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SAFETY CULTURE: A CONCEPT IN CHAOS?

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A growing number of studies have been conducted to define and assess safety culture in a variety of complex, high-risk, industries. The purpose of the present study was to review these efforts in order to gain a better understanding of the "safety culture" concept, along with the highly related concept of "safety climate." Results suggest that there exists considerable disagreement among researchers as to how safety culture should be defined and whether or not safety culture is inherently different from the concept of safety climate. These differences, however, are not generally due to the uniqueness of the industry or work domain being studied, since many researchers have focused on common domains (e.g., nuclear power). A synthesis of these various perspectives was conducted and hybrid definitions of both safety culture and climate are provided. Perhaps a common nomenclature and set of definitions will enable researchers to better share information and strategies for improving safety culture.

Recent years have witnessed a growing interest in the concept of safety culture within high-risk industries. The term "safety culture" can be traced back to the nuclear accident at Chernobyl in 1986 (Cox & Flin, 1998; Mearns & Flin, 1999; Rochlin & Von Meier, 1994; Pidgeon, 1998; Weick, 1987; Flin, Mearns, Gordon, & Fleming, 1998). On April 26, 1986, two explosions blew off the 1000-ton concrete cap sealing the Chernobyl-4 reactor, releasing molten core fragments into the immediate vicinity and fission products into the atmosphere. It was the worst accident in the history of commercial nuclear power generation. It has so far cost over 30 lives, contaminated some 400 square miles around the Ukrainian plant and significantly increased the risk of cancer deaths over a wide area of Scandinavia and Western Europe (Reason, 1990). A "poor safety culture" was identified as a factor contributing to the Chernobyl disaster by the International Atomic Energy Agency (IAEA, 1986, as cited in Cox & Flin, 1998) and OECD Nuclear Agency (1987, as cited in Mearns & Flin, 1999; Pidgeon, 1998). Since then safety culture has been discussed in other major accident enquiries and analyses of safety failure, such as the King's Cross underground fire in London and the Piper Alpha oil platform explosion in the North Sea (Cox & Flin, 1998, Pidgeon, 1998).

According to Meshkati (1997), the most dramatic turning point for "safety culture" in the United States came with an aviation accident that killed 14 people —the in-flight structural breakup and crash of Continental Express Flight 2574 near Eagle Lakes, Texas, on September 11, 1991. As a member of the National Transportation Safety Board at that time, Dr. John Lauber suggested that the probable causes of this accident included "The failure of Continental Express management to establish a corporate culture which encouraged and enforced adherence to approved maintenance and quality assurance procedures" (NTSB/AAR-92/04, 1992, p. 54, in Meshkati, 1997). As a result of this and other similar aviation accidents, safety culture came to the forefront as the exclusive topic at the National Summit on Transportation Safety, hosted by the NTSB in 1997.

The recognition of the importance of safety culture in preventing accidents has led to a plethora of studies attempting to define and assess safety culture in a number of complex, high-risk, industries. However, there have as yet been few attempts to examine the definitions of safety culture that have been proposed in the literature, nor have there been many attempts to examine the various instruments and methods commonly used to assess safety culture within organizations. Furthermore, such terms as "safety climate" are often used in conjunction with safety culture with little if any differentiation between the concepts. Consequently, while the concept of safety culture continues to attract more and more attention, the existing empirical efforts to study safety culture and its relationship to organizational outcomes have remained "unsystematic, fragmented and in particular under-specified in theoretical terms" (Pidgeon, 1998). The purpose of the present study, therefore, was to conduct a comprehensive review of the literature and other data sources to gain a better understanding of this concept known as "safety culture."

METHOD

In order to identify the articles related to safety culture and safety climate, we searched the PsycINFO electronic database (1887-2001), Social Science Citation Index (SSCI, 1987-2001), and CD-ROM databases of proceedings from six human factors conferences. All databases were searched using *safety culture, safety climate, organizational safety,* and *aviation safety* as keywords. We also reviewed the references cited in the articles from the above search, and identified what had not been covered. Also, to include unpublished studies (dissertations, technical reports and conference papers) that met our inclusion criteria, we contacted libraries and authors to access these documents. Finally, to identify any applied instruments or systems that are actually used in organizations to assess safety, we searched the Internet using the Google search engine with keywords including *safety culture/climate measurements,* and *instruments*. From these searches, we obtained 107 documents, ranging from 1974 to 2001, with the majority published in the 1980's and 1990's.

