

Safety Culture Literature Review

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ABSTRACT

The occupational injury rate in the manufacturing sector is higher than the average of all private industries, necessitating safety studies. Occupational safety can be measured through different approaches. Safety culture, a predictive measure of safety, studies the workers' perceptions of safety of the workplace. This measure includes several dimensions of safety like management commitment, involvement and work place hazard evaluation and was chosen as a method of evaluation in this study. safety culture is a valuable construct, it has some inherent weaknesses ,researchers know how to measure particular components of safety culture, with specific focus on individual and organizational factors. Such existing methodologies can be leveraged for future assessments and safety culture is best viewed as a dynamic, multi-faceted overall system composed of individual, engineered and organizational models. By addressing all these components of safety culture, organizations have a better chance of understanding, evaluating, and making positive changes towards safety within their own organization with a help of questionnaires.

In this paper effort has been made to define various criteria in safety measurement and to review the literature on safety culture. This paper advocates the balanced view for managing safety in the workplace. The following sections details the literature on the origins, definitions, differences between safety climate and safety culture, models, questionnaires , other types of studies related to this construct.

1. Safety Culture

The term safety culture gained its first official use in an initial report into the Chernobyl accident (IAEA, 1986). This report introduced the concept to explain the organizational errors and operator violations that laid the conditions for disaster. Public Inquiry reports have since implicated poor

safety culture within operating companies as a determinant of several high-profile accidents since, such as the explosion on the Piper-Alpha oil platform in the North Sea (Cullen, 1990); the fire at King's Cross underground station (Fennell, 1988); the sinking of the Herald of Free Enterprise passenger ferry (Sheen, 1987), and the passenger train crash at Clapham Junction (Hidden, 1989). The relevance of safety culture to safe operation is not disputed (Cox & Flin, 1998). Indeed, Reason (1998) argues that it is a concept 'whose time has come' (p. 293). However, there is no definitive definition of the concept for two main reasons: (i) different researchers emphasise different elements of safety culture as most salient, and (ii) culture of any kind is an extremely difficult concept to succinctly define. Reason (1997) makes the case that for engineers, defining organizational culture has '...the definitional precision of a cloud' (p. 192). The same argument may also be levelled at defining safety culture (Pidgeon, 1991). A number of definitions of safety culture are offered in the literature. For a comprehensive analysis of 18 of these definitions (including definitions of safety climate, considered in the following section), see Guldenmund (2000, p. 228). Two of the dominant definitions are as follows. With reference to the Chernobyl disaster, the International Atomic Energy Agency (IAEA) defined safety culture as '...assembly of characteristics and attitudes in organizations and individuals which established that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance' (IAEA, 1991; p. 1). The UK Health and Safety Commission (HSC) endorse this position and provide a number of characteristics that are expected in positive safety cultures by defining the concept as '... the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and

proficiency of, an organization's health and safety management. Organizations 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 preventative measure.' (HSC, 1993; p. 23).

Most definitions of safety culture encapsulate beliefs, values, and attitudes that are shared by a group. As human behaviours (and thus at an individual level, safe or unsafe behaviours) are partly guided by personal beliefs, values, and attitudes (Fazio, 1986; Kleinke, 1984), continued workplace safety may have its base in individually, and organizationally constructed shared beliefs that safety is important. A related theme evident in the definitions of safety culture offered is that of individual norms. Ostrom, Wilhelmsen and Kaplan (1993) argue that a culture is comprised of social norms, which are unspoken rules of behaviour that, if not followed, result in sanctions. An example of a positive safety norm may be that the workforce reports all procedural irregularities. Reason (1997) argues that this norm will only develop under the conditions he calls a 'reporting culture' – a culture in which workers feel free to report their errors and near misses to management without unjust punishment. An example of a less positive safety norm may be that work is conducted on live equipment when under time pressure, i.e. without isolating equipment. Understanding the safety culture of an organization, work site or work-group as a whole may be difficult but identifying and understanding the dominant safety norms may be a more manageable method of attending to specific issues.

