IMPROVING SAFETY PERFORMANCE IN CONSTRUCTION THROUGH CULTURAL CHANGE

Sam Wamuziri[1]

Construction Management Group, School of Engineering and the Built Environment, Merchiston Campus, Napier University, 10 Colinton Road, Edinburgh, EH10 5DT, UK

This paper provides an evaluation of safety culture in the UK construction industry. Firstly, an overview of recent changes in accident statistics in the industry is given. Analysis of safety data collected by the UK's Health and Safety Executive (HSE) reveals that safety performance in UK construction appears to have reached a plateau. In fact, the fatal injury rate appears to have gone up in the last two years. Future improvement of safety performance therefore remains a subject of current debate. It is suggested in this paper that future improvements in performance are likely to come not from more legislation or simply changes to management systems. Rules, regulations and managements systems have their role to play in improving safety performance. However, on their own they are inadequate to bring about further major improvements in safety performance which are required in the industry. It is postulated in this paper that a major cultural shift in attitudes is still required in the industry. The concept of safety culture is discussed in this paper including an assessment of its main characteristics. Research on safety culture in aviation, mining, nuclear and offshore sectors is assessed with a view to drawing important lessons for the construction industry. Results of a pilot survey to assess the characteristics of safety climate and culture in a large UK contracting organisation are provided. The results reveal a clear divergence in attitudes and views of managers and employees in this particular organisation. It is concluded that the safety climate or culture of an organisation can be assessed and changed over a period of time. A toolkit to assist in this process has been developed and published by the UK health and Safety Executive. However studies are required to develop this toolkit further to take into account the regulations, risks and management systems that are specific to the construction industry.

Keywords: accident statistics, health and safety law, safety climate, safety culture.

INTRODUCTION

Many construction workers are killed or injured every year as a result of construction operations. Others suffer ill health. The hazards are not restricted to those working on site. Children and members of the general public are also killed or injured due to inadequate control of construction activities. The construction industry's performance has improved over the years but the rates of death, serious injury and ill health are still too high. Accident rates today in the construction industry are one-quarter of those reported in the 1960s and half those reported in the 1970s (Wamuziri, 2006). A construction site is a more dangerous workplace in comparison to some other places of work such as a factory. According to the Health and Safety Executive (HSE), those who spend their working lives on construction sites have a 1 in 300 chance of being

---

[1] s.wamuziri@napier.ac.uk

killed at work. Accidents and ill health also have a financial cost. The business case for improving safety performance in construction is abundantly clear (HSE, 2003).

There is still great potential to improve the health and safety record of the industry. The Egan report – a government sponsored review of the UK construction industry published in July 1998 (DETR, 1998) recognised this and argued the industry to provide decent and safe working conditions. Measured in terms of the number of reportable accidents per 100 000 employees in any given year, the report states that some leading clients and construction companies have achieved reductions in reportable accidents of 50-60% in two years or less. The report challenged construction companies to set targets to reduce the number of reportable accidents annually by 20% in addition to simultaneous improvements in other project performance measures (DETR, 1998). Cultural change throughout the organisation is recognised as one of the ingredients necessary to bring about these safety improvements. Ten years since publication of the Egan report, accident statistics reveal that the targets set in the report have not been achieved. In fact over the last few years, the fatal accident injury rates are actually increasing.

Safety culture may be considered as a sub-set of organisational culture. In this paper, the ten year targets set in the year 2000 to improve health and safety performance in UK Construction are firstly evaluated. The concept of safety culture is evaluated in this paper including an assessment of its key characteristics. A review of research studies on safety culture in other high-risk industries such as nuclear, offshore, and the mining sectors is provided with a view to drawing important lessons for the construction industry. Finally, results of a pilot survey to assess the characteristics of safety climate and culture is a large UK contracting organisation are given.

