

Managing workplace safety risks: a supply chain perspective

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Executive Summary

Workplace safety represents significant risks. The catastrophic consequences of workplace safety incidents include severe injury, tragic loss of life, huge insurance costs, legal consequences and other losses. Although there is considerable literature relating to safety in the immediate workplace, there has been limited research focus examining supply chain safety/risks. Hence, this report addresses workplace safety from a supply chain perspective. It is recognised that workplace incidents/injuries may have their root cause upstream along the supply chain and not only just in the immediate workplace.

This report is based on a review of the relevant literature. Factors contributing to workplace safety are highlighted. These relate to the operations function, the human resource function and other external factors. A number of existing safety models are identified including the hazard management approach adopted by WorkSafe Victoria (WorkSafe). A supply chain perspective is absent from workplace safety risk management models. The current practices are dominated by a focus within the organisation without taking the supply chain into account. However, the Occupational Health and Safety Act 2004 and the 'Chain of Responsibility' legislation initially developed by the National Transport Commission began to deal with safety issues beyond the four walls of the organisation.

Two key characteristics are underlined by the supply chain perspective (Mentzer *et al.*, 2001). First, it implies a systems approach to view the whole supply chain as a single entity rather than a set of fragmented parts. Second, it requires a strategic orientation toward cooperative effort to synchronize and converge intra and inter-firm operational and strategic capabilities into a unified whole. This approach and strategic orientation can be applied in managing workplace safety risk. The supply chain ripple effect makes it essential to manage supply chain risks in a collaborative manner with other supply chain partners (Norrman & Jansson, 2004). The supply chain must not be treated in a fragmented manner but as a whole. The risks faced by one entity could be addressed through interactions with other supply chain partners. A collaborative supply chain provides an efficient platform for supply chain risk management. This has already been demonstrated in the transportation industry to improve road safety for drivers. 'Chain of Responsibility' provisions in legislation have provided clear identification of responsibilities of the various stakeholders involved and hold them responsible for breaching their responsibility.

A supply chain perspective is taken to developing a workplace safety management model. This model is adapted from the one proposed by Manuj and Mentzer (2008). Compared with current models applied to workplace safety risk management, in the proposed model, safety risk identification, control and monitoring are applied at the supply chain level rather than within the organisation. Based on the results of the assessment, appropriate measures of risk control can be determined which can include elimination, substitution, engineering, administration and the use of personal protective equipment.

In implementing the proposed model, it will be necessary to enlarge the current roles and responsibilities of WorkSafe inspectors, regulators, health and safety representatives, unions, governments and industry groups so that supply chain safety risk management can be effectively carried out. There must be effective

knowledge sharing along supply chain partners about any safety issues and collaborative efforts can be made to reduce workplace safety risks.

Future research is recommended to refine and validate the proposed model through workshops with representation from key stakeholders as well as testing of the model through implementation within several high risk industries.

Background

The importance of workplace safety has increased significantly over the past three decades as a result of advances in technology and the increasing complexity in technical/production systems (e.g. use of advanced manufacturing technologies), the dramatic changes occurring in logistics and operations practices (e.g. the use of Just-in-Time and Lean Production Systems) and the growing diversity of the workforce (Brown, 1996). In some respects, the trend towards globalisation and outsourcing has further increased concern relating to workplace safety. Materials, components and equipment used in many Australian workplaces are often sourced from different parts of the world and the supply chains associated with these are often complex. Local managers have limited knowledge of the risks associated with these supply chains, some of which may result in workplace safety issues and incidents.

Workplace safety represents significant risk to individuals, companies, industries, governments and the community as a whole. The catastrophic consequences of workplace safety incidents include severe injury, tragic loss of life, huge insurance costs, legal consequences and other losses (Brown, 1996; Cantor, 2008). Of the 12 million people who were employed in Australia at some time during the 2009-10 financial year, 5.3% (640,700 people) experienced at least one work-related injury or illness (ABS, 2012). The work-related injury rate in 2009-10 was 53 injuries per 1,000 people employed, down from a rate of 64 per 1,000 in 2005-06. The fall in the overall work-related injury rate since 2005-06 was driven by a reduction among men (from 74 to 55 per 1,000), while the rate among women remained steady (at 51 per 1,000). On a global scale, approximately 1.1 million people die each year in workplace related injuries (NOHSC, 2002).

