confirms that:

- high quality communication positively influences workers' organisational commitment (Parker et al., 2001), and
- misalignment between managers' H&S priorities and workers' perceptions of what managers want will lead to adverse outcomes including distrust, reluctance to engage in communication and a loss of confidence in management.

Clarke (1999) examined the perceptions of the importance of a number of safety issues at three hierarchical levels of a rail transport organisation – drivers, supervisors, and managers. Participants were asked to indicate their own views about the relationship between H&S and operational efficiency, and to indicate what they thought the views of other levels within the organisation were. For example, workers were asked to comment on their own H&S priorities and those of their managers and supervisors. The results revealed considerable misalignment and misperception. All three groups commented that H&S was important at their own level. However, workers substantially underestimated managers' and supervisors' H&S priorities. Managers believed they were effectively communicating their commitment to H&S to supervisors and workers, yet workers' perceptions of 'what managers really want' were vastly different.

Communication needs to occur within and between all levels of an organisation. Clark (1999) argues that the intermediate role of supervisors in management-worker communication requires careful attention. Supervisors are often the conduit through which managers' H&S priorities are communicated. Zohar and Luria (2003) demonstrated that safety climate perceptions and safety behaviours can improve dramatically by increasing the frequency and quality of supervisors' H&S related interactions with workers. Zohar and Luria (2004) suggested that at a workgroup level, supervisors play a critical role in shaping H&S climates by communicating the importance of H&S in their interactions with workers. They note three aspects of supervisors' communication that help to ensure H&S remains a workgroup priority.

Table 6.4: Aspects of supervisor communication

Pattern orientation	This is the extent to which the pattern of supervisory actions suggest the priority of one goal over another – for example, safety over production
Pattern variability	This is the extent to which similar events or situations elicit similar supervisory actions in terms of relative priorities
Pattern simplicity	This is the clarity and ease with which supervisors' behavioural patterns can be interpreted and understood

Supervisors in the construction industry play a particularly important role because of the decentralised and non-routine nature of work. Cigularov et al. (2010) examined the influence of H&S communication in the US construction industry. They reported that when workers feel they can talk openly and freely to their supervisors about H&S there are safer work practices and fewer instances of work induced bodily pain.

In the Danish construction industry, Kines et al. (2010) examined the frequency with which supervisors discuss H&S with workgroup members. They reported that supervisors interact very frequently with group members but that 85-97% of these exchanges involved discussing production issues. H&S topics were only raised in 6-16% of exchanges between supervisors and workers. They introduced a feedback based coaching program to encourage supervisors to increase the H&S content of their daily verbal exchanges with workers. This program significantly increased the frequency with which H&S was included in discussions between supervisors and workers (from 6% to 62% at one site).

Kines et al. (2010) also reported that workgroup safety performance and physical safety levels at the worksite were significantly improved as a result of the coaching program. The extent to which production was discussed in supervisor-worker exchanges did not reduce during this research, leading Kines et al. (2010) to conclude that increasing H&S communication does not reduce communication about other aspects of workgroup performance.

Due to the international labour market, local availability of skilled labour and the global economy, an increasing number of foreign workers are engaged in the construction sector. Strategies should be developed to support communication with migrant workers. Paul (2013) suggests four basic measures to improve H&S communication with migrant workers:

1. provide professional interpreters to translate information
2. convey information using pictures where possible
3. organise work to minimise language barriers, and
4. provide English language development opportunities.

Hare et al. (2013) describe using pictorial aids for communicating hazards and controls to migrant workers at UK construction sites. They developed a lexicon of critical H&S terms and produced an inventory of pictorial images to reflect these concepts. Fifty migrant workers were asked to interpret the meaning of each image. The majority of images were correctly interpreted (using a threshold level of acceptability of 85% correct interpretations). The authors noted that workers from different countries had different levels of success in interpreting the images correctly. Workers from European countries identified more images correctly than workers of African and Indian origin. This research suggests that pictorial aids can be helpful in communicating simple H&S messages. However, cultural differences can influence comprehension of pictorial images. It is advisable that pictorial images are thoroughly tested among diverse worker groups before they are relied upon.

It is important to recognise that construction workers themselves can often develop highly effective methods for communicating H&S information. Non-traditional forms of communication can be very effective ways to share tacit and unspoken H&S knowledge even though they do not rely on proficiency in the dominant language. For example, Tutt et al. (2013) described how a diverse group of Eastern European construction workers developed their own H&S language, such as using gestures and simple verbal symbols. This enabled them to communicate effectively and maintain a high level of safety in their work tasks.

Component 3: Organisational goals and values

H&S is understood to be of strategic importance to the organisation's operations.
Managers at all levels demonstrate a genuine commitment to H&S as a core value.
The potential for conflict between H&S and cost/production is acknowledged, but communications and decision making demonstrate H&S is consistently given a very high priority.
H&S is considered seriously when allocating resources (including time).
Safe and healthy behaviour is expected, enabled and supported throughout the entire organisation.

What is valued, and what the organisation and its members aspire to be, are fundamentally shaped by the basic assumptions at the heart of organisational culture. The Australian Work Health and Safety Strategy 2011-2012 states that all workers 'have the right to work in a healthy and safe working environment', and 'well-designed, healthy and safe work will allow workers in Australia to have more productive working lives' (p.4). These statements align with the United Nation's Universal Declaration of Human Rights, and are reflected in duties of care present in all Australian work health and safety legislation. Organisations in which H&S is assumed to be a basic human right are likely to develop work processes that provide workers with the highest practical level of protection against harm to their health and safety from hazards and risks arising from work.

The relative priority placed on H&S within an organisation (or subunit) has been identified as a component of the prevailing H&S culture. Guest et al. (1994) define safety culture as,

> … the underlying beliefs and assumptions in the organisation or among a subgroup about risk, danger and safety. It will include the way these issues are viewed and *the priority attached to them in determining day-to-day behaviour* (cited in Clarke, 1999, italics added).

Cultural assumptions about the right balance between H&S and profitability are frequently measured as a component of H&S culture/climate (see, for example: Lawrie et al., 2006; Høivik et al., 2009; Cox & Cheyne, 2000). Flin et al. (2000) identify work pressure (that is, work pace and workload) as one of the core components of an organisational safety climate. They also suggest that the balance maintained between safety and pressure for production is a key safety component of an H&S culture.

Hale (2000) shares this view, suggesting that the role played by senior managers in driving this component of H&S culture is particularly important.

> The importance which is given by all employees, but particularly top managers, to safety as a goal alongside and in unavoidable conflict with other organisational goals; for example, whether actions favouring safety are sanctioned and rewarded even if they cost time, money or other resources (Hale, 2000, p.12).

Guldenmund (2000) has pointed out that an organisation's core cultural beliefs and assumptions do not have to be especially concerned with H&S. They can be about any number of things that may or may not have an impact on H&S. Cultural assumptions only become a problem when an organisation's view about what is good takes priority over and detracts from the organisational H&S effort (Hopkins, 2006). Reason (1998) has suggested that (at least in the short term) there is an 'inevitable conflict' between an organisation's goals for safety protection and production. Within an organisation, the claims to protection and production are usually not perceived as equal. Consequently, balancing these conflicting imperatives can be delicate and difficult.

Reason (2000) suggested that the way in which conflict is resolved and trade-offs are made reflects the organisational culture. He uses the introduction of the Davy lamp to the mining industry in the 1800s to illustrate the paradoxical nature of the protection-production trade-off. To reduce the risk

of explosions in mines, the Davy lamp was introduced to isolate the light source (a naked flame) from combustible gases. However, mine owners recognised using the Davy lamp enabled miners to work in rich coal seam areas previously considered too dangerous to mine. Ironically, following the introduction of this new protective technology, the incidence of mine explosions increased.

Analysis of serious organisational accidents often reveals the existence of cultural drivers that 'normalised' unsafe practices and led people to ignore early warning signs in order to maintain production or project progress. For example, Hopkins (2006) described a situation in the rail industry in which a culture of punctuality in the running of trains resulted in denying risk in the operating environment, culminating in a serious accident. Hopkins (2006) also documented how a culture in which production was valued more highly than safety – a 'can do' attitude and a command and discipline orientation – created the conditions in which a number of Air Force personnel were exposed to toxic chemicals over a 20 year period. The cultural assumption that a high production rate is for 'the greatest good' of the organisation is often cited as a factor in corner-cutting in relation to H&S (see, for example, Guldenmund, 2000). In the construction industry context, time and cost performance are so ingrained as basic assumptions about what constitutes a successful project that it is easy to imagine a negative H&S impact.

In many situations, the basic assumptions driving organisational behaviour are not specifically concerned with H&S but they do have a significant impact. However, it is possible that a belief in the importance of H&S can be one of an organisation's basic assumptions. Arguably, this will create the conditions required for H&S to be taken seriously within the organisation in the context of competing organisational objectives.

Zwetsloot et al. (2013) have proposed that health, safety and wellbeing at work represent important values in themselves. However, other organisational values (or 'basic assumptions') also contribute to H&S outcomes. They identified three clusters of organisational values that are influential to health and safety in an organisation.

Table 6.5: Organisational values and their influence on H&S

Valuing people	A positive attitude toward people and their 'being', including core values of interconnectedness, participation and trust
Valuing desired individual and collective behaviour	'Doing', primarily comprising core values of justice and responsibility
Valuing alignment of personal and organisational development	'Becoming', characterised by core values of development and growth, and resilience

Workers need to accurately perceive organisational goals and values regarding safety. According to Zohar (2000), workers' perception of the relative priority of the safety goal is developed by observing and experiencing patterns of managerial behaviours. Management must demonstrate consistent behaviours, reflected in:

- congruence between statements and actions – they must 'walk the talk', and
- consistent managerial responses to safety in different situations (for example, when facing adverse project events such as delays or disruptions).

At the group level, workers interpret supervisory actions over time as reflecting an overall emphasis or de-emphasis on safety (Zohar, 2000). They assess whether supervisory practices converge into an internally consistent pattern regarding the relative priorities of safety goals versus competing goals. Workers' perception of the priority of safety goals will diminish if supervisors emphasise safety on some occasions but on other occasions ignore safety to pursue production goals.

Component 4: Supportive environment

The physical condition of the workplace (and amenities) reflects a commitment to excellence in H&S.

Managers, workers and contractors engage in effective cross-functional cooperation and teamwork in projects delivery.

Jobs are designed to ensure high standards of health, safety and wellbeing for all personnel.

All personnel feel competent and capable to perform their work in a way that promotes health, safety and wellbeing.

Managers, workers and contractors experience good working conditions with regard to time pressures, workloads and stress.

All personnel can maintain a positive work-life balance.

Cox and Cheyne (2000) identified a supportive work environment as a facet of H&S culture. Research confirms that features of the physical and psychosocial work environment influence H&S-related behaviour and performance (Christian et al., 2009). Parker et al. (2001) reported that workers' adoption of safe working practices is positively predicted by workers' perceptions that their employing organisation provides a work environment that is supportive of good supervision, training adequacy, job security and communication quality. Having a supportive work environment is believed to influence H&S in a number of ways. A direct effect is likely to flow from the open and effective communication, appropriate levels of training and supervisory concern for H&S. An indirect effect has also been suggested: organisational support is believed to produce higher levels of organisational commitment (Barling et al., 2003), job satisfaction (Parker et al., 2001) and trust (Zacharatos et al., 2005).

Oliver et al. (2002) analysed the role played by social relations at work (expressed as the social support received from one's supervisor and colleagues) and the physical work environment. They reported that perceptions of social support and of the level of safety of the physical work environment were both linked to safety related behaviour and involvement in accidents. Specifically:

- the more social support workers receive, the safer their behaviour and the less likely they are to be involved in accidents, and
- the more risky the physical work environment is perceived to be, the less involved workers will be in organisational H&S activities and the more likely they are to be involved in workplace accidents.

Understanding the effects of a supportive work environment on H&S in individual or workgroup behaviour, requires an understanding of the concept of climate – that is, perceptions of the work environment. Wallace et al. (2006) argued that workers do not respond directly to the work environment. They perceive and interpret the work environment before acting in a way that is consistent with their interpretation.

A great deal of research interest has focused on perceived organisational support – that is, the global perceptions workers form about the extent to which the organisations is concerned about their wellbeing (Eisenberger et al., 1990). Perceptions of organisational support have been linked to a strong and positive safety climate, workers' compliance with organisational H&S policies, and reduced involvement in work accidents (Gyekye & Salminen, 2007). Wallace et al. (2006) used the term 'foundation climate' to describe workers' perceptions of the ambient climate for organisational support and management-worker relationships. They found that the perceptions of support (expressed in the foundation climate) were strong predictors of safety outcomes. Developing strong and positive climates for safety is the mechanism by which global perceptions of a supportive work environment (the foundation climate) positively influenced safety outcomes.

Workers who perceived strong organisational support developed positive safety climates that drove improved safety outcomes. In a study of Swedish blue collar construction workers, Larsson et al. (2008) reported that favourable worker perceptions of the work environment (in terms of the psychosocial conditions experienced at work, including social support) are linked to workers' engagement in structural, interactive and personal safety behaviour.

Work organisation characteristics have also been examined as a driver of positive safety climates and performance. Work organisation refers to the 'way work processes are structured and managed, such as job design, scheduling, management, organisational characteristics and policies and procedures' (DeJoy et al., 2010, p.140). DeJoy et al. (2010) described 'healthy work organisations' as those with organisational, physical, social and technological environments that are supportive of workers' health, safety and wellbeing.

A number of studies have focused on aspects of job design in shaping safety climates and outcomes. For example, Parker et al. (2001) examined H&S and the role of job autonomy, defined as 'the degree of discretion employees have over important decisions in their work, such as the timing and methods of their tasks' (p.212). They reported that job autonomy is significantly linked to safety-relevant behaviour. Drawing on a large Australian dataset, Barling et al. (2003) reported that workers involved in high quality work have fewer work injuries. Barling et al. (2003) defined high quality work as characterised by autonomy, task variety and the development of workers' skills and capabilities.

Building on this research, Zacharatos et al. (2005) examined the relationship between H&S and high performance work systems. They identified ten features of a high performance work system.

Table 6.6: Zacharatos et al.'s ten features of a high performance work system

Employment security	The extent to which an organisation provides stable employment
Selective hiring	Ensuring a fit between workers and the work environment
Extensive training	Allowing workers to acquire competencies to control their work
Self-managed teams and decentralised decision making	Fostering cohesion and a sense of safety responsibility
Reduced status distinctions	Increasing communication between managers and workers
Information sharing	Ensuring people have full information required to perform their work
Compensation contingent on safe performance	Paying people well and recognising safe working practices
Transformational leadership	Providing a stimulating, motivational and caring work environment
High quality work	Including appropriate workload, role clarity and job control
Measuring management practices	Ensuring that the quality of the organisation's H&S effort is appropriately measured

Zacharatos et al. (2005) report high performance work system elements are linked to more positive organisational safety climates and greater trust in management. In turn, positive perceptions of the safety climate and trust are linked to:

- workers' personal safety orientation – comprising safety knowledge, safety motivation, safety compliance and safety initiative, and
- fewer safety incidents – that is, injuries requiring first aid, and near misses.

Hale (2000) argues that the quality of an organisation's culture for H&S is partly indicated by 'which aspects of safety in the broadest sense of the word are included in that concept, and how the priority is given to, and felt between the different aspects' (p. 12). Increasingly, traditional approaches to H&S are being expanded to reflect organisations' interest in promoting workers' health, wellbeing and work-life balance.

Australian construction workers are a high risk group for work-life imbalance and poor health (Du Plessis et al., 2013). Health assessments of some 176,483 male construction workers in the state of Victoria revealed significant levels of: high blood pressure (33%), high total cholesterol levels (26%), high risk of developing type 2 diabetes (26%), and high blood glucose levels (25%). Unhealthy lifestyle behaviours were also evident including: physical inactivity (57%), risky alcohol intake (63%), below recommended vegetable intake (93%), below recommended fruit intake (55%), and smoking (29%) (WorkHealth Victoria, 2013).

The work environment conditions experienced by project based construction may contribute to unhealthy behaviour/lifestyle. Long work hours are typical of project based construction work and work-family conflict (WFC) is high (Lingard & Francis, 2004). Work hours and WFC are consistently linked to chronic disease risk factors including:

- poor diet (Devine et al., 2006)
- high cholesterol (Van Steenbergen & Ellemers, 2009)
- lack of physical exercise and low physical stamina (Burton & Turrell, 2000; Van Steenbergen & Ellemers, 2009)
- high body mass index (Van Steenbergen & Ellemers, 2009), and
- harmful levels of alcohol consumption (Frone et al., 1997; Roos et al., 2006).

Australian construction workers themselves have attributed their high levels of alcohol use to working long hours (MacKenzie, 2008). Construction workers also state that long hours, insufficient recovery opportunities, and exhaustion prevent them from participating in healthy lifestyle activities such as sport and physical exercise (Lingard et al., 2010).

Wilson et al. (2004) described how the way that work is organised – particularly in relation to the level of social and organisational support available to workers – predicts psychological adjustment to work demands and shapes workers' health and wellbeing. Dollard and Bakker (2010) suggest that workplaces develop a psychosocial safety climate which relates to the priority of regard for psychological health within an organisation. They provided evidence that the psychosocial safety climate can be measured and used to predict psychological health changes over time. Nahrgang et al. (2011) reported that a supportive work environment is the most consistent predictor of workers' burnout, engagement and safety outcomes.