RESULTS

Of the 107 documents identified for our study, approximately half (n = 54) discussed organizational safety without reference to either culture or climate. A total of 23 articles referred to organizational culture, organizational climate or both topics, but did not discuss issues of safety. This resulted in a total of 30 articles that specifically referred to safety culture, safety climate, or both concepts. Only these 30 articles describing safety culture or safety climate were further analyzed.

Safety Culture

Among the articles referring to safety culture, 18 provided definitions of the term. Seven of the articles generally defined the concept in the same way, excluding slight differences of terminology (e.g., workplace, entity, environment). Most of the articles focused on safety culture in industries other than aviation (e.g., nuclear power, manufacturing). Those that were related to aviation were primarily geared toward military aviation (see Appendix A for a list of key articles).

Although various definitions of safety culture have been used, the majority does appear to have several features in common. The commonalities among safety culture definitions are as follows:

- Safety culture is a concept defined at group level or higher, which refers to the *shared values* among all the group or organization members.
- Safety culture is concerned with formal safety issues in an organization, and closely related to, but not restricted to, the management and supervisory systems.

- Safety culture emphasizes the contribution from everyone at every level of an organization.
- The safety culture of an organization has an impact on its members' behavior at work.
- Safety culture is usually reflected in the contingency between reward system and safety performance.
- Safety culture is reflected in an organization's willingness to develop and learn from errors, incidents, and accidents.
- Safety culture is relatively enduring, stable and resistant to change.

Safety Climate

Among the articles referring to safety climate, 12 provided definitions of the term. None of the articles defined the concept exactly in the same way. Most of the articles focused on safety climate in industries other than aviation (e.g., nuclear power, manufacturing). Again, those related to aviation were primarily geared toward military aviation (see Appendix A).

From the time safety climate was first introduced by Zohar (1980), the literature has not presented a generally accepted definition. Some definitions of safety climate are almost identical to definitions of safety culture. However, the majority of definitions differ from safety culture in common ways. In general, the commonalities of safety climate definitions include:

- Safety climate is a psychological phenomenon, which is usually defined as the *perceptions* of the state of safety at a particular time.
- Safety climate is closely concerned with intangible issues such as situational and environmental factors.
- Safety climate is a temporal phenomenon, a "snapshot" of safety culture, relatively unstable and subject to change.

DISCUSSION

The recognition of the importance of safety culture in preventing accidents has led to a growing number of studies to define and assess safety culture in a variety of complex, high-risk, industries. The purpose of the present study is to review these efforts in order to gain a better understanding of the "safety culture" concept, along with the concept of "safety climate." The results of this review study clearly agree with Pidgeon's (1998) informal observation that the existing empirical efforts to study safety culture have been "unsystematic, fragmented and in particular under specified in theoretical terms" (Pidgeon, 1998).

Currently, there exists considerable disagreement between researchers as to how safety culture should be defined and whether or not safety culture is inherently different from the concept of safety climate. These differences, however, are not generally due to the uniqueness of the industry or work domain being studied, since many researchers have focused on common domains (e.g., nuclear power). Nonetheless, the present literature review suggests that there is a growing consensus concerning both the dimensions and definitions of safety culture and safety climate. Based on this review, we put forward the following definitions in an attempt to synthesize the literature in the areas of safety culture and safety climate.

Safety culture: The enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety; act to preserve, enhance and communicate safety concerns; strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes; and be rewarded in a manner consistent with these values.

Safety climate: The temporal state measure of safety culture, subject to commonalities among individual perceptions of the organization. It is

therefore situationally based, refers to the perceived state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on the features of the current environment or prevailing conditions.

What benefit will come from such common definitions of both safety culture and safety climate? Perhaps we can expect a more systematic methodology for measuring these organizational dimensions to be developed. Or, perhaps a common standard for benchmarking "good" safety cultures, both within and across industries will arise. A common nomenclature and set of definitions may at least enable researchers to share information and strategies for improving safety culture. Until then, however, such differences across researchers, concepts, and definitions will only serve to hinder progress in this area and the idea of safety culture will continue to be a concept in chaos.

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APPENDIX A: ABBREVIATED BIBLIOGRAPHY

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