

Impact significance of construction clients' culture on contractors' health and safety (H&S) culture- An exploratory Delphi study

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Abstract

Contractors' top management has been identified in many studies to be of great importance to H&S performance and continual improvement. Therefore developing strategies that support and motivate contractor top management, implement H&S elements would ensure a gradual and sustained improvement of H&S in the construction industry. This way construction workers' H&S can be assured and in so doing achieve sustainability in the industry through skills preservation.

The paper reports on an analysis of impact significance of clients on contractors. It will underscore the point that has been made before using different methodologies that client H&S culture is critical to contractors' H&S culture because it is crucial to H&S performance

Keywords

Clients, Contractors, Culture, H&S, Impact significance

1. Introduction

H&S performance improvement in the construction industry has increasingly received attention in recent years. Some authors argue that the commitment might be influenced by the introduction of major pieces of legislation, coupled with increased personal responsibility of senior managers and organizations for H&S (Fitzgerald, 2005). Other reasons for the focus on H&S include a need to develop good or better image of the construction industry (Misnan and Mohammed, 2007) and in some ways to address the H&S record which in comparison to many industries is really undesirable. For larger multi-national organizations, the need for H&S improvement could be a corporate social responsibility issue. Therefore these countries are working at improving their H&S performance (Smallman and John, 2001).

For example, these methods include designing for construction worker safety (Gambetese and Hinze, 1999; Gambetese, Behm and Hinze, 2005; Hecker, Gambetese and Weinstein, 2005), continual improvement of safety management systems (Chua and Goh, 2004), addressing H&S culture (Molenaar, Park and Washington, 2009; Parker, Lawrie and Hudson, 2006; Chinda and Mohamed, 2007), the model client framework (Lingard, Blismas, Cooke and Cooper, 2009), use of incentives and disincentives (Tang, Qiang, Duffield, Young and Lu, 2008). Other methods include multi-stakeholder involvement (Suraji, Sulaiman, Mahyuddin and Mohamed, 2006). Even though many ways of improving H&S have been

suggested, there has not been much study on approaches that advocate for a holistic approach to achieve a multi-stakeholder involvement. In addition, there has not been an objective identification of each party's capacity to influence H&S outcome and thus attain the desired H&S improvement in the industry.

This paper presents an analysis of impact significance on contractor H&S of construction clients in the construction industry. Based on this analysis, the extent to which clients can influence contractor H&S performance and which client cultural aspects are essential to influence H&S performance will be established. These can then be used as a H&S assurance or leading indicator of contractor H&S performance.

The importance of contractors and specifically contractors' top management commitment to H&S has been recognized in many studies (Suraji et al 2006 and Gould and Joyce, 2002). Contractor H&S performance is very important. Therefore knowledge on the impact significance of clients on contractors' H&S performance is essential as this information can aid in formulating targeted strategies to assure contractor H&S performance.

2.0 The study

A Delphi study method was used to explore the impact significance of the identified stakeholders on project H&S. The Delphi method was preferred instead of survey methods as the current study was addressing the 'what could' kind of questions as opposed to the 'what is' kind of questions (Hsu and Sandford, 2007). The Delphi methodology was also considered to be a much stronger methodology for its rigorous query of experts which is achieved through many iterations and feedback.

The Delphi study involved invited panellists and it retained eleven active members. This number of panellists was considered adequate based on what other Delphi studies have used and recommended. Delbecq, Van de Ven and Gustafson (1975) suggest that ten to fifteen panellists could be sufficient if the background of the panellists is homogenous. A review by Rowe and Wright (1999) indicates that the size of a Delphi panel has ranged from three to eighty in peer reviewed studies. Okoli and Pawlowski (2004) and Skulmoski, Krahn and Hartman (2007) also mention a panel size of about ten to eighteen members. Hallowell and Gambatese (2010) suggest a minimum of eight panellists. Based on the above and the fact that the Delphi method does not depend on the statistical power (Okoli et al, 2004), but rather on group dynamics for arriving at consensus among experts, a panel of eleven members was considered adequate.

