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Benchmarking occupational health and safety performance of Australian construction companies

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Abstract

It is mandatory for Australian construction companies to provide a safe working environment for their workers and sub-contractors. Consequently, occupational health and safety (OHS) is a major issue for construction firms mainly due to the fear of prosecution. The recent introduction of Zero Tolerance by the Victorian government WorkCover Authority provided even higher OHS safety standards for the construction industry. This has placed a increased burden on construction companies especially small firms that are not in a position of financial strength.

The size of the companies has been found to be a major contributing factor to the OHS performance of construction contractors. This research is based on benchmarking study of 44 construction companies in Victoria, Australia. The results show that the major factors influencing safety performance were; company size, and management commitment to OHS.

Keywords : Occupational health and safety, construction management, Australia

INTRODUCTION

There was a major change in our OHS legislation in Victoria, Australia with the introduction of Occupational Health and Safety Act, 1985. The Act was based on the findings of the UK Roben Committee of Inquiry and has resulted in the following feature being incorporated in the Act (VWA 1998) To impose a high duty on the parties in the workplace to ensure that, ***'so far as is practicable'***, that they exercise their responsibilities in a way that is not harmful to the health and safety of any person.

While it is well understood that the building and construction industry is dangerous by its nature, increased emphasis needs to be placed on occupational health and safety management (OHS) on site. However, increased policing and raising fines can only goes so far to improve the OHS performance of the industry. This research is based on a benchmarking survey of small, medium and large construction firms to determine their ability to comply with the regulation of OHS.

OHS Management System ' does size matter?'

Most research done into occupational health and safety has shown that the high rates of injury are primarily due to inadequate, or non-existent, OHS management systems. Therefore, the application of an 'effective' management systems leads to safer construction and reduces incidence of injuries and work related diseases (Davies, 1999).

Past research has shown (Jaselskis, 1996) that an effective way of measuring the safety performance of a company is by using a combination of both quantitative and qualitative safety measurements. To improve construction safety performance statistical data and various management elements, need to be analysed. Quantitative measures include; lost time and severity rates, and experience modification rating (EMR), ie. a measure used to calculate insurance premiums of companies. Qualitative ratings consist of outstanding, average, and below-average project management performance, as determined by OHS assessors.

Holmes (1999) conducted research from a sample of Australian companies and found that small construction firms did not manage OHS risks as effectively as larger firms. Data from the Australian Bureau of Statistics shows that the majority of Australian construction firms were small businesses, 97% of general construction businesses employ less than 20 employees, and 85% employing less than five people (VWA, 1998). Holmes commented that, small businesses did not feel the need to focus on OHS in their management systems and believed that the control of risk is the responsibility of employees. This was contrasted with the attitude of large businesses that indicated that OHS should be integrated into their entire management system across all projects within the company.

A similarly study was conducted by Wilson (2000) who found that safety attitudes varied by the size of the company. He suggested that there is some doubt whether smaller companies can benefit from higher standards of OH&S practice, due to the implementation costs involved. Other research (Lingard, 1994) showed that firms having more resources and experience tend to deal with health and safety issues more effectively. Therefore in a relative sense, larger companies tend to be more committed to safety. It is also possible that OHS regulations which require formal documentation procedures do not fit the traditions, competence and needs of very small companies (Hale, 1998).

Mayhew (1997) states that industries where subcontracting is common, often has a higher incidence of serious injuries and fatalities. In his analysis of the United States census data, he found that self-employed workers were more than twice as likely to be killed at work. Subcontractors are generally much smaller companies than main contractors, hence are less well organized and have fewer resources to implement a proper OHS systems. According to Holmes (1999) they are also less committed, because of their smaller involvement on the project as a whole..

Management Commitment

Nishgaki (1994) carried out an investigation of 35 cases of construction injuries that occurred in the 1980s. During interviews with construction managers and workers it was found that 'humanware' accounted for much of the underlying causes of occupational accident recurrence. "Humanware" is defined as a function composed of; leadership, fellowship, and the interaction between them. His research suggested that the major causes of OHS failures are; inadequate safety education, inadequate instruction, poor housekeeping and 'wilful transgression'. According to the Nishgaki's research, employers and employee's attitude plays a major part in safety on site. Nishgaki's findings showed that *management commitment* is responsible for the majority of the "humanware" problem.

