IMPLEMENTING OCCUPATIONAL HEALTH AND SAFETY IN SMALL CONSTRUCTION ENTERPRISES

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ABSTRACT
This research is based on a benchmarking study of occupational health and safety (OHS) management practices of construction companies in Australia. It is mandatory for Australian construction firms to provide a safe working environment for their workers and sub-contractors. However, many small to medium enterprises that are not in a position of financial strength, struggle to provide adequate levels of OHS.

The results show that the size of the company is a major contributing factor to their OHS performance. Small enterprises employing less than 25 employees have comparatively low levels of management performance compared to larger enterprises. Company size is a limiting factor that impacts on the ability of small firms to implement comprehensive OHS plans. Nevertheless, some firms seem to be able to provide better OHS management practices than their size would suggest.

This research analyses a group of good and ‘mediocre’ performers across a range of OHS management criteria, in order to identify benchmarks that lead to best practice. The results show that a variety of risk management practices, particularly design control and health and safety review, were used by the better performing contractors. The paper concludes with the implications of the study for small to medium enterprises in the construction industry.

Keywords: Occupational health and safety, Construction management, Small to medium enterprises, Australia

INTRODUCTION
While it is well understood that the building and construction industry is inherently dangerous, increased emphasis needs to be placed on occupational health and safety management (OHS) both on and off site. There is a large body of evidence to show that construction is amongst the most dangerous industries in the economy (Champoux & Brun 2003). There is also a lesser amount of research that indicates that smaller firms have greater difficulty in ensuring the safety of their workforce compared to larger firms (Holmes, 1999; Champoux, D, et al 2003; McVittie, D et al 1997). These two issues significantly impact the construction industry, making the improvement of OHS a difficult task. This research is based on a benchmarking survey of small and medium sized construction firms to measure their capacity to implement comprehensive OHS management systems.

SMALL FIRM AND SUBCONTRACTING
A significant problem within the construction industry is the disorganisation and subcontracting and its effects on OHS. The growing dependence on subcontracting work has significant implications on the management of safety and is "an important source of injury at work" (Mayhew et al. 1997). Loosemore and Andonakis (2007) highlight the "complex web of constantly changing contractual relationships" as significant influences on the OHS performance of the construction industry. Loosemore and Andonakis (2007) further highlight the propensity of principal contractors to transfer risk onto subcontractors that lack the knowledge and resources needed to properly
address OHS. In addition, Mayhew et al. (1997) state that organisations consisting of “self employed workers, teams or small employers do not have the resources to devote to OHS that is the case with larger organisations”. This ultimately creates a gap in the knowledge and understanding about OHS.

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 similar study conducted by Wilson (2000) 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 OHS practice, due to the implementation costs involved. Other research (Lingard & Rowlinson 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, the research suggests 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 proper OHS systems. According to Holmes (1999) they are also less committed, because of their smaller involvement on the project as a whole.

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 addition, 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 and Rowlinson (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 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 OHS criteria for contractors and sub-contractors (CIDA 1995). The CIDA matrix contained 16 criteria however the final survey removed 3 criteria from the questionnaire due to lack of relevance to the study and to reduce the length of the questionnaire. This framework does not conflict with current industry standards (i.e. National Construction Standard, Guide to Best Practice, etc.) and was utilized as a benchmarking tool.

The system allows the grading of companies’ occupational health and safety between 0 and 5 against OHS system elements that are set out on the CIDA matrix. Level 0 was disregarded in the author’s questionnaire. It was assumed that the contractors who responded have a least some appreciation and awareness of OHS. The system elements are matched to quality assurance standard AS 3901. The questionnaire requires the respondents to subjectively assess their own OHS management within the system.

A questionnaire was developed based on the CIDA’s Health and Safety Continuous Improvement Matrix, also included 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 management. Also there were 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 13 elements, 3 were deleted due to a lack of relevance 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 was
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. Of the 44 organisations represented in the data, 21 were classified as small with less than 25 employees with the remainder classified as medium to large comprising at least 26 employees and included firms up to 150 employees. The survey was not designed to be an exhaustive study but instead is only indicative of the trends within the Victorian industry. 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; 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
The DA was undertaken to determine if CIDA matrix criteria could be used to identify the differences between 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 (0.51) 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 is often tempting to use the unstandardized weight to interpret the function but it is better to use the standardized weights (Table 4).

The major finding of this research (Table 1) was that company size had a significant influence on a company’s OHS performance. The score was lower for small firms compared to large firms for all of the critier in the CIDA matrix. This result was consistent with research by, 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 management performance.

Table 1 Average OHS matrix score by company size

<table>
<thead>
<tr>
<th>CIDA Element</th>
<th>Small contractors (0-25 Employees)</th>
<th>Large contractors (26-100+ Employee)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Std. Dev.</td>
<td>Mean Std. Dev.</td>
<td>Valid N</td>
</tr>
<tr>
<td>B1-Management Responsibility</td>
<td>3.05 0.97</td>
<td>4.04 0.98</td>
</tr>
<tr>
<td>B2-Health &amp; Safety System</td>
<td>2.86 1.06</td>
<td>4.22 0.80</td>
</tr>
<tr>
<td>B3-Contract Review</td>
<td>2.05 1.12</td>
<td>3.22 1.78</td>
</tr>
<tr>
<td>B4-Design Control</td>
<td>2.57 1.16</td>
<td>3.61 1.41</td>
</tr>
<tr>
<td>B5-Purchasing</td>
<td>2.76 1.04</td>
<td>3.39 1.20</td>
</tr>
</tbody>
</table>
B6-Work Method Control 2.76 0.89 21 3.87 0.87 23
B7-Inspection & Testing 1.67 1.11 21 2.87 1.39 23
B8-Control of Non-conformance 2.29 1.35 21 3.65 1.15 23
B9-Corrective & Preventative Action 2.81 1.03 21 3.91 1.04 23
B10-Health & Safety Records 2.86 1.01 21 3.87 0.92 23
B11-Health & safety Auditing 2.24 1.04 21 3.43 1.44 23
B12-Training 2.71 0.78 21 3.57 1.12 23
B13-Statistical Techniques 1.95 0.97 21 3.35 1.37 23