The selection of panellists was based on criterion sampling. Panellists were selected for a purpose to apply their knowledge to a concept raised in the study based on the criteria that was developed from the research questions under investigation. A Delphi study does not depend on a statistical sample that attempts to be representative of any population. Instead it is a group decision mechanism requiring qualified experts who have deep understanding of the issues (Okoli et al, 2004). Therefore, one of the most critical requirements is the selection of qualified experts as it is the most important step in the entire Delphi process because it directly relates to the quality of the results generated (Hsu and Sandford, 2007). In view of the above, successful panel members had to meet at least four of the following criteria adopted from Skulmoski et al (2007) and Hallowell et al (2010):

- Knowledge and experience in construction H&S;
- Knowledge and experience in construction project management;
- Have appropriate academic qualifications;
- Professional registration with a recognized built environment or H&S registration body;
- Have published articles in peer reviewed journals, books and or conferences;
- Industry experience of at least five years;

- Capacity and willingness to participate;
- Sufficient time to participate;
- Effective communication skills

Panel members were identified from three sources. The first source was the CIB W099 register of members located on the CIB WO99 website (CIB W099-Safety and Health in Construction, 2010). The CIB W099 is a working commission that was set up on royal appointment to enable researchers on construction H&S in the world collaborate as well as protect H&S. The second source was the conference proceedings of the CIB WO99 from year 2005 to 2009. Individuals who had frequently appeared as authors or keynote speakers were identified as potential experts on the study. The third and last source was indentified through references of individuals working in the area of H&S in the local construction industry in Southern Africa.

The panel consisted of two members from South Africa, three from the United States of America (USA), and the United Kingdom (UK), one from Singapore, Hong Kong, and Sweden. Of these panellists one of them had a Doctor of Science (DSC) Degree, six had a Doctor of Philosophy (PhD) degree, two had a Master of Science (MSc) degree, one had a Bachelor of Science (BSc.) degree and one had a Diploma in Safety Management. All the panellists specialized in construction safety. In terms of their current occupation, three of the panellists were employed by contracting organizations, one by a consulting organization, and six by universities. All panellists held very senior positions in their organizations and were involved in community service.

The panel had a cumulative of 243 years of experience. The lowest number of years of experience was seven and the highest was 45 years. The calculated mode of years of experience was 15, the mean was 22.1 years and the median was 15 years. Experience was an important factor in determining who was an expert. Therefore a minimum number of years was set to be five years. In terms of publications, 10 of the panellists had published in peer reviewed journals, conference proceedings and books. Between them, they had published 57 books and monographs, 19 chapters in books, 187 peer reviewed academic journals, 345 recent conference papers and 341 other publications comprising of articles in professional journals, technical reports, policy papers, expert witness documentation and key note addresses. In addition to their publication, the panel had led and managed 108 funded research projects. Three panellists served on editorial boards of 43 peer reviewed journals and conference proceedings. The bar chart labelled figure 1.0 below shows the contribution of panellists to the above mentioned publications.

Table 1: Panellists publications

Panel publications	No. of publications
Books and monographs	57
Chapters in books	19
Peer reviewed Journals	187
Peer reviewed Conference proceedings	345
Funded research	108
Other publications	341
Editorial board membership	43
Referee for journals	22
Referee for Conference proceedings	30