Jaselskis (1996) commented that management need to be more active in the safety program and where possible, superintendents should also play a significant role in determining the safety performances on their projects. Research by Dejoy (1985) showed that safety records reflect how upper management perceives the causes of safety performance. The safety program is most effective when it involves two-way communication between workers and managers.

However, high-level management often has little first hand experience on site, it is therefore difficult for them to relate to the needs of workers.

For instance, the wearing of protective clothing and the use of safety equipment is crucial in reducing the effects of accidents on construction sites. However, both Harper (1998) and Holmes (1999) suggested that *management commitment* is required to enforce the wearing of safety equipment. It is often the case that safety equipment is provided, but employees are reluctant, or neglect, to wear it. Consequently, the provision of safety equipment alone does not improve construction site safety, there also needs to be a corporate culture that encourages its use.

Employee Committees

A safety committee often consists of representatives of the employer, worker and subcontractor. This encourages interaction between the parties and helps improve trust and communication and the expertise of each party can be put to use. Safety committees have proved to be effective in discovering unsafe practices and problems. Nishgaki (1994) suggested that regular inspection of the site using safety patrols promote good job safety. Similarly, Hinze (1988) found the more site visits by the upper managers the better the site safety. Pre-construction site reviews help establish areas of concern and later 'tool box' meetings give the chance for the employee to be involved, (Harper, 1998). A safety committee helps to promote accident prevention and safe working habits by the employee's.

The employees tend to be more aware of hazards in the work place than employers and therefore should be involved in the safety program. They can relate more easily to the safety program if they are involved. It has been shown that regular meetings held on site help to find OHS problems and solutions and improve accident prevention. (Hinze, 1988)

Nishgaki (1994) found management commitment should be backed up with means such as hardware (safety equipment) and the continued enforcement by software (standard work procedures, safety regulations.) Lingard (1994), found more sophisticated scheduling methods improve OHS standards, but often they can only be carried out with larger companies because of their expertise and resources.

Management Policy and Training

Davies (1999) suggests that the company policy statements issued by the employers should be clearly understood by their employees. Policy statements should indicate how the company is organised with respect to the health and safety responsibilities of the management, and should further state the managers' commitment to providing safety information, training and advice to employees.

It is very important to enhance the ability of the workers and the managers to anticipate possible hazards in the work place. However, according to Wilson (2000), companies with poor safety performance often leave safety training to site experience, and this may be inadequate to prevent occupational accidents. Nishgaki (1994), and Garza (1988) both recommended that educating workers about all aspects of work safety and giving them the skill to look after themselves, is the right thing to do. Davies (1999) suggests that effective training in the construction industry is one means by which safety can be improved and company management must be active in order to reduce the number of injuries and fatalities.

The Cost of implementing Occupational Health and Safety

Cost has a role in reducing accidents and improving efficiency. According to Hinze (1988) safety is an important issue, but many people do not feel it is vital to the success of projects. Research by Tang (1997) into the injuries on 18 construction projects suggested that the higher the investment in safety, the better the safety performance. However, Holmes (1999) points out that, time and economic constraints appear to influence the way that individuals perceive risks and consequently risks should be identified prior to construction.

Hinze (1988) has found that injury rate tends to be higher where those projects were competitively bid. It is common practice for the contractors to discount their jobs just to win the tender, and as the result OHS suffers. Safety is often found to be the first item to face cost cutting as the employers often believe that implementing a safety system will cost more. In additional, managerial focus tends to concentrate on production 'at cost' and safety does not help production therefore it suffers when a project runs over budget Hinze (1988).

On the other hand Wilson (2000) suggested that the main contractors should have a good working knowledge of safety procedures. However, the main contractor often leave the responsibility of safety to the individual subcontractors and may never take an active part in ensuring that the subcontractor are taking all measures necessary to provide a safe working environment. Lingard (1994) found that very few contractors take safety performances into account when selecting a subcontractor. Her research results suggest that by screening suppliers and contractors, accidents are reduced and OHS standards improved.

In order for this study to be effective a method was required to standardize the measurement of Construction Company's safety performance. A number of previous researchers have considered this issue. Research by Jaselskis (1996) recommended that companies should set OHS benchmarks, his methodology was based on collecting, both qualitative and quantitative information about the company's safety performance to determine OHS.

