Aligning Safety Policy Development, Learning and Implementation: from Boardroom to Site

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Abstract

This paper has two aims: (1) to investigate if any misalignment exists from the company's boardroom decision making to onsite implementation in relation to construction safety and (2) to understand how on-site workers learn and develop their safety attitude, skills and knowledge. To achieve these aims, questionnaires were developed and distributed and interviews were conducted with key project leaders. Analyses found several misalignments and human factor barriers during the process of safety policy implementation and improvement. This paper suggests that the misalignments can be minimised by realising the nature of safety learning in practice which leads to changes in the safety learning approach for on-site workers, and the barriers can be removed by improving project leaders' skills, such as self-awareness, visioning, apparent sincerity, and understanding people.

Keywords: construction safety, safety implementation misalignment, safety learning, skills of project leaders

1. Introduction

Although senior management commitment is indispensable for successful construction safety program implementation, safety should not only be the responsibility of senior managers. Without the participation of onsite personnel and workers, construction safety implementation will never be effective. Whilst the senior management may be committed to safety, the onsite workers' interpretation and implementation of safety may not be the same or aligned with the senior management expectations. Research has shown that there is a real issue of misalignment in implementing safety policy from the governments' policy development, to company's boardroom decision, and to onsite implementation. Habibi and Fereidan (2009) assessed the attitudes of three levels of refinery personnel in Iran, including top management, supervisory staff and frontline workers, towards safety culture in the organisation, and they found significance differences between the management level and both the supervisory staff and frontline workers. In the Thai construction industry, Pungvongsanuraks and Chinda (2010) found a misalignment of safety culture perceptions between management and workers, where top management believes that safety empowerment and training are important whilst workers consider this as a waste of time because they want to focus their effort at maintaining their productiveness. Likewise, Fung et

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al. (2005) found divergences of behaviour, attitude and perception towards safety culture among top management, supervisory staff and frontline workers in the Hong Kong construction industry. Similarly, Chen et al. (2012) found a gap in construction safety climate awareness between management and workers in Taiwan.

This paper aims to investigate whether this misalignment exists in the Australian construction industry using quantitative and qualitative methods. It will also discuss barriers that may hinder safety policy implementation. By considering the learning process of workers for developing their safety knowledge and skills, this paper will provide recommendations to minimise safety implementation misalignment in construction organisations.

2. Research Methods

2.1 Quantitative method

Questionnaire survey was the quantitative method used in this research. This method was suitable to collect a large number of data for comparing results between groups. A self-assessed questionnaire was used to assess the level of safety climate in construction projects. The questionnaire items were developed based on a review of the existing safety climate studies (Zohar, 1980; Brown and Holmes, 1986; Dedobbeleer and Béland, 1991; Williamson et al., 1997; Cox and Cheyne, 2000; Glendon and Litherland, 2001; Mohamed, 2002; Lin et al., 2008; Zohar and Luria, 2005; and Zhou et al., 2009) to find commonalities and ensure the content validity of the questionnaire. Twenty-two items were identified based on this existing literature.

To fulfil the research aims, project management personnel, such as project managers, site managers, project engineers and supervisors, working at large construction organisations in Australia were selected as the target population. These organisations typically consider safety as one of their priorities and have an established safety management system. Members of the Australian Constructors Association (ACA), an association representing the Australia's leading construction organisations, were invited to participate in the survey. As a result of this, 356 project management personnel participated in the questionnaire survey. However, 83 responses had missing data, and were discarded. In total, 273 responses were valid and analysed further.

In questionnaire development, only those items that provide the best representation of the construct should be retained. Item analysis was performed to evaluate the 22 items identified initially and to retain only those with the highest item-to-total correlations, i.e., item-to-total correlations of 0.40 or greater (Nunnally and Bernstein, 1994). Item no. 19 (it is only a matter of time before I am involved in an accident) had a correlation of 0.158 and was eliminated. The remaining items were further evaluated to identify those that could not load to any factors or generated loadings that did not exceed 0.4 (Lin et al., 2008). Factor analysis with a principal components method and varimax rotation was carried out for this purpose (Nunnally and Bernstein, 1994). The pattern of factor loadings showed that item no. 4 (necessary equipment/ tools to perform the job safely are readily available) did not load to any factors, and so it was eliminated.