ACCIDENT STATISTICS IN UK CONSTRUCTION

The UK Government and the HSE also recognised the potential to improve workplace health and safety. In July 2000, they set targets to improve the UK's health and safety record over a ten-year period. The targets set specifically for the construction sector are to (HSE, 2003):

- reduce the incidence rate of fatalities and major injuries by 40% by 2004/05 and 66% by 2009/10.
- reduce the incidence rate of cases of work-related ill-health by 20% by 2004/05 and 50% by 2009/10.
- reduce the number of working days lost per 100,000 workers from work-related injury and ill health by 20% by 2004/05 and by 50% by 2009/10.

The HSE further recognised that cultural change in the industry is necessary to deliver these targets and that such improvements can only be achieved if all those involved in construction projects play their role.

There were 71 fatal injuries to workers in UK Construction in 2004/05, the same number as in 2003/04. The majority of these deaths (28 representing 39%) were due to falls from height. This means that in 2004/05, 32% of all work related deaths in the UK were in the construction industry. In 2000/01, there were 5.9 fatal accidents per 100,000 employees compared to 3.4 per 100,000 in 2004/05. This represents a decrease of 42% in the number of fatal injuries over this particular five year period. In the year 2006/07, there were 77 fatal injuries to workers in construction, a 28% increase on the previous year. Of these 77 fatalities, 50 were employees and 27 were self-employed, compared to 43 and 17 in 2005/6 respectively. In 2006/07, 32% of all

worker deaths were in the construction industry. The rate of fatal injury to workers in construction rose to 3.7 per 100,000 workers, from 3.0 per 100,000 workers in 2005/6.

Since 1999/00 there has been a downward trend in the number of major injuries sustained by employees in the UK construction industry. In the period since 2000, there has been a steady drop in the number of major accidents. In 2000/01 there were 380.9 major accidents per 100,000 employees. This dropped to 299.4 per 100,000 in 2004/05. This represented a 21 percent improvement over this five-year period. Furthermore, the rate of major injury to employees decreased by 4% from 370.8 per 100,000 employees in 2006/07 to 295.4 in 2005/06. This continues the general downward trend seen since 1998/99, and is the lowest since the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations were introduced in 1996. In 2006/07, the most common kind of accident was a slip or trip 988 (27%). As in previous years, falling from a height accounted for a high number of major injuries, 987 (27%). The next two most common kinds of accident were being hit by moving/falling objects (649) accounting for 17%, and being injured while handling, lifting or carrying (525) accounting for 14% of major injuries. HSE statistics show that the number of workers that sustained non-fatal (includes major and over 3 day) injuries in construction decreased by 8% in the year 2006/7, from 935 to 861 per 100,000 and continuing the downward trend since 1999/2000.

The ten year health and safety targets for the UK construction industry were set in June/July 2000. Today in 2008, it is only two years away from 2010 and therefore an appropriate point to analyse statistics and evaluate whether these well intended goals and targets set by government and the industry will be achieved. The industry aimed to reduce the incident rate of fatalities and major injuries by 40% by 2004/05. The data above shows that the number of fatalities actually fell by 42% which was a good indicator that the goal of a 66% reduction by 2009/10 might well be achieved. Unfortunately, fatal accident rates in the two year period from 2005/06 to 2006/07 show an upward trend. Based on the Labour Force Survey (LFS), the rate of reportable non-fatal injury in construction was 1600 per 100 000 workers (1.6) in 2005/6 and is statistically higher than the average for all industries (1000 per 100,000 workers – 1.0%) (HSE, 2008).

Research carried out into accident rates has shown that small enterprises have a below average health and safety performance across all industries (HSE, 2006). Workplace size has a significant influence on trends in occupational injuries, with Small and Medium Enterprises (SMEs) accounting for proportionately higher rates for major injuries than larger enterprises (Nichols, 1995). Some of the reasons found for SME poor health and safety management performance are due to (Walters, 1998):

- limited resources
- limited knowledge of regulatory resources
- poor awareness of economic advantages of health and safety
- poor knowledge and understanding of safe working practices
- short-term economic pressure and competition
- inadequate enforcement and absence of preventive services.

It should also be noted that there is a dominance of very small companies in the UK Construction industry, with 93% of all registered construction companies employing less than 7 people, (Dainty, Briscoe and Millet, 2001). It is clearly partly because of this that the construction industry has a poor health and safety record.