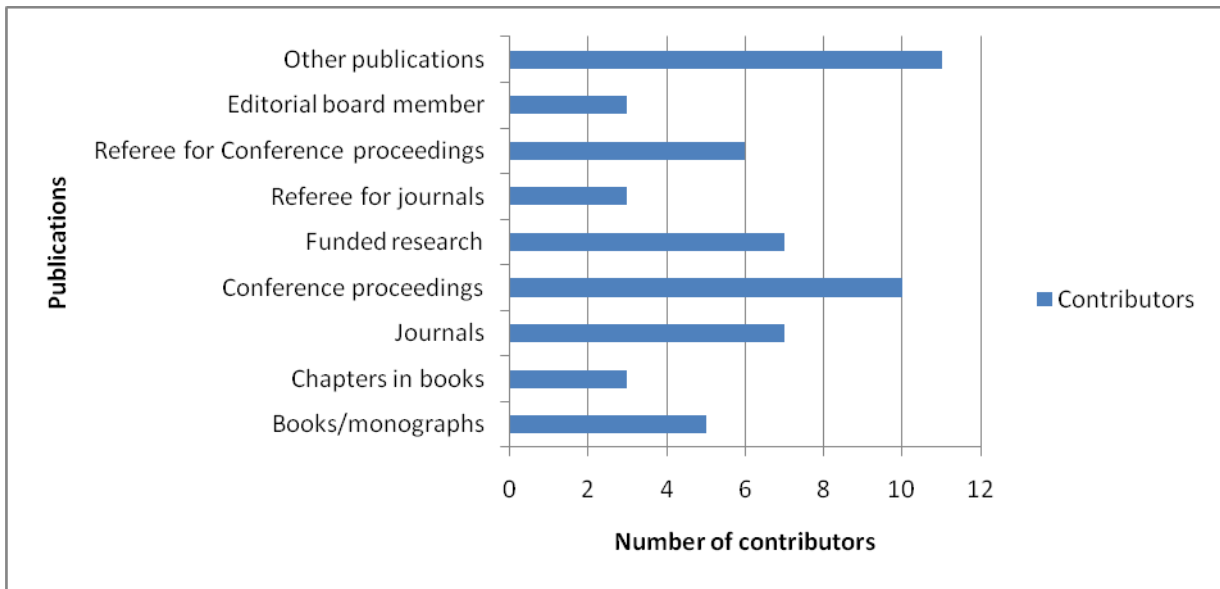


Figure 1: Publications by panel members

The current Delphi study involved three rounds of an iterative process with the view of achieving consensus between the panel members on the impact significance of clients and designers on H&S consideration at various project phases. Panellists were requested to rate the probability that H&S would be considered at project phases as a result of clients and designers H&S cultural influence. The probability scale ranged from 1 to 10 representing 0 to 100%. Further, panellists were requested to rate the negative impact that would result if a particular stakeholder’s cultural element was absent. The impact scale was based on a 10 point rating scale ranging from low to critical. This aspect indicated the severity of the culture or cultural element.

A two stage analysis of data from the Delphi was conducted using Microsoft office Excel, a spreadsheet software program. The first stage involved analysis to establish or confirm consensus on responses to the predetermined criteria. This involved determining the group median responses for each question. After the third round of the Delphi, absolute deviations (D_i) about the group medians ($m(X)$) of each rating for every question were calculated using equation 1.0. In addition, mean absolute deviations (MAD) were calculated for every question. This is a calculated mean of all absolute deviations for all panellists about the median on each question. Further analysis involved determining the statistical range in ratings by panellists on each question and the percentage of panellists with a similar opinion inclination on each and every question. Consensus was determined to have been achieved when the MAD was less than one unit below or above the group median, the range in ratings on each question between all panellists was below 4.0 and the percentage of panellists that were of a similar inclination in opinion was 60% and above on a particular question.

$$D_i = [x_i - m(X)]$$

Equation 1

Where:

D_i = Absolute deviation

x_i = Panellist rating

$m(X)$ = Measure of central tendency

The second stage of Delphi data analysis, involved determining the impact significance of clients' cultural factors on contractors' top management, H&S performance. The significance of the impact of various factors associated with the clients' H&S culture was categorised as critical, major, moderate, minor or low. The categorisation was helpful in determining which client factor was important and relevant for contractor H&S performance. The impact significance of a factor was obtained as a product of the overall rated probability (likelihood) that a client factor would influence contractor to implement H&S elements and the rated negative impact (severity) on the contractor implementing the elements that would result if the client factor was absent. This relationship is illustrated in equation 2.0 below.

$$\text{Impact Significance} = \text{Likelihood factor} \times \text{Severity factor}$$

Equation 2

2.0 Findings

The impact significance of factors of client H&S culture on contractors' top management H&S performance was evaluated. The objective of the evaluation was to establish client H&S culture influence on contractor top management's H&S performance. The client H&S culture factors of commitment, competence, involvement and leadership's influence were assessed individually and collectively on contractor top management.

The average impact significance of all client factors of H&S culture on contractors' top management was found to be 6.60. According to the rating scale, this value indicates that the level of clients' impact on contractors' top management is of 'major impact significance'.