In order to determine the factor structure of the 20-item safety climate questionnaire, factor analysis with principal axis method and varimax rotation was performed. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.915 and Bartlett's test of sphericity is significant ($p<0.05$) indicating that factor analysis is suitable for analysing the data. Based on the eigenvalues (greater than one) and the scree plot, four dimensions of safety climate were extracted, namely, management commitment, safety training, employee's involvement, and safety rules. The items that form each dimension are listed in Section 3.

2.2 Qualitative method

Semi-structured interview was the qualitative method adopted to provide insights from construction practitioners and to enrich the quantitative research results. Potential interview participants were selected from the questionnaire survey respondents who indicated their willingness to participate in the interview. Furthermore, the interview participants were purposely chosen to represent various roles in construction projects. A total of eight interviews were conducted and the profile of the interview participants is presented in Table 1. This variety of job positions is advantageous for the research because it enables the proposed relationships to be verified by industry practitioners from different management functions. Furthermore, the interview participants had an average of 21.8 years of experience in the construction industry, thus ensuring that they had sufficient experience of safety issues across different contexts. Two key questions were asked during the interviews. The first question was about common issues or barriers that hinder safety performance improvement in the Australian construction industry. The second question sought the opinions of the interview participants concerning the misalignment in construction safety implementation and/or perceptions between management and on-site workers.

Table 1: Interview participants

Code	Position	Age	Education	Experience (yr)
CAM-01	Commercial administration manager	50-54	Bachelor	37
PM-02	Project manager	45-49	Bachelor	24
HSEM-03	Branch EHS manager	45-49	Diploma	28
PE-04	Project engineer	25-29	Bachelor	5.5
CM-05	Construction manager	35-39	Bachelor	19
CE-06	Commissioning engineer	>55	Diploma	36
SM-07	Site manager	40-44	High school	15
HSEM-08	National HSE manager	40-44	Diploma	10
Average year of work experience =				**21.8**

3. Results and Discussions

3.1 Safety Climate Perceptions: Managers vs. Supervisors

The quantitative data were classified into two groups. The first group is managers comprising construction managers, project managers, site managers, safety managers, and

other managerial positions. The second group is supervisors comprising project engineers, site engineers, site supervisors, safety officers, and other engineering or supervisory positions. The t-test with independent samples was used to compare the means of the two groups and the results are presented in Table 2.

Table 2: Safety climate comparison between managers and supervisors

No	Items	Group 1 (N=178)	Group 2 (N=95)
	Dimension 1: Management commitment	**4.21**	**3.95**
SC1	Top management considers safety as equally important as production and profits.	4.31	4.07
SC2	Top management acts decisively when a safety concern or problem is raised or occurred.	4.35	4.18
SC3	Top management evaluates (give rewards/discipline) employees' safety performance.	3.76	3.65
SC5	Site safety personnel have sufficient power and authority.	4.15	4.02
SC6	Top management requires each manager/department to improve/maintain safety performance.	4.31	4.00
SC7	My supervisor or line manager follows safety procedures in every situation, e.g., during deadline, behind schedule, planning stage.	4.11	3.86
SC8	My supervisor or line manager is committed and shows interest towards safety.	4.31	4.12
SC9	My supervisor or line manager considers my safety performance.	4.20	3.81
SC10	My construction project site is a safe place to work.	4.28	3.95
SC11	Supportive working relationships exist in the project when it comes to safety.	4.20	3.87
SC15	The company encourages and acts upon feedback from employees on safety issues.	4.19	3.94
SC16	The company frequently holds safety campaigns or safety awareness programs.	4.20	3.94
SC22	Safety rules and procedures are enforced in the project.	4.34	4.00
	Dimension 2: Safety training	**4.10**	**3.85**
SC12	I have received enough training to perform my job safely.	4.04	3.82
SC13	My safety training provides sufficient knowledge to identify potential safety risks and hazards.	4.15	3.87
	Dimension 3: Employee's involvement	**4.51**	**4.20**
SC17	Safety is one of my priorities when I do my job.	4.58	4.33
SC18	I am involved to improve safety performance in the project.	4.44	4.07
	Dimension 4: Safety rules	**4.10**	**3.86**
SC14	Company's safety policy, information, and issues are available to everyone involved.	4.35	4.07
SC20	The safety rules and procedures in the project/ company are practical, realistic, and appropriate.	3.98	3.73
SC21	It is easy to access safety rules, procedures, and information when required.	3.97	3.77
	Safety Climate Average	**4.21**	**3.95**

