KNOWLEDGE BASIS IN SAFETY CULTURE FOR RESEARCHERS AND PRACTITIONERS

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ABSTRACT

This paper presents the main characteristics of the knowledge basis in safety culture which is being developed at the IPEN-CNEN/SP, one of the Brazilian nuclear institutes of research. The main objective of this basis is to organize the information about safety culture found in the literature and to make it available to researchers and practitioners. The first stage of the development of this basis is already finished being the subject of this work.

1.   INTRODUCTION

When examining the literature on safety culture, it is perceived that safety culture has been studied from many assumptions and perspectives. This variety of approaches and understandings, on one hand has resulted in a very rich and dense literature on the subject, but on the other hand has created some difficulties, both practical and theoretical, to researchers and practitioners. Review papers trying to describe the state of the art have experienced this difficulty as most of them they failed to provide an overarching framework for the subject mostly leaving aside either some important epistemological concepts or practical aspects.

Aiming to structure, in a sensible way, the existing knowledge in this area, a group of researchers of IPEN-CNEN/SP are developing a project to put together an organized knowledge basis in safety culture. The main objective is to make available a living source of consultation and reference, both under the epistemological and practical focus, to researchers and practitioners. The structure and content of this basis shall be represented by means of a portal screen that will make the information available in a friendly way. For some key concepts, concept maps, as proposed by Joseph Novak, will be used. All concepts will be accompanied by their definitions and other explanatory data of interest. Concept maps will also serve to provide a thematic navigation of the users to detailed information in documents, links or even experts' e-mail addresses. The construction of the concept maps is done using the freeware software called Cmap_tools®.

2.   STAGES OF DEVELOPMENT OF THE PROJECT

The knowledge basis project will be developed in two stages. The first stage, which is the subject of this paper, consists of the first layers of detailing, involving the key concepts of the

whole basis.

The knowledge basis developed in this stage originated from a preliminary version prepared by the authors of this paper. Then, through a first round of feedback, the members of the Group of Knowledge Management and Safety Culture of IPEN-CNEN/SP made suggestions which were included in the basis.

The second stage of the project is supposed to start in the second half of 2009 and will count on the collaboration of invited experts who do not belong to IPEN-CNEN/SP and are expected to present suggestions to help validate the knowledge basis. These professionals will be selected according to an interactive process called "snowball". At the end of the project, the concepts identified in the first stage will be detailed. In addition, a number of directories shall be added to the basis.

3. STRUCTURE OF THE WORK

The knowledge basis will consist of three parts described below:
a) Portal, where the main areas of interest are presented and linked to its detailed content;
b) Directories with information on researchers, organizations, etc, in the area of safety culture;
c) Concept maps detailing some important concepts.

Some of the main areas (dominion) considered in the basis are presented below:
* Research paradigms: Description of the functionalist and interpretive paradigms that underpin the studies of the safety culture [1];
* Theories on the genesis of accidents: Description of the theories of Turner [2], Perrow [3], Pieroski [4], Dörner [5], Reason [6] and Rasmussen [7];
* Methods for changing the safety culture: Behaviorist method (bottom up approach), method based on attitudes (top down approach) and mixed methods [8];
* Conceptual models of the safety culture: Multilevel model of culture (based on Schein`s model [9]), "Total Safety Culture Model" [10], safety culture as an "Informed Culture" [6] and "Reciprocal Safety Culture Model" [11];
* Methods for evaluating the safety culture: "Business Excellence Model of Safety Culture" [12], and "Health and Safety Climate Survey Tool" [13];
* Methods for data collection: Description of the main methods for evaluation of attitudes;
* Programs to improve the safety culture: Eurocontrol [14], Shell [15], British Railway System [16], Eletronuclear, IEN, etc;
* Methods for assessing the stages of development and maturity of safety culture in the organization: Shell [15], IAEA [17];
* Simulation methods, techniques and tools that can contribute to quantitative approaches of the safety culture [18].

The main directories are presented below:
* Directory of experts and researchers: Contact information and professional experience of experts of nuclear institutions in Brazil (CNEN and its institutes, INB, Eletronuclear, universities, etc);
* Directory of editorial sources: Data on the principal journals and organizations that regularly publish work on safety culture;
* Directory of events (conferences, congresses, etc): Names and periodicity of events

which, traditionally, include topics related to safety culture in their programming;
- Experience of companies or organizations: Description of the experience of national and international companies in the area of safety culture;
- Directory of courses and training: Contact information, programmes, teachers and organizations that deliver courses on the theme;
- Directory of nuclear accidents and incidents: Localization and description of the major accidents and incidents in the nuclear area caused by weak safety culture.

4. KNOWLEDGE BASIS CONTENT: FIRST STAGE

The main areas included in the first stage of the knowledge basis in safety culture are presented in the portal showed in Figures 1 and 2. However, in this work only the underlying concepts, theoretical models and perspectives of the researchers are outlined.