Social support in the workplace is also a key factor in providing a protective buffer against the harmful effects of work stressors. For example, in a study of Australian construction workers, Lingard and Francis (2006) reported that when workers perceive high levels of organisational or supervisor support they are less likely to suffer burnout as a consequence of long working hours and work-life imbalance. This is important for both workers' health and workers' safety because burnout is negatively related to working safely (Nahrgang et al., 2011).

Component 5: Responsibility

Managers at all levels understand and openly acknowledge their responsibilities for H&S.
All managers, workers and contractors are aware of their potential to influence H&S.
All personnel demonstrate care and concern in looking after the health and safety of themselves and others who could be impacted by their actions in the workplace.
Managers, workers and contractors have a strong sense of 'ownership' of the organisation's H&S processes and practices.

Organisations with a positive safety culture ensure that all employees are aware of their H&S responsibilities. Pidgeon (1991) argued that an organisation with a good safety culture promotes a caring atmosphere in which workers at all levels take some personal responsibility for H&S. In the construction industry, Törner and Pousette (2009) reported that supporting the attainment of high H&S standards requires people at many levels in an organisation to assume responsibility for H&S.

Managers need to be aware of how their decisions and actions could impact on H&S. For example, it is important for managers to allocate resources that are consistent with, and appropriate for, the organisation's H&S objectives. In road maintenance, Glendon and Litherland (2001) suggested that workers need sufficient 'thinking time' to plan and carry out their work in a healthy and safe manner, and to have a reasonably balanced workload. This outcome requires managers to establish realistic time schedules and to provide an appropriate number of workers with the required skills and attitudes for completing projects.

The UK's Health and Safety Executive (2012) reported that in organisations with good H&S cultures, managers try to resolve conflicts between safety and production before workers feel pressured to take shortcuts.

Promoting personal responsibility for safety is important for H&S performance. In their safety climate model, Cheyne et al. (1998) showed that there is a positive relationship between individual safety responsibility and the level of safety activities. Individual safety responsibility influences the extent to which the level of safety activities is prioritised among other organisational variables (such as safety management, and safety standards and goals) and group processes (including personal involvement and communication).

Harvey et al. (2002) found that managers perceive safety as their responsibility to a greater extent than workers do. Managers and supervisors need to raise employees' awareness of taking personal responsibility for safety. Previous research indicates that when managers and supervisors have a caring attitude, workers are motivated to pay more attention to safe working practices. Parker et al. (2001) reported that when team leaders' adopted a considerate and coaching oriented approach to accepting personal responsibility for safety, workers were motivated to put greater effort into safe working practices.

Jannadi (1995) reported that management's concern for workers' welfare encouraged safe behaviour among workers and improved safety performance in the workplace. Workers who reported lower injury frequency felt their employer was concerned about them, and had a higher tendency to stay in the same department even if there were other available options. Jannadi also found that safety is positively influenced when supervisors adopt a caring attitude. Workers reported lower injury frequency if their ideas were considered seriously by supervisors, and if they were praised for good work performance.

Studies conducted by Geller and colleagues (Roberts & Geller, 1996; Geller et al., 1996) show that a caring attitude among coworkers promotes H&S. They use the term 'actively caring' to describe workplaces in which 'employees care enough about the safety of their coworkers to act accordingly' (Roberts & Geller, 1996, p. 54). Actively caring requires employees to:

> … go beyond the call of duty to identify environmental hazards and unsafe work practices and then implement appropriate corrective actions when unsafe conditions or behaviors are observed (Roberts & Geller, 1995, p 54).

Geller reported that 'active caring' is positively correlated to personal characteristics and group cohesion.

Burt et al. (1998) also reported that workers' caring attitudes are positively correlated to group cohesion and workers' work satisfaction. They developed the Considerate and Responsible Employee (CARE) scale to measure workers' attitudes toward their coworkers' safety. The CARE scale comprehensively covers various aspects of a caring attitude, including:

- reminding coworkers about hazards
- assisting coworkers to work safely
- discussing and sharing safety information with coworkers
- correcting coworkers' unsafe acts
- avoiding creating hazards to coworkers by their own behaviours, and
- informing management about hazards.

Burt et al. (2008) found that workers will develop a caring attitude if they trust management's commitment to safety. The researchers suggested that workers would not develop a caring attitude toward coworkers if they perceive that they could be reprimanded for leaving their work to help coworkers. Similarly, workers might not alert management and other coworkers to a hazard created by a coworker if they feel that management may punish the worker who created the hazard.

Wadick (2010) claimed that contractors should help to create a safe workplace on construction sites by promoting thoughtfulness between subcontractors. In the domestic building industry, Wadick (2010) found that subcontractors attempt to finish work quickly and rarely consider other workgroups that depend on them. Due to thoughtlessness, subcontractors frequently leave unnoticed hazards which lead to accidents. For example, carpenters may leave loose floorboards that unsuspecting workers from other workgroups fall through. One subcontractor left their mess for others to clean up or trip over (Wadick, 2010). A caring attitude should exist within each workgroup, and extend to the whole project organisation – everyone should care about the influence of their behaviour on the H&S of all personnel involved in the project.

Component 6: Learning

All managers, workers and contractors consistently question whether there are new or better ways to ensure H&S in the organisation's operations.

Open reporting of incidents, errors or deviation from procedures is actively encouraged.

Managers at all levels are open and responsive to feedback about H&S performance, and H&S hazards or issues are resolved in a timely manner.

H&S performance is measured using a combination of leading indicators.

Assessments of organisational H&S performance are used to facilitate learning and continuous improvement.

Managers, workers and contractors are encouraged to discuss 'what worked and what didn't', and to share operational H&S knowledge and experience.

Reason (1997) identified a learning culture as a vital component of an organisation's safety culture. Reason describes a learning culture as characterised by:

- the willingness and competence to draw the right conclusions from the safety system, and
- the willingness to implement changes or reforms when necessary.

A learning culture encompasses ongoing reflection about current safety practices and beliefs, and the ongoing search for ways of eradicating or minimising risks (Pidgeon, 1998; Pidgeon, 1991). Reflexivity is a precaution against the rigid compliance with existing rules and procedures to the neglect of unforeseen hazards (Pidgeon, 1991). It is recommended that reflexivity can be facilitated through the use of 'think tanks', members of which assess the available intelligence about safety by asking questions about how work is undertaken, whether rules and procedures are effective or whether there are safer and more effective ways of working in some situations (Pidgeon, 1991).

Reflexivity should be facilitated by incident reporting systems that collect, analyse and disseminate information about incidents and near misses. Reporting is important because incidents normally share similar precursors with patterns displayed by particular disasters (Pidgeon, 1991). The incubation model of disasters suggests that near miss incidents differ from real disasters only by the absence of the final trigger event and the presence of chance (Pidgeon, 1998). Near miss incidents are warning signals for organisations to reflect on current safety systems and practices.

Wiegmann et al. (2004) suggest that an effective incident reporting system is the keystone in identifying vulnerabilities associated with existing safety management before an accident occurs. However, an effective system improves safety only if an organisation is willing to learn proactively and to adapt its operations.

An effective reporting system is the keystone in identifying vulnerabilities associated with existing safety management before an accident occurs (Wiegmann et al., 2004). Improving safety is maintained by organisations' willingness to learn proactively and to adapt their operations based on incident reporting (Wiegmann et al., 2004). An effective reporting system provides workers with timely and valuable feedback, informs them that their reporting has been reviewed and that appropriate actions will be taken (Wiegmann et al., 2004). If workers observe that their reporting of incidents or deviations does not lead to any action, they will revert to seeing them as part of normal work process (Hale, 2003) and organisations will lose valuable opportunities for proactive improvements.

Clarke (1998) investigated the organisational factors affecting the incident reporting of British Rail train drivers. The most frequently reported reason (32%) for not reporting an incident was that the incident was 'just part of the day's work'. This implies that incidents were not reported because they were accepted as the norm. Drivers' intention not to report was significantly predicted by the

interaction between two perceptions: 'just part of the day's work' and 'nothing would get done'. This indicates that the norm was reinforced when workers perceived that their reporting would not result in any corrective actions by management. Another significant predictor of drivers' intention not to report incidents was found to be 'managers take no notice' – drivers were unwilling to report an incident if they perceived that managers would be unconcerned by the report. These findings suggest that it is important for managers to respond to employees' incident reporting and take timely remedial measures. Managers' positive reactions to incident reports will improve workers' intentions to report an incident. Previous research has suggested that feedback can improve workers' accountability for performance (London & Sessa, 2006).

A learning culture is associated with a questioning attitude. Hale (2003) argues that it is important for workers to have creative mistrust in their risk control system. This means they are always expecting new problems, or new implications from old ones, and never believe that their safety culture or safety performance is ideal. Nurturing creative mistrust also means there are explicit and supportive provisions for whistleblowers to inform management about latent safety problems; for example, instances of conflict with other organisational goals, such as schedule requirements.

A mature safety culture can emerge only if an organisation is a learning organisation (Fleming, 2000). Research (IAEA 2002a; Saw et al., 2010; Weick et al., 1999) has identified essential characteristics of a learning organisation. They include:

- striving for continuous improvement and new ideas
- ensuring that all the individuals and teams are aware of the benefits of improving safety
- learning from one's own experience and from the experience of others
- sharing ideas and information internally and externally, and being open to and encouraging innovation
- being mindful that things can go wrong and tolerating (but learning from) legitimate mistakes
- allowing flexibility in searching for safer ways of working
- actively learning from errors and failures rather than seeking to blame and/or find a scapegoat
- questioning commonly held assumptions about what is safe and working to uncover latent (hidden) hazards in work systems, and
- fostering knowledge sharing throughout the organisation, crossing boundaries of teams, disciplines or divisions.

Gherardi and Nicolini (2000) suggest that safety knowledge is a form of organisational expertise that develops over time among professional or technical groups within an organisation. An organisation's culture and safety are created through dialogue that engages the perspectives of different technical/professional groups that make up the organisation. Knowledge sharing informs the safety orientation of all parties. It assists them to jointly seek optimal solutions to problems by amending their own perspectives, creating new ideas and resolving conflict.

Through knowledge sharing, one professional/technical group (for example, engineers) can learn to see problems from the perspective of other groups (for example, workers) and resolve problems in a way that meets the needs of both groups.

A learning organisation should proactively seek feedback and suggestions from employees at all levels. Hale (2003) argues that causes of incidents, solutions and opportunities for safety improvement should be sought:

- by considering the interaction of many causal factors rather than focus on individual behaviours alone, and
- in many places and from many people, most notably those who work directly with the technology and the hazards.

Hale (2003) argues that causes for incidents and opportunities for improvements should be sought in the interaction of many causal factors rather than in individual behaviour. Therefore, solutions and safety improvement should be sought in many places and from many people, most notably those who work directly with the technology and the hazards (for example, frontline workers).

Previous research has found that frontline workers in the construction industry have a great deal of health and safety knowledge and are highly motivated to use this knowledge, but often do not possess the skills required to communicate their knowledge effectively (Maloney et al., 2007). Management needs to use appropriate approaches to seek feedback and suggestions from frontline workers who are in the best position to know how jobs should be performed safely.

A learning organisation applies continuous benchmarking within the organisation, and between projects. Benchmarking supports an organisation to draw up checklists of practices to consider, and supports an assessment of strength and weaknesses that facilitates continuous learning and progress (Saw et al., 2010).

Various indicators have been developed to support assessment of the quality of aspects of safety culture. Combining leading indicators and performance assessment can provide more comprehensive insights into an organisation's safety performance and help an organisation to take proactive safety improvement measures (Lingard, et al., 2013). Mearns (2009, p.491) defines leading indicators as performance measures 'that provide information that helps the user respond to changing circumstances and take actions to achieve desired outcomes or avoid unwanted outcomes'.

Leading indicators:

- measure how well an organisation is managing health and safety risk more directly than the occurrence of accidents – this is because accidents include an element of chance, while leading indicators do not, and
- provide an immediate feedback mechanism, enabling organisations to improve H&S management processes before deficiencies result in incidents, injuries or illnesses (Hinze et al., 2013).

The IAEA (2005) proposes that 'safety is learning driven', and lists seven attributes of this characteristic:

- a questioning attitude prevails at all organisational levels
- open reporting of deviations and errors is encouraged
- internal and external assessments, including self-assessments, are used
- organisational experience and operating experience (both internal and external to the facility) are used
- learning is facilitated through the ability to recognise and diagnose deviations, to formulate and implement solutions, and to monitor the effects of corrective actions
- safety performance indicators are tracked, trended, evaluated, and acted upon, and
- individual competencies are developed systematically.

Component 7: Trust in people and systems

Workers and contractors trust the quality and intention of the organisation's H&S systems.
The organisation is perceived to 'say what it does, and do what it says' in relation to H&S.
Work processes and practices are consistent with the organisation's espoused H&S values.
H&S systems for incident/error reporting are perceived to be 'just'. This means that a clear and well understood line divides what is acceptable and unacceptable behaviour, and that the reporting of information that can be used to improve H&S performance is rewarded and encouraged.
Workers and contractors believe that if they report H&S problems or errors they will not be punished, and that the information they provide will be acted upon to improve H&S.

Reason (1997) proposed that a safety culture can be socially engineered by developing the subcomponents of reporting and learning cultures but trust is required to integrate these subcomponents into an effective H&S culture. Notwithstanding the importance of trust in developing an H&S culture, most H&S culture/climate studies do not investigate the presence or otherwise of trust (Burns et al., 2006).

In contrast, many H&S culture studies do investigate perceptions of various aspects of the H&S management system. For example, Flin et al. (2000) reviewed 18 scales used to assess safety climate and identified employees' perceptions of, and attitude to, safety systems as the second most frequently examined dimension. Safety systems include various aspects of organisational safety management systems such as the status of safety officers, safety committees, safety policies, and safety arrangements such as permit to work systems and provision of equipment. Törner and Pousette (2009) interviewed frontline supervisors and workers' safety representatives in the construction industry, and reported that a well-functioning safety system was perceived by interviewees to be important for achieving high safety standards.

Hale (2000) distinguishes safety culture from the management structures or systems established to deliver H&S in an organisation. For Hale, structures – elements of H&S management systems – are important for maintaining good H&S performance. Structures include:

- H&S policies, plans and procedures
- clearly allocated responsibilities
- open communication channels
- risk assessment and safety in design processes, and
- monitoring, feedback and learning systems.

In Hales' opinion, these structures are related to, but not the same as, the H&S culture. Hale argues for a distinction between the objective presence of H&S system elements (like policies, procedures, and processes) and

> … the trust which people have in the procedures and their feeling of competence to cope with risk. Culture tools would then more clearly be focusing on the *attitudes, beliefs and perceptions shared by natural groups as defining norms and values, which determine how they act and react in relation to risks and risk control systems*. (Hale, p.7, author's italics).

According to Hale's distinction, H&S culture may be more appropriately framed as workers' trust in management structures and systems.

Trust is defined as an individual's tendency to rely on other people or entities in a risk situation. Those on whom an individual relies is a 'trustee' – the willingness to rely on a trustee is based on positive expectations of the trustee's behaviour or intention (Rosseau et al., 1998, cited in Conchie et al., 2011). For health and safety, trust is described as individuals' attitudes to, and expectations of, other people and the organisational systems embedded within the institutions (Jeffcott et al., 2006).

There is considerable evidence about the positive effect of trust on safety related behaviours, including:

- personal safety orientation, such as safety knowledge, safety motivation, safety compliance, and safety initiative (Zacharatos et al., 2005), and
- open safety communication (Carroll, 2002).

Burns et al. (2006) describe how workers in a UK gas plant reported high levels of trust in their workmates, lower levels of trust in their supervisors, and even lower levels of trust in the plant managers. These findings highlight the importance of understanding the expression of trust at different levels within an organisational hierarchy.

An individual's trust attitude toward other people or entities develops from beliefs about trustworthiness of the other people. This is determined by a number of qualities that broadly fall into three categories:

- ability, which reflects the person's competence to perform a task
- integrity, which refers to the extent to which the person is honest and open in sharing information, and
- benevolence, which indicates the extent to which the person shows concern for other's welfare (Mayer et al., 1995, cited in Conchie et al., 2011).

It is inferred that workers form an attitude of trust toward safety management systems by searching for similar qualities. This inference is supported by previous studies. For example, Kines et al. (2011) identified the dimension of '*trust in the general efficacy of the safety system*' as an important dimension of safety culture. The efficacy of the safety system is described as the system's ability to achieve safety objectives and goals – for example, the effectiveness of safety activities, and reducing the number of accidents and injuries.

A recent study found that 'consistency' is an important indicator of integrity that affects the development of workers' trust in safety leadership (Conchie et al., 2011). Similarly, Simoms (2002) suggests that 'Behavioural Integrity' influences employees' trust in management and organisational outcomes. 'Behavioural Integrity' refers to the congruence between management's words and deeds, and espoused values and enacted values. This implies that for a safety system to be trustworthy, the process and practices defined by the safety system should align with H&S values espoused by the organisation. It is important to ensure consistency between 'what is said' by the system and 'what is done' in practice. Michael et al. (2006) found that supervisors' safety related communication did not improve safety related events (that is, accidents in the last 12 months), and did not reduce reported injuries. This may be explained partly by workers' perceptions that increased safety communication is just 'lip service', with little actual safety commitment and engagement from supervisors or other management levels.