The next section of the research outlines the model used to benchmark OHS performance using a Capability Maturity Matrix which was created by an industry think tank, known as the Construction Industry development Agency (CIDA) In 1994 Monk performed a similar questionnaire in New South Wales using the CIDA matrix system. Her results showed a large difference between the OHS performance for small contractors (10-19 employees) compared to large companies (150 plus employees). The study concluded that on average, smaller contractors did not perform up to level 2 of the matrix which is below the minimum required to meet legislative compliance. The results of this survey were then compared to Monk (1994) and some conclusions are drawn.

METHODOLOGY

The Health and Safety Continuous Improvement Matrix developed by the CIDA (1995) is a benchmarking system for the comparison of OHS performance across the Australian construction industry. The CIDA system allows a company's occupational health and safety performance to be measured against the Australian Construction Industry Pre-Qualification Criteria for Contractors and Sub-Contractors. The system allows the grading of companies'

occupational health and safety between 0 and 5 against sixteen OHS system elements that are set out on the CIDA matrix (Table 1). The system elements are matched to quality assurance standard AS 3901

In addition the handbook "SAA HB53-1994, *A management system for OHS and Rehabilitation in the construction industry"* provides the minimum OHS and rehabilitation management system requirements in situations where " a contract between two parties requires the demonstration of a capability to design and implement and auditable system". The system is suitable for both large and small companies as was considered the most appropriate research mechanism for the evaluation of OHS performance of Australian construction companies.

Table 1 - OH&S Elements

CIDA System Element Descriptions	
• Management Responsibility	• Inspection, measuring and test equipment *
• Health and Safety System	• Inspection and test status *
• Contract Review	• Control on non-conformance
• Design Control	• Corrective and preventive action
• Document Control **	• Handling, storage, packaging and delivery **
• Purchasing	• Health and safety records
• Purchaser supplied product **	• Health and safety auditing
• Product identification and traceability *	• Training
• Work method control	• Servicing *
• Inspection and testing	• Statistical techniques

Notes

* Not included in the CIDA Health and Safety Continuous Improvement Matrix

** Deleted from the questionnaire due to lack of relevance to the study and to reduce the length of the questionnaire.

There are six performance levels (0-5). The questionnaire requires the respondents to objectively assess their own OH&S performance within the system. The general descriptions of the levels are as follows;

Level 5 - Sustaining best practice

Level 4 - High level of continuous improvement

Level 3 - Committed to improvement beyond minimum regulatory requirements

Level 2 - Satisfies regulatory requirements adequate understanding of duty of care

Level 1 - Awareness of need and in process of change inadequate understanding of duty of care

Level 0 - Total ignorance. *

NB: * Level 0 is disregarded in the author's questionnaire. It was assumed that the contractors who responded have a least some appreciation and awareness of OHS.

A questionnaires was developed based of the CIDA's Health and Safety Continuous Improvement Matrix, also include were questions relating to the type of companies, and the type of projects that they undertake. Initially a pilot study was conducted to examine the ability of the questionnaire to obtain the information necessary for the research.

Pilot studies are an effective way of improving question wording and avoid mistakes in the questionnaires. They allow researchers to identify potential problems and errors, including improvement of wording for a better understanding of the questions. The pilot study showed that the questionnaire was too long. The final questionnaire was reduced in size to approximately half of the original pilot study questionnaire.

A total of 230 questionnaires were sent to Victorian construction companies by post. The sample of companies was obtained from the author's own private contacts and from the Yellow Pages listing of the Melbourne telephone directory.

The questionnaire comprised two parts: **Part A,** demographic of the company, their characteristics, in relation to contract size, contract duration, number of employees and other factors found in the literature review which has an influence on the company's OHS standards. Also other questions relating to; attitude of the company management, OHS tender costs, and the effectiveness of safety committees. These results were compared with scores obtained from Part B of the questionnaire. **Part B,** comprises the CIDA's the Health and Safety Continuous

Improvement Matrix using the original 16 elements, 3 were deleted and only a brief description of the element was given.

In essence the survey required firms to rate their existing performance against the criteria shown in the CIDA matrix.. The survey design used randomized questioning so the level of the matrix were not immediately obvious. This was done to reduce the effect of firms exaggerating their performance against the matrix. Responses were received from 44 organisations, the range of companies was considered to be representative of the construction firms in Victoria, Australia. The data from each response was entered onto SPSS, and used for analysis of the survey data.