1.1 Defining Safety Climate

Zohar (1980) coined the term safety climate in an empirical investigation of safety attitudes in Israeli manufacturing, and defined it as '...a summary of molar perceptions that employees share about their work environments' (p. 96). More recent definitions echo this, for example, Niskanen (1994b) defines safety climate as '...a set of attributes that can be perceived about particular work organizations and which may be induced by the policies and practices that organizations impose upon their workers.' (p. 241). Additionally, Cabrera, Isla and Vilela (1997) conceptualise safety climate as organizational members' shared perceptions about their work environments and organizational safety policies. Therefore, the definitions of safety climate are clearly related to those of safety culture. For example, Guldenmund (2000) points out that shared aspects are stressed in both sets of definitions. The main differences in the definitions are that whereas safety culture is

characterised by shared underlying beliefs, values, and attitudes towards work and the organization in general, safety climate appears to be closer to operations, and is characterised by day-to-day perceptions towards the working environment, working practices, organizational policies, and management. Thus, safety culture and safety climate appear to operate on different levels and this reflects the origin of the concepts in the organizational psychology literature of the 1980's and earlier social and behavioural psychology. As many of the definitions of safety culture and safety climate have common elements, safety climate may reflect the underlying culture of the work-group or organization, although its focus is actually much narrower than safety culture. More specifically, safety culture is seen as a sub-facet of organizational culture (Cooper, 2000) and exists at a higher level of abstraction than safety climate (Reichers & Schneider, 1990). It seems plausible that safety culture and safety climate are not reflective of a unitary concept, rather, they are complementary independent concepts.

2. Safety Culture Assessment

There are a variety of methods that have been used to assess safety culture and safety climate. Unfortunately, however, there are no standardized or off the shelf tools that can be used across domains or even within a single domain (Cox & Flin, 1998). Nonetheless, approaches to assessing safety culture should take into account several critical issues, including the measurement method, level of analysis, and implementation constraints.

2.1 Methods of Measurement

Tools for assessing safety culture can be classified as either qualitative or quantitative methods. Qualitative methods include employee observations, focus group discussions, historical information reviews, and case studies (Wreathall, 1995). With qualitative measurement strategies, organization members usually serve as informants, who interact directly or indirectly with researchers, using their own terms and concepts to express their point of view, as in focus group discussions (Rousseau, 1990). Therefore, through qualitative measurement, intensive and in-depth information can be obtained using the focal group's own language.

In contrast, quantitative approaches attempt to numerically measure or score safety culture using procedures that are often highly standardized and calibrated, such as highly structured interviews, surveys and questionnaires, and Q-sorts (Wreathall, 1995). In quantitative measurement strategies,

organization members usually serve as respondents who react to a standard set of stimuli or questions provided by the researchers (Rousseau, 1990). Quantitative methods are relatively easy to use in cross-sectional comparisons, generally simple to implement in different organizations and by other researchers, and straightforward to interpret according to a common, articulated frame of reference (Wreathall, 1995).

2.2 Level of Assessment

One of the major questions that also arise when considering the development of tools for assessing safety-culture is whether the assessment should be at global or local levels. That is, should the organization as a whole be assessed (global) or do assessments need to occur within the organization's various sublevels, such as divisions or departments (local)? For example, within the context of aviation, some researchers have suggested that cultures vary considerably across operational settings such as the flight deck, maintenance, and ramp environments. The same is likely to be true across various departments within other types of organizations as well. Therefore, separate assessment instruments may be needed to examine the different units within an organization. Consequently, it is important to identify the level(s) of assessment that is to be performed in order to provide a frame of reference and to make use of standardized descriptors. Failure to do so may create problems in obtaining consensus across respondents (Rousseau, 1990).

2.3 Assessment Procedures and Implementation

Assessment procedures and implementation issues revolve around two primary questions. The first question concerns who will be involved in the assessment processes. In other words, will the assessment method need to be implemented by an individual, such as a safety representative within an organization or an individual government inspector, or by a team of safety personnel? The answer to this question, however, may be a function of many factors. For example, organizational and union representatives may need to take part in the assessment process, not only to provide the manpower needed to perform the task, but also to make the process acceptable to industry and organizational personnel. However, there may be times when an individual may have to implement the system alone, either because of the format of the assessment method used, or because the organization that is being evaluated is too small to provide the additional representatives needed to perform the task.