Workers' trust in a safety system is affected by the extent to which they feel engaged by the system. According to IAEA (2002a), there is a gap between having well defined rules and procedures on paper, and having the procedures understood, and consistently applied by employees. The content of the rules and procedures should be intelligible and relevant to employees who use them. Rules and procedures, reinforced by training, need to clearly inform employees about the reasons for particular requirements. This is because employees will only be committed to rules and procedures when they believe the rules and procedures are important and relevant to them.

Wiegmann et al. (2004) identify the quality and effectiveness of an organisation's reporting system as a facet of safety culture. However, the effectiveness of reporting systems varies considerably. Processes for reporting incidents, near misses and errors can be designed to encourage reporting behaviour by ensuring that the reporting process:

- is easy to use
- is confidential
- is anonymous, and
- establishes a clear separation between organisational departments involved in collecting and analysing H&S information and departments responsible for determining whether disciplinary action is warranted.

However, Reason (1997) argues that the most important determinant of reporting is trust. Trust in reporting processes is closely related to the concept of 'error management climate' (Hofmann & Mark, 2006; van Dyck et al., 2005). The error management climate refers to workers' 'perceptions of organisational practices relating to communicating about errors, to sharing error knowledge, to help in error situations and to quickly detecting and handling errors' (van Dyck et al., 2005, p.1229). Cigularov et al. (2010) have argued that workers' perceptions of managers' openness and responsiveness to error reporting should be considered as integral to an organisation's H&S climate. In their study of the US construction industry, Cigularov et al. (2010) reported that, alongside H&S communication, workers' perceptions of subcontractors' error management climate was associated with safer work practices and fewer instances of work induced bodily pain. Jeffcott et al. (2006) suggest that 'trust-rich environments' characterised by open communication are conducive to workers' willingness to identify and report abnormal events and errors.

For the reporting system to be effective, Reason (1997) argues that a 'just' culture should be engineered. Organisations with a just culture recognise that not all errors and unsafe acts should be punished without considering their origins and circumstances. Reason (1997) used a decision tree of culpability of unsafe acts to illustrate that a large number of errors and unsafe acts are actually system induced and blame cannot be attributed to an individual.

Organisations with a just culture encourage and even reward individuals who report safety related issues, which may enable them to identify the latent error conditions in organisational systems. However, it is equally unacceptable to exempt from discipline any acts that lead to organisational accidents, such as unreasonable reckless, negligent or malevolent behaviour. Organisations with a just culture draw a clear line between acceptable and unacceptable actions.

Workers' trust in a safety system is also determined by the quality of information the system provides. Conchie and Burns (2009) investigated workers trust in a variety of information sources in the UK construction industry. They reported that workers' trust in an information source is largely determined by the belief that the source's information is accurate. Workers reported a higher level of trust in the HSE (the regulator) and safety managers than they did in project managers and supervisors.

These findings have implications for organisations' safety systems: for example, information in the safety system should be reviewed regularly and updated based on new lessons learned, new hazards identified, and new information received. Only accurate and useful safety information is effective in preventing risks and protecting workers from dangers. The information should be communicated effectively to all levels to ensure that it is fully understood. H&S training should target workers and holders of safety critical positions such as project managers and supervisors. Training should aim to enhance safety competency, increase knowledge and understanding of safety procedures, improve awareness of required actions and procedures, and enhance understanding of potential hazards

(Dingsdag et al., 2008). These outcomes would help supervisors to communicate safety information accurately to workers and increase workers' trust in the information provided by them.

Normally, it is assumed that trust in safety management systems is associated with positive safety outcomes and distrust is associated with negative safety outcomes. This is challenged by recent studies showing that complete trust may result in negative safety outcomes. A certain level of distrust produces positive safety outcomes. Jefcott et al. (2006) reported that rule-based trust (that is, a high level of trust in a system of rules) may have negative effects on safety partly because it reduces flexibility to cope with abnormal situations that are not covered by pre-specified rules and procedures.

Based on interview data, Conchie and Donald (2008) argue that safety-specific trust and distrust have both positive and negative functions in safety. Specifically, trust results in positive outcomes such as open communication, reduced perceptions of risk among employees, and improved employee confidence in safety management.

However, the benefits of safety-specific trust are associated with moderate levels of trust. Complete trust may result in problems such as increased risks of mistakes and accidents, and reduced personal responsibility for safety. These problems may be avoided by a certain level of distrust in others' behaviours or in the safety system. This distrust finds expression in the form of questioning, monitoring or checking.

Conchie and Donald (2008) conclude that an effective H&S system needs both elements of moderate trust and moderate distrust.

Component 8: Resilience

Managers, workers and contractors are consistently mindful that, even with the best H&S system in place, it is possible for things to go wrong.

All personnel anticipate future H&S challenges and feel competent to respond appropriately to new (identified or unidentified) hazardous situations.

Managers, workers and contractors are willing to defer to others with appropriate technical expertise and experience when non-routine situations arise.

It is recognised that written H&S procedures may not cover all circumstances. Adaptive behaviour may be required in exceptional circumstances.

All circumstances in which deviation from procedure occurs are viewed as critical opportunities to improve the design of work and/or H&S systems.

An organisation with a positive safety culture will have a high level of resilience, defined as:

> … the intrinsic ability of a system to adjust its functioning prior to, during, or following changes and disturbances so that it can sustain required operations under both expected and unexpected conditions (Hollnagel et al., 2011, p. xxxvi).

An alternative definition of resilience is: 'the capability to cope with unanticipated dangers after they have become manifest, learning to bounce back' (Wildavsky, 1991, p. 77, cited in Weick et al., 1999).

Hollnagel (2010) suggests that the quality of resilience is related to four essential qualities or abilities. An organisation should have the ability to:

1. Respond to new or unusual situations in an appropriate way

Recognising that it is not enough to rely entirely on a set of policies and procedures because actual situations often differ from expected situations. This may be especially true in non-routine work, such as construction. When irregular threats to H&S arise, people need to respond in a way that ensures their H&S in the new and unexpected situation. This requires adaptive behaviour and flexibility, but also a clear understanding about the boundaries of acceptable behaviour.

2. Flexibly monitor what is going on, including its own performance

Flexibility means monitoring systems are assessed from time to time so that they do not become normalised by routine practice. Monitoring enables an organisation to deal proactively with matters that may become critical in the near future if left unattended.

3. Anticipate future events that could impact on H&S

This refers to the ability to go beyond the current situation, and to anticipate what may happen in future. Anticipation enables an organisation to pre-empt and deal with potential problems and new situations as they arise.

4. Learn from experience

The ability to learn from what has happened by making changes to procedures, roles and functions, or even to the organisation itself. This learning ability enables the organisation to deal with dynamic and complex environments.

Reason (2000) questions the slogan of 'Target zero', and argues that the slogan actually conveys a potentially dangerous message that a decisive victory can be achieved in the 'safety war'. Reason claims that instead of seeking decisive victory, organisations should have an abiding concern with failure and recognise that their safety systems are fallible. A resilient organisation should know that hazards are never completely eradicated and that errors, unexpected situations and accidents are inevitable (Reason, 2000). Unexpected, adverse events are valuable – they are important indicators of areas in which the safety of a system can be improved (Olive et al., 2006).

Organisations need backup systems. Most organisations have developed complex safeguards and barriers in both 'hard' forms (such as physical containment and automated safety features) and 'soft' forms (mainly paper and people oriented, like rules and procedures, training, and drills) (Reason, 2000). However, a resilient organisation should avoid excessive reliance on redundancy as this can:

- create a false sense of security
- reduce the extent to which people are mindful of potential risks, and
- compromise the ability to deal with unexpected situations (Olive et al., 2006).

Reason (2000) warns that the 'defences-in-depth' created by redundancy and complexity may actually create or conceal danger. Reason (2000) argues that a belief that safety systems are infallible can make people 'forget to be afraid'.

An organisation's resilience is reflected by the flexibility and variability in operations. Many organisations attempt to reduce the number of unsafe acts by requiring employees to comply rigidly with procedures. They see errors and violations as workers' deviations from standard procedures and subject to sanctions and disciplines. Unfortunately, focusing on punishment leads to the organisations' loss of opportunities to reflect on current procedures and analyse the systemic causes of workers' unsafe acts. Reason argues that procedures are 'feed-forward control devices' (Reason, 2000, p. 8), meaning they are developed at one time and location, and are applied at future times and locations. The problem of local variations requires flexibility in applying procedures. Reason (2000) argues that human variability, reflected in moment-to-moment adaptations and adjustments to changing environments, is critical to system safety in an uncertain and dynamic world. Human variability is actually one of the system's most important safeguards.

Collective mindfulness is claimed as an essential component of organisational resilience (Reason, 2000; Weick, 1999). According to Weick et al. (1999), collective mindfulness is the result of a number of cognitive elements, including preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience, and under-specification of structures.

Collective mindfulness is expressed in at least in three ways:

- active differentiation and refinement of existing categories and distinctions
- creation of new discontinuous categories out of continuous streams of events that flow through activities, and
- a more nuanced appreciation of context and of alternative ways to deal with it (Weick et al., 1999, p. 37).

For Reason (2000), collectively mindful organisations are characterised by:

- working hard to extract the most value from the little data they have about rare events and catastrophic failures
- being active in creating a reporting culture that encourages or rewards people who report incidents and near misses
- working on the assumption that what seems to be an isolated failure may stem from a number of 'upstream' causal chains – they strive for system reforms rather than applying local repairs, and
- being aware that system failures can take a variety of yet-to-be-encountered forms – looking out for unexpected paths through which active failures or latent conditions can defeat the system defences.

Component 9: Engagement

Workers and contractors are actively engaged in the organisation's H&S processes.

Those people whose H&S could be affected by decisions made by the organisation are properly consulted before decisions are made.

Decision makers are mindful of the need to consult workers and contractors about day-to-day operational issues and issues of strategic importance, such as implementing safety in design.

Consultation is respectful and the organisation acts positively and swiftly to resolve conflicts should they arise.

Workers and contractors have a meaningful voice in the organisation's H&S management processes.

An organisation with a positive safety culture actively engages its employees in safety activity development and decision making processes (Cox & Cheyne, 2000; O'Toole, 2002). Employee engagement is defined as:

> Personnel from all levels of the organisation are involved in decision making, safety planning and providing ideas for improvement. Employee participation and feedback are actively sought (HSE, 2005b).

Safety participation is described as 'helping co-workers, promoting the safety program within the workplace, demonstrating initiative, and putting effort into improving safety in the workplace' (Neal et al., 2000, p. 101). Neal and Griffin (2006) report that workers' safety participation is associated with reduced accident occurrence in workgroups. Similarly, Christian et al. (2009) identified the negative relationship between safety participation and accident and injuries in their meta-analysis of workplace safety.

A number of studies suggest that managers can effectively engage workers in safety activities through empowerment. Wiegmann et al. (2004) argue that an organisation with a 'good' safety culture empowers its employees and ensures they understand clearly their important role in promoting safety. They describe empowerment as the perceptions or attitudes of employees' that are created by upper level management's delegation of authority or responsibility. Kines et al. (2011) suggest that delegation of power demonstrates that managers trust workers' ability and judgement, and value workers' contribution to safety management. Workers who feel empowered tend to:

- have higher motivation to 'make a difference'
- go beyond normal duties to secure organisational safety, and
- take more responsibility for ensuring safe operations (Wiegmann et al., 2004).

Shannon et al. (1997) reviewed ten studies examining the relationship between organisational and workplace factors and workplace injuries. They reported that empowering workers and delegating safety activities were consistently associated with a lower injury rate. The relationship was statistically significant in at least two thirds of the studies where it was examined.

Recent studies have noted other leader behaviours that are influential in engaging employees in safety participation. Clarke and Ward (2006) examined the influence of leaders on the safety climate and on engaging employees in safety participation. They reported that two influencing tactics available to leaders – consultation and rational persuasion – significantly and positively impacted on workers' safety participation. In organisations where leaders share relevant H&S information with workers, involve them in decision making and encourage worker involvement, the safety climate is more positive and workers are more active participants in workplace H&S processes. Clarke and Ward found that inspirational appeals, in which emotional language is used to emphasise the importance of a task and stimulate employees' enthusiasm also improved the safety climate and increased workers' safety participation.

Clarke and Ward suggest that leaders may engage workers in safety participation through a combination of transformational leadership (such as consultation and inspirational persuasion) and transactional leadership (such as rational persuasion and coalition building).

Employee engagement should target employees at all levels. Törner and Pousette (2009) investigated the preconditions for, and components of, high safety standards in the construction industry. They interviewed workers and frontline supervisors and found that a crucial aspect of safety is to engage employees in high quality interaction and cooperation across organisational functions and hierarchical levels. Interaction and cooperation are supported by mutual trust, empowerment and listening well. Supervisors play an important role in engaging frontline workers by fostering a feeling among workers that supervisors rely on them, expect feedback from them, and trust their judgements. This feeling stimulates workers' intention to take initiatives, and to come up with ideas for safety improvement. To further facilitate worker engagement, upper level management needs to:

- motivate supervisors to facilitate effective worker-management communication in both directions, and to keep safety communication 'alive', and
- demonstrate high levels of interest by listening and responding promptly to workers' suggestions and contributions.

6.2 Conclusion

Nine components of H&S culture have been identified, defined and described. Each of these components is well supported in the literature pertaining to H&S culture and performance. An attempt has been made to describe each of these components of H&S culture based on the published research and available evidence.

However, most of the published literature relates to H&S culture in other industry settings; for example, the oil and gas, and aviation industries. While it is anticipated that the components of H&S culture will be similar in other industries, it is by no means certain that the nine components of H&S culture in the construction industry will be expressed in the construction industry in the same way as they are in other industry contexts.

For this reason, the culture components and their descriptions should be subject to a robust qualitative evaluation. This evaluation (described more fully in Part 9 of this report) would enable the validity of the culture components to be confirmed by a panel of construction industry experts. This evaluation would confirm the validity of the culture components (and the sub-elements of each component) in the context of the Australian construction industry.

Part 7: The H&S Culture Maturity Model – descriptors

7.1 Introduction

Part 7 presents descriptors for each component of the H&S Culture Maturity Model.

Table 7.1 presents the components of H&S culture derived from the literature. For each component of H&S culture, descriptors have been developed to reflect the five levels of maturity. At the upper end of the maturity continuum are 'generative' organisational cultures. At the lower end, are 'pathological' organisational cultures.

It is important to note that organisational cultures may not develop consistently. For example:

- a culture could be reactive on one component of the model and proactive in others
- parts of an organisation (projects, departments or groups) might develop a mature H&S culture more rapidly than other parts of the organisation.

The H&S Culture Maturity Model can be used by organisations wishing to understand the maturity of their H&S culture and to plot a course for improvement.

The Model is based on a review of the Australian and international research literature. It is important to note that the Model is yet to be validated. It is recommended that validation of the Model is undertaken to ascertain its applicability, relevance and usefulness in the Australian construction industry context.