Although efforts by both industries and researchers have reduced the risk of injury in the workplace significantly over the past two decades, hundreds of injuries and serious incidents still occur every day. In Australia, there have been many approaches applied by governments, unions and organisations to reduce the financial and social cost to both society and workers. Each state has enacted regulations with strict rules and harsh penalties for non-compliance. Thousands of pages of codes of practice, guidelines and standards are formed to support these legal requirements. Organisations have themselves implemented many procedures, policies and standards recognising the huge financial and legal exposure of poor safety. Cost reduction goals and regulatory pressure have also pushed forward academic research in workplace safety issues (Brown, 1996).

Although there is considerable literature relating to safety in the immediate workplace, there has been limited research focus examining supply chain safety or supply chain risks. Hence, this report addresses workplace safety from a supply chain perspective. It is recognised that workplace incidents/injuries may have their root cause upstream along the supply chain and not only in the immediate workplace.

This report reviews several workplace safety models proposed in the academic literature and those used in practice. It discusses the concept of supply chains and supply chain risk management and then proposes a model of workplace safety risk

management encompassing the supply chain perspective. Conclusions and some recommendations for future research are presented.

Research Questions/Issues

This report sets out to address the following research questions/issues:

- Identify existing supply chain management models/concepts.
- Do these models include safety improvement?
- How could the models be applied to improve supply chain safety?
- Are there any important regulatory issues to consider with respect to applying supply chain safety initiatives – what powers do regulators need to improve safety?
- Are there any supply chain models or aspects of supply chain models which warrant further exploration.

Method

This report is based on a review of the relevant literature. The method involved an examination of articles published in the leading academic journals with respect to the research questions/issues mentioned above. Relevant reports available from industry associations/regulatory bodies and government agencies were also used in our review.

Results

Factors Contributing to Workplace Safety and Relevant Models

Workplace safety impacts everyone at work and families at home. Besides the emotional burden due to injury or death, there are also financial losses resulting from insurance costs and legal consequences (Brown, 1996; Cantor, 2008). As a result, there are many professions and resources dedicated to reduce safety risk in the workplace.

In academic research, there is a burgeoning interest in exploring workplace safety issues. Brown (1996) highlights three major factors contributing to increasing workplace safety issues as illustrated in Figure 1. It is clear that employees are working in an increasingly complex and hazardous environment and management must take responsibility for identifying and eliminating the root causes of potential incidents/injuries.