CONCEPT OF SAFETY CULTURE IN CONSTRUCTION

Safety culture can be considered as a particular aspect or subset of organisation culture. No review of safety culture would be complete without an evaluation of the relevant aspects of organisational culture. The definition of safety culture must therefore be consistent with the parent term organisational culture. Establishing a link between safety culture and safety of construction operations requires an understanding of the characteristics of safety culture. Such characteristics must be consistent with the definition and key attributes of organisational culture. The culture on construction sites is inevitably a task culture where individuals may take risks and break rules and procedures to get the job done. There is general consensus that there is a difference between the terms organisational culture and organisational climate. Cox and Cheyne (2000) take the view that culture in general and safety culture in particular, is often characterised as an enduring aspect of the organisation with trait-like properties and not easily changed. On the other hand, organisational climate can be viewed as a manifestation of organisational culture. If culture represents the more trait-like properties of personality, climate can be taken to be more of state-like properties of mood.

Cox and Cheyne (2000) argue that climate is a temporal manifestation of culture, which is reflected in the shared perceptions of the organisation at a discrete point in time. Guldenmund (2000) states that organisational climate is commonly conceived as a distinct configuration with limited dimensionality surveyed through self-completion questionnaires and that up to a certain point, objective and semi-quantitative. On the other hand, organisational culture is often determined through a combination of methods including observations, focus groups, interviews, through mutual comparisons and so on. Measures of organisational culture are thus qualitative and difficult to quantify. Choudhry et al (2007) agree that the term safety culture is distinct but related to other concepts which include safety climate, behaviour based safety, and safety system. They further assert that the concept of safety culture is gaining popularity in the construction industry because of its ability to embrace perceptional, psychological, behavioural and managerial factors. They suggest however that there is as yet no verifiable process that can be used to analyse safety culture in a construction environment. Although norms and values remain relatively stable, culture can be learned. That is why a lot of research effort has been directed towards understanding the influences, ingredients and consequences of culture. The overall objective is to understand these aspects and influence them so as to change the overall culture of the group or organisation.

A culture is a set of norms and beliefs. It is about both individuals and groups of people who share common values and attitudes. The common-sense view of a culture could be summed up in the phrase "the way we do things around here". The term "safety culture" was first introduced into common use in the nuclear industry following the Chernobyl nuclear accident in 1986. The reasons for the accident were proposed to be not only technical or individual human errors. It was suggested that management, organisation and attitudes also influence safety. In recent years, it has attracted considerable attention in the offshore industry following investigations into the 1988 Piper Alpha disaster in which 167 people died. Other high risk industries in which the concept of safety culture has been researched include tunnelling, mining and aviation.

On the concept of safety culture with specific reference to the construction industry, Anderson (1998) writes: "*It is clearly a 'good thing'. Quite how it should be researched, evaluated and improved within the construction industry is, as yet unclear, but the gains that have been made elsewhere just cannot be ignored.*" A comprehensive definition of safety culture which has been widely adopted in research and other scientific publications is one proposed by The Advisory Committee on the Safety of Nuclear Installations (ACSNI). According to the ACSNI (1993), "the safety culture of an organisation is the product of the individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisations' health and safety management. Organisations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures".

High standards of health and safety will be achievable if people can report errors and near misses. These are a source of vital information. A reporting culture and a learning culture in which people can admit and learn from such genuine mistakes without fear of blame or punishment requires also to establish a just culture in which employees are confident that they will be treated fairly if they report accidents and near misses. Obviously, wilful carelessness cannot be accepted. In any organisation, people should be disciplined or indeed prosecuted for wilful contribution to or creation of conditions in which accidents, injury or ill-health result. According to Fang et al (2006), the concept of safety culture in construction is an important one. In an extensive case study involving over 4,719 records collected from over 54 construction sites, Fang et al (2006) report that there is a relationship between the safety climate on site and personal characteristics of the employees. The personal characteristics explored in their study include: gender, marital status, education level, number of family members to support, safety knowledge, drinking habits, direct employer and individual safety behaviour. Mohamed (2003) suggests that the balanced scorecard can be used to benchmark organisational safety culture in construction. He argues that the tool can be used to translate a firm's safety policy into a clear set of goals across the following four areas: management, operational, customer and learning. Mohamed (2003) asserts that the balanced scorecard should enable construction organisations to pursue incremental safety performance improvements.