Table 7.1: The H&S Culture Maturity Model: Descriptors for assessing the maturity of an H&S culture in construction companies/projects

Culture component	H&S Culture Maturity Continuum				
	Pathological	**Reactive**	**Calculative**	**Proactive**	**Generative**
Leadership	• Managers respond negatively to all criticism • Managers and workers are suspicious about each other • Managers change their message based on the circumstances • Managers are more concerned with operational issues	• Managers are not interested in safety until something goes wrong	• Safety is about managing risk and avoiding prosecution	• Managers will actively ask about safety and procedures • Senior managers are visible in the workplace and demonstrably interested in safety • Workers feel comfortable talking about their concerns to managers at any level	• Managers at all levels actively walk the talk and demonstrate H&S • Safety is driven by genuine concern for people • Managers are consistently good role models
Organisational goals and values	• Profitability is the only concern of managers. Safety is seen as costing money • Managers prioritise cost minimisation at the expense of safety	• Cost is important but there is some investment in preventing work injuries and illnesses • Project schedule and cost reduction pressures dominate decision making	• Safety and profitability are juggled (as opposed to being balanced). Managers make public statements about the importance of H&S but do not 'walk the talk' consistently • Expenditure on H&S is regarded as discretionary • Managers ensure that H&S standards are maintained, even if this costs money/time • Safety is regarded as a bureaucratic impediment to the work	• The organisation states that H&S is the top priority • The rationale for this is that H&S contributes to financial success • H&S and profitability are juggled and the organisation accepts some project delays to ensure H&S standards are met • Safety personnel are an asset to the business and influential in business decisions	• H&S and profitability are well balanced • H&S is an integral part of all business activity and decision making • H&S is understood to make a positive contribution to the future of the business

Culture component	H&S Culture Maturity Continuum				
	Pathological	**Reactive**	**Calculative**	**Proactive**	**Generative**
Communication	• Managers do not communicate with workers and contractors except to tell them not to cause problems • Communication is one way and directive • Important H&S information is not communicated to workers or contractors • Conflicting messages about the importance of H&S are conveyed	• Limited and intermittent H&S information is communicated to workers and contractors • H&S promotion 'slogans' are communicated by managers • Slogans have limited effectiveness and any positive impact soon diminishes • Safety messages when given are sometimes unclear • Communication is mainly top-down usually occurring to resolve an issue. There is little or no opportunity for bottom-up communication of H&S concerns or ideas for improvement	• Managers share limited H&S information with workers and contractors • Despite the frequency of top-down and bottom-up communication, workers' suggestions and ideas for safety improvements have little impact	• H&S information is routinely and regularly communicated to workers and contractors • Two way communication is actively encouraged • Suggestions and ideas by workers and contractors for H&S improvement are taken seriously and implemented where possible	• The organisation actively and openly shares H&S information with workers and contractors • H&S communication is frequent, open and effective • H&S communication is a strong and consistent two way process. Managers receive as much H&S information as they give

Culture component	H&S Culture Maturity Continuum				
	Pathological	**Reactive**	**Calculative**	**Proactive**	**Generative**
Supportive environment	• Work is designed and scheduled in a way that creates excessive time pressure, workload, stress and fatigue • Obstructive and uncooperative relationships exist between groups • A 'silo mentality' exists • People feel overwhelmed and unable to perform work in a healthy and safe manner • The physical environment is 'dirty, dangerous and demanding'	• Managers and workers deal with stress and workload problems as they arise • Health and wellbeing are treated as an individuals' responsibility • In the workplace there are low levels of cooperation and poor information flows as the priority is to complete the work • The physical workplace, amenities and equipment reflect the bare minimum standard	• An effort is made to improve workers health and wellbeing but work schedules still demand excessive hours • Managers are aware of the importance of managing H&S. They pay 'lip service' to H&S. There is often a gap between organisational H&S policies/procedures and accepted practices • Levels of cooperation and communication reflect functional roles and relationships • The physical workplace, amenities and equipment comply with industry standards	• Work is restructured so far as possible to support health and work-life balance • Functional teams work hard at sharing and cooperating to improve H&S • Physical workplace and equipment provided reflect good industry practice	• Design job and work conditions that positively promote health and work-life balance • Effective cross functional cooperation and team work • All people feel they have the knowledge, skills, and ability to work in a healthy and safe way • Willing to invest in innovative ways to provide a safe and healthy workplace
Responsibility	• Managers believe that H&S is each individual's responsibility and people should 'look after themselves' • There is widespread unwillingness to take responsibility for H&S • People are reluctant to accept that they each have a role in H&S • People turn a blind eye if they observe an unsafe practice	• Everybody feels bad when something goes wrong but won't accept responsibility • Assumption that accidents 'just happen' and that some individuals are more prone than others • People are concerned but do not intervene	• There are safety officers who assume the role of policing the workplace • Incidents of unsafe practices are reported but personal responsibility is avoided • We work within the law	• H&S is treated as a line responsibility and advisors provide technical input • Workers stop unsafe practices when observed • Managers, workers and contractors are developing a commitment to H&S and care and concern for the H&S of themselves and others	• The safety officer role is assumed by everyone • At every level there is a willingness to take personal responsibility for H&S • Managers look inwards as well as outwards to look at causes for H&S issues • All personnel actively demonstrate care and concern in looking after their H&S and that of others • Collective norms and expectation drive H&S behaviour

Culture component	H&S Culture Maturity Continuum				
	Pathological	**Reactive**	**Calculative**	**Proactive**	**Generative**
Learning	• Workers fear that if they report accidents, errors or safety issues they will be regarded as trouble-makers • The causes of accidents, errors and deviations from procedures are not analysed • The analysis of accidents, errors or deviations from procedures focuses on identifying someone to blame • H&S performance data is not systematically collected and analysed • No actions are proposed for ongoing H&S improvement • Feedback is not sought from workers, contractors and others about the effectiveness of H&S policies and processes • H&S training provides basic minimum requirements only	• H&S performance is measured using only the incidence of serious injury (that is, lost time injury frequency rates) • Accident investigations focus on identifying immediate causes. No attempt is made to identify the systemic causes of accidents • Preventive actions recommended are mainly 'behavioural' • Feedback is sought from workers, contractors and others about the effectiveness of H&S policies and processes but feedback is never acted upon • H&S training is generic and compliance focused	• H&S performance is measured using 'lagging' indicators, such as the occurrence of accidents, injuries and illnesses • Accident investigations consider broader workplace conditions and work processes as possible causes • Recommended preventive actions address workplace and work process improvements • Feedback is sought from workers, contractors and others about the effectiveness of H&S policies and processes, and feedback is sometimes used to inform H&S improvement actions in some instances (usually only when a serious accident has occurred) • The organisation provides structured training programs to its workers and stakeholders • H&S training is passive and procedural	• H&S performance is measured using mainly 'lagging' indicators but some 'leading' indicators are also used • Accident investigations attempt to identify systemic causes of accidents including those relating to the organisational culture, risk management processes, design of projects and project management practices • Preventive actions address organisational issues • Feedback from workers, contractors and others about the effectiveness of H&S policies and processes is sought and often (but informally) used to inform H&S improvement actions • Training is engaging and produces a knowledgeable worker	• H&S performance is measured using a balanced mix of 'lagging' and 'leading' indicators, including surveys of workers' experiences and perceptions • Accident investigations rigorously uncover the systemic causes of accidents, including those relating to the organisational culture, risk management processes, design of projects and project management practices • Preventive actions address 'upstream' issues, including safety in design and project planning • Feedback is actively encouraged from workers, contractors and others about the effectiveness of H&S policies and processes, and feedback is systematically analysed and considered in formal H&S planning processes • H&S training is reflective and allows for applied and intelligent application

Culture component	H&S Culture Maturity Continuum				
	Pathological	**Reactive**	**Calculative**	**Proactive**	**Generative**
Resilient	• H&S policies and procedures are rigid documents that cover all eventualities • Managers are complacent and believe that the 'paper' H&S system is a failsafe way to avoid accidents	• The organisation makes H&S policies and procedures to comply with minimum legislative requirements • Policies and procedures are restrictive documents produced to avoid litigation	• H&S policies and procedures are developed with good intentions to prevent accidents from occurring • Policies and procedures are written in response to particular H&S hazards/risks and are intended to regulate individuals' behaviour	• H&S policies and procedures comprehensively cover the organisation's activities • Policies and procedures are extensively integrated into training provided to workers and contractors	• Managers trust workers and contractors to recognise situations in which H&S policies and procedures need to be challenged • Workers and contractors' feedback about practical issues is incorporated in the review of H&S policies and procedures • The culture supports creative thinking (mindfulness) to envisage new solutions and designs
Engagement	• Workers and contractors are not engaged in organisational or project level H&S activities • Managers have no interest in engaging workers or contractors in H&S activities	• Workers and contractors are invited to participate in H&S activities only after a serious accident has occurred • Managers will only ask for workers' and contractors' input into H&S activities when required to do so	• Some workers and contractors are involved in H&S related activities • Managers engage in limited consultation with workers and contractors on basic H&S issues like training, safety equipment, and housekeeping	• Workers and contractors are generally encouraged to participate in H&S activities • Managers actively seek input from workers and contractors relating to operational aspects of H&S in the organisation/project, including daily work planning and safe work procedures	• All workers and contractors feel actively involved in and able to influence H&S activities in the organisation/project • Managers actively seek input from workers and contractors concerning strategic aspects of H&S in the organisation/project, including issues of safety in design, and the design and operation of the H&S management system. • Workers tacit knowledge about H&S is valued and used in a positive way

Culture component	H&S Culture Maturity Continuum				
	Pathological	**Reactive**	**Calculative**	**Proactive**	**Generative**
Trust in people and systems	• Accidents are denied and shrouded in secrecy • Systems are designed to protect the company and its profits • Systems are unstructured and poorly documented	• Procedures are developed in response to incidents after the event, like a band aid • Systems are constructed for legal compliance and paper trails • Systems are developed to identify the guilty party after an incident • Systems do not change as a result of the incident • Workers do not report H&S issues because they believe nothing will be done to resolve them • Systemic causes of accidents may be identified, but there is no resolution	• Procedures are used to enforce the rules • Well structured and thorough safety system reporting in place • Procedures produce lots of data and action items, but opportunities to address real issues are often missed • Despite formal reporting systems, many accidents, errors or deviations from procedure are not reported • Workers feel uncomfortable reporting accidents, errors or deviations from procedures and are reluctant to do so	• Procedures are continually updated to reflect change • Reporting looks for WHY rather than WHAT and WHEN • Processes are meaningful to workers • Cross auditing inside and outside the organisation encourages systems improvement • Most accidents, errors and deviations from procedures are reported and investigated • Workers are somewhat uncomfortable reporting errors or deviations from procedures but are willing to do so because they hope that this will result in H&S improvement	• Accidents are genuinely reported • There is a continuous informal search for non-obvious problems to assist in identifying new ideas and solutions • Investigations are open, transparent and search for a deep level of understanding of how accidents happen • There is systematic follow up to ensure change following an investigation • All accidents, errors and deviations from procedures are reported and investigated • Workers feel comfortable reporting errors or deviations from procedures and firmly believe that this will result in H&S improvements

(Adapted from Filho et al., 2010; Ayers et al., 2013; Parker et al., 2006)

Part 8: The ACA H&S Climate Assessment Tool

8.1 Introduction

Part 8 describes the development of the ACA H&S Climate Assessment Tool. Samples of the questions from the Tool are presented at Appendix A of this report. The relationship between the Tool and the H&S Culture Maturity Model is described.

The ACA H&S Climate Assessment Tool has been developed to complement the H&S Culture Maturity Model.

The H&S Climate Assessment Tool is a multilevel questionnaire for surveying construction workers.

The multi-level nature of the assessment distinguishes the Tool from other safety climate surveys that are commercially available. The measurement of H&S climate at different levels within an organisation is particularly important in construction due to the decentralised structure and the fact that work is undertaken in semi-autonomous (often subcontracted) workgroups.

Thus, the ACA H&S Climate Assessment Tool measures the safety climate at the levels of:

1. the organisation (principal contractor),
2. the project, and
3. the workgroup.

It is acknowledged that the safety climate can vary between projects within a single organisation or between workgroups within a single project.

The ACA H&S Climate Assessment Tool quantitatively measures workers' perceptions about the organisation's H&S climate at a given point in time.

Following Schein's model of culture (discussed in Parts 2 and 4 of this report), the H&S Climate Assessment Tool measures the intermediate 'layer' of the H&S culture. This layer is concerned with workers' espoused values and attitudes that flow from the organisation's underlying basic assumptions.

It is generally accepted that these underlying basic assumptions are difficult to measure using quantitative methods. The H&S Climate Assessment Tool is unlikely to fully reveal all of the deeply held assumptions that form the core of an organisational culture. However, it will enable the state of the prevailing H&S climate to be quantified at a given point in time. Safety climate measurement tends to focus on the present state of the organisational environment – it constitutes a 'snapshot' in time. The H&S Climate Assessment Tool can be used over time to measure whether the organisational climate for H&S is improving, remaining the same, or deteriorating.

Measuring the relationship between H&S climate and H&S performance over time enables the organisational and climatic indicators of future H&S performance to be identified (Sorensen, 2002). Measuring H&S climate also provides a systematic method for making comparisons between organisations or organisational subunits – for example, in benchmarking. Mearns et al. (2001) argue that it is also extremely useful to identify areas of strength and weakness in organisational H&S climates to support the transfer of learning and good practice.

Repeated use of the H&S Climate Assessment Tool will enable construction organisations to identify trends over time. This is important in construction projects because the emphasis on safety can vary over time which impacts on H&S climate perceptions and performance (Humphrey et al., 2004).

Regular and repeated use of the H&S Climate Assessment Tool will provide:

1. a consistent leading indicator of the state of H&S
2. feedback about areas of strength and opportunities for improving H&S management, and
3. knowledge about the interaction between project events, the state of the H&S climate and H&S performance over time.

8.2 How the ACA H&S Climate Assessment Tool was derived

Hale (2000) argues that a distinction needs to be drawn between:

- the safety culture, and
- structural properties and aspects of the safety management system, such as policies, procedures, managerial responsibility, and reporting structures.

Hale argues that audit tools are useful for identifying how well a safety management system is functioning – for example, if plans are in place, whether responsibilities are allocated, and whether H&S is communicated. These things are important. However, climate assessment tools provide information about why a safety management structure is working or not. Hale (2000, p.6) maintains that a distinction needs to be drawn between:

- top-down audits of management systems that examine safety documents and compliance with safety system requirements, and
- bottom-up attempts to understand 'the motor behind, or even conflict within the structure'.

Hale (2000) concedes that both these forms of assessment are concerned with whether a safety system is working, but management systems audits are concerned with whether a system is working in a factual sense. H&S climate assessment tools are more concerned with workers' perceptions and trust in organisational safety structures and processes.

Hale argues that some audit tools include cultural elements that are difficult to observe directly, like commitment to H&S. Similarly, some safety culture/climate tools include components that reflect the H&S management systems and structures, rather than the culture/climate.

Hale cautions against simplistic approaches to measuring cultural influences on safety. Because safety is an obviously 'good thing', it is likely that questions asking directly about attitudes towards safety will always be answered in a positive way. Hale (2000) argues that cultural influences on safety will be revealed only by questions about values and beliefs, such as 'what causes accidents?' and 'how do organisations react to reported errors and accidents?'

For this reason the ACA H&S Climate Assessment Tool reflects the 'core' components of H&S Culture identified in the H&S Maturity Model. Wherever possible, previously used and tested survey questions were identified for each of these components. The survey questions are available in the published H&S climate literature. Questions (or groups of questions, referred to as scales) were selected using three criteria.

Table 8.1: Criteria for including questions in the H&S Climate Assessment Tool

Criterion 1	They reflect the components of H&S culture identified in the H&S Culture Maturity Model
Criterion 2	They are supported by evidence describing their reliability and/or validity
Criterion 3	The scales are of a suitable length and structure for use in the Australian construction context

All of the questions included in the H&S Climate Assessment Tool were drawn from the published sources identified in Appendix B. The scales from which questions were drawn and their respective reliability data (in previous studies) are shown at Appendix C. All of the scales from which questions were drawn demonstrated acceptable levels of reliability when used in previous research. However, in almost all instances, these questions have not been deployed in the assessment of H&S Climate in the construction industry. Nor were the questions developed and tested for use in Australia. **It is therefore recommended that the H&S Climate Assessment Tool undergo quantitative testing for reliability and validity in the Australian construction context. Some of the questions may be modified on the basis of this testing.**

8.3 The relationship between the H&S Culture Maturity Model and the H&S Climate Assessment Tool

It is very difficult (arguably impossible) to uncover and evaluate the basic assumptions at the core of organisational culture using quantitative survey tools. Consequently, the relationship between the H&S Maturity Model and H&S Climate Assessment Tool is neither straightforward nor direct.

Lawrie et al. (2006) attempted to develop a survey instrument that would directly measure the state of H&S culture in terms of Hudson's five levels of maturity, which the ACA H&S Culture Maturity Model adopts. Lawrie et al. attempted to develop questions or statements that described an organisation at varying levels of maturity. They tested these statements to determine whether they were useful in measuring the maturity level of various components of H&S cultures. The results were disappointing. Participants were unable to clearly discriminate (using the survey) between the five maturity levels. As previous research has failed to develop a reliable and valid way of measuring the maturity of an H&S culture using survey techniques, it was decided that the H&S Climate Assessment Tool:

- would reflect the components of the H&S Culture Maturity Model, and
- would not necessarily be used to measure and position organisations on their maturity in relation to the nine components of the H&S Culture Maturity Model.

These decisions are consistent with recognising that H&S climate reflects the intermediate layer of organisational culture, but does not constitute the core basic assumptions that form the culture.

Notwithstanding this, the H&S Climate Assessment Tool provides construction organisations with a strong understanding of the strength and level of their H&S cultures.

Zohar and Luria (2004) describe safety climates using two parameters: first, their strength, and second, their level. The H&S Climate Assessment Tool uses a two-dimensional schema in which the H&S climate can be positioned according to the properties of strength and level.

H&S climate perceptions held by members of a particular social group (such as an organisation, project or workgroup) can range from weak to strong:

- in a strong H&S climate there is very high consensus between members about the priority placed on safety
- in a weak H&S climate there is a low level of consensus concerning commitment to safety.

The level of H&S climate refers to the relative priority placed on H&S within a group, as perceived by members of that group. The level of the H&S climate can be expressed as either:

- high – that is, perceptions of a high level of H&S commitment, or
- low – that is, perceptions of low safety commitment.

It is possible for an H&S climate that is supportive of safety (high in level) to be either weak or strong, depending upon the degree to which this perception is shared among workers in the same group.

Table 8.2 suggests four theoretically distinct types of H&S climate positioned according to their strength and level.

Table 8.2: Types of H&S climate

Type 1	An indifferent H&S climate: • weak strength and low level
Type 2	An obstructive H&S climate: • strong strength and low level
Type 3	A contradictory H&S climate: • weak strength and high level
Type 4	A strongly supportive H&S climate: • strong strength and high level

Previous research in the Australian construction industry revealed that workgroups with strongly supportive H&S climates had significantly lower reportable and medical treatment injury rates than other workgroups (Lingard et al., 2010).