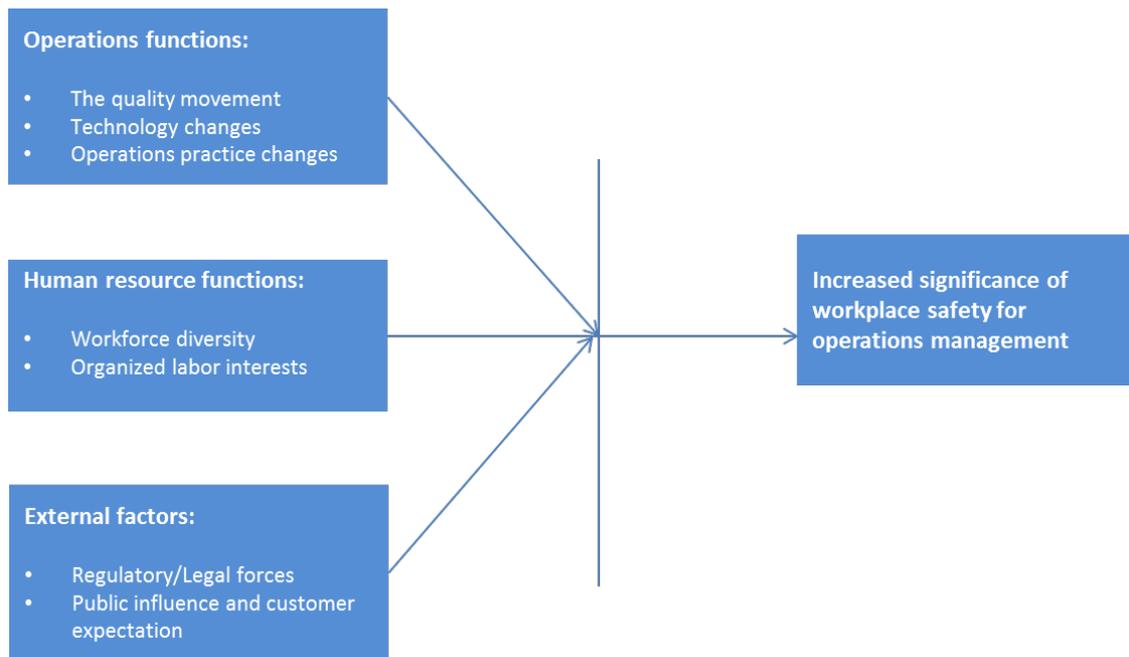


Figure 1: Factors contributing to workplace safety (Source: Brown 1996)

Besides identifying the individual factors contributing to workplace safety risk, there are also studies that adopt a systematic approach to managing safety risk. For example, Makin and Winder (2008) proposed a framework which characterised three main areas where hazards in the workplace occur (see Figure 2). These are (i) the people to whom a duty of care is owed, (ii) the physical workplace with facilities, infrastructure and hardware that people use, and (iii) the management strategies and systems employed. The authors proposed a number of prevention strategies for dealing with hazards occurring in these three areas including: equipping people with knowledge and skills to avoid hazards, applying risk assessment and control to the point where alterations are made to the existing physical environment and provision of regular feedback and communication in the system, etc. Bellamy *et al.* (2008) proposed a warning triangle for controlling workplace safety risk consisting of a safety management system, organisational factors and human factors and (see Figure 3). Research has also explored workplace safety issues from other perspectives. For example, Credo *et al.* (2010) investigated the relationship between workplace safety with organisational ethics, leadership and organisational support. Arezes and Miguel (2008) studied the relationship between individual, contextual and perceptual-cognitive factors. Christian *et al.* (2009) examined safety issues from the role of person and situational factors. Thomason and Pozzebon (2002) examined the relationship between safety and compensation claim management practices. Despite the variety of the perspectives mentioned above, a supply chain perspective is absent from this literature.

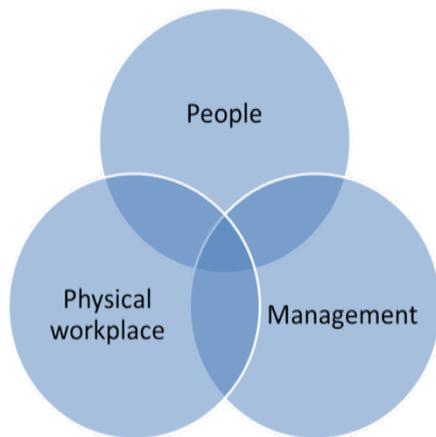


Figure 2: Areas where hazards may develop in the workplace (Source: Makin and Winder, 2008)



Figure 3: A warning triangle (Source: Bellamy et al., 2008)

In practice in many industries, workplace safety risk is commonly managed using a five-step risk management model comprising risk identification, assessment, control, implementation and evaluation. As an example, Figure 4 displays a model used by WorkSafe Victoria. This model is based on the Occupational Health and Safety Act 1985. However, Safe Work Australia (2011) provides a somewhat different model of the risk management process which is illustrated in Figure 5. The two models are not significantly different except that the latter version does not specifically show the 'evaluation of controls' step. With reference to Figure 4, in the hazard identification step, all situations or events that could give rise to injury or illness are identified. In the risk assessment step the frequency and level of risk exposure are assessed. The company's own experience and other companies' performance are utilized in this assessment. In the third step (risk control), appropriate measures to control the risk (e.g. elimination, substitution, engineering and administration) are determined and appropriate ones implemented in step four. The final step involves evaluation to determine whether the risks have been effectively controlled. This may involve repeating the process again until all risks are minimized. The whole process involves consultation between employers, employees and Health and Safety Representatives about work safety issues and management methods. Similar models are applied in Occupational Health and Safety (OHS) risk management in Queensland and NSW.