The results were presented in two ways. Firstly a set of descriptive statistics showing the average scores for each factor was undertaken. This was followed by a Discriminant Analysis (DA) which is a form of MANOVA; this was undertaken to distinguished between groups of firms the each displayed similar characteristics.

Discriminant analysis involves deriving a variate, the linear combination of the two (or more) independent variables that discriminate best between a *priori* defined groups. Discrimination is achieved by setting the variate's weights for each variable to maximize the between-group variance relative to the within-group variance. The linear combination for discriminant analysis, also known as the discriminant function

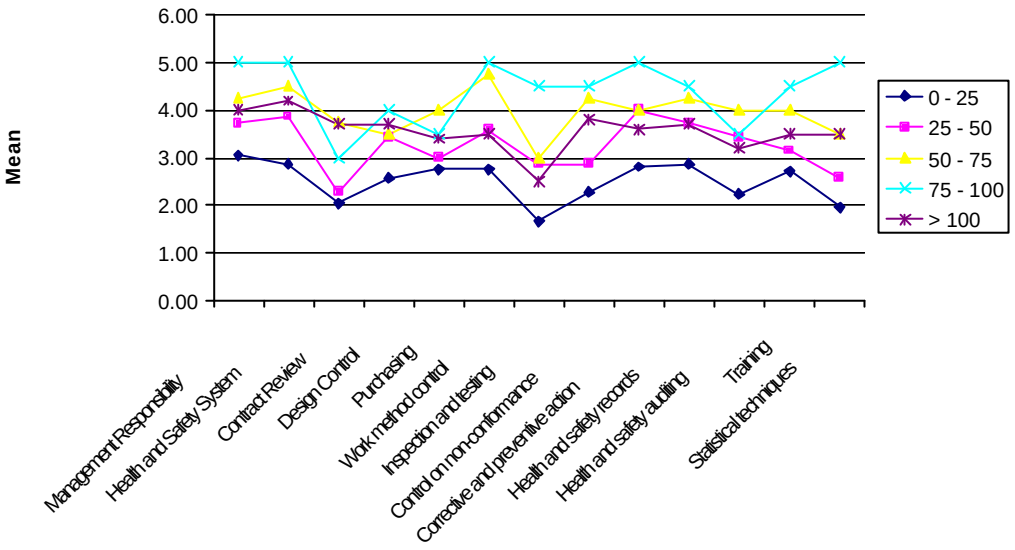
Discriminant analysis is the appropriate statistical technique for testing the hypothesis that the group means of a set of independent variables for two or more groups are equal. To do so, discriminant analysis multiplies each independent variable by its corresponding weight and adds these products together. The result is a single composite discriminant score for each individual in the analysis.

The following section present the results of 44 survey responses involving self-rating against the CIDA OHS capability maturity matrix The next section commences with a brief set of descriptive statistics, and then uses discriminant analysis (DA) as the main analytical instrument.

RESULTS AND DISCUSSIONS

The major finding of this research was that *company size* had a significant influence on a company's OHS performance. This result was consistent with research by Hinze (1988), Wilson (2000) and Holmes (1999). The study shows that there were important differences between the larger and smaller contractors on all CIDA elements (Figure 1). This is not a surprising finding because smaller companies' lack the resources to perform at a high level of OHS performance. In general, smaller companies have poorer standards, all the bottom five companies, have less than 25 employees.

Figure 1-Average OHS performance by company size



According to Monk (1994) many occupational accidents and injuries are due to a breakdowns in the existing OHS management systems. The result shown in (Table 2) was found to be consistent with this research. When contractors scored highly in the *Management Responsibility* and *Health and safety System* elements their total OHS standards tended to be higher. These

two elements have the highest overall average scores, and it is likely that many of the respondents recognised their importance.