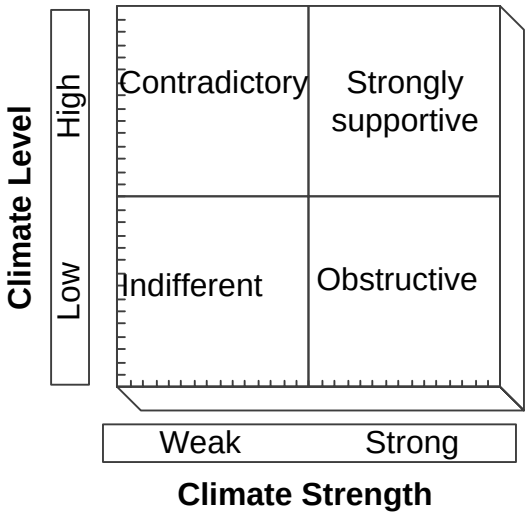

Figure 8.1: Different types of H&S climate

8.4 Conclusion

The nine components of H&S culture are reflected in the ACA H&S Climate Assessment Tool. The Tool enables measurement and assessment of the H&S climate at a given point in time. The assessment can take place at various levels, including the organisation, the project or the workgroup.

The H&S Climate Assessment Tool can be used to:

- analyse trends or changes in the climate and H&S performance over time, and
- assess both the strength and level of the H&S climate in a particular organisation, project or workgroup.

Previous research evidence suggests that using survey data to position organisations in the H&S Culture Maturity Model may be difficult and possibly unreliable.

The H&S Climate Assessment Tool comprises sets of survey questions (subscales) that reflect the nine components of the H&S Culture Maturity Model. These scales were selected for their applicability, relevance and evidence of their reliability and validity. However, most are untested in the Australian construction context.

Consequently, the H&S Climate Assessment Tool should be subject to robust empirical testing to ensure it is reliable and valid in the Australian construction environment.

Part 9: Conclusions and recommendations

9.1 Introduction

Part 9 provides an overview of the development of the ACA H&S Culture Framework components and identifies important next steps for testing and validating the H&S Culture Maturity Model and the H&S Climate Assessment Tool:

- Section 9.2 summarises the steps taken in developing the ACA Culture Maturity Framework
- Section 9.3 presents recommendations for testing and validating the H&S Culture Framework prior to industry-wide implementation.
- Section 9.4 suggests steps for the future implementation and use of the H&S Culture Framework.

9.2 Development of the H&S Culture Framework

The H&S Culture Framework presented in this report is based on a comprehensive review of the bodies of research literature about H&S culture and H&S climate. The way culture is expressed at the national, industry and organisational levels, and the impact of culture on H&S, were examined.

At the organisational level culture is understood to be expressed in three layers. At the core are basic assumptions. These may not be safety related but can exert a significant influence on the way that H&S is valued and enacted within an organisation. These basic values are deeply held, often unstated and, by their nature, difficult to uncover. However, the basic assumptions that form the core of an organisational culture are also expressed as more accessible (and measurable) espoused beliefs and values and artefacts. It is argued that these outer expressions of culture are the focus of safety climate measurement, which attempt to quantify workers' perceptions of the quality and operation of an organisation's culture for H&S at a given point in time.

A defining feature of the literature was the lack of a clear and consistent definition of H&S culture. Based on an extensive review of the literature the H&S Culture Framework was developed using the following steps.

Table 9.1: Development of the H&S Culture Framework

Step 1	The H&S culture and safety climate literature was subject to a detailed analysis to identify common themes identified as facets of H&S culture and/or safety climate. Considerable overlap was noted between many facets of H&S culture and safety climate. Thus, the difference between H&S culture and climate is more one of depth of expression rather than substantive content.
Step 2	Based on the analysis of common themes identified in the literature, nine broad H&S culture components were identified. These are: • Leadership • Communication • Organisational goals and values • Supportive environment • Responsibility • Learning • Trust in people and systems • Resilience

Step 3	Drawing on the literature, an operational definition was developed for each of these components of an H&S culture. The definitions attempted to capture the 'essence' of each component of H&S culture.
Step 4	A previously used schema was used to produce descriptors reflecting the nine components of H&S Culture at five levels of maturity. At the upper end of the maturity continuum are 'generative' organisational cultures. At the lower end are 'pathological' organisational cultures. The resulting matrix is the H&S Culture Maturity Model presented in Part 7 of this report.
Step 5	The nine components of H&S Culture were used to develop the H&S Climate Assessment Tool (a sample set of questions are presented at Appendix A). The Tool reflects the facts that workers' perceptions of the organisational environment, and managerial action: • form a 'surface layer' expression of the organisational culture, and • are amenable to measurement.
Step 6	The H&S Climate Assessment Tool is a survey instrument that measures workers' perceptions of H&S activity at three distinct levels: • the organisation • the project, and • the workgroup. This multi-level approach reflects the decentralised structure of the construction context. It allows for differences between projects and/or workgroups to be measured and understood.
Step 7	A comprehensive review of previously used H&S climate measures was undertaken. This review identified extensive conceptual overlap between the content of many existing and published H&S climate surveys. Using this literature, safety climate subscales (or sets of questions) that best reflected the operational definitions of the nine H&S culture components were identified and included in the H&S Climate Assessment Tool. Three criteria were used for inclusion in the pool of questions. These were: • they reflect the components of H&S culture identified in the H&S Culture Maturity Model • they are supported by evidence describing their reliability and/or validity, and • the scales are of a suitable length and structure for use in the Australian construction context.

9.3 Recommendations for testing and validation

The H&S Culture Maturity Model and the H&S Climate Assessment Tool are both based on an international body of literature reflecting research conducted in a diverse range of industry sectors, including nuclear power, oil and gas, and aviation. It is recommended that, before being widely implemented, the Model and Tool are tested in the Australian construction industry context. Lawrie et al. (2006) note that, despite the existence of many models of H&S culture, what constitutes a good or a bad safety culture has been subject to little empirical evaluation. It is particularly important to consider the validity of an H&S culture model in the specific national and industry content in which it is to be used. Safety culture may be seen as part of a corporate culture, which is part of an industrial culture and a national culture. Safety cultures are very likely to differ between themselves, and to differ from industrial and national cultures.

The importance of validating models of H&S culture, and climate assessment tools, was recognised by Hale (2000) in his critical review of H&S culture:

> The challenge is to find tools which allow us to assess effectively whether a given organisation has such a [positive safety] culture, and to help develop it, if it does not. We face also the even greater challenge to demonstrate that this culture is really the only one which is favourable to good safety performance. Validation should always be our long term aim (p.13).

Recommendation for validating the H&S Culture Maturity Model

It is recommended that:

- *the H&S Culture Maturity Model be subject to a qualitative assessment of its validity in the Australian construction context.*

The H&S Culture Maturity Model presented in Part 7 describes the nine components of H&S culture at varying levels of maturity, ranging from 'generative' to 'pathological.'

The five level development schema used in this Maturity Model was used previously by Hudson (2007), Parker et al. (2006), and Filho et al. (2010), to explain the evolution of a safety culture. More recently, the five level model was used by Ayers et al. (2013) to describe the cultural differences in the way that Australian construction contractors engage in H&S consultation with workers.

Notwithstanding its previous use, attempts to quantitatively validate the five level maturity model have been mixed. Lawrie et al. (2006) tried to develop survey questions that reflected the five levels of cultural maturity, and to use these questions to evaluate the level of cultural maturity of an organisation. However, this proved difficult and the survey failed to discriminate adequately between the five levels. Validation would involve a panel of industry experts (drawn from ACA membership) who would be asked to:

- review the content of the H&S Culture Maturity Model
- determine whether the content accurately reflects the progressive development of maturity in relation to the nine components of H&S culture, and
- add or amend the descriptors, as appropriate, until consensus is reached.

At this point, a number of scenarios describing a range of managerial and organisational approaches to H&S would be developed to reflect different levels of cultural maturity (from pathological to generative) in relation to the nine components.

The industry experts would be provided with these scenarios and asked to rate the levels of maturity described according to the H&S Culture Maturity Model. The experts' ratings would be compared to determine the degree of agreement.

If an acceptable threshold level of agreement is attained, the content of the final H&S Culture Maturity Model would be confirmed. On this basis, it could be concluded that:

- the content of the H&S Culture Maturity Model is valid, and
- the gradations specified for developing cultural maturity are meaningful.

Recommendation for validating the H&S Climate Assessment Tool

It is recommended that:

- *the ACA undertakes a pilot study, prior to releasing the H&S Climate Assessment Tool for industry-wide use.*

This recommendation follows a generally accepted view that before being used in the target population (in this case, Australian construction organisations), H&S climate instruments should undergo piloting and validity testing.

The H&S Climate Assessment Tool has followed an accepted development process in which:

- the area of interest was demarcated and fully investigated through an in-depth literature review
- aspects relevant for measurement were identified and defined, and
- a set of questions was formulated.

A pilot study could be run within the operations of a single ACA member organisation. It would:

- enable an assessment of the extent to which construction workers understand and respond reliably to the questions
- involve quantitative validation of the factor structure of the survey – the factor structure relates to the extent to which the grouping of questions reflects distinct components of the H&S climate, and
- ensure that instructions and questions are appropriate for the particular level of aggregation at which the H&S climate is measured (for example, the organisation, project and workgroup).

9.4 Recommendation for future implementation and use of the H&S Culture Framework

The H&S Culture Framework can be used to guide construction organisations in determining the degree of maturity of their H&S cultures. The Framework recognises that H&S culture might develop at varying in paces between organisational departments, projects or regional divisions. The H&S Culture Maturity Model can act as a 'road map' for developing a strong and positive organisational culture in which H&S is fully integrated into all business and project decision making.

The H&S Culture Framework provides a practical H&S Climate Assessment Tool that can be used by construction organisations to measure the state of their H&S climates at a given point in time. One criticism levelled at many H&S culture models is that they do not establish criteria for assessment. Consequently, the relationship between specified culture components and safety performance is unclear (Sorensen, 2002).

The ACA H&S Climate Assessment Tool has the potential to:

- become a systematic method for comparing organisations (for example, in benchmarking), and
- help ACA member organisations to identify their areas of H&S cultural strength and weakness (Mearns et al. 2001).

A unique feature of the ACA H&S Climate Assessment Tool is its multi-level approach. It can stand as a leading indicator of H&S performance. This approach to measuring H&S climate:

- enables H&S climate scores to be aggregated at the workgroup, project and organisational levels
- supports managers in transferring good practices between workgroups and projects, and
- enables managers to intervene to remedy H&S problems before accidents or ill-health occur.

Automating data collection, analysis and reporting, using the H&S Climate Assessment Tool, might be considered at the implementation stage of the H&S Culture Framework.

References

Advisory Committee on the Safety of Nuclear Installations, (1993), ACSNI study group on human factors, Third report, Her Majesty's Stationary Office, London.

Alavinia, S. M., van Duivenbooden, C. & Burdorf, A. (2007). Influence of work-related factors and individual characteristics on work ability among Dutch construction workers. Scandinavian Journal of Work, Environment & Health, 33(5), 351.

Allaire, Y. & Firsirotu, M. E., (1984), Theories of organisational culture. Organisation studies, 5(3), 193-226.

Alvesson, M., (2012), Understanding organisational culture, Sage, London.

Antonsen, S., (2009), Safety culture and the issue of power. Safety Science, 47(2), 183-191.

Arboleda, A., Morrow, P. C., Crum, M. R. & Shelley, I, M. C., (2003), Management practices as antecedents of safety culture within the trucking industry: similarities and differences by hierarchical level. Journal of Safety Research, 34(2), 189-197.

Aritua, B., Smith, N. J. & Bower, D., (2009), Construction client multi-projects – a complex adaptive systems perspective. International Journal of Project Management, 27(1), 72-79.

Ashcroft, D. M., Morecroft, C., Parker, D. & Noyce, P. R., (2005), Safety culture assessment in community pharmacy: development, face validity, and feasibility of the Manchester. Quality and Safety in Healthcare, 14(4), 417-421.

Australian Bureau of Statistics, (2013), Gender Indicators, Australia, Cat. 4125.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics, (2012), Migration, Australia, Cat. 3412.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics, (2010a), Australian Labour Market Statistics, Cat. 6105.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics, (2010b), Australian Economic Indicators, Cat. 1350.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics, (2004), Private Sector Construction Industry, Cat. 8772.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics, (1999), Private Sector Construction Industry, Cat. 8772.0, Australian Bureau of Statistics, Canberra.

Ayers, G., Culvenor, J. F., Sillitoe J. & Dennis Else, (2013), Meaningful and effective consultation and the construction industry of Victoria, Australia. Construction Management and Economics, 31(6), 542-567.

Bakker, A. B. & Schaufeli, W. B., (2008), Positive organisational behaviour: Engaged employees in flourishing organisations. Journal of Organisational Behavior, 29(2), 147-154.

Barling, J., Kelloway, E. K. & Iverson, R. D., (2003), High-quality work, job satisfaction and occupational injuries. Journal of Applied Psychology, 88(2), 276-283.

Barling, J., Loughlin, C. & Kelloway, K. E., (2002), Development and test of a model linking safety-specific transformational leadership and occupational safety. Journal of Applied Psychology, 87(3), 488-496.

Blewett, V., Rainbird, S., Dorrian, J., Paterson, J. & Cattani, M., (2012), Keeping rail on track: preliminary findings on safety culture in Australian rail. Work: A Journal of Prevention, Assessment and Rehabilitation, 41(1), 4230-4236.

Blismas, N., Sher, W., Thorpe, A. & Baldwin, A., (2004a), A typology for clients' multi‐project environments. Construction Management and Economics, 22(4), 357-371.

Blismas, N. G., Sher, W. D., Thorpe, A. & Baldwin, A. N., (2004b), Factors influencing project delivery within construction clients' multi-project environments. Engineering, Construction and Architectural Management, 11(2), 113-125.

Brondino, M., Silva, S. A. & Pasini, M., (2012), Multilevel approach to organisational and group safety climate and safety performance: Co-workers as the missing link. Safety Science, 50(9), 1847-1856.

Burns, C., Mearns, K. Y. & McGeorge, P., (2006), Explicit and implicit trust within safety culture. Risk Analysis, 26(5), 1139-1150.

Burrell, G. & Morgan, G., (1994), Sociological paradigms and organisational analysis, Arena, Aldershot.

Burt, C. D. B., Gladstone, K. L. & Grieve, K. R., (1998), Development of the Considerate and Responsible Employee (CARE) scale. Work & Stress, 12(4), 362-369.

Burton, N. W. & Turrell, G., (2000), Occupation, hours worked, and leisure-time physical activity. Preventive medicine, 31(6), 673-681.

Bust, P. D., Gibb, A. G. F. & Pink, S., (2008), Managing construction health and safety: Migrant workers and communicating safety messages. Safety Science, 46(4), 585-602.

Campbell, I., (2002), Extended working hours in Australia. Labour & Industry: a journal of the social and economic relations of work, 13(1), 91-110.

Carroll, J. S. (2002). Leadership and safety in nuclear power and health care. Paper presented at Managers and Safety in High Reliability Organisations Seminar, Aberdeen University, UK, 21 May.

Chatman, J. A. & Jehn, K. A, (1994), Assessing the relationship between industry characteristics and organisational culture: how different can you be? Academy of Management Journal, 37(3), 522-553.

Cheyne, A., Cox, S., Oliver, A. & Tomás, J. M., (1998), Modelling safety climate in the prediction of levels of safety activity. Work & Stress, 12(3), 255-271.

Cheyne, A., Oliver, A., Tomas, J.M. & Cox, S., (2002), The architecture of employee attitudes to safety in the manufacturing sector. Personnel Review, 31(5/6), 649-70.

Chiaburu, D.S. & Harrison, D.A., (2008), Do peers make the place? Conceptual synthesis and meta-analysis of coworker effects on perceptions, attitudes, OCBs and performance. Journal of Applied Psychology, 93(5), 1082-103.

Christensen, E. W. & Gordon, G. G., (1999), An exploration of industry, culture and revenue growth. Organisation Studies, 20(3), 397-422.

Christian, M., Bradley, J., Wallace, C. & Burke, M., (2009), Workplace Safety: A Meta-Analysis of the Roles of Person and Situation Factors. Journal of Applied Psychology, 94(5), 1103-1127.

Cigularov, K. P., Chen, P. Y. & Rosecrance, J., (2010), The effects of error management climate and safety communication on safety: A multi-level study. Accident Analysis and Prevention, 42(5), 1498-1506.

Clarke, S., (2000), Safety culture: under-specified and overrated? International Journal of Management Reviews, 2(1), 65-90.

Clarke, S., (1999), Perceptions of organisational safety: implications for the development of a safety culture. Journal of Organisational Behaviour, 20(2), 185-198.

Clarke, S., (1998), Organisational factors affecting the incident reporting of train drivers. Work & Stress, 12(1), 6-16.

Clarke, S. & Ward, K., (2006), The role of leader influence tactics and safety climate in engaging employees' safety participation. Risk Analysis, 26(5), 1175-1185.

Conchie, S. M. & Burns, C. (2009), Improving occupational safety: Using a trusted information source to communicate about risk. Journal of Risk Research, 12(1), 13-25.