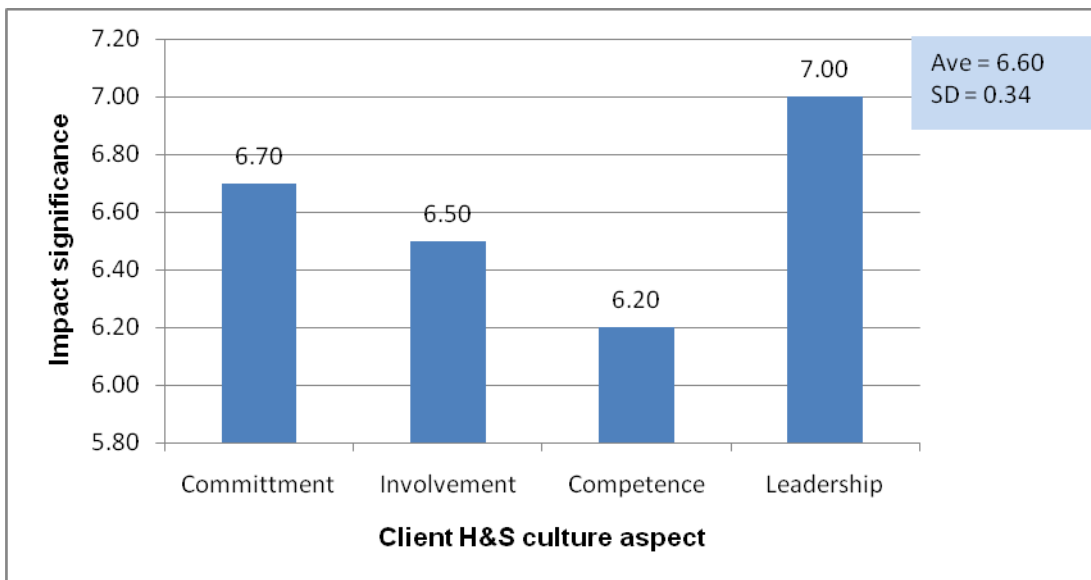


Figure 2: Impact significance of factors of client H&S culture on contractors' H&S performance

All the factors of client H&S culture have an impact significance of more than 5.0 but not more than 7.0. The rating for this scale range in the study was described as 'major impact significance'.

Figure 2 also shows that client leadership has the highest impact significance compared to all other factors of client H&S culture. This factor had an impact significance rating of 7.0. The client factor of H&S culture with the least impact significance on contractor top management was found to be the client competence. Client competence had a rating of 6.20. Although the impact significance was lower compared to all other factors, its impact was also described as ‘major’. It was observed that the difference in impact ratings between all factors was minimal. The standard deviation in impact significance values was 0.34 suggesting a small variability between all client factors of H&S culture’s influence.

On average, the likelihood of contractors’ top management implementing various H&S elements due to clients’ influence was determined to be 83%. See figure 3. The suggestion was that the implementation of H&S elements by contractors’ top management was ‘very likely to occur’ with client influence. The standard deviation in the likelihood of H&S elements being implemented was found to be 0.03 which was again a small variability.