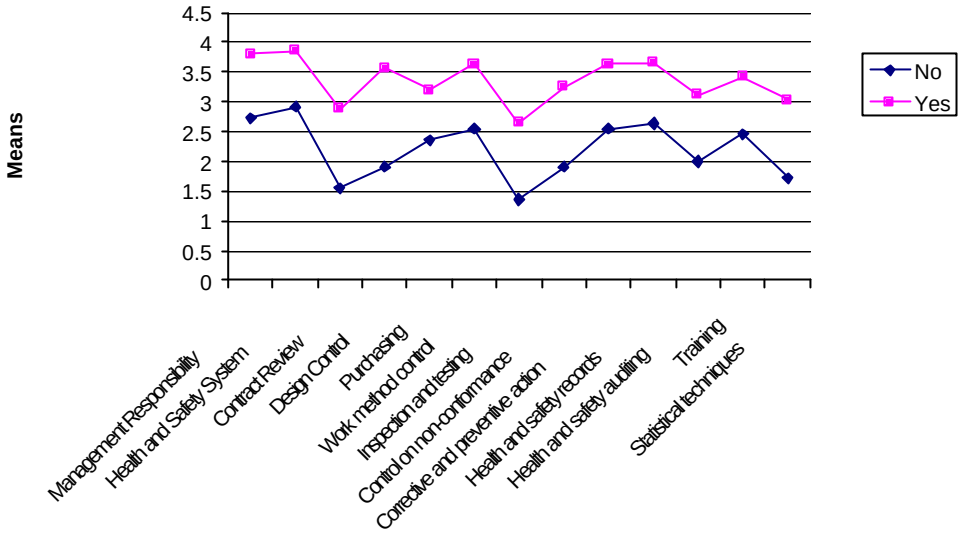
Table 2 – Average OHS matrix score by number of company employees

CIDA Element	Number Of Employees					Average
	0 – 25	25 - 50	50 - 75	75 - 100	100+	
Management Responsibility	3.05	3.71	4.25	5.00	4.00	3.88
Health and Safety System	2.86	3.86	4.5	5.00	4.20	3.81
Contract Review	2.05	2.29	3.75	3.00	3.70	3.24
Design Control	2.57	3.43	3.50	4.00	3.70	3.57
Purchasing	2.76	3.00	4.00	3.50	3.40	3.06
Work method control	2.76	3.57	4.75	5.00	3.50	3.46
Inspection and testing	1.67	2.86	3.00	4.50	2.50	2.7
Control on non-conformance	2.29	2.86	4.25	4.50	3.80	3.25
Corrective and preventive action	2.81	4.00	4.00	5.00	3.60	3.61
Health and safety records	2.86	3.71	4.25	4.50	3.70	3.71
Health and safety auditing	2.24	3.43	4.00	3.50	3.20	3.19
Training	2.71	3.14	4.00	4.50	3.50	3.39
Statistical techniques	1.95	2.57	3.50	5.00	3.50	3.25
Average Score	2.51	3.26	3.98	4.38	3.56	3.39
No. of firms	21	7	4	2	10	44

The provision of the safety equipment is not a major OHS contributing factor in distinguishing between the OHS performance of firms. This is because employers have a legal duty to provide protective clothing and equipment free of charge. All respondents except one provide safety equipment to their employees. However, OHS is likely to be improved if contractors are committed to ensuring that their workers use the safety equipment. ie. *Management Commitment*

Wilson (2000) found that safety training plays a part in the OHS standard. The results of the research found that smaller companies perform poorer in this element compared to larger companies. However, it does not seem to be a major factor that influences the overall safety performance. One of the unexpected findings in this research was that all the companies' scores for *Inspection and Testing* were the poorest amongst all the other elements. The reason is that there is little regulatory guidelines or mandatory requirements for testing the employees' health or monitoring their working environments.

Figure 2 – Average score by whether firms include OHS costs in tenders



The next part of the research investigated whether it is possible to improve safety performance without the need to increase the size of the firm. The matrix scores were interrogated based on the notion that firms that it may be possible for a firm to increase it's OHS performance by strategically addressing only a few of the criteria.

A Discrininamt Analysis (DA) was undertaken using the responses to the question about whether OHS costs were included with the bid price. It was speculated that firms that recognized the importance of OHS cost in advance, and made specific allowance for it, should have better OHS performance.

Hinze (1988) found that injury rate tends to be higher when projects were competitively bid. Although competitive bidding alone should not affect OHS performance, research suggested that cost pressures tended to reduce the commitment to safety. This research questioned contractors about how they allow for the cost of implementing OHS plans on their projects. The results bleow (table 3) shos the size of the firms and whether OHS costs for each project are included with the bid price.

