

Safety Culture and Safety Climate: A Review of the Literature

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ABSTRACT: Recent years have witnessed a growing concern over the issue of safety culture within high-risk industries. The purpose of the present review is to summarize and integrate the numerous reports and studies that have been conducted to define and assess safety culture, as well as the highly related concept of safety climate. Safety professionals have increasingly turned their attention to social science for insight into the causation of industrial accidents. Studies have underlined the potential threats to occupational safety of this workforce. Surprisingly, however, very little research has been conducted on national culture and occupational safety. In this paper, we examine how national culture may play a role in important antecedents of safety behavior that have identified. We discuss safety knowledge, safety motivation, and safety climate. In this paper, there is keen definition; origin and factors of safety culture and safety climate are discussed based on literature collected.

KEYWORDS: Safety culture, safety climate.

I. INTRODUCTION

Effective safety management in the twenty-first century involves paying attention to human factors as system components with as much potential to cause, or save, dangerous system states as technical components. By paying attention to human factors, highly reliable organizations can identify and capture potential hazards before they manifest as accidents [5]. One method of achieving this is by measuring the state of safety through so-called 'leading' indicators such as safety culture or safety climate [8]. These are seen as distinct from 'lagging' indicators of safety such as accidents as they offer insight into the state of safety without the need for retrospective analyses of negative safety outcomes.

Empirical research on safety climate has developed considerably since Zohar's seminal study in Israeli manufacturing. However, the theoretical development of safety climate and safety culture has not mirrored that progression [11]. Despite a general agreement among researchers, regulatory bodies, and industry that these concepts are worthwhile concepts for research and application, little consensus has been reached over other important issues. For example, there are multiple definitions of the two concepts; safety climate and safety culture are often confused in the literature despite having distinct etymology [12]; no clear model demonstrating the impact of safety climate and safety culture on bottom-line safety organizational performance has been developed; numerous methods covering different sets of factors have been used to measure the concepts, and many of the studies that have been reported suffer from methodological failings [14]. This literature review treats safety climate as distinct from safety culture, despite the confusion surrounding the two concepts in the literature.

The aims of this literature review are fourfold:

- i. Differentially define safety culture and safety climate
- ii. Outline the origins and conceptual development of safety culture and safety climate
- iii. Examine methods of measuring safety culture and safety climate

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- iv. Discuss the published results of empirical studies on safety culture and safety climate.

II. THEORETICAL ISSUES

A. Defining safety culture

The term safety culture gained its first official use in an initial report into the Chernobyl accident [27]. 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 [22]; the fire at King's Cross underground station [26]; the sinking of the Herald of Free Enterprise passenger ferry [16], and the passenger train crash at Clapham Junction [29]. The relevance of safety culture to safe operation is not disputed. Indeed, argues that it is a concept 'whose time has come'. However, there is no definitive definition of the concept for two main reasons: (i) different researchers emphasize different elements of safety culture as most salient, and (ii) culture of any kind is an extremely difficult concept to succinctly define [33]. Reason makes the case that for engineers, defining organizational culture has '...the definitional precision of a cloud'. The same argument may also be leveled at defining safety culture [39].

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 [28]. 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).

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 [34], 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. [33] argue that a culture is comprised of social norms, which are unspoken rules of behaviour that, if not followed, result in sanctions.

B. Defining safety climate

Zohar 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'. More recent definitions echo this, for example, Niskanen 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.' Additionally, [17] conceptualize safety climate as organizational members' shared perceptions about their work environments and organizational safety policies [41].

Therefore, the definitions of safety climate are clearly related to those of safety culture. For example, Guldenmund points out that shared aspects are stressed in both sets of definitions. The main differences in the definitions are that whereas safety culture is characterized by shared underlying beliefs, values, and attitudes towards work and the organization in general, safety climate appears to be closer to operations, and is characterized by day-to-day perceptions towards the working environment, working practices, organizational policies, and management [26]. 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 2010's and earlier social and behavioral psychology. As many of the definitions of safety culture and safety climate have common elements, safety climate may reflect the underlying

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culture of the work-group or organization, although its focus is actually much narrower than safety culture [31].

C. Origins of safety culture and safety climate

The concept of safety culture has its origin in the social and behavioural psychology of the 2010's and 2012's that came to the fore in the organizational psychology, organizational behaviour, and management literature of the 2013's. This literature offers a number of definitions of organizational cultures and climates that clearly resonate with those presented on safety cultures and climates above. For example, Uttal defines organizational culture as 'Shared values (what is important) and beliefs (how things work) that interact with an organization's structures and control systems to produce behavioral norms (the way we do things around here)'. This definition appears to be so relevant to the current topic that [35] wrongly cites this as a definition of safety culture rather than organizational culture.

Culture is learned through the process of socialization which may be one of the reasons why culture change is a long and difficult process. Formal training will reflect a flavour of the underlying culture but much of the information needed by the individual to understand and become part of the culture will be inferred through observation and informal discussions with the workforce. Therefore, the best method of understanding a culture may be to be part of that culture. The procedure confirms this assertion by conducting ethnographic research onboard US aircraft carriers [32].

Another early recognition of the impact on managers on climate was by [16] who recognized the importance of daily role modeling behaviours of supervisors and managers in setting the climate. Coyle latterly define organizational climate as employee perceptions of 'the social and organizational circumstances in which employees work' [24], emphasizing that climate is a phenomenon that can change daily and be influenced by circumstance. Climate influences what work is done, how work is done, and by whom work is done. Climate may operate at the level of individuals and small cohesive groups [22].