The review of the academic literature and current industrial practice reveals a glaring gap; that a supply chain perspective is absent from workplace safety risk management models. Current practices are dominated by a focus within the organisation without taking the supply chain into account. As mentioned earlier, globalisation and outsourcing have increased the significance of workplace safety. The root causes of hazards/risks may not reside within the final workplace where the materials, components and equipment are utilised but upstream of the supply chain. The root causes may possibly be due to design flaws, manufacturing defects, packaging errors, improper storage and handling or a combination of these factors.

Any one of the entities upstream in the supply chain may ultimately be responsible for these risks/hazards.

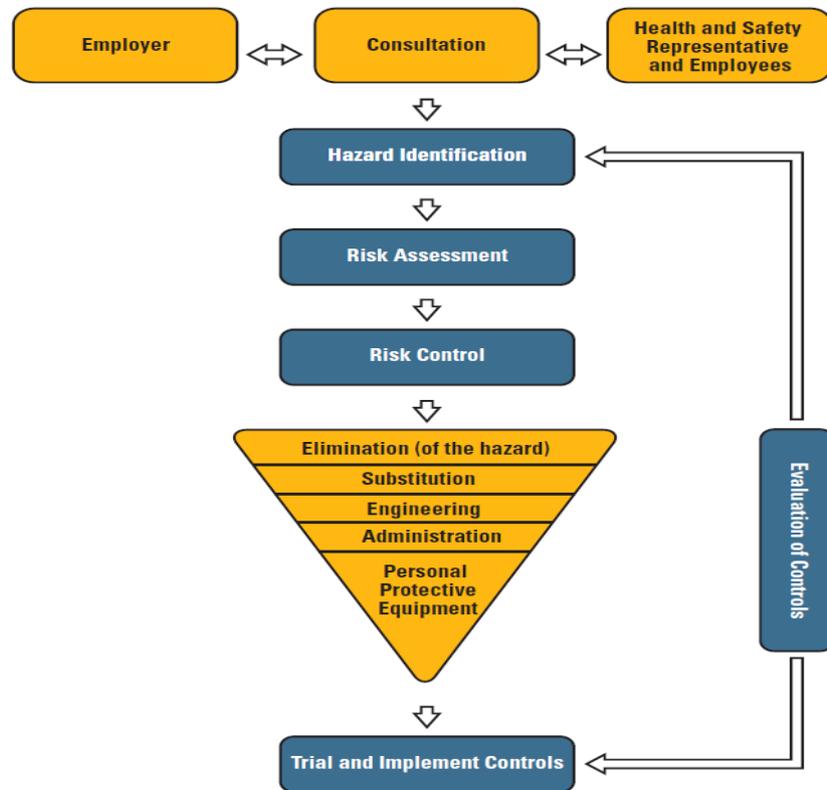


Figure 4: The hazard management approach (Source: WorkSafe, Officewise - A guide to health & safety in the office, 2006)

A positive step taken in this direction is the ‘Chain of Responsibility’ legislation and the Occupational Health and Safety Act 2004. The principle behind the ‘Chain of Responsibility’ legislation, developed by the National Transport Commission, is as follows:

“Any party who has control in the transport chain can be held responsible and may be made legally liable.”

The parties referred to include consignors, packers, loaders, drivers, operators and schedulers, receivers and employers. This clearly demonstrates the concept of the supply chain being applied in improving the safety of all concerned.

Building on the model presented in Figure 2 earlier, we propose that a fourth area, supply chain, is added to people, physical workplace and management to better represent a model for workplace safety risk management (see Figure 6 below). A supply chain perspective guarantees contribution to managing the risk more efficiently and proactively.