The underline numbers signify significant differences between the two means at 0.05. Similarly as found in previous studies, the results also confirm that there are different safety perceptions between the management and supervisory levels in the Australian construction industry. Generally speaking, managers perceived higher level of safety climate than the supervisors. This condition is disconcerting as it indicates that the managers are detached from the real safety condition on-site. This misalignment needs to be minimised if safety performance to be further improved.

3.2 Sources of misalignment

Thematic analysis of the interview transcripts supports the quantitative results. All interview participants agreed that there is a misalignment in safety implementation in their organisation. The managers have certain expectations in the implementation of safety policies and system, but the implementation at the site level does not meet these expectations. It seems that the enforcement of both national and organisational safety policies is not adequate to correct this.

There are various sources causing this misalignment:

- The first source is the experience and knowledge of individuals. Interviewee PM-02 said that the management understands the law and what needs to be done to meet the requirements; however, the workers may not understand this, thus creating a misalignment. Interviewee CAM-01 explained further that the management is placed in a situation that allows them to have greater understanding of potential safety risks because of their experience and training. Supervisory level, on the other hand, may not possess the same experience and associated knowledge when it comes to identifying and managing safety risks.
- The second source is the differing perceptions on the importance of safety. The managers may consider safety as an important aspect in their projects. As such, they try to identify as many safety risks as possible in the project and fill in many paper works and forms. The supervisors, however, may perceive safety as an extra work. Since the managers have identified many risks, the supervisors feel compelled to do hours of tool box talks and prepare safe work method statements. From the workers' perspective, they simply want to do their day-to-day tasks, but they are required to listen to lengthy tool box talks and fill in numerous safety permits which they consider as a hindrance to their productivity.
- The third source is ineffective safety management system caused by poor skill training and development programs. For example, the management wants to progress quickly, but their human resource does not have the capacity to do it. Interviewee HSEM-08 stated that it is impossible to improve safety without a specific system in place and capable people who can follow and manage the system. There is a timeframe involved in an investment, in the people, and in the system to get the outcome that the management is after. Interviewee CE-06 also stated that when the management writes procedures that cannot be achieved by people, then the whole thing is destined to failure. Furthermore, the management tends to defend their system by saying that they have applied training process to equip their people.

However, they may have not assessed the effectiveness of such training. An attempt to accelerate the learning process by 'forcing' people to sit in a room for several days and expecting them to implement what they have learnt is pointless. It should also be considered that some people may learn well in a classroom-structured environment, but the others may feel that this approach is irrelevant and a waste of time as pointed out by several interviewees including CAM-01, PE-04, CM-05, and CE-06.

3.3 Barriers in safety program implementation

When the interview participants were asked about barriers in implementing safety policies and programs, four barriers were put forward: complacency, multi-sociocultural characteristic, lack of safety commitment, and resistance to change. First, in relation to complacency, management must acknowledge the fact that workers will cut corners, take shortcuts, get distracted, and make mistakes no matter how perfect the safety management system is. Therefore, it is important to scrutinise the system to help minimise those mistakes in critical times. The key steps, from the safety perspective, should be determined. If workers tend to make mistakes at a particular step, then the risks should be properly identified and the right controls be put in place. This is not about writing more statement or contents in the work instructions or project plan; it is about understanding the workforce. For example, 'if the workers are doing shortcuts because they want to be home at 5.30pm to watch a sport match, then the managers need to acknowledge this fact and adjust their plan to eliminate safety risks of rushing with work in late afternoon' (HSEM-08).