SAFETY CULTURE IN OTHER HIGH-RISK INDUSTRIES

According to Laurence (2005), a positive safety culture requires:

- Higher management commitment to safety
- Open communication channels
- A stable, experienced workforce
- High quality housekeeping
- A safety emphasis on training
- Full-time safety personnel reporting to top management.

A positive safety culture provides a platform on which to build greater awareness, understanding, and compliance with safety rules and regulations. Although research by Laurence (2005) did not focus on safety culture in the mining industry per se, analysis of responses from 500 mineworkers on the development of more effective mine safety rules and regulations revealed that:

- Management and regulators should not continue to produce more and more safety rules and regulations to cover every aspect of mining because miners will not read nor comprehend this level of detail.
- Detailed prescriptive regulations, detailed safe work procedures, voluminous safety management plans will not influence activities or behaviour of a miner. The aim should be to develop a framework of fewer rules but of the highest quality.
- Achieving more effective rules and regulations is not the only answer to a safer workplace. Emphasis should be placed on ensuring that a positive safety culture exists and that communication channels are open and working well.

The Piper Alpha disaster led to a fundamental review of health and safety law in the offshore oil and gas processing sectors in the UK. A lot of research was also initiated although these efforts were initially focussed on improvements in technology and management systems. Cox and Cheyne (2000) carried out extensive research on safety culture in the offshore industry and have developed, tested and validated a safety climate assessment toolkit. The key areas which can be "measured" using the model on a scale of 1 to 10 in relation to health and safety culture or climate are: management commitment, communication, safety systems, work environment, supportive environment, involvement, co-operation, personal appreciation of risk, personal priorities, competence and management style. In addition, Cox and Cheyne (2000) take the view that further improvements in safety in the offshore sector may best be realised through enhanced efforts in the areas of human factors and through associated developments in health and safety.

Use of such a toolkit brings a number of benefits. The first is that it can raise the profile of health and safety in the organisation. Secondly, it allows active monitoring of the health and safety culture in the firm. Thirdly, it provides an opportunity to discuss openly issues relating to health and safety culture and encourages participation of all workers in health and safety matters. Finally, the performance of the firm can also be benchmarked against the performance of similar firms in the sector.

Gurjeet and Gurvinder (2004) report findings of research based on a very extensive survey of businesses and individuals in the aviation industry in New Zealand. They reiterate the view that a positive safety culture will thrive where there is a senior management commitment to safety. Their study revealed that aircraft maintenance businesses considered positive safety practices and safety education as the two most important factors for ensuring safety. Furthermore, aircraft maintenance engineers considered positive safety practices, safety education, implementation of safety policies and procedures to be the most important aspects in ensuring safety in the aircraft maintenance system. They found that a positive safety sub-culture appeared to have emerged amongst aircraft maintenance engineers. This is a sub-culture of commitment to ensuring safety by strongly following standards, regulatory procedures and safety practices. This was a positive finding given that 12 percent of major aviation disasters are due to inspection maintenance inadequacy. The study also revealed that pilots considered luck to a significant contributor to safety. Overall they concluded that various sectors in the aviation industry need to do more to improve the prevailing safety culture.

Findings on a comprehensive study of safety culture in the nuclear industry are presented in Lee and Harrison (2000) and conclude that personnel safety surveys can be usefully applied to deliver a multi-perspective, comprehensive and economical

assessment of the safety culture in an organisation and to explore the dynamic inter-relationships of its composition or parts. They also comment on the HSE's Health and Safety Climate Assessment Toolkit based on Guidance HSG65 entitled "Successful Health and Safety Management"(HSE, 1998). This signifies official endorsement of health and safety climate or culture assessment by the UK regulatory body. It should however be noted that Guidance HSG65 provides generic guidance for planning, organisation and control of health and safety across all workplaces. Clearly, risks, safety problems and safety management will differ from sector to sector although there are bound to be similarities. This HSE Safety Climate Assessment Toolkit ought to be developed further so that it is customised for relevant sectors such as agriculture, construction, offshore oil extraction, manufacturing or service sectors to take account of the risks and management procedures and systems in different industries.