2.4 Benefits of the Assessment

By undertaking a safety culture assessment a company can:

- Determine its level of safety culture
- Obtain positive and negative aspects of health and safety (H&S) in the workplace
- Identify areas for improving H&S management systems
- Raise the H&S profile in the organisation
- Involve employees in H&S issues
- Identify perception gaps (in respect to H&S) between managers/supervisors and employees
- Benchmark (compare) H&S results at different sites (multi-national/multi-site organisation)
- Provide insurers with a risk measurement level that combines the results of a number of assessment methods
- Encourage continuous improvement through recommendations
- Assess through employer/employee perceptions the effectiveness of the H&S effort.

2.5 SAFETY CULTURE VERSUS SAFETY CLIMATE

Whereas safety culture represents long-term attitudes, beliefs and the stable ways in which people behave, safety climate represents a snapshot of the current state of these factors at any one time (Flin et al., 2000). Thus, safety climate is something that an organization 'has' at a particular time. Flin et al. (2000) identified emergent themes in their review of 18 published reports on safety climate. They report that the most commonly measured climate dimensions are those related to management, risk, safety arrangements, procedures, training, and work pressure (in that order). It is noted that the use of the term safety climate appeared prior to the use of the term safety culture in the literature.

However, while there is little empirical evidence relating measures of safety culture to safety outcomes, there does seem to be consensus that there is a link between safety climate and safety performance as demonstrated in a variety of studies across industries. For example, Zohar (2010) concludes that safety climate has been validated as a robust leading indicator of safety outcomes, Mearns, et al. (2003) notes that it is becoming accepted that a favorable safety climate is essential for safe operation based on a number of studies that demonstrate that elements of

safety climate have been found to be predictors of unsafe behaviors or accidents, and a metaanalysis performed by Christian, et al. (2009) found a significant correlation between safety climate and safety outcomes. However, Gadd and Collins (2002) conclude that there has been little research that has attempted to validate safety climate assessment tools with actual safety performance, and that most research relies on self-reported measures of behavior rather than actual safety behaviors. Gadd and Collins (2002) suggest that such an approach might be subject to social desirability biases, where people respond as they feel they “should” rather than as they would actually behave. Thus, the survey results may not actually predict behavior in the organization

Cox and Flin (1998) note that questionnaires that claim to measure safety culture or safety climate are very similar in terms of what dimensions they choose to focus on. Silbey (2009) notes that most of the assessment techniques used to measure safety culture rely on data collected from individuals through survey instruments, and thus may actually be measuring safety climate. Similarly, Guldenmund (2010) suggests that safety climate scales have been used extensively to (attempt to) measure safety culture

3. CASE STUDIES

There have been multitudes of case studies that have assessed safety culture in a specific company or industry. A review of these case studies was undertaken to identify any studies in which researchers specifically measured the effect of safety culture interventions – that is, where they measured safety culture, took specific actions to address shortcomings identified, and then re-measured safety culture to identify the effects of their interventions. Similarly, Hale et al (2010) conducted a literature review looking for studies that documented the effect of interventions on safety culture, and concluded that there are few methodologically sound studies that have been published. While no such studies were found, there were some studies that did attempt to look at changes in safety culture due to various factors. A few of these studies are summarized below.

Nielsen, Rasmussen, Glasscock and Spangenberg (2008) looked at two twin plants (owned by the same company) which manufacture wind turbines. Despite being owned by the same company and producing the same products, one plant (Plant B) had significantly more errors than the other (Plant A). Plant A, prior to the study, was involved in a comprehensive work environment project based on worker

involvement and one focus was on safety related issues.