The second barrier is the multi-cultural characteristic of the Australian construction industry and the diverse backgrounds of construction workforce. An interview participant (CAM-01) gave a simple, but intriguing example on how a simple question 'do you understand?' can cause miscommunication, which may lead to a bigger problem. In responding to this question, when individuals from a certain culture say 'yes', it means 'yes, they understand'. On the other hand, for individuals from another culture, they may say 'yes' because of politeness, whilst in reality they actually do not understand or only understand partially. Furthermore, cultural background also influences how people develop certain values or concepts in regards to safety. Interviewee CM-05 highlighted that Australians are risk-taking people who have a belief that encourages them to trust themselves and take risks. This belief may make them over confident and do unnecessary risk-taking behaviours.

The third barrier is poor safety commitment from senior management and client. Many construction practitioners still focus on traditional project objectives like time and cost instead of safety. Even senior managers are also susceptible to this traditional mindset in their leadership and operation. They may say that they are committed to safety, but during tough times they 'overlook' safety and strive to gain as much profit as possible from the project. Clients are also responsible in creating a work environment that sets safety aside. In many cases, cost is the main factor that determines which company would win tenders, a condition that is particularly prevalent in government projects. Without the support and commitment from the clients, it is difficult for construction organisations to uphold safety whilst attaining time and cost objectives (PM-02, HSEM-03, SM-07).

The fourth barrier, which is also related to human characteristic, is the resistance to change. People, who have been in the industry for many years, believe that they 'know' how to work and do not like to change. They tend to resist new things that they do not understand. Although some may realise that there is a better and safer way to work, but since they have done it in a certain way for a long time, it is hard for them to change.

3.4 Removing the barriers and rectifying the misalignment

This research has identified several strategies for removing the barriers and rectifying the misalignment, including top management commitment, safety learning and safety skill development, and each of these strategies is discussed in details in the following sections.

3.4.1 Top management commitment

In order to rectify this misalignment, there is a basic factor that should be focused upon, that is, management commitment. Safety policy and program/system implementation must flow in a top down manner because top management is the one who has the authority to establish safety budget and enforce safety implementation throughout the organisation. Senior managers should be committed and accountable to safety by doing the talking, i.e., they should consider 'safety first'. By demonstrating such commitment, they become the initiator for fostering a strong safety culture in the organisation (PM-02, HSEM-03, CM-05, HSEM-08).

3.4.2 Safety learning

The interview participants explained how their organisations provide safety training and learning for implementing standard safety measures to maintain and improve safety performance. Initially, they train everyone to a minimum standard, for example, by using the Safety White Card Course, which has been mandated in Australia, requiring individuals to complete the course before they can undertake any construction activities. Passing this course, therefore, can be considered as a common denominator and an indication of basic safety competence in the Australian construction industry. Achieving this minimum requirement is far from sufficient for construction organisations who aspire to uphold safety as one of their priorities and project objectives. Consequently, they 'upgrade' their personnel's safety knowledge by authorising regular safety training, safety induction to explain work hazards, and a daily tool box talk at the start of the day.

However, there is an issue concerning the ineffectiveness of the current safety training programs. A study has shown that a classroom-like training setting only has short-term impacts on safety performance and that workers tend to forget what they have learnt and as a result safety performance returns to where it was before (Laukkanen, 1999). Learning is clearly necessary for construction practitioners, especially workers, to perform their work safely. This learning is fundamental for maintaining and improving safety performance in the construction industry. However, although organisational learning and knowledge management have been widely implemented, current practices seem to have overlooked the problems and complexities of knowledge making and learning process (Styhre, 2006).

In many cases, learning was seen as an acquisition of knowledge which can be accomplished through classroom instruction and training. This view of learning considers that knowledge can be easily transferred from one medium to the minds of learners (Gherardi and Nicolini, 2000, 2002). From this perspective, learning is mainly focused on its outcomes and very much taken as a "given". This view sees learning as being achieved by simply plucking an item from the tree of knowledge (Tsoukas and Mylonopoulos, 2004). Many educational and training methods adopt a philosophy that views learning as a product or on-the-shelf solution that can be simply added to the mind or readily stored and transmitted via some kind of electronic technology (Hager, 2004). Consequently, much organisational learning literature and many studies are concerned with the potential to codify, package, and disseminate knowledge throughout organisations and workplaces. Although this approach may seem to be practical and straightforward, it is important to realise that learning does not comprise a technological device aimed at capturing, processing, storing, and disseminating data and information, but is situated in local practices where people collaborate and cooperate to solve daily issues (Styhre, 2006). From this perspective, safety should be considered as the final outcome of a collective construction process. A safe workplace, therefore, is the result of constant engineering of diverse elements, e.g., skills, materials, interpersonal interactions, which are integral to the work practices of various project stakeholders. In other words, learning about safety involves taking part in the social world, i.e., learning takes place among and through others. Knowledge is integrated and distributed in everyday activities, and so learning cannot take place if participation in those activities is not possible (Gherardi and Nicolini, 2002).