RESEARCH OBJECTIVES AND METHODOLOGY

The overall objectives of this study are to compare and contrast safety culture and other related attributes such as safety climate and to assess whether safety culture can actually be measured and quantified and to evaluate the extent to which it can be used to improve safety performance in a construction organisation. The initial part of the investigation involved review of relevant literature on the subject of safety culture, safety climate and organisation culture. The literature review has revealed some ambiguity over the definitions of safety culture and safety climate although the two terms are clearly distinct. The second part of the study involved design of a questionnaire. The questionnaire was a multi-option format questionnaire with 60 questions. Open ended questionnaires were limited to only two so as not to discourage participation. Open ended questions clearly require thought on the part of the respondent since they have to formulate an answer. The questionnaire was administered to a group of employees in a particular organisation with the support of senior management. In total, 35 site based employees completed the questionnaire. Three senior managers also completed the questionnaire to provide a management perspective. A detailed analysis and discussion of the survey results will be the subject of a separate paper. The discussion in the following section is limited to some of the emerging perspectives from the site employees and the managers in relation to some of the attributes of safety culture.

DISCUSSION OF PRELIMINARY RESULTS

A worker's safety behaviour is guided by the safety ethics of the organisation in which he or she works. The organisation's safety climate can therefore influence a worker's personal safety behaviour. One of the questions posed in the questionnaire was whether management in this particular organisation does not sacrifice safety standards for productivity. There was overwhelming agreement from management that they have a positive attitude to safety and that they do not sacrifice safety standards for productivity. It was interesting to note however that the workers did not concur completely with management's self evaluation. Only 67% of the workforce actually agrees that their management does not sacrifice safety for productivity whilst 100% of the management believe this to be the case.

Most construction organisations have an accident reporting system. Organisations must report work-related deaths, major injuries or over three day injuries, work-related diseases, and dangerous occurrences under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995. A set of questions were posed to try and establish why their organisation implements an accident report

system. 100% of the respondents agreed or strongly agreed that accidents are thoroughly investigated in the workplace. This highlights an overwhelming belief amongst employees in this construction organisation that its management is committed to investigating accidents. Part of the reason of course is to comply with the RIDDOR provisions. However, there was not the same united belief amongst the workforce as to why the management are so committed to implementing such a thorough investigation system. When asked if they felt that investigations aim at finding causes of accidents rather than blaming individuals, a significant proportion of 21% did not agree or strongly agree. And when asked if they felt that accident investigations and reports are used to improve the health and safety of the organisation only 84% agreed or strongly agreed with 5% actually disagreeing.

The workforce was also presented with a series of statements to evaluate the actions of management in response to safety issues. The results reveal a lack of faith in the overall safety climate which was demonstrated by the fact that:

- 12% of the workforce did not agree when asked if management acts promptly to prevent accidents happening again;
- 12% of workforce asked did not agree that health and safety is well organised by management;
- 17% of the workforce asked did not agree that the management ensure that the management ensure that safety issues are quickly and effectively dealt with.

On a positive note, 97% of the workforce agree or strongly agree that health and safety concerns are effectively communicated within the organisation. The remaining 3% were neutral. Asked if their supervisor was willing to listen and discuss safety issues, 93% agreed or strongly agreed. On the surface this suggests that there is a healthy system in operation for communication of health and safety matters.