Holmes (1999) suggested that OHS risk should be identified prior to construction and the costs of OHS should be included in the tender. Companies that allow OHS costs in their tenders seem to have a much higher performance in all elements, on average one standard level higher (Figure 2)

Tables 3 – Number of employees in firms by whether OHS cost are included in tenders

Cost inc in Bid	0 – 25 Emp	25 – 50 Emp	50 – 75 Emp	75 – 100 Emp	100 + Emp	Total	%
No	6	2	1		2	10	25%
Yes	15	5	3	2	8	33	75%

The DA was undertaken to determine if CIDA matrix criteria could be used to identify firms that did and did not make specific allowance for OHS in their bid prices. The results showed that the DA was effective at identifying such contractors. The Eigenvalue was high (0.466) indicating that the DA is a good discriminator. The DA function is a simple linear equation that can be used to investigate the relative impact of each of the independent variables contained in the function. It often tempting to use the unstandardized weight to interpret the function but it is better to use the standardized weights.(Table 4)

Table 4 Standardized Canonical Discriminant Function Coefficients

	Function
	1
B1-Management Responsibility	.292
B2-Health & Safety System	-.193
B3-Contract Review	-.945
B4-Design Control	2.018
B5-Purchasing	.821
B6-Work Method Control	.243
B7-Inspection & Testing	-.389
B8-Control of Non-conformance	-.531
B9-Corrective & Preventative Action	-.825
B10-Health & Safety Records	.457
B11-Health & safety Auditing	-.743
B12-Training	.270
B13-Statistical Techniques	-.053

It can be clearly seen (Table 4) that the most significant discriminator is *Design Control (2.018),*; this relates to criteria about how the risk assessments are carried out prior to the commencement of the project. Firms that rated themselves low on the matrix indicated that they do not undertake a formal risk management process, and instead rely mainly on *past experience of staff*. This approach was contrasted with firms that rated themselves more highly; in those cases firms indicated that used a *Formal review process based on well establish procedures*.

The next most important discriminator (Table 4) was *Contract Review* (-0.945), which was based on a similar criteria. The contract review criteria questioned about how firms check their documents prior to the submission of a bid. Once again, firms that rated themselves lowly tended to use informal *adhoc* approaches to OHS. This can be contrasted with higher ratings for firms that they used *Formal reviews with well established procedures*. Poor performance in this element means that inadequate resource tend to be been allocated for OHS. The bottom 5 companies all perform poorly in this elements compared to the top 5 companies; this supports the findings of Holmes (1999)

In other words, firms that took the time to specifically identify OHS risks associated with upcoming projects were more highly rated on the CIDA matrix. It was not surprising to find that the majority of firms that do <u>not</u> allow for OHS cost in their bids were the small firms. (Table3). This seems to suggest that these firms will find it difficult to implement the most to effective of OHS during the construction phase of their projects. It is more likely that these firms have an *adhoc* approach to the OHS that leads overtime to greater risks of serious injury, and a lower overall performance.

Both Nishgaki (1994) and Hinze (1988) found that regular involvement by the company management improved the safety standards. This research found that to be true, all the top 5 contractors have regular OHS management reviews compared to only one of the bottom 5 contractors. It should be noted that the bottom 5 companies are smaller firms, and it is possible that the company management of those organisations may perceive that there is less risk associated with small value contracts. As a result there may be an expectation that safety can take care of itself without further assistance.

CONCLUSION

As expected the major factor affecting the OHS standard was found to be the *company's size*. This research found that larger contractors tend to perform better compared to smaller companies because they have greater resources to do so. Large firms' generally do larger projects with more risks and so are required to implement better OHS plans.

Small contractors and sub-contractors on the other hand, generally perform poorly for similar reasons; their projects are generally smaller and have lesser OHS risks. Many occupational health and safety professionals believe that the application of effective occupational health and safety management systems will lead to a better OHS performance. *Management commitment* plays a major role in OHS performance. However, small companies seem to lack both the financial resources and management commitment to improve their own OHS performance.

The construction industry contains a very large proportion of small firms that may not be in a strong position to implement good OHS systems. However, firms that want to improve their OHS performance should become more strategic about their actions. This research has shown that small contractors tend not to include OHS costs in their tenders reducing their ability to deal with potential problems. Contractors that have more formal process for identifying their OHS costs prior to bid, tend to become higher rated on the CIDA matrix;.

Finally existing government safety regulations place considerable pressure on all firms, large and small, to protect the construction workforce. This research has shown that small firms do not seem to have the ability or motivation to achieve high levels of OHS when benchmarked against larger firms. This calls into question the notion that OHS performance can be achieved by simply raising government OHS regulations. Small firms should perhaps be targeted for special resources and training opportunities.

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