Employees from both plants attended a one week introductory course on safety. Accident data (self-reported) was collected at both plants from one year prior to baseline and until six months after the study. Audits were conducted at T0 and T1 and questionnaire data was collected as well. The researchers did not have a formal intervention but the intervention Plant A learned was transferred to Plant B over the course of the study. The researchers found that the self-reported accident data decreased in Plant B. Unfortunately, it is unclear what the work environment project entailed and exactly what knowledge was transferred from Plant A to Plant B. Thus, it is hard to interpret the researchers’ results and make a definite statement about a change in safety culture

Zhou, Fang and Mohamed (2011) examined the consistency of safety climate factor structure and safety climate questionnaires over a three year period at a Chinese construction company. Construction workers at the Chinese construction company were given a survey of safety climate in 2004 and again in 2007. The survey consisted of 87-items asking about key aspects of safety climate within the organization. The researchers performed a factor analysis on the items for both years and found that both years comprised the same four-factor structure of safety culture; 1) safety regulations, 2) safety supervision, safety training and workmates support, 3) management commitment and 4) safety attitude. In addition, the confirmatory factor analysis established that the second-order factor of safety climate was unchanged. While this study found a change in perception over time, the study did not identify a particular safety issue and implement an intervention or training to address this issue. This study does not shed any light onto any quantitative behavioral safety change.

Fang, Chen and Wong (2006), interested in safety culture, conducted a safety climate questionnaire to all sites and all employees at a leading construction company and its subcontractors in Hong Kong. The questionnaire entailed 110 items. The researchers performed a factor analysis on the results and found 15 different factors, the first 10 being: (1) safety attitude and management commitment, (2) safety consultation and safety training, (3) supervisor’s role and workmate’s role, (4) risk taking behavior, (5) safety resources, (6) appraisal of safety procedure and work risk, (7) improper safety procedure, (8) worker’s involvement, (9) workmate’s influence and (10) competence. The researchers also performed a logistic regression and

found significant relationships between safety climate and personal characteristics, including: (1) gender, (2) marital status, (3) education level, (4) number of family members to support, (5) safety knowledge, (6) drinking habits, (7) direct employer and (8) individual safety behavior.

4. Safety Culture Assessment

4.1 Assessment Approaches

Guldenmund distinguishes for example three broad approaches: the academic (anthropological), analytical (psychological) and the pragmatic (Guldenmund, 2010, pp. 183 ff., p. 197). These distinct approaches each entail specific methods and instruments to assess an organization's safety culture.

- Academic (anthropological) approach focus on past time and the information aimed to retrieve is qualitative with descriptive research characteristics. The assessment strategy and method involves Fieldwork, ethnographical-inspired methods (e.g. document analysis, observations, focus groups, interviews, etc.)
- Analytical (psychological) approach focus on present time and the information aimed to retrieve is quantitative on safety climate with descriptive research characteristics. The assessment strategy and method involves Safety climate scales, questionnaires.
- Pragmatic (experience based) approach focus on future time and the information aimed to retrieve is safety culture maturity (level) with normative, prescriptive research characteristics. The assessment strategy and method involves Behaviorally Anchored Rating Scales.

4.2 Questionnaire

The questionnaire provides companies with information about their current safety climate, and highlights areas of strength and of weakness. If the tool is used appropriately, it can be used to determine the impact of new initiatives. The tool can also be used to form one element of a multiple perspective health and safety benchmarking process.

The questionnaire contains some numerable items requiring answers on a three or five point Likert-type scale. It has the five responses as

- 5 = Strongly agree
- 4 = agree
- 3 = neither agree or disagree
- 2 = disagree
- 1 = strongly disagree

Questionnaire are commonly used with the following instructions

- To collect factual information in order to classify people and their circumstances.

- To gather straight forward information relating to people's behavior.
- To look at basic attitudes/opinions of a group of people relating to particular issues.
- To measure the satisfaction of the customer with a product or service.

Types of questions in a survey are classified into five categories

- Open-ended(essay or short-answer)
- Close-ended(multiple choice or yes/no)
- Partial-ended(multiple choice with other options)
- Scaled
- Ranking

Questionnaire should be well designed and it requires thought and effort, similarly it need to be planned and developed in number of stages to gather useful and relevant information. They are

- Initial consideration
- Question content, phrasing and response format
- Question sequence and layout
- Pre-test(pilot study) and revision
- Final questionnaire