Although the importance and necessity of existing safety training programs is undeniable, learning should not only be seen as a product, but also a process where the learner is part of the environment (Hager, 2004). Rather than solely depending on 'arm's length' methods, there is a need to use approaches to safety learning that are more collaborative, and which prioritise dialogue and practical problem solving (Bluff, 2011). Aligning with this view, some interview participants (CAM-01, PE-04, CM-05, SM-07, and HSEM-08) voiced the need to have a kind of on-the-job training and informal training/learning for safety. On-the-job training is flexible and relevant to what people do in the organisation. It is a type of training in which an experienced employee adopts or mentors a new employee to teach him or her how to perform job duties (Samson and Daft, 2009). Informal training, on the other hand, occurs through interactions and feedback among employees as a result of a learning need in the context of working. Much of what people know about their jobs they learn informally from asking questions and getting advice from other employees and their supervisors, rather than from formal training programs. Informal training may involve group problem solving, job shadowing, coaching, or mentoring (Mathis and Jackson, 2011). As shown previously, a great deal of safety learning occurs informally, thus construction organisations should be able to harvest the advantages of informal learning by developing a work environment that promotes such learning. Having argued the importance of informal training, construction organisations should also make sure that the correct learning contents are used and exchanged during the learning process. Unsafe habits, shortcuts, and ways to bypass regulations, for example, are not learning experience that organisations want to nurture. Therefore, the correct culture of safety has to be developed first and become the basis of both on-the-job and informal trainings.

3.4.3 Developing project leaders' safety skills

It is fair to say that the safety implementation barriers identified are related to human factors. As such, there is a need for project leaders to improve their skills to manage these factors. Research has found that self-awareness, visioning, and apparent sincerity are the foundational skills. They are precursors of scoping and integration, and self-management, which are the first-tier mediator skills. Thereafter, the second-tier mediator skills are social awareness, social astuteness, and relationship management (Zou and Sunindijo, 2012). Five of these skills are discussed below.

Self-awareness is the first foundational skill because when people are aware of their values, strengths, and weaknesses, it will affect the way they manage themselves (self-management) which will also be reflected on their actions. These actions, subsequently, will impact on the quality of relationships they build with others, which eventually determine their leadership effectiveness (HSEM-03 and CM-05). Previous studies also found that self-awareness is the core and starting point of self-management, relationship management, and effective leadership (Goleman, 2001).

Visioning, as the second foundational skill, is closely related to goal setting, both personal and organisational goals. In the context of this present research, safety should be part of the overall vision in which zero harm set as one of the key project objectives (PM-02). A maxim which says 'what you see is what you get' cannot be any truer in relation to this concept of visioning (HSEM-03, CM-05, and HSEM-08). Another important consideration about visioning is that the goals must be achievable and clearly expressed (CE-06). This is the basis to motivate and inspire people by providing meaning and challenge to their work (Samson and Daft, 2009). Visioning helps project leaders establish scope and integrate safety into specific goals and expectations, which align with the capability of the human resource and the organisation in general. When a goal is beyond the capacity of the organisation, the goal would simply be nice words on a paper without any realisation in practice (CE-06).

Apparent sincerity, the third foundational skill, is needed to create positive first impressions, which is important in every socialisation process. First impressions are crucial in any relationship because they are lasting and influence the way people see subsequent data about the perceived object or person. Therefore, project leaders need to appear sincere and create a first impression which conveys that they are genuinely interested in the effective management of safety risks and improvement of safety performance. In addition, apparent sincerity is needed to communicate safety vision effectively because project leaders have to cultivate trust first before influencing people to accept the vision. As a consequence of this, other project stakeholders will recognise the importance of safety and project leaders will have a positive start on influencing the others to consider safety as equally important as other project objectives.