Conchie, S. M. & Burns, C., (2008), Trust and risk communication in high-risk organisations: A test of principles from social risk research. Risk Analysis, 28(1), 141-149.

Conchie, S. M. & Donald, I. J., (2008), The functions and development of safety-specific trust and distrust. Safety Science, 46(1), 92-103.

Conchie, S. M., Donald, I. J. & Taylor, P. J., (2006), Trust: Missing piece(s) in the safety puzzle. Risk Analysis, 26(5), 1097-1104.

Conchie, S. M., Taylor, P. J. & Charlton, A., (2011), Trust and distrust in safety leadership: Mirror reflections? Safety Science, 49(8-9), 1208-1214.

Cooper, M. D., (2000), Towards a model of safety culture. Safety Science, 36(2), 111-136.

Cooper, M. D. & Phillips, R. A., (2004), Exploratory analysis of the safety climate and safety behaviour relationship. Journal of Safety Research, 35(5), 497-512.

Cox, S. J. & Cheyne, A. J. T., (2000), Assessing safety culture in offshore environments. Safety Science, 34(1-3), 111-129.

Cox, S. & Flin, R., (1998), Safety culture: Philosopher's stone or man of straw? Work & Stress, 12(3), 189-201.

Cullen, D., (1990), The Public Inquiry into the Piper Alpha Disaster, Her Majesty's Stationary Office, London.

Dainty, A., Green, S. & Bagilhole, B., (2007), People and culture in construction: a reader, Taylor & Francis, Oxon.

Dainty, A. R. J. & Lingard, H., (2006), Indirect discrimination in construction organisations and the impact on women's careers. ASCE Journal of Management in Engineering, 22(3), 108-118.

Debrah, Y. A. & Ofori, G., (2001), Subcontracting, foreign workers and job safety in the Singapore construction industry. Asia Pacific Business Review, 8(1), 145-166.

DeJoy, D. M., Wilson, M. G., Vandenberg, R. J., McGrath-Higgins, A. L. & Griffin-Blake, C. S., (2010), Assessing the impact of a healthy work organisation intervention. Journal of Occupational and Organisational Psychology, 83(1), 139-165.

Demers, C., (2007), Organisational change theories: A synthesis, Sage Publication, Los Angeles.

Devine, C. M., Jastran, M., Jabs, J., Wethington, E., Farell, T. J. & Bisogni, C. A., (2006), 'A lot of sacrifices': Work–family spillover and the food choice coping strategies of low-wage employed parents. Social science & medicine, 63(10), 2591-2603.

Dickson, M. W., BeShears, R. S. & Gupta, V., (2004), The impact of societal culture and industry on organisational culture: theoretical explanations. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman & V. Gupta (Eds.), Culture, Leadership, and Organisations, Sage Publications, Thousand Oaks.

DIMIA, (2011), Population flows: immigration aspects 2009-2010, Department of Immigration and Citizenship, Canberra.

Dingsdag, D. P., Biggs, H. C. & Sheahan, V. L., (2008), Understanding and defining OH&S competency for construction site positions: Worker perceptions. Safety Science, 46(4), 619-633.

Dollard, M. F. & Bakker, A. B., (2010), Psychosocial safety climate as a precursor to conducive work environments, psychological health problems, and employee engagement. Journal of Occupational and Organisational Psychology, 83(3), 579-599.

Du Plessis, K., Cronin, D., Corney, T. & Green, E., (2013), Australian blue-collar men's health and wellbeing: contextual issues for workplace health promotion interventions. Health Promotion Practice, 14, 715-720.

Eisenberg, E. M. & Witten, M. G., (1987), Reconsidering openness in organisational communication. Academy of Management Review, 12(3), 418-426.

Eisenberger, R., Fasolo, P. & LaMastro, D., (1990), Perceived organisational support and employee diligence, commitment and innovation. Journal of Applied Psychology, 75(1), 51-59.

Ely, R. J. & Meyerson, D. E., (2010), An organisational approach to undoing gender: The unlikely case of offshore oil platforms. Research in Organisational Behavior, 30, 3-34.

Fellows, R. & Liu, A. M. M., (2013), Use and misuse of the concept of culture. Construction Management and Economics, 31(5), 401-422.

Filho, A. P. G., Andrade, J. C. S. & Marinho, M. D. O., (2010), A safety culture maturity model for petrochemical companies in Brazil. Safety Science, 48(5), 615-624.

Fleming, M., (2000). Safety culture maturity model, Offshore Technology Report 49, HSE books, London.

Flin, R., Mearns, K., O'Connor, P. & Bryden, R., (2000), Measuring safety climate: identifying the common features. Safety Science, 34(1-3), 177-192.

Flin, R. & Yule, S., (2004), Leadership for safety: industrial experience. Quality and Safety in Health Care, 13, 45-51.

Findley, M., Smith, S., Gorski, J. & O'Neil, M., (2007), Safety climate differences among job positions in a nuclear decommissioning and demolition industry: employees' self-reported safety attitudes and perceptions. Safety Science, 45(8), 875-889.

Frone, M. R., Russell, M. & Cooper, M. L., (1997), Relation of work-family conflict to health outcomes: A four year study of employed parents. Journal of Occupational and Organisational Psychology, 70(4), 325-335.

Fruhen, L. S., Mearns, K. J., Flin, R. H. & Kirwan, B., (2013), From the surface to the underlying meaning-an analysis of senior managers' safety culture perceptions. Safety Science, 57, 326-334.

Gale, A. & Cartwright, S., (1995), Women in project management: entry into a male domain?: a discussion on gender and organisational culture – part 1. Leadership & Organisation Development Journal, 16(2), 3-8.

Geertz, C., (1973), The interpretation of cultures: Selected essays, Hutchinson & Co, London.

Geller, E. S., Roberts, D. S. & Gilmore, M. R., (1996), Predicting propensity to actively care for occupational safety. Journal of Safety Research, 27(1), 1-8.

Gerhart, B. & Fang, M., (2005), National culture and human resource management: Assumptions and evidence. The International Journal of Human Resource Management, 16(6), 971-986.

Gherardi, S. & Nicolini, D., (2000), To transfer is to transform: the circulation of safety knowledge. Organisation, 7(2), 329-348.

Gherardi, S., Nicolini, D. & Odella, F., (1998), What do you mean by safety? Conflicting perspectives on accident causation and safety management in a construction firm. Journal of Contingencies and Crisis Management 6(4), 202-213.

Glendon, A. I. & Litherland, D. K., (2001), Safety climate factors, group differences and safety behaviour in road construction. Safety Science, 39(3), 157-188.

Glendon, I. & Stanton, N. A., (2000), Perspectives on safety culture. Safety Science, 34, 193-214.

Gordon, G. G., (1991), Industry determinants of organisational culture. Academy of Management Review, 16(2), 396-415.

Griffin, M.A. & Neal, A., (2000), Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. Journal of Occupational Health Psychology, 5(3), 347-358.

Guldenmund, F. W., (2007), The use of questionnaires in safety culture research – an evaluation. Safety Science, 45(6), 723-743.

Guldenmund, F. W., (2000), The nature of safety culture: a review of theory and research. Safety Science, 34(1-3), 215-257.

Guldenmund, F., Cleal, B. & Mearns, K., (2013), An exploratory study of migrant workers and safety in three European countries. Safety Science, 52, 92-99.

Gyekye, S. A. & Salminen, S., (2007), Workplace safety perceptions and perceived organisational support: Do supportive perceptions influence safety perceptions? International Journal of Occupational Safety and Ergonomics, 13(2) 189-200.

Hale, A. R., (2000), Culture's confusions. Safety Science, 34 (1-3), 1-14.

Hale, A. R., (2003), Safety management in production. Human Factors and Ergonomics in Manufacturing & Service Industries, 13(3), 185-201.

Hale, A. R. & Hovden, J., (1998), Management and culture: the third age of safety. A review of approaches to organisational aspects of safety, health and environment, In A. M. Feyer & A. Williamson (Eds), Occupational injury: Risk prevention and intervention, Taylor and Francis, London.

Hare, B., Cameron, I., Real, K. & Maloney, W., (2013), Exploratory Case Study of Pictorial Aids for Communicating Health and Safety for Migrant Construction Workers. Journal of Construction Engineering and Management, 139(7), 818-825.

Harré, N., Field, J. & Kirkwood, B., (1996), Gender differences and areas of common concern in the driving behaviours and attitudes of adolescents. Journal of Safety Research, 27(3), 163-173.

Harris, C. R., Jenkins, M. & Glaser, D., (2006), Gender differences in risk assessment: Why do women take fewer risks than men. Judgment and Decision Making, 1(1), 48-63.

Harvey, J., Erdos, G., Bolam, H. & Gregory, D. T., (2002), An examination of different safety cultures in a nuclear processing plant. Risk, Decision and Policy, 7(1), 69-80.

Haukelid, K., (2008), Theories of (safety) culture revisited – An anthropological approach. Safety Science, 46(3), 413-426.

Håvold, J. I., (2010), Safety culture and safety management aboard tankers. Reliability Engineering & System Safety, 95(5), 511-519.

Håvold, J. I., (2007), National cultures and safety orientation: A study of seafarers working for Norwegian shipping companies. Work & Stress, 21(2), 173-195.

Health and Safety Commission, (2001), The Ladbroke Grove Rail Inquiry. Part 2 Report, The Rt Hon Lord Cullen, HSE Books, London.

Health and Safety Commission, (1993), Third report: Organizing for safety, ACSNI study group on human factors, Her Majesty's Stationary Office, London.

Health and Safety Executive, (1997), Health and Safety Climate Survey Tool, Health and Safety Executive, London.

Health and Safety Executive, (2012), Safety Culture on the Olympic Park, Research Report 942, HSE Books, London.

Health and Safety Executive, (2005a), A review of safety culture and safety climate literature for the development of the safety culture inspection toolkit, Research Report 367, HSE Books, London.

Health and Safety Executive, (2005b), Development and validation of the HMRI safety culture inspection toolkit, Research Report 365, HSE Books, London.

Hidden, A., (1989), Investigation into the Clapham Junction Railway Accident, Her Majesty's Stationary Office, London.

Hinze, J., Thurman, S. & Wehle, A., (2013), Leading indicators of construction safety performance. Safety Science, 51(1), 23-28.

Hofmann, D. A. & Mark, B., (2006), An investigation of the relationship between safety climate and medication errors as well as other nurse and patient outcomes. Personnel Psychology, 59(4), 847-869.

Hofmann, D. A. & Morgeson, F. P., (1999), Safety-related behaviour as a social exchange: The role of perceived organisational support and leader-member exchange. Journal of Applied Psychology, 84(2), 286-296.

Hofmann, D. A. & Stetzer, A., (1998), The role of safety climate and communication in accident interpretation: implications for learning from negative events. Academy of Management Journal, 41(6), 644-657.

Hofstede, G., (1991), Cultures and organisations: software of the mind, McGraw-Hill, London.

Hofstede, G. & Hofstede, G., (2005), Cultures and organisations, software of the mind, intercultural cooperation and its importance for survival, McGraw-Hill, New York.

Høivik, D., Tharaldsen, J. E., Baste, V. & Moen, B. E., (2009), What is most important for safety climate: The company belonging or the local working environment? – A study from the Norwegian offshore industry. Safety Science, 47(10), 1324-1331.

Hollnagel, E., (2011), Resilience engineering in practice: A guidebook, Ashgate, Burlington.

Hollnage, E., (2010), Extending the scope of the human factor, In E. Hollnagel (Ed.), Safer complex industrial environments, CRC Press, Boca Raton, 37-59.

Hopkins, A., (2011), Management walk-arounds: Lessons from the Gulf of Mexico oil well blowout. Safety Science, 49 (10), 1421-1425.

Hopkins, A., (2006), Studying organisational cultures and their effects on safety, National Research Centre for OHS Regulation, Australian National University, Canberra.

Hopkins, A., (2006), What are we to make of safe behaviour programs? Safety Science, 44(7), 583-597.

Hsu, S. H., Lee, C. C., Wu, M. C. & Takano, K., (2010), The influence of organisational factors on safety in Taiwanese high-risk industries. Journal of Loss Prevention in the Process Industries, 23(5), 646-653.

Hudson, P., (2007), Implementing safety culture in a major multi-national. Safety Science, 45(6), 697-722.

Humphrey, S. E., Moon, H., Conlon, D. E. & Hofmann, D. A., (2004), Decision making and behaviour fluidity: How focus on completion and emphasis on safety changes over the course of projects. Organisational Behaviour and Human Decision Processes, 93(1), 14-27.

Hudson, P., (1999), Safety Culture – the Way Ahead? Theory and Practical Principles, Centre for Safety Science, Leiden University, Leiden.

Iacuone, D., (2005), 'Real Men Are Tough Guys': Hegemonic Masculinity and Safety in the Construction Industry. The journal of men's studies, 13(2), 247-266.

Inness, T., Turner, N., Barling, J. & Stride, C. B., (2010), Transformational leadership and employee safety performance: A within-person, between-jobs design. Journal of Occupational Health Psychology, 15(3), 279-290.

International Atomic Energy Agency, (1986), Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident, Safety Series 75-INSAG1, International Safety Advisory Group, International Atomic Energy Agency, Vienna.

International Atomic Energy Agency, (2002a), Key practical issues in strengthening safety culture, INSAG-15, International Atomic Energy Agency, Vienna.

International Atomic Energy Agency, (2002b), Safety culture in nuclear installations: Guidance for use in the enhancement of safety culture, International Atomic Energy Agency, Vienna.

International Atomic Energy Agency, (2005), Safety Culture in the Maintenance of Nuclear Power Plants, Safety Reports Series No. 42, International Atomic Energy Agency, Vienna.

Janis, I. L., (1972), Victims of groupthink: A psychological study of foreign-policy decisions and fiascos, Houghton Mifflin, Oxford.

Jannadi, M. O., (1995), Impact of human relations on the safety of construction workers. International Journal of Project Management, 13(6), 383-386.

Jeffcott, S., Pidgeon, N., Weyman, A. & Walls, J., (2006), Risk, Trust, and Safety Culture in U.K. Train Operating Companies. Risk Analysis: An International Journal, 26(5), 1105-1121.

Jorgensen, E., Sokas, R. K., Nickels, L., Gao, W. & Gittleman, J. L., (2007), An English/Spanish safety climate scale for construction workers. American Journal of Industrial Medicine, 50, 438-44.

Kath, L. M., Marks, K. M. & Ranney, J., (2010), Safety climate dimensions, leader-member exchange, and organisational support as predictors of upward safety communication in a sample of rail industry workers. Safety Science, 48(5), 643-650.

Kines, P., Anderson, L. P. S., Spangenberg, S., Mikkelson, K. L. & Dyreborg, J., (2010), Improving construction site safety through leader-based verbal safety communication. Journal of Safety Research, 41(6), 399-406.

Kines, P., Lappalainen, J., Mikkelsen, K. L., Olsen, E., Pousette, A., Tharaldsen, J., Tómasson, K., Törner, M., (2011), Nordic Safety Climate Questionnaire (NOSACQ-50): A new tool for diagnosing occupational safety climate. International Journal of Industrial Ergonomics, 41(6), 634-646.

Kelloway, E. K., Mullen, J. & Francis, L., (2006), Divergent Effects of Transformational and Passive Leadership on Employee Safety. Journal of Occupational Health Psychology 11(1), 76-86.

Koch, C., (2013), From crew to country? Local and national construction safety cultures in Denmark. Construction Management and Economics, 31(6), 691-703.

Larsson, S., Poussette, A. & Törner, M., (2008), Psychological climate and safety in the construction industry-mediated influence on safety behaviour. Safety Science, 46(3) 405-412.

Lawrie, M., Parker, D. & Hudson, P., (2006), Investigating employee perceptions of a framework of safety culture maturity. Safety Science, 44(3), 259-276.

Lingard, H. & Blismas, N., (2006), Building a safety culture: the importance of 'shared mental models' in the Australian construction industry. In D. Fang, R. Choudhry, J. Hinze (eds.) Proceedings of CIB W99 International Conference on Global Unity for Safety and Health in Construction, Beijing, China, 28-30 June 2006, 201-208.

Lingard, H., Cooke, T. & Blismas, N., (2011), Coworkers' response to occupational health and safety: An overlooked dimension of group-level safety climate in the construction industry? Engineering, Construction and Architectural Management, 18(2), 159-175.

Lingard, H., Cooke, T. & Blismas, N., (2010), Safety climate in conditions of construction subcontracting: A multi-level analysis. Construction Management and Economics, 28(10), 313-825.

Lingard, H., Cooke, T. & Blismas, N., (2009), Group-level safety climate in the Australian construction industry: within-group homogeneity and between-group differences in road construction and maintenance. Construction Management & Economics, 27(4), 419–432.

Lingard, H. & Francis, V., (2006), Does a supportive work environment moderate the relationship between work-family conflict and burnout among construction professionals? Construction Management and Economics, 24(2), 185-196.

Lingard, H. & Francis, V., (2005), The decline of the 'traditional' family: work-life benefits as a means of promoting a diverse workforce in the construction industry of Australia. Construction Management and Economics, 23(10), 1045-1057.

Lingard, H. & Francis, V., (2004), The work-life experiences of office and site-based employees in the Australian construction industry. Construction Management and Economics, 22(9), 991-1002.