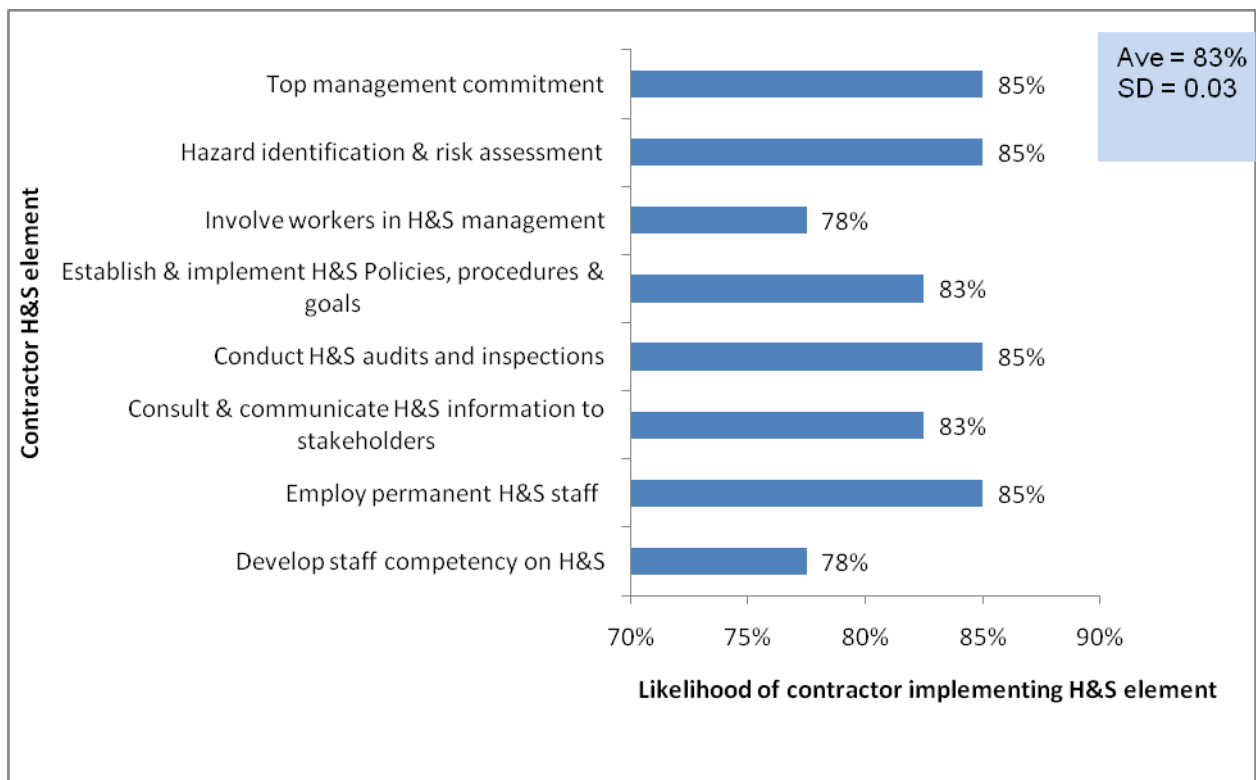


Figure 3: Likelihood of contractors’ implementing H&S elements due to client influence

The following six out of eight identified H&S elements were determined to be ‘very likely’ to be implemented by contractors’ top management as a result of clients’ influence:

1. Employ permanent H&S staff;
2. Conduct H&S audits and inspections;
3. Carry out hazard identification and risk assessment;
4. Top management commitment i.e. likelihood of improvement;
5. Consult and communicate H&S information to stakeholders;
6. Establish and implement H&S policies, procedures and goals.

The elements that were least likely to be implemented included contractors’ top management ‘involving workers in H&S management’ and ‘developing staff H&S competence’. These two elements had likelihood values of less than 80% but not less than 70% likelihood. See figure 3.

3.0 Discussion

Improving H&S performance on a construction project has to do with the extent to which contractors perform in terms of H&S. The aspect of contractor H&S performance is therefore an important aspect in improving H&S performance in the overall construction project. Therefore measures should be in place to ensure that contractor H&S performance is encouraged. The question however is, 'how do we assure contractor H&S performance?'

The current study was therefore a response in part to the above question and sought to determine the impact significance of clients on contractor H&S performance.

The consensus among panellists regarding the likelihood of contractor implementing H&S elements as a result of client influence was rated to be an average of 83%. The panel determined that contractor H&S performance i.e. implementing the identified elements was 'very likely to occur' with clients' influence. This finding is in agreement with other studies that have alluded to the fact that clients can influence H&S performance (Huang et al 2006). The current finding in addition, estimates the extent to which clients could influence contractor H&S performance.

The panel determined that the severity of clients' H&S culture on H&S consideration was 'critical'. Panellists indicated that the negative impact on contractor performance if factors of clients' culture were not apparent was determined to be above 8.0.

The resulting culture impact significances to contractor H&S performance ranged from 'major' to 'critical'. The suggestion was that clients' influence would assure contractor H&S performance. The client cultural factor of leadership was rated to be more critical compared to other client cultural factors to contractor H&S performance. The suggestion was that in order to ensure contractor H&S performance, clients would need to provide visible leadership on H&S.

3.0 Conclusion

Findings from the study reviewed the following:

- Clients H&S culture influence on contractor H&S performance has a high impact significance;
- All clients H&S cultural aspects of involvement, commitment, competence and leadership have impact significance ranging from 'major' to 'critical';
- Contractors were 'very likely' to implement H&S elements with clients' influence;
- In order to assure contractor H&S performance, client H&S culture and influence is necessary.

Clients' culture influence would cause contractors' implementation of H&S to 'very likely occur' with a likelihood of over 83%. The significance of this finding is that with the influence of clients, there is an assurance of a better contractor H&S performance and thus may achieve the desired improvement. Positive clients' H&S culture could therefore be taken as a leading indicator for a better contractor H&S performance.

Although the above findings do contribute to existing knowledge, this exploratory Delphi study is currently being verified using another study with a different method.

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