Organizational culture research has been more concerned with definition and theoretical underpinnings; measurement has been qualitative in nature, through use of observation and interviews, and the results of these have been linked less with organizational outcomes such as productivity, efficiency, and satisfaction, in preference for in-depth case studies. In contrast, organizational climate research has valued empirical research of the concept over theoretical development. Climate has predominantly been measured by qualitative methods such as questionnaires, and analyses have linked a positive organizational climate with several outcome measures, including increased production [26].

III. CONCEPTUAL DEVELOPMENT OF SAFETY CULTURE AND SAFETY CLIMATE

The theoretical and empirical development of safety culture and climate has followed the pattern set by organizational culture and climate, although to a lesser extent. As stated previously, most efforts have focused on the empirical issues surrounding safety climate although it is possible to identify theoretical development of concepts within the safety culture literature. Also, the terms safety culture and safety climate have been used interchangeably in the literature [19]. Denison states that the research methods used by researchers can aid distinction between studies that have measured safety culture from those that have measured safety climate. He states that measuring culture requires qualitative methods whereas climate can be measured by quantitative methods and goes on to argue that quantitative measures such as questionnaire surveys cannot fully represent the underlying safety culture.

IV. MEASURING SAFETY CULTURE

It is important to note that conceptual differentiation between safety culture and safety climate dictates that measuring safety culture and safety climate requires different methods. A number of qualitative methods have been used to measure safety culture, including interviews; focus groups, audits, and expert ratings. Studies that have measured safety culture have generally used a case study format to report findings. Thus, there are case studies of high reliability organizations, comparisons of high and low accident plants, and narratives of organizational crises. Studies that have measured safety culture have generally rejected quantitative methods such as questionnaires as an inappropriate means

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of data collection. However, a number of studies have used qualitative methods to investigate safety culture, and then developed quantitative methods on the basis of those results [34].

V. CASE STUDIES OF HIGH RELIABILITY ORGANIZATIONS (HROS)

The US nuclear aircraft carriers that Roberts investigated are one set of so-called 'High Reliability Organizations' (HROs). HROs perform better than they are expected to give the level of technology employed and levels of risk managed during regular, high tempo operations [35]. They emphasize shared values that characterize safety culture and differ from other organizations by focusing on process reliability above product reliability, and by maintaining this high level of process reliability for long periods of time. Often the nature of their business means that they cannot slow performance under the threat of danger.

HROs have great importance with respect to safety culture and research on HROs makes a strong case for safety culture as a facet of organizational culture by synthesizing the findings of the research on HROs to one global construct called 'mindfulness' [21]. Mindfulness is a state of constant awareness within high-hazard environments that is always looking for failure, managing safety while maintaining high-tempo operations, and empowering sharp-end operators with commensurate experience to make critical decisions. Much of the success and failure of organizations to manage highly complex technology is attributed to the extent to which management genuinely advocate mindfulness in operations [41].

VI. MEASURING SAFETY CLIMATE

The purpose of this section is to review the safety climate literature, paying particular attention to the results of studies that have identified influences on, and the influences of safety climate. In total, 31 studies were identified in the literature and are reviewed in this section. The majority of these studies were conducted in high hazard industrial sectors, including transport, power generation, offshore oil and gas production, manufacturing, and construction. The results are presented thematically, under the headings managerial factors, supervisory factors, workforce factors.

A. Managerial factors

This category is used to refer to all factors that non-supervisory management can directly influence. These include organizational policies, systems and procedures, management and leadership style, and management commitment to safety. A recent review of safety climate studies and thematic analysis of safety climate factors by [40] found that 72% of the studies assessed the role of management. Management was also identified as one of only two factors (the other being workforce involvement) that were properly replicated across studies [18]. A third review of safety climate themes included a number of studies not covered in the two reviews above, and found that management was the most frequently measured dimension [20].

B. Supervisory factors

A model that integrates the safety influences of managers is offered by Thompson, Hilton and Witt (1998), who tested a model based around two central pathways; (i) from 'organizational politics' to 'manager support for safety' to 'safety conditions'; (ii) from 'supervisor fairness' to 'supervisor support for safety' to 'safety compliance'. Management support for safety was also found to positively influence supervisor support for safety. Thompson et al. (1998) concluded that management has an influence on safety conditions but workforce compliance with safety rules and regulations under those conditions is influenced by the perceived fairness of the supervisor.

C. Workforce factors

Cheyne, et al. (1998) found that the individual responsibility of workforce members played an important role in the success of safety management influence on safety activities. In this multi-sample analysis of workforce perceptions within a multinational manufacturing company, mediating factors included personal involvement, communication and

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hazards. Cheyne et al. (1999) investigated the role of workers' personal responsibility further in a study of multiple organizations and concluded that personal responsibility for safety is complementary to, and not a replacement of, good safety training.

VII. CONCLUSIONS

After reviewing the literature, the overwhelming impression it leaves is that safety climate research has been conducted for 20 years with no great consensus regarding the important factors or questions to ask, save that they should be measured by means of a workforce questionnaire. In contrast, the fact that safety culture exists at a higher level of abstraction than safety climate, and is less widely measured lends it almost higher status than climate. This may be because the notion of culture is far more salient to individuals as it reflects personal heritage, what individuals believe in, and may guide many in-role behaviours. Culture seems far more important in determining who we are, and why we behave in certain ways, whereas climate can be seen as more of a reflection of what we are and what we do. Additionally, the body of research on safety climate has demonstrated that in many cases workforce perceptions of safety climate have been related to safety outcomes.

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