Lingard, H., Francis, V. & Turner, M., (2010), Work-family conflict in construction: Case for finer-grained analysis. Journal of Construction Engineering and Management, 136(11), 1196-1206.

Lingard, H., Francis, V. & Turner, M., (2010), The rhythms of project life: A longitudinal analysis of work-life experiences in construction. Construction Management and Economics, 28(10), 1085-1098.

Lingard, H. & Holmes, N., (2001), Understandings of occupational health and safety risk control in small business construction firms: barriers to implementing technological controls. Construction Management & Economics, 19(2), 217-226.

Lingard, H., Wakefield, R. & Blismas, N., (2013,), If you cannot measure it, you cannot improve it: Measuring health and safety performance in the construction industry, Paper presented at the 19th Triennial CIB World Building Congress, Brisbane, Australia, 5-9 May 2013.

London, M. & Sessa, V. I., (2006), Group feedback for continuous learning. Human Resource Development Review, 5(3), 303-329.

Loosemore, M. & Chau, D. W., (2002), Racial discrimination towards Asian operatives in the Australian construction industry. Construction Management and Economics, 20(1), 91-102.

Loosemore, M. & Galea, N., (2008), Genderlect and conflict in the Australian construction industry. Construction Management and Economics, 26(2), 125-135.

Loosemore, M. & Lee, P., (2002), Communication problems with ethnic minorities in the construction industry. International Journal of Project Management, 20(7), 517-524.

Loosemore, M., Phua, F., Dunn, K. & Ozguc, U., (2010), Operatives' experiences of cultural diversity on Australian construction sites. Construction Management and Economics, 28(2), 177-188.

Lu, C. S. & Shang, K. C., (2005), An empirical investigation of safety climate in container terminal operators. Journal of Safety Research, 36(3), 297-308.

Maierhofer, N. I., Griffin, M. A. & Sheehan, M., (2000), Linking manager values and behaviour with employee values and behaviour: A study of values and safety in the hairdressing industry. Journal of Occupational Health Psychology, 5(4), 417-427.

MacKenzie, S., (2008), A close look at work and life balance/wellbeing in the Victorian commercial building and construction sector, Building Industry Consultative Council, Melbourne.

Maloney, W. F., Cameron, I. & Hare, B., (2007), Tradesmen involvement in health and safety. Journal of Construction Engineering and Management, 133(4), 297-305.

Mayhew, C. & Quinlan, M., (1997), Subcontracting and occupational health and safety in the residential building industry. Industrial Relations Journal, 28(3), 192-205.

Mayhew, C., Quintan, M. & Ferris, R., (1997), The effects of subcontracting/outsourcing on occupational health and safety: Survey evidence from four Australian industries. Safety Science, 25(1-3), 163-178.

Mearns, K., (2009), From reactive to proactive – Can LPIs deliver? Safety Science, 47(4), 491-492.

Mearns, K. & Flin, R., (1999), Assessing the state of organisational safety – culture or climate? Current Psychology, 18(1), 5-17.

Mearns, K., Flin, R., Gordon, R. & Fleming, M., (1998), Measuring safety climate on offshore installations. Work & Stress, 12(3), 238-254.

Mearns, K., Whitaker, S. M. & Flin, R., (2003), Safety climate, safety management practice and safety performance in offshore environments. Safety Science, 419(8), 641–80.

Mearns, K., Whitaker, S. M. & Flin, R., (2001), Benchmarking safety climate in hazardous environments: a longitudinal, inter-organisational approach. Risk Analysis, 21(4), 771-786.

Mearns, K. & Yule, S., (2009), The role of national culture in determining safety performance: Challenges for the global oil and gas industry. Safety Science, 47(6), 777-785.

Melia, J. L., Mearns, K., Silva, S. A. & Lima, M. L., (2008), Safety climate responses and the perceived risk of accidents in the construction industry. Safety Science, 46(6), 949-958.

Merriti, A. C. & Helmreich, R. L., (1996), Human Factors on the Flight Deck: The Influence of National Culture. Journal of Cross-Cultural Psychology, 27(1), 5-24.

Meyer, J. W & Rowan, B., (1977), Institutionalized organisations: Formal structure as myth and ceremony. American journal of sociology, 83, 340-363.

Michael, J. H., Guo, Z. G., Wiedenbeck, J. K. & Ray, C. D., (2006), Production supervisor impacts on subordinates' safety outcomes: An investigation of leader-member exchange and safety communication. Journal of Safety Research, 37(5), 469-477.

Mullen, J. E., (2005), Testing a model of employee willingness to raise safety issues. Canadian Journal of Behavioral Sciences, 37(4), 259-268.

Mullen, J. E. & Kelloway, E. K., (2009), Safety leadership: A longitudinal study of the effects of transformational leadership on safety outcomes. Journal of Occupational and Organisational Psychology, 82(2), 253-272.

Mullen, J. E., Kelloway, E. K. & Teed, M., (2011), Inconsistent style of leadership as a predictor of safety behaviour. Work & Stress, 25(1), 41-54.

Naevestad, T. O., (2009), Mapping research on culture and safety in high-risk organisations: Arguments for a sociotechnical understanding of safety culture. Journal of Contingencies and Crisis Management, 7(2), 126-136.

Nahrgang, J. D., Morgeson, F. P. & Hofmann, D. A., (2011), Safety at work: a meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. Journal of Applied Psychology, 96(1), 71-94.

Neal, A. & Griffin, M. A., (2006), A Study of the Lagged Relationships Among Safety Climate, Safety Motivation, Safety Behaviour, and Accidents at the Individual and Group Levels. Journal of Applied Psychology, 91(4), 946-953.

Neal, A. & Griffin, M. A., (2002), Safety climate and safety behaviour. Australian Journal of Management, 27, 67-75.

Neal, A., Griffin, M. A. & Hart, P. M., (2000), The impact of organisational climate on safety climate and individual behaviour. Safety Science, 34(1), 99-109.

O'Dea, A. & Flin, R., (2001), Site managers and safety leadership in the offshore oil and gas industry. Safety Science, 37(1), 39-57.

Olive, C., O'Connor, T. M. & Mannan, M. S., (2006), Relationship of safety culture and process safety. Journal of Hazardous Materials, 130(1-2), 133-140.

Oliver, A., Cheyne, A., Tomás, J. M. & Cox, S., (2002), The effects of organisational and individual factors on occupational accidents. Journal of Occupational and Organisational Psychology, 75(4), 473-488.

O'Toole, M., (2002), The relationship between employees' perceptions of safety and organisational culture. Journal of Safety Research, 33(2), 231-243.

Parker, M., (2000), Organisational Culture and Identity, Sage Publications, London.

Parker, S. K., Axtell, C. M. & Turner, N., (2001), Designing a safer workplace: Importance of job autonomy, communication quality, and supportive supervisors. Journal of Occupational Health Psychology, 6(3), 211-228.

Parker, D., Lawrie, M. & Hudson, P., (2006), A framework for understanding the development of organisational safety culture. Safety Science, 44(6), 551-562.

Paul, J. A., (2013), Improving communication with foreign speakers on the shop floor. Safety Science, 52, 65-72.

Peetz, D., Townsend, K., Russell, B., Houghton, C., Fox, A. & Allan, C., (2003), Race Against Time: Extended Hours in Australia. Australian Bulletin of Labour, 29(2), 126-142.

Phillips, M. E., (1994), Industry Mindsets: Exploring the Cultures of Two Macro-organisational Settings. Organisation Science, 5(3), 384-402.

Phillips, J. & Spinks, H., (2012), Skilled migration: temporary and permanent flows to Australia, Department of Parliamentary Services, Parliament of Australia.

Pidgeon, N., (1998), Risk assessment, risk values and the social science programme: why we do need risk perception research. Reliability Engineering & System Safety, 59(1), 5-15.

Pidgeon, N., (1991), Safety culture and risk management in organisations. Journal of Cross-Cultural Psychology, 22(1), 129-140.

Prussia, G. E., Brown, K. A. & Willis, P. G., (2003), Mental models of safety: do managers and employees see eye to eye? Journal of Safety Research, 34(2), 143-56

Reason, J., (1997), Managing the risks of organisational accidents, Ashgate, Aldershot.

Reason, J., (1998), Achieving a safe culture: theory and practice. Work & Stress, 12(3), 293-306.

Reason, J., (2000), Safety paradoxes and safety culture. Injury Control and Safety Promotion, 7(1), 3-14.

Reynolds, J., (2005), In the Face of Conflict: Work-Life Conflict and Desired Work Hour Adjustments. Journal of Marriage and Family, 67(5), 1313-1331.

Reynolds, J. & Aletraris, L., (2007), Work–family conflict, children, and hour mismatches in Australia. Journal of Family Issues, 28(6), 749-772.

Richter, A. & Koch, C., (2004), Integration, differentiation and ambiguity in safety cultures. Safety Science, 42(8), 703-722.

Roberts, D. S. & Geller, E. S., (1996), An 'actively caring' model for occupational safety: A field test. Applied and Preventive Psychology, 4(1), 53-59.

Roos, E., Lahelma, E. & Rahkonen, O., (2006), Work-family conflicts and drinking behaviours among employed women and men. Drug and Alcohol Dependence, 83(1), 49-56.

Rail Safety and Standards Board, (2003), Industry Guide to Safety Culture Tools and Methods, Rail Safety and Standards Board, London.

Sackmann, S. A., (1997), Cultural complexity in organisations: Inherent contrasts and contradictions, Sage Publications, Thousand Oaks.

Safe Work Australia, (2012a), Compendium of Workers' Compensation Statistics Australia 2010-11, Safe Work Australia, Canberra.

Safe Work Australia, (2012b), Australian Work Health and Safety Strategy 2012-2022, Safe Work Australia, Canberra.

Sang, K. J. C., Ison, S. G. & Dainty, A. R. J., (2009), The job satisfaction of UK architects and relationships with work-life balance and turnover intentions. Engineering, Construction and Architectural Management, 16(3), 288-300.

Saw, J. L., Wilday, J. & Harte, H., (2010), Learning organisations for major hazards and the role of the regulator. Process Safety and Environmental Protection, 88(4), 236-242.

Schein, E. H., (2010), Organisational culture and leadership (4th ed.), Jossey-Bass, San Francisco.

Schein, E. H., (2006), Organisational culture and leadership (3rd ed.), Jossey-Bass, San Francisco.

Schein, E. H., (1999), The corporate culture survival guide, Jossey-Bass, San Francisco.

Schultz, M. & Hatch, M. J., (1996), Living with multiple paradigms: The case of paradigm interplay in organisational culture studies. Academy of Management Review, 21(2), 529-557.

Shannon, H. S., Mayr, J. & Haines, T., (1997), Overview of the relationship between organisational and workplace factors and injury rates. Safety Science, 26(3), 201-217.

Shannon, H.S. & Norman, G.R., (2009), Deriving the factor structure of safety climate scales. Safety Science, 47(3), 327-329.

Sherratt, F., Farrell, P. & Noble, R., (2013), UK construction site safety: Discourses of enforcement and engagement. Construction Management and Economics, 31 (6), 623-635.

Simard, M. & Marchand, A., (1994), The behaviour of first-line supervisors in accident prevention and effectiveness in occupational safety. Safety science, 17(3), 169-185.

Simard, M. & Marchand, A., (1995), A multilevel analysis of organisational factors related to the taking of safety initiatives by work groups. Safety Science, 21(2), 113-129.

Simard, M. & Marchand, A., (1997), Workgroups' propensity to comply with safety rules: The influence of micro-macro organisational factors. Ergonomics, 40(2), 172-188.

Simoms, T., (2002), Behavioral integrity: The perceived alignment between managers' words and deeds as a research focus. Organisation Science, 13(1), 18-35.

Smircich, L., (1983), Concepts of culture and organisational analysis. Administrative science quarterly, 28(3), 339-358.

Sorensen, J. N., (2002), Safety culture: a survey of state of the art. Reliability Engineering and System Safety, 76(2), 189-204.

Spangenberg, S., Baarts, C., Dyreborg, J., Jensen, L., Kines, P. & Mikkelsen, K. L., (2003), Factors contributing to the differences in work related injury rates between Danish and Swedish construction workers. Safety Science, 41(6), 517-530.

Sparer, E. H. & Dennerlein, J. T., (2013), Determining safety inspection thresholds for employee incentive programs on construction sites. Safety Science, 51(1), 77-84.

Stattin, M. & Järvholm, B., (2005), Occupation, work environment and disability pension: A prospective study of construction workers. Scandinavian Journal of Public Health, 33(2), 84-90.

Tan, B. L. B., (2002), Researching managerial values: a cross-cultural comparison. Journal of Business Research, 55(10), 815-821.

Tharaldsen, J. E., Olsen, E. & Rundmo, T., (2008), A longitudinal study of safety climate on the Norwegian continental shelf. Safety Science, 46(3), 427-439.

Teo, E. A. L., Ling, F. Y. Y. & Chong, A. F. W., (2005), Framework for project managers to manage construction safety. International Journal of Project Management, 23(4), 329-341.

Törner, M. & Pousette, A., (2009), Safety in construction – a comprehensive description of the characteristics of high safety standards in construction work, from the combined perspective of supervisors and experienced workers. Journal of Safety Research, 40(6), 399-409.

Trajkovski, S. & Loosemore, M., (2006), Safety implications of low-English proficiency among migrant construction site operative. International Journal of Project Management, 24(5), 446-452.

Tucker, S., Chmiel, N., Turner, N., Hershcovis, M. S. & Stride, C.B., (2008), Perceived organisational support for safety and employee safety voice: The mediating role of coworker support for safety. Journal of Occupational Health Psychology, 13(4), 319-330.

Tutt, D., Pink, S., Dainty, A. R. J. & Gibb, A., (2013), 'In the air' and below the horizon: migrant workers in UK construction and the practice-based nature of learning and communicating OHS. Construction Management and Economics, 31(6), 515-527.

Van Dyck, C., Frese, M., Baer, M. & Sonnentag, S., (2005), Organisational error management culture and its impact on performance. Journal of Applied Psychology, 90(6), 1228-1240.

Van Steenbergen, E. F. & Ellemers, N., (2009), Is managing the work-family interface worthwhile? Benefits for employee health and performance. Journal of Organisational Behavior, 30(5), 617-642.

Van Wanrooy, B. & Wilson, S., (2006), Convincing the toilers? Dilemmas of long working hours in Australia. Work, Employment and Society, 20, 349-368.

Varonen, U. & Mattila, M., (2000), The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. Accident Analysis and Prevention, 32(6), 761-9.

Wadick, P., (2010), Safety culture among subcontractors in the domestic housing construction industry. Structural Survey, 28(2), 108-120.

Wallace, J. C., Popp, E. & Mondore, S., (2006), Safety climate as a mediator between foundation climates and occupational accidents: a group-level investigation. Journal of Applied Psychology, 91(3), 681-688.

Waring, A. E., (1992), Organisational Culture, Management, and Safety, Paper presented at the British Academy of Management 6th Annual Conference, Bradford University, 14-16 September.

Weick, K. E., Sutcliffe, K. M. & Obstfeld, D., (1999), Organizing for reliability: processes of collective mindfulness. Research in Organisational Behavior, 21, 81-123.

Welch, L. S., (2009), Improving work ability in construction workers – let's get to work. Scandinavian journal of work, environment & health, 22(3), 321-324.

Wiegmann, D. A., Zhang, H., von Thanden, T. L., Sharma, G. & Gibbons, A. M., (2004), Safety culture: an integrative review, The International Journal of Aviation Psychology, 14(2), 117-134.

Williams, A., Franche, R., Ibrahim, S., Mustard, C. A. & Layton, F. R., (2006), Examining the relationship between work-family spillover and sleep quality. Journal of occupational health psychology, 11(1), 27-37.

Williamson, D., (2002), Forward from a Critique of Hofstede's Model of National Culture. Human Relations, 55(11), 1373-1395.

Wilson, M. G., Dejoy, D. M. & Vandenberg, R. J., (2004), Work characteristics and employee health and well-being: Test of a model of healthy work organisation. Journal of Occupational and Organisational Psychology, 77(4), 565-588.

WorkHealth, (2013), WorkHealth checks in Victoria's Construction industry, WorkSafe Victoria, Melbourne.

Wu, T. C., Chen, C. H. & Li, C. C., (2008), A correlation among safety leadership, safety climate and safety performance. Journal of Loss Prevention in the Process Industries, 21(3), 307-318.

Zacharatos, A., Barling, J. & Iverson, R. D., (2005), High-performance work systems and occupational safety. Journal of Applied Psychology, 90(1), 77-93.

Zohar, D., (2008), Safety climate and beyond: A multi-level multi-climate framework. Safety Science, 46(3), 376-387.

Zohar, D., (2002a), The effect of leadership dimensions, safety climate and assigned priorities on minor injuries in work groups. Journal of Organisational Behavior, 23(1), 75-92.

Zohar, D., (2002b), Modifying supervisory practices to improve subunit safety: a leadership-based intervention model. Journal of Applied Psychology, 87(1), 156-163.

Zohar, D., (2000), A Group-Level Model of Safety Climate: Testing the Effect of Group Climate on Microaccidents in Manufacturing Jobs. Journal of Applied Psychology, 85(4), 587-596.

Zohar, D., (1980), Safety climate in industrial organisations: theoretical and applied implications. Journal of Applied Psychology, 65(1), 96-102.