Social awareness and social astuteness are also important skills for understanding people and remove barriers that hinder safety program implementation and improvement as explained by interviewees CAM-01, PM-02, and SM-07. The multi-stakeholder characteristic

of construction projects and the diverse backgrounds of construction workforce make these skills crucial for project management personnel to communicate effectively, build trust, and embed safety values in others. Completing a project is about getting work done through others. Without the ability to understand people, it is difficult to relate to others and get work done through them. The temporary nature of construction projects and the involvement of multiple stakeholders also limit the luxury of gradually building long-term relationships with the team. As a result, project leaders have to be able to quickly and accurately read and understand the others involved in the project execution to develop trust and productive relationships for achieving project success.

4. Conclusion

Figure 1 summarises the issues and factors that have been discussed in this paper. There is misalignment in safety implementation between top/senior management, supervisory, and worker levels caused by differences in knowledge, experience, perceptions on the importance of safety, and poor safety training programs. Rectifying this misalignment requires project leaders and senior managers, as well as frontline workers to modify their safety learning approach. Safety learning and knowledge development should depend not only on classroom-structured approach, but also on a realisation that safety learning occurs in practice through interactions with artefacts and people at work. Safety learning requires active participation of the learner in the real project execution context.

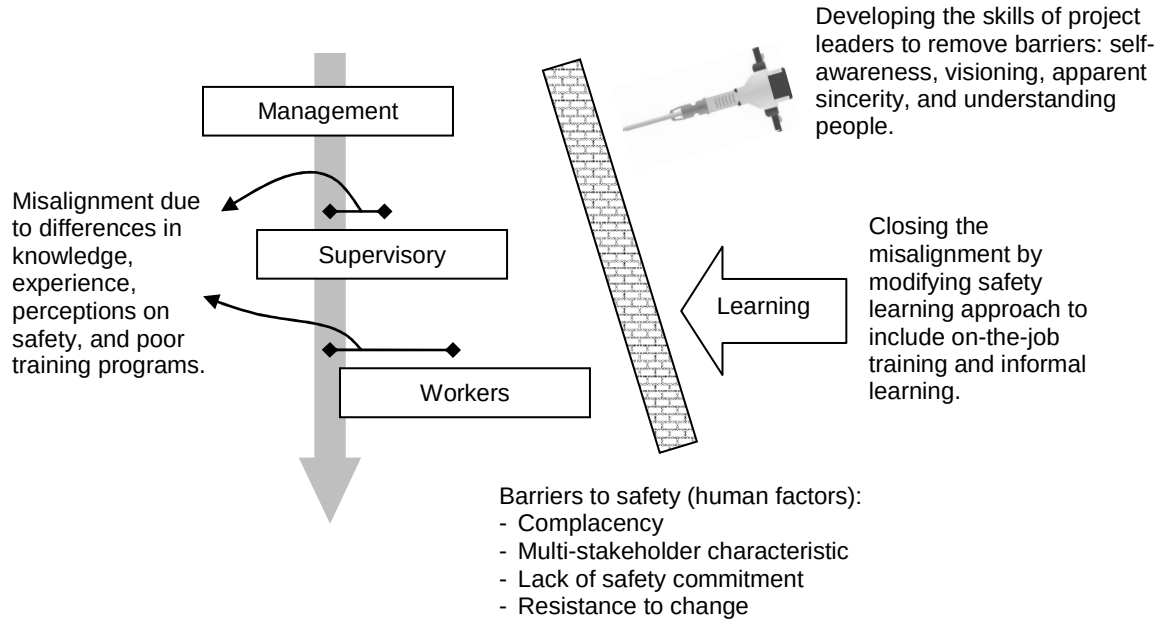

Figure 1: Rectifying the misalignment and removing the barriers in safety implementation

Such approach, however, will not be successful without removing the existing human factors barriers that hinder safety implementation. Removing these barriers requires project leaders

to develop their skills which include aspects of self-awareness, visioning, apparent sincerity, and social astuteness and social awareness to understand people.