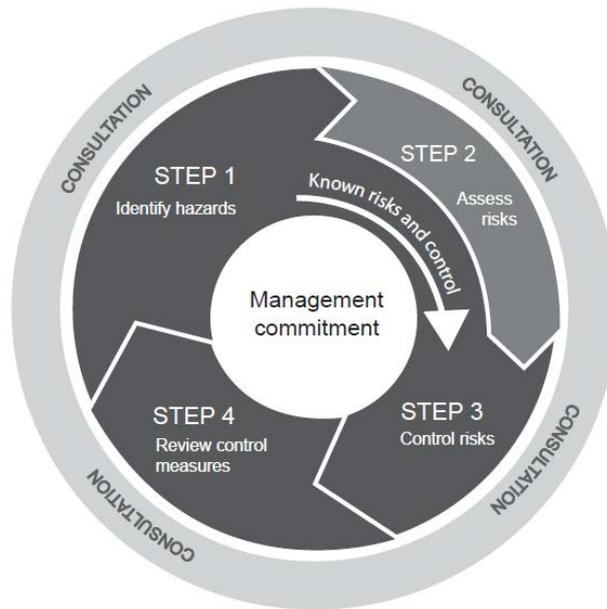


Figure 5: The risk management process (Source: Safe Work Australia, 2011 “How to Manage Work Health and Safety Risks – Code of Practice”)

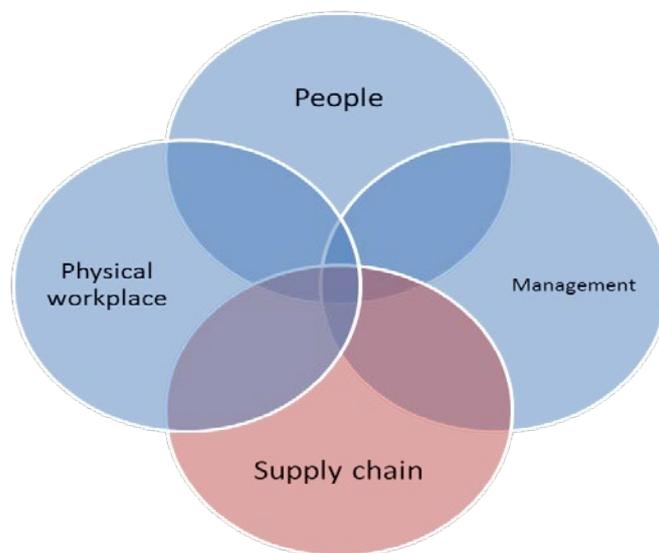


Figure 6: Areas where hazards may develop in the workplace

Supply Chain Management

The term ‘supply chain management’ (SCM) was first introduced in the early 1980s as a new approach to strategic logistic management (Cooper *et al.*, 1997). The significance of SCM has grown in importance since the 1990s when competition intensified due to globalization. Organisations began to realize that optimization of

internal production processes was no longer sufficient in this environment and that the whole supply chain needed to be optimised (Li *et al.*, 2005).

A supply chain is an alignment of firms that bring products or services to market (Lambert *et al.*, 1998). A supply chain spans the entire end-to-end chain - from the initial source (supplier's supplier, etc.) to the ultimate consumer (customer's customer). It involves many independent organisations and thus managing intra- and inter-organisational relationships is essential. The original use of supply chain management emphasized an inventory reduction both within and across the firm, from a logistics perspective and SCM has been used as a synonym for logistics (Cooper *et al.*, 1997). However, this perspective has broadened. As corporations have turned increasingly to outsourcing, they have to look for ways to effectively ensure the supply of products and services. This has led to an orientation towards building closer supplier relationships and a closer coordination effort along the supply chain. Information sharing amongst supply chain members has become a key enabler to supply chain effectiveness.

Two key characteristics are underlined by the supply chain perspective (Mentzer *et al.*, 2001). First, it implies a systems approach to view the whole supply chain as a single entity rather than a set of fragmented parts. Second, it requires a strategic orientation toward cooperative effort to synchronize and converge intra- and inter-firm operational and strategic capabilities into a unified whole. This approach and strategic orientation can be applied in managing workplace safety risk.