Firms were then classified as “actively” planning their future OHS if they specifically included cost in their tenders, firms that did not make a plan to allocate cost in their tenders were classified in this research as be “reactive” (Table 2). In other words, those firms that responded in the positive to the question, Do you include the cost of OHS in tenders, were classified as “Active”, and the negative were classified “reactive”. This was used as the basis for determining the difference between the firms using discriminant analysis (DA).

<table>
<thead>
<tr>
<th>Cost inc. in Bid</th>
<th>0 – 25 Emp</th>
<th>25 – 50 Emp</th>
<th>50 – 75 Emp</th>
<th>75 – 100 Emp</th>
<th>100 + Emp</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive (No)</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Active Yes</td>
<td>15</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>33</td>
<td>75</td>
</tr>
</tbody>
</table>

The next phase of the research considered the question of scores for firms that indicated that they did plan for the cost of OHS in their tenders. A Discriminant 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 management practices.

It can be clearly seen (Table 3) that the most significant discriminator is Design Control (0.777), which 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 results of the DA also show (Table 3) that the next significant discriminator is Health & Safety System (-0.615), which relates to criteria about how the OHS policy is embedded in the firm’s organisational procedures Firms that rated themselves low on the matrix indicated that they do not have formal and comprehensive OHS policies in place and instead have Little or no obvious policy and rely mainly on ad-hoc procedures. This approach was contrasted with firms that rated themselves more highly; in those cases firms indicated that used a Continuous improvement plans, fully resourced OHS and consultative processes for all system components.
Table 3 – Standardized Canonical Discriminant Function Coefficients

<table>
<thead>
<tr>
<th>Benchmark Criteria</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1-Management Responsibility</td>
<td>.217</td>
</tr>
<tr>
<td>B2-Health &amp; Safety System</td>
<td>-.615</td>
</tr>
<tr>
<td>B3-Contract Review</td>
<td>-.059</td>
</tr>
<tr>
<td>B4-Design Control</td>
<td>.777</td>
</tr>
<tr>
<td>B5-Purchasing</td>
<td>.019</td>
</tr>
<tr>
<td>B6-Work Method Control</td>
<td>.471</td>
</tr>
<tr>
<td>B7-Inspection &amp; Testing</td>
<td>-.028</td>
</tr>
<tr>
<td>B8-Control of Non-conformance</td>
<td>.320</td>
</tr>
<tr>
<td>B9-Corrective &amp; Preventative Action</td>
<td>-.235</td>
</tr>
<tr>
<td>B10-Health &amp; Safety Records</td>
<td>.435</td>
</tr>
<tr>
<td>B11-Health &amp; safety Auditing</td>
<td>-.559</td>
</tr>
<tr>
<td>B12-Training</td>
<td>.308</td>
</tr>
<tr>
<td>B13-Statistical Techniques</td>
<td>.081</td>
</tr>
</tbody>
</table>

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 not allow for OHS cost in their bids were the small firms (Table 2). This seems to suggest that these firms will find it difficult to implement the most 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.

DISCUSSIONS

The major finding of this research was that company size had a significant influence on a company’s OHS management. (Figure 1) According to (Monk 1994) many occupational accidents and injuries are due to breakdowns in the existing OHS management systems. The result shown in was found to be consistent with this research.

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.
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 may be possible for a firm to increase its OHS performance by strategically addressing only a few of the criteria.

The DA (Table 3) showed that the most significant differences in the OHS matrix score occurred in the Design Control and Health and safety System elements. This indicates that contractors that scored highly in these criteria tended to be higher on the matrix. These two elements have an important impact on safety performance and it is likely that many of the respondents recognised their importance.

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 regardless of the size. 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.

Hinze (1988) found that injury rate tends to be higher when projects were competitively bid. Although competitive bidding alone should not affect OHS performance, the 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 below (Table 2) shows the there were 10 Reactive firms and 33 Active firms. As previously mentioned this was based on whether they included costs in their tender prior to construction. 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 1).

CONCLUSION
As expected the major factor affecting the OHS management practices was found to be the company’s size. This research found that larger contractors tend to have better management structures 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 planning. This research supports previous work conducted by Wilson (2000) that found that it was
difficult for smaller companies to benefit from higher standards of OHS practice, due to the implementation costs involved.

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.

Firms that identified that they actively plan for OHS in advance seem to perform better against the CIDA matrix. Design Control and Health and Safety Systems are two of the criteria that appear to discriminate the practices of “active” and “inactive” firms, regardless of size. These two criteria play a major role in OHS management and this research suggests that any could improve OHS performance by concentrating in those areas.

REFERENCES