CONCLUSIONS

After a long period of sustained improvements in safety performance of the UK construction industry, recent accident statistics reveal that the fatal accident injury rates in the industry are actually rising again. The ambitious targets set for improvement in safety performance in the Egan report 10 years ago appear not to have been achieved. Measures to improve safety performance in the industry remain the subject of debate in academia and industry. Although legislation has a role to play, more legislative measures are not the panacea to what is clearly a complex issue. There has been recent change in legislation including the CDM Regulations 2007 and the Corporate Manslaughter and Corporate Homicide Act 2007 which came into force on 6th April 2008. It is suggested that change in safety culture has a role to play in improving safety performance. It should be acknowledged however that that are still a number of authors who take the view that safety culture is a fuzzy academic concept, lacking in empirical validation. As a consequence, they argue that it is not a valid management tool that can be measured in an effort to reduce accident rates and improve safety performance (Clarke, 2000).

This paper has also reported results of a pilot survey carried out to evaluate the culture in a large UK contracting organisation. Preliminary results show clear divergence of views between the managers and the workforce in this particular organisation. What is clear however is that further research is required in construction to develop a set of validated measurement methods of safety culture in the construction industry. It is also necessary then to increase understanding of the factors that comprise both

positive and negative construction safety cultures and to expand the availability and use of effective interventions to maintain safe work practices all the time in the industry.

REFERENCES

ACSNI (1993). Advisory Committee on the Safety of Nuclear installations Human Factors Study Group Third Report: *Organising for Safety*, HSE Books, Sheffield.

Anderson, J (1998) Growing a safety culture. *In:* Barnard M (Ed) *Health and Safety for Engineers*, London: Thomas Telford.

Cox, S J and Cheyne, A J T (2000) Assessing safety culture in Offshore Environments. *Safety Science* **34**, 111-129.

Choudhry, R M, Fang, D and Mohamed, S (2007) Developing a Model of Construction Safety Culture. *ASCE Journal of Management in Engineering*, **23**(4), 207-212.

Clarke, S G (2000) Safety Culture: Under-Specified and overrated? *International Journal of Management Reviews*, **2**(1), 65-90.

Dainty, A R J, Briscoe, G H and Millet, S J (2001). Subcontractor perspectives on Supply Chain Alliances, *Construction Management and Economics*, **19**, 841-848.

Department of the Environment, Transport and the Regions (DETR) (July 1998) *Rethinking Construction: The Report of the Construction Task Force*. London: HMSO.

Fang, D; Chen, Y and Wong, L (2006) Safety Climate in Construction Industry: A Case Study in Hong Kong. *ASCE Journal of Construction Engineering and Management*, **132**(6) (June), 573-584.

Guldenmund, F W (2000). The nature of safety culture: a review of theory and research. *Safety Science*, **34**, 215-257.

Gurjeet, K G and Gurvinder, S S (2004). Perceptions of safety management and safety culture in the aviation industry in New Zealand. *Journal of Air Transport Management*. **10,** 233-239

Health and Safety Executive (2003). *Health and Safety in Construction*, 2ed. HSG150, Sheffield: HMSO.

HSE (1998). *Successful Health and Safety Management*. HSG65, Sheffield: HMSO.

Health and Safety Executive (HSE, 2008), *Work-related injuries and ill-health in Construction*; Available from www.hse.gov.uk Accessed on 12th February 2008.

Laurence, D (2005). Safety rules and regulations on mine sites: The problem and a solution. *Journal of safety research* **36,** 39-50.

Lee, T and Harrison, K (2000) Assessing Safety Culture in nuclear power stations. *Safety Science* **34**, 61-97.

Mohamed, S. (2003) Scorecard Approach to Benchmarking Organisational Safety Culture in Construction. *ASCE Journal of Construction Engineering and Management*, **129**(1), 80-88.

Nichols T (1995), Size of employment unit and injury rates in British manufacturing: a secondary analysis of WIRS 1990 data, *Industrial Relations Journal*, **26**(1), 45-56.

Walters, D (1998) Employee representation and health and safety: A strategy for improving health and safety performance in small enterprises? *Employee Relations*, **20**(2), 180-195.

Wamuziri, S (2006), Safety culture in the construction industry, *Proceedings of the Institution of Civil Engineers: Municipal Engineer*, **159**(3), 167-174.