Figure 7 below depicts a typical supply chain showing upstream the supplier's suppliers (material suppliers) and downstream the workplace where the final materials, components and equipment are utilized. In between are a variety of other independent organisations including components (Tier 1) suppliers, the manufacturer, logistic provider, distributor/ wholesaler, retailers and customers. If the manufacturer is located overseas, then this chain also includes importers and exporters. The design of the product/equipment could reside within the manufacturer and/or suppliers or even as an independent entity.

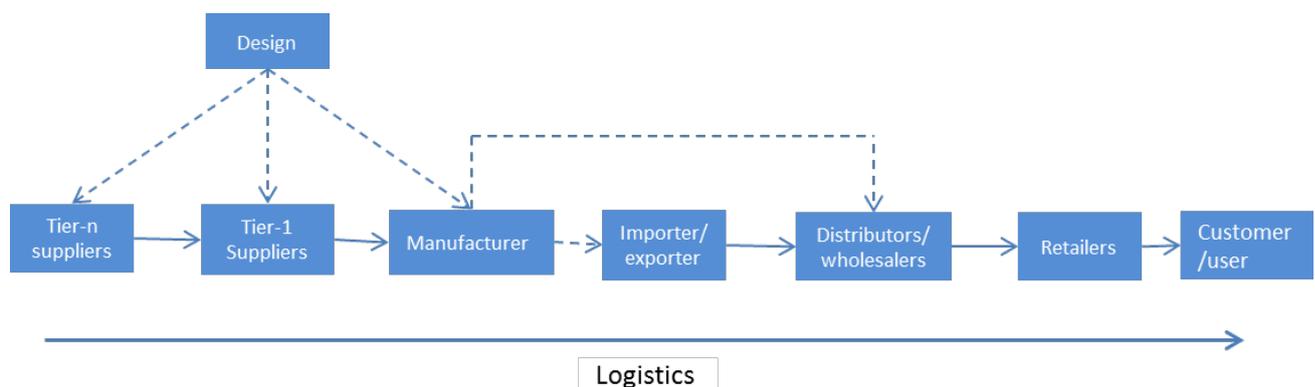


Figure 7: A typical supply chain

Supply Chain Risk Management

The management of risks in supply chains has drawn substantial attention from both practitioners and academics in recent years. Current trends such as outsourcing and lean practices, punctuated by escalating natural or man-made disasters, have exposed supply chains more easily to risks. Supply chain risks are considered as a “danger” or “hazard” (e.g. Harland *et al.*, 2003; Peck, 2006) that will result in loss or other negative outcome to the supply chain. There are a wide range of risks that could seriously impact on a supply chain. Tang and Tomlin (2008) categorized risks into seven types: supply risks, process risks, demand risks, intellectual property risks, behavioural risks, political risks and social risks whilst Matook *et al.* (2009) identified ten types of risks which are price risk, quantity risk, quality risk, process risk, technology risk, economic risk, environmental risk, management risk, chaos risk and inventory risk. Regardless of the types of risks, the sources of supply chain risks generally reside in the following three levels (Jüttner *et al.*, 2003):

- Environmental level: refers to supply chain environments which could be either natural or socio-political, e.g. political risk, natural risk, social risk, etc.
- Supply chain level: refers to interactions between organisations within the supply chain.
- Organisational level: lies within the boundaries of the supply chain entities and range from labour (e.g. strikes) or production uncertainties (e.g. machine failure) to IT system uncertainties.

Supply chain risk has two components: (i) the probability of the occurrence of an adverse event and (ii) the negative consequences of the event (Brindley, 2004). Therefore, risk mitigation strategies could be developed to address these two components (Tang & Tomlin, 2008). A number of risk management strategies have been proposed to reduce supply or demand risks. For example, Giunipero & Eltantawy (2004) have suggested strategies including industry consolidations, partnerships/alliances, E-procurement, just-in-time deliveries, small flexible supply base, increased coordination and early supplier involvement. Focussing on minimising supply risk, Zsidisin *et al.* (2000) have proposed strategies such as forming strategic alliances with suppliers, having suppliers responsible for developing risk mitigation plans, maintaining a common platforms for products, direct access to "brainware" of suppliers, supplier certification and supplier development. The approaches undertaken need to fit the characteristics of the underlying decision environment, however a collaborative relationship and interactive information sharing between supply chain partners are conditions to make the implication of risk management strategies successful (Kleindorfer & Saad, 2005).