Future research should aim at developing assessment instrument and learning strategies for project leaders to develop their skills for safety. At the worker level, construction organisations need to find ways to promote the effectiveness of their on-the-job safety training and informal safety learning process, that will improve workers mental model, attitude and technical skills in recognising safety risk and mitigate the risks by developing and implementing safe work methods and behaviour.

References

Bluff L (2011) *Something to Think About - Motivations, Attitudes, Perceptions and Skills in Work Health and Safety*, Canberra, Safe Work Australia.

Brown R L and Holmes H (1986) "The use of a factor-analytic procedure for assessing the validity of an employee safety climate model", *Accident Analysis & Prevention*, 18(6): 455-470.

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

Dedobbeleer N and Béland F (1991) "A safety climate measure for construction sites", *Journal of Safety Research*, 22(2): 97-103.

Gherardi S and Nicolini D (2000) "To transfer is to transform: The circulation of safety knowledge", *Organization*, 7(2): 329-348.

Gherardi S and Nicolini D (2002) "Learning the trade: A culture of safety in practice", *Organization*, 9(2): 191-223.

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

Goleman D (2001) An EI-based theory of performance, In: C Cherniss and D Goleman (Eds.), *The Emotionally Intelligent Workplace*, 27-44, San Francisco, Jossey-Bass.

Fung I W H, Tam C M, Tung K C F, and Man A S K (2005) "Safety cultural divergences among management, supervisory and worker groups in Hong Kong construction industry", International Journal of Project Management, 23(7): 504-512.

Habibi E and Fereidan M (2009) "Safety cultural assessment among management, supervisory and worker groups in a tar refinery plant", *Journal of Research in Health Sciences*, 9(1): 30-36.

Hager P (2004) "Conceptions of learning and understanding learning at work", *Studies in Continuing Education*, 26(1): 3-17.

Laukkanen T (1999) "Construction work and education: Occupational health and safety reviewed", *Construction Management and Economics*, 17(1): 53-62.

Lin S, Tang W, Miao J, Wang Z, and Wang P (2008) “Safety climate measurement at workplace in China: A validity and reliability assessment”, *Safety Science*, 46(7): 1037-1046.

Mathis R L and Jackson J H (2011) *Human Resource Management*, Mason, OH, South-Western Cengage Learning.

Mohamed S (2002) “Safety climate in construction site environments”, *Journal of Construction Engineering and Management*, 128(5): 375-384.

Nunnally J C and Bernstein I H (1994) *Psychometric Theory*, 3rd ed., New York, McGraw-Hill.

Pungvongsanuraks P and Chinda T (2010) “Investigation of safety perceptions of management and workers in Thai construction industry”, *Suranaree Journal of Science and Technology*, 17(2): 177-191.

Samson D and Daft R L (2009) *Management*, 3rd Asia Pacific ed., South Melbourne: Cengage Learning.

Styhre A (2006) “Peer learning in construction work: Virtuality and time in workplace learning”, *Journal of Workplace Learning*, 18(2): 93-105.

Tsoukas H and Mylonopoulos N (2004) “Introduction: Knowledge construction and creation in organizations”, *British Journal of Management*, 15(S1): S1-S8.

Williamson A M, Feyer A, Cairns D, and Biancotti D (1997) “The development of a measure of safety climate: The role of safety perceptions and attitudes”, *Safety Science*, 25(1-3): 15-27.

Zhou Q, Tang W, Fang D, and Wang T (2009) “Organizational safety climate in construction: The development of instrument and factor structure”, *Proceedings of the CIB W099 Conference, Working Together: Planning, Designing and Building a Healthy and Safe Construction Industry*, 21-23 October, Melbourne, Australia.

Zohar D (1980) “Safety climate in industrial organizations: Theoretical and applied implications”, *Journal of Applied Psychology*, 65(1): 96-102.

Zohar D and Luria G (2005) “A multilevel model of safety climate: Cross-level relationships between organization and group-level Climates”, *Journal of Applied Psychology*, 90(4): 616-628.

Zou P X W and Sunindijo R Y (2012) “Skills for managing safety risk, implementing safety task, and developing positive safety climate in construction project”, *Automation in Construction*, http://dx.doi.org/10.1016/j.autcon.2012.10.018.