Zohar, D. & Luria, G., (2004), Climate as a social-cognitive construction of supervisory safety practices: scripts as proxy of behaviour pattern. Journal of Applied Psychology, 89(2), 322-333.

Zohar, D. & Luria, G., (2003), The use of supervisory practices as leverage to improve safety behaviour: a cross-level intervention model. Journal of Safety Research, 34(5), 567-577.

Zohar, D. & Tenne-Gazit, O., (2008), Transformational leadership and group interaction as climate antecedents: a social network analysis. Journal of Applied Psychology, 93(4), 744-757.

Zwetsloot, G. I. J. M., van Scheppingen, A. R., Bos, E. H., Dijkman, A. & Starren, A., (2013), The Core Values that Support Health, Safety, and Well-being at Work. Safety and Health at Work, 4(4), 187-196.

Appendix A: H&S Climate Assessment Tool

The table below contains a list of H&S climate survey questions that reflect the expression of each of the nine dimensions of H&S culture at the levels of:

- the organisation (principal contractor)
- the project, and
- the workgroup.

This list of questions is a 'pool' of potential questions from which a subset would be selected for each dimension/level of safety. An instrument to measure responses to each of these questions would be developed to measure responses to each question.

These questions are indicative only and are subject to a robust validation process, where any 'problem questions' could be replaced or withdrawn from the final instrument.

ABOUT THE PRINCIPAL CONTRACTOR

LEADERSHIP	• Management of [principal contractor's name] really cares about the health and safety of the people who work here • Management of [principal contractor's name] sometimes turns a blind eye when health and safety procedures/instructions/rules are broken • Management of [principal contractor's name] is strict about working safely when work falls behind schedule • I am strongly encouraged by management of [principal contractor's name] to report unsafe conditions • Management of [principal contractor's name] acts quickly and decisively when a safety concern is raised
ORGANISATIONAL GOALS AND VALUES	• In [principal contractor's name], there is sometimes pressure to put production before safety • Management of [principal contractor's name] shows commitment to health and safety as a core value • [Principal contractor's name] would stop us working due to safety concerns, even if it means losing money • Management of [principal contractor's name] clearly considers the safety of employees of great importance • Management of [principal contractor's name] emphasises that safety procedures be carefully followed
RESPONSIBILITY	• Management of [principal contractor's name] tries to get all workers to meet or exceed safety standards • Management of [principal contractor's name] provides adequate training to the workforce • Management of [principal contractor's name] takes the lead on safety issues • Management of [principal contractor's name] has defined the safety objectives clearly • Management of [principal contractor's name] is only interested in safety after there is an accident

COMMUNICATION	• There is good communication at [principal contractor's name] sites about health and safety issues which could affect me • Workers are always given feedback by [principal contractor's name] about accidents/incidents that occur • Work problems are openly discussed between workers and management at [principal contractor's name] sites • Workers can express their views about safety policy at [principal contractor's name] sites • Workers are always told about changes in working procedures at [principal contractor's name] sites
SUPPORTIVE ENVIRONMENT	• Management of the [principal contractor's name] cares about the negative effect that job uncertainty has on workers' health and safety • Workers at [principal contractor's name] sites have high levels of job satisfaction • At [principal contractor's name] sites it is considered important for workers to have sufficient time for family or social life • When working at [principal contractor's name] sites, workers are expected to put their job before their family or social life • At [principal contractor's name] sites there are no barriers stopping us from working well with each other
LEARNING	• [Principal contractor's name] encourages open reporting of mistakes and errors that could affect health and safety • [Principal contractor's name] is constantly seeking new ways to work more safely • [Principal contractor's name] actively uses information about errors or problems to improve safe work procedures • At [principal contractor's name] sites safety performance indicators are used by managers to improve performance • At [principal contractor's name] sites, errors are considered to be very useful for improving the work process
TRUST IN PEOPLE AND SYSTEMS	• If an incident occurs, managers at [principal contractor's name] sites do not automatically blame workers but consider other organisational causes, such as communications and work design • At [principal contractor's name] sites, people are willing to report incidents • At [principal contractor's name] sites, investigations help to prevent accidents from recurring • At [principal contractor's name] sites, workers are always given feedback about incidents that have occurred • At [principal contractor's name] sites, procedures are only there to 'cover managers backs'
ENGAGEMENT	• [Principal contractor's name] talks to workers about the effectiveness of the health and safety management system • At [principal contractor's name] sites, I feel involved when decisions are made about safety issues which may affect me • [Principal contractor's name] engages workers in health and safety inspections and audits • At [principal contractor's name] sites, I can influence health and safety performance • At [principal contractor's name] sites, I have a fair opportunity to influence managers' safety related decisions
RESILIENCE	• At [principal contractor's name] sites, resources are managed so we are always able to cope with a small amount of unexpected change • People in [principal contractor's name] are encouraged to 'think outside of the box' to improve health and safety • At [principal contractor's name] sites, early warning signs of safety problems are identified and addressed • At [principal contractor's name] sites, managers actively listen to safety concerns to prevent problems before they arise • At [principal contractor's name] sites, a good record does not stop managers from trying to identify safety problems

ABOUT THE PROJECT

LEADERSHIP	• The project management team is determined to maintain a safe project environment • The project management team encourages me to express my ideas and opinions about safety at work • The project management team is strict about working safely even when work falls behind schedule • The project management team considers safety when setting production speed and schedules • The project management team acts decisively when a safety concern is raised
ORGANISATIONAL GOALS AND VALUES	• The high priority placed on health and safety is reflected in project documentation, communications and decision making • Safety is a primary consideration in planning and allocating project resources • In practice, concerns for production sometimes overrides concerns for safety on this project • Project management clearly considers the safety of employees of great importance • Unsafe behaviour is sometimes tolerated by project management
RESPONSIBILITY	• On this project, there is constant pressure to keep working • On this project, there are enough resources to get the job done safely • The project management team takes responsibility for the project's safety record • The project management team tries to get workers to meet or exceed safety standards • The project management team ensures workers are provided with needed safety equipment
COMMUNICATION	• The project management team operates an open door policy on safety issues • On this project, I am satisfied with the way I am kept informed about health and safety activities which affect me • On this project, there is poor communication between the principal contractor and subcontractors • The project management team openly accepts ideas for improving health and safety • The project management team is easy to talk to about health and safety issues
SUPPORTIVE ENVIRONMENT	• On this project, there are enough workers to carry out the required work safely • On this project, workers have enough time to plan and carry out their tasks safely • On this project, workloads are well managed and reasonable • The project management team supports workers who need flexibility to attend to family or personal matters • Workers on this project cooperate with each other to get the work done safely
LEARNING	• On this project, errors and deviations are considered to be very useful for improving the work process • In this project, an error provides important information about how we continue our work • When working on this project, people think a lot about how errors could have been avoided • On this project, employees discuss ways to prevent errors from happening again • Workers feel free to question the decisions or actions of those with more authority on this project
TRUST	• People on this project are willing to report incidents • On this project, accident investigations are mainly used to identify who is to blame • On this project, accident investigations consider project management causes, such as scheduling, planning and resources • On this project, workers are usually satisfied with the follow-up and measures taken after accidents have taken place • I trust the project management team to be fair in the way that they deal with safety

ENGAGEMENT	• On this project, I can influence health and safety performance • On this project, I feel involved when decisions are made about health and safety issues which could affect me • On this project, I have a fair opportunity to influence decisions made by the project management team • I am involved in informing management of important safety issues on this project • I am never involved in the ongoing review of safety activities on this project
RESILIENCE	• The project management team thinks about what could go wrong so that they can prevent accidents • On this project, if something out of the ordinary happens, people know who has the expertise to respond • On this project, the managers and foremen are willing to ask for health and safety advice from workers who have 'hands on' experience • When the safety record is good, the project management team loses interest in making improvements • Project managers actively listen for problems in the project because it helps them to prepare a better response

ABOUT THE WORKGROUP

LEADERSHIP	• My supervisor talks about his/her values and beliefs regarding the importance of safety • My supervisor provides constant encouragement to do our jobs safely • My supervisor suggests new ways of doing our jobs more safely • My supervisor listens to my concerns about safety on the job • My supervisor refuses to ignore safety rules when work falls behind schedule
ORGANISATIONAL GOALS AND VALUES	• In this workgroup, people worry about job security when deciding whether to speak up about safety • In this workgroup, I sometimes violate safety rules to get the job done • In this workgroup, I report dangerous situations when I see them • In this workgroup, I ask my colleagues to stop work when I think the job is being done in a risky manner • In this workgroup, I stop working if I think it would be dangerous for me to continue
RESPONSIBILITY	• In this workgroup, workers avoid creating hazards for coworkers • In this workgroup, coworkers discuss changes that could improve safety • I can influence safety performance in this workgroup • Safe working is a condition of employment in this workgroup • People in this workgroup want to achieve high levels of safety
COMMUNICATION	• In this workgroup, workers feel comfortable discussing safety issues with their supervisor • In this workgroup, workers try to avoid talking about safety issues with their supervisor • In this workgroup, workers feel that their supervisor openly accepts ideas for improving safety • I speak to coworkers who are at risk and encourage them to fix safety problems • In this workgroup, coworkers remind each other to take precautions
SUPPORTIVE ENVIRONMENT	• I fully understand the health and safety risks associated with my work • I fully understand the health and safety procedures, instructions, and rules for my job • If I get into difficulties at work, I know my coworkers will help me out • My supervisor supports workers who need to temporarily reduce their working hours for family or personal reasons • My coworkers cooperate with each other to get the work done safely

LEARNING	• In this workgroup, workers discuss ways to prevent errors from happening again • In this workgroup, workers are given feedback about changes made based on incident reports • Workers freely speak up if they see something that may negatively affect safety in this workgroup • When someone in the workgroup makes an error, they share it with the rest of us so no-one else makes the same mistake • When people in this group make an error, they can ask others for advice on how to continue
TRUST IN PEOPLE AND SYSTEMS	• In my workgroup, I trust my supervisor's judgement when it comes to safety • In my workgroup, reporting your own mistakes is encouraged by supervisors • In my workgroup, workers are treated fairly by supervisors, who understand some errors are inevitable • There is a clear distinction between unavoidable errors and unacceptable actions in this workgroup • In my workgroup, workers are satisfied with follow-up measures after accidents have taken place
ENGAGEMENT	• I feel involved when health and safety procedures, instructions and rules are developed or reviewed in my workgroup • In my workgroup, I feel involved when decisions are made about safety issues which may affect me • I am given a fair opportunity to influence the decisions made by supervisors • I am involved in informing supervisors of important safety issues in this workgroup • I am never involved in the ongoing review of safety in my workgroup
RESILIENCE	• In my workgroup, if something out of the ordinary happens, people know who has the knowledge and experience to respond • It is generally easy to obtain assistance from coworkers or supervisors when something comes up that I don't know how to handle • In my workgroup, safety knowledge is used as needed to cope with new or different situations • Supervisors proactively monitor what is happening in the workgroup to have an early warning of emerging issues • My workgroup considers it's very important to learn from our mistakes and problems

Appendix B: Source of H&S climate questions

Source	Leadership	Organisational goals & values	Responsibility	Communication	Supportive environment	Learning	Trust in people & systems	Engagement	Resilience
Brondino et al., 2011			√						
Burt et al., 1998			√						
Cheyne et al., 1998		√	√						
Cigularov et al., 2010						√			
Complian et al., 1993					√				
Conchie & Donald, 2009							√		
Cox & Cheyne, 2000	√	√			√			√	
dos Santos Grecco et al., 2014							√		
Glendon & Litherland, 2001				√	√				
Hofmann & Moregeson, 1999			√	√					
HSE, 1999	√	√		√	√		√	√	
IAEA, 2005		√				√			
Kath et al., 2010				√					
Koster et al., 2011	√								
Means et al., 2003				√	√			√	
Stephenson, 2010					√				√
Tharaldsen et al., 2008		√							
Tucker & Turner, 2011				√					
Zohar, 2000	√								
Zohar & Luria, 2005	√								

Appendix C: Derivation of H&S Climate Assessment Tool questions and corresponding reliability data

The table below identifies the sources of questions incorporated into the ACA H&S Climate Assessment Tool.

For each set of questions the Cronbach's alpha (α) statistic is also presented if available. This is a measure of the reliability of each set of questions. Reliability analysis indicates whether a set of questions measures an abstract concept (for example, H&S leadership) in a useful way. Using reliability analysis, the extent to which survey questions are related to each other is considered, and an overall index of the internal consistency of each set of questions is produced. Generally speaking, a Cronbach's alpha score of 0.70 or above is considered acceptable.

Leadership		
Source	***Original construct***	***Reliability data***
HSE, 1999	Management commitment	NA
Cox & Cheyne, 2000	Management commitment	Cronbach's α = 0.85
Zohar & Luria, 2005	Global factor concerning managerial commitment Global factor concerning supervisory commitment	Cronbach's α = 0.92 Cronbach's α = 0.95
Koster et al., 2011	Safety-specific transformational leadership	Cronbach's α = 0.97
Zohar, 2000	Supervisory action Supervisory expectation	Cronbach's α = 0.90 Cronbach's α = 0.87

Responsibility		
Source	***Original construct***	***Reliability data***
Hofmann & Moregeson, 1999	Safety commitment	Cronbach's α = 0.89
Brondino et al., 2011	Supervisor's safety climate Co-workers safety climate scale	Confirmatory factor analysis with good model fitness
Burt et al., 1998	Caring and responsible co-worker (CARE)	Cronbach's α = 0.91
Cheyne, 1998	Individual responsibility Personal involvement Safety management	Confirmatory factor analysis with good model fitness

Organisational goals and values		
Source	***Original construct***	***Reliability data***
HSE, 1999	Pressure for production	NA
Cox & Cheyne, 2000	Priority of safety	Cronbach's α = 0.72
IAEA, 2006	Safety is a clearly recognised value	NA
Tharaldsen et al., 2008	Safety prioritisation Safety versus production Individual motivation	Cronbach's α : 2001 = 0.86, 2003 = 0.72 Cronbach's α : 2001 = 0.70, 2003 = 0.73 Cronbach's α : 2001 = 0.67, 2003 = 0.67
Cheyne et al., 1998	Safety standards and goals	Confirmatory factor analysis with good model fitness

Communication		
Source	***Original construct***	***Reliability data***
HSE, 1999	Communication	NA
Glendon & Litherland, 2001	Communication and support	Cronbach's α = 0.93
Mearns et al., 2003	Communication about safety	NA
Kath et al., 2010	Upward safety communication	Cronbach's α = 0.86
Hofmann & Mogeson, 1999	Safety communication	Cronbach's α = 0.85
Tucker & Turner, 2011	Safety voice	Cronbach's α = 0.92

Supportive environment		
Source	***Original construct***	***Reliability data***
HSE, 1999	Job security and satisfaction	NA
Mearns et al., 2003	Work pressure	NA
Cox & Cheyne, 2000	Work environment	NA
Glendon & Litherland, 2001	Relationships Work pressure	Cronbach's α = 0.82 Cronbach's α = 0.89
Compian et al., 1993	Communication/cooperation within workgroup	Cronbach's α = 0.81
Stephenson, 2010	Minimisation of silo mentality	Cronbach's α = 0.76

Learning		
Source	***Original construct***	***Reliability data***
IAEA, 2006	Safety is driven by learning	NA
Cigularov et al., 2010	Error management climate	Cronbach's α = 0.90
Olsen, 2010	Learning, feedback, and improvement	Cronbach's α = 0.78

Trust in people and safety systems		
Source	***Original construct***	***Reliability data***
Conchie & Donald, 2009	Safety-specific trust	Cronbach's α = 0.83
HSE, 1999	Accidents/incidents/near misses	NA
dos Santos Grecco et al., 2014	Just culture	NA

Engagement		
Source	***Original construct***	***Reliability data***
HSE, 1999	Perception of personal involvement in health and safety	NA
Means et al., 2003	Involvement in health and safety	NA
Cox and Cheyne, 2000	Involvement	Cronbach's α = 0.71

Resilience		
Source	***Original construct***	***Reliability data***
Stephenson, 2010	Minimisation of silo mentality	Cronbach's α = 0.76
	Capability and capacity of internal resources	Cronbach's α = 0.72
	Staff engagement and involvement	Cronbach's α = 0.71
	Information and knowledge	Cronbach's α = 0.75
	Innovation and creativity items	Cronbach's α = 0.72
	Devolved and responsive decision making	Cronbach's α = 0.73
	Internal and external situation monitoring and reporting	Cronbach's α = 0.82
	Strategic planning	Cronbach's α = 0.68
	Participation in exercise	Cronbach's α = 0.79
	Proactive posture items	Cronbach's α = 0.70

About RMIT Centre for Construction Work Health and Safety

The RMIT Centre for Construction Work Health and Safety provides leading-edge, applied research to the construction and property industries. Our members are able to work with organisations to analyse health and safety (H&S) performance and identify opportunities for improvement. We can develop and evaluate innovative solutions, provide specialised H&S programs or undertake other research-based consulting activities. Our work addresses real-world H&S challenges and our strong international linkages provide a global perspective to our research.

Website: http://www.rmit.edu.au/research/health-safety-research

E-mail: constructionwhs@rmit.edu.au