The difference between supply chain risk management and the traditional risk management approach is its supply chain perspective (Thun & Hoenig, 2011). Risk is traditionally managed at an individual organisation, however the supply chain ripple effect makes it essential to manage supply chain risks in a collaborative manner (Norrman & Jansson, 2004). The supply chain must not be treated in a fragmented manner but as a whole. A collaborative supply chain provides an efficient platform of supply chain risk management.

Managing Workplace Safety Risk with a Supply Chain Perspective

Based on the discussion above, we recommend taking a supply chain perspective to developing a workplace safety management model. One such model is proposed in Figure 8 below. This model is adapted from the one proposed by Manuj and Mentzer (2008). In their study of global supply chain risk management, Manuj and Mentzer incorporate a supply chain perspective with the five-step risk management approach to examine supply risk, operational risk and demand risk across a global supply chain. We adapted this model to fit with workplace safety risk management in terms of the risk identified, the risk control strategies and the enablers in the implementation stage.

Compared with current models applied to workplace safety risk management, in the proposed model, safety risk identification, control and monitoring will be applied at the supply chain level rather than within the organisation. In Step 1, the identification of root causes is conducted not just within the organisational boundary but extended to the whole supply chain. Some causes of incidents/injuries may well relate to design flaws where the designer must take responsibility. Other incidents/injuries could relate to the materials used, manufacturing processes, poor packaging, improper storage and handling and ineffective logistics or a combination of many of these along the supply chain. The whole supply chain needs to be carefully scrutinised to identify the root causes. In step 2, risk assessment, each of the safety risks identified are assessed based on the two dimensions, namely the frequency or likelihood of that exposure and the degree of harm resulting from that exposure. Assessment of these risks must become the joint responsibility of employers and employees. Without this approach the root causes of the risk and the optimum solution may not be developed and implemented. Based on the results of the assessment, appropriate measures of risk control can be determined in step 3. These measures can include:

- Elimination - Redesign work processes or equipment to eliminate the possibility of risk exposure.
- Substitution - Materials, equipment or processes can be replaced with less hazardous ones.
- Engineering - This may involve the provision of mechanical aids, barriers, guarding or insulation to prevent risk exposure.
- Administration - This may involve establishing policies, procedures and work practices to reduce risk exposure as well as the provision of specific training and supervisory practices.
- Personal protective equipment - such as protective clothing, gloves, glasses and helmets.

Once appropriate measures have been determined, implementation of these measures must be carried out with care in step 4. If individual organisations are likely to under-invest in safety risk management, policy tools, such as third part inspection, regulations and standards, or economic incentives through subsidies and fines, could be applied to ensure and enforce a certain level of investment (Cohen & Kunreuther, 2007). The current roles and responsibilities of WorkSafe inspectors, regulators, health and safety representatives, unions, governments and industry groups will need to be enlarged so that supply chain safety risk management can be

effectively carried out. Besides these driving forces, necessary information and guidance will need to be provided to all entities along the supply chain so that collaboration and coordination amongst the members of the supply chain can start. Furthermore, it is important to continually highlight the significance of safety across the whole supply chain through frequent communication between the supply chain partners.

Figure 8 also shows the need for review and evaluation (step 5). Workplace safety risk management must become an iterative process. Through continuous reviewing and refining the risk control measures, satisfactory results can be achieved.

Conclusions

The proposed model presented in Figure 8 for supply chain safety risk management provides a new perspective into workplace safety, extending current practice from the organisation level to the supply chain level. Root causes of incidents/injuries happening in the workplace need to be identified along the whole upstream supply chain. Each supply chain entity needs to apply such a model to establish a “safe” supply chain. The success of implementing such a model requires a supply chain perspective with each entity understanding its role. There must be effective knowledge sharing along supply chain partners about any safety issues and collaborative efforts made to reduce workplace safety risks.