Steps to be considered in developing effective questionnaire

- Decide what information you need to collect for your program;
- Search for previous evaluative efforts on programs similar to yours to see what others may have done (and review their questionnaires if possible, but be sure to obtain permission if using a questionnaire or items developed by someone else);
- Draft your questions or modify questions on an existing survey to fit your own program needs;
- Place the questions in logical order;
- Re-read the entire questionnaire and add specific instructions, transitions, and any clarifying information for questions or responses (in parentheses where applicable);
- Focus on the format of the questionnaire with attention to layout, readability, time demands on respondents, logic and clarity of content;
- If time allows, have a few co-workers complete the questionnaire to identify problem areas in your survey;
- Revise the instrument as needed based on feedback provided;
- Prepare educators on protocol for implementing the questionnaire;

4.3 Benefits of Assessment

By undertaking a safety culture assessment a company can:

- determine its level of safety culture
- obtain positive and negative aspects of health and safety (H&S) in the workplace

- identify areas for improving H&S management systems
- raise the H&S profile in the organization and involve employees in H&S issues
- identify perception gaps (in respect to H&S) between managers/supervisors and employees
- establish a base-line against which an organization can monitor the impact of interventions designed to improve H&S
- benchmark (compare) H&S results at different sites (multi-national/multi-site organization)
- provide insurers with a risk measurement level that combines the results of a number of assessment methods
- encourage continuous improvement through recommendations
- assess through employer/employee perceptions the effectiveness of the H&S effort.

5. Safety culture survey methodology

5.1 Dialogue with Workers

Before undertaking the survey, communicate the workers that:

- the aim is to improve the overall safety culture – individual answers will be anonymous
- understand the workers what they really think and experience
- if they can't figure out an exact answer, they should choose the closest statement
- they must provide one answer only to each question
- they must answer all questions in each section
- the survey takes approximately 15 minutes to complete.

5.2 Questionnaire Survey

Either distributes the questionnaire to the workers by email, or print it and hand out copies.

The questionnaire is split into six sections, on:

- training and supervision
- safe work procedures
- consultation
- reporting safety
- management commitment
- injury management and return to work

Provide the whole questionnaire to the workers in one go, or in sections over time. Choose what will work best in the workplace.

Remember to communicate with workers how they can return their completed questionnaires – e.g. into an anonymous box.

5.3 Enter the Data in the Tool

Once you have all of the completed questionnaires, someone will need to enter all the responses into the Excel tool.

- Save the Excel tool somewhere appropriate.
- Open your saved copy of the Excel tool, clicking on 'Enable macros' when prompted.
- Go to the data input sheet (first tab) of the Excel tool. Here you will find basic instructions on how to input data.
- Once you have read through the instructions, click 'Start'.
- Working through the completed questionnaires one at a time, enter the workers' responses by clicking on the corresponding answers.
- Save the changes to the Excel tool after entering the responses from each worker's questionnaire.

There is an important note that if the whole survey is done again at a later date, ensure that you delete all of the respondents and their answers from row 3 onwards on the data sheet (fourth tab) of the Excel tool, before you start entering the new data.

5.4 Review the Result

When all of the data is entered into the Excel tool, take a position to review the results.

Look at the summary sheet and traffic light chart (second and third tabs), which break down the results by question and by section.

The green-orange-red coding shows how workers perceive the safety culture in the organization.

- Green zone - Workers think you have a good safety culture in this area. You still need to monitor and review your systems to maintain this level and to continually improve.
- Orange zone - Workers think that you have started improving safety culture and are on the right track, but there is more you can do in this area.
- Red zone - Workers are expressing a lack of belief in your commitment to safety culture, and your systems may not be in place or not working well. Something has broken down or has not been started. You need to take immediate action in this area.

6. Conclusion

In conclusion, safety culture is a valuable construct, but has some inherent weaknesses. One such

weakness is that there are multiple definitions of safety culture and multiple methods exist for evaluating this construct. The literatures includes unique definitions for safety culture and safety climate, these terms are often used interchangeably. This is problematic because in some studies, it is difficult to know whether safety culture or safety climate was measured. Many researchers theorize that safety culture is an emergent property of a system that is relatively stable and difficult to change. Alternatively, safety climate is seen as a transient property that is sensitive to external environments and situations.

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