Recommendations

Future research could be carried out in the follow areas:

- Further refinement and validation of the proposed model through workshops with representation from key stakeholders. This would determine the value of the model and its acceptance by organisations/industries.
- Testing of the model through implementation within several high risk industries. This would help identify benefits and challenges associated with implementation.
- Further research into how the model can be integrated into normal business practices.

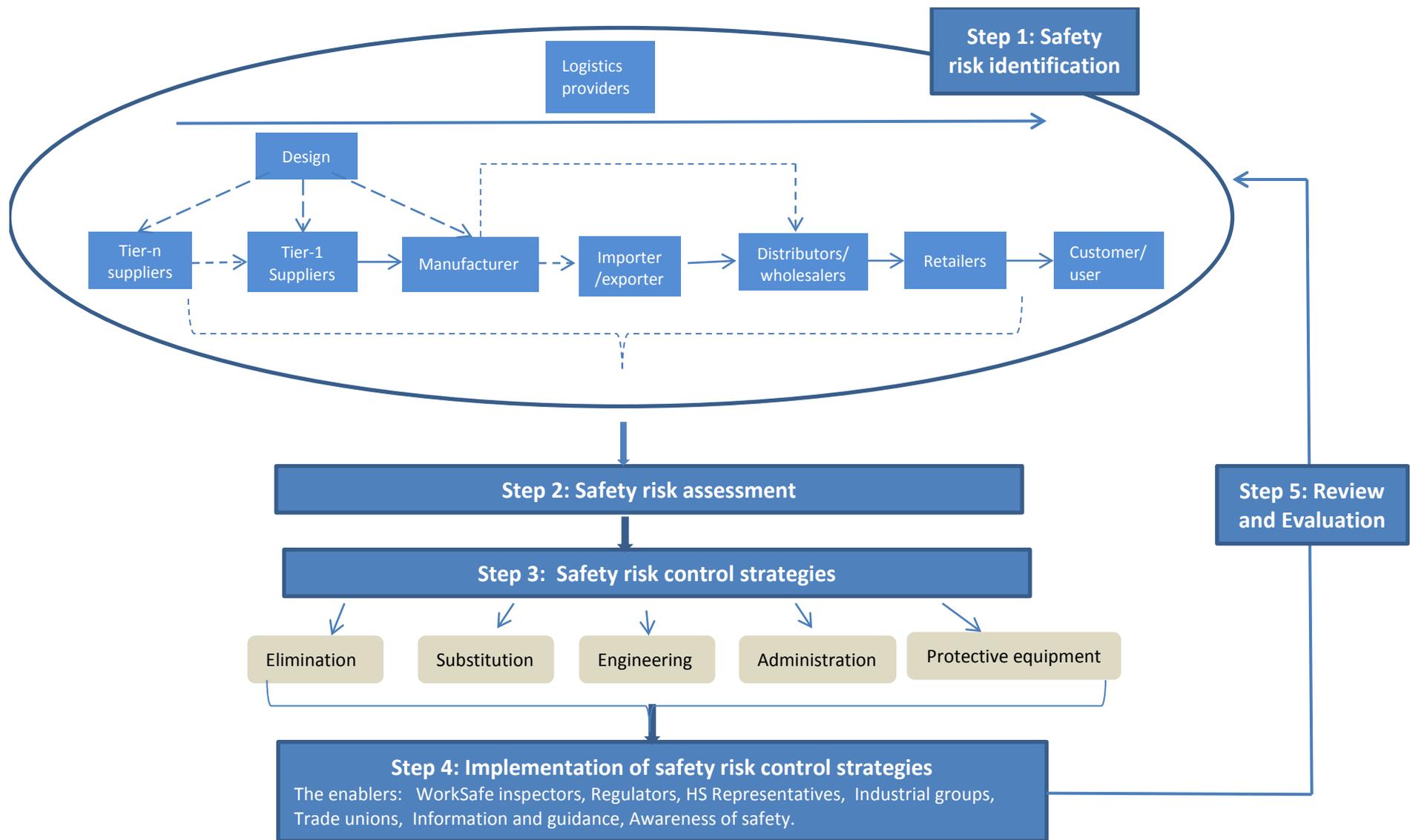


Figure 8. A model of workplace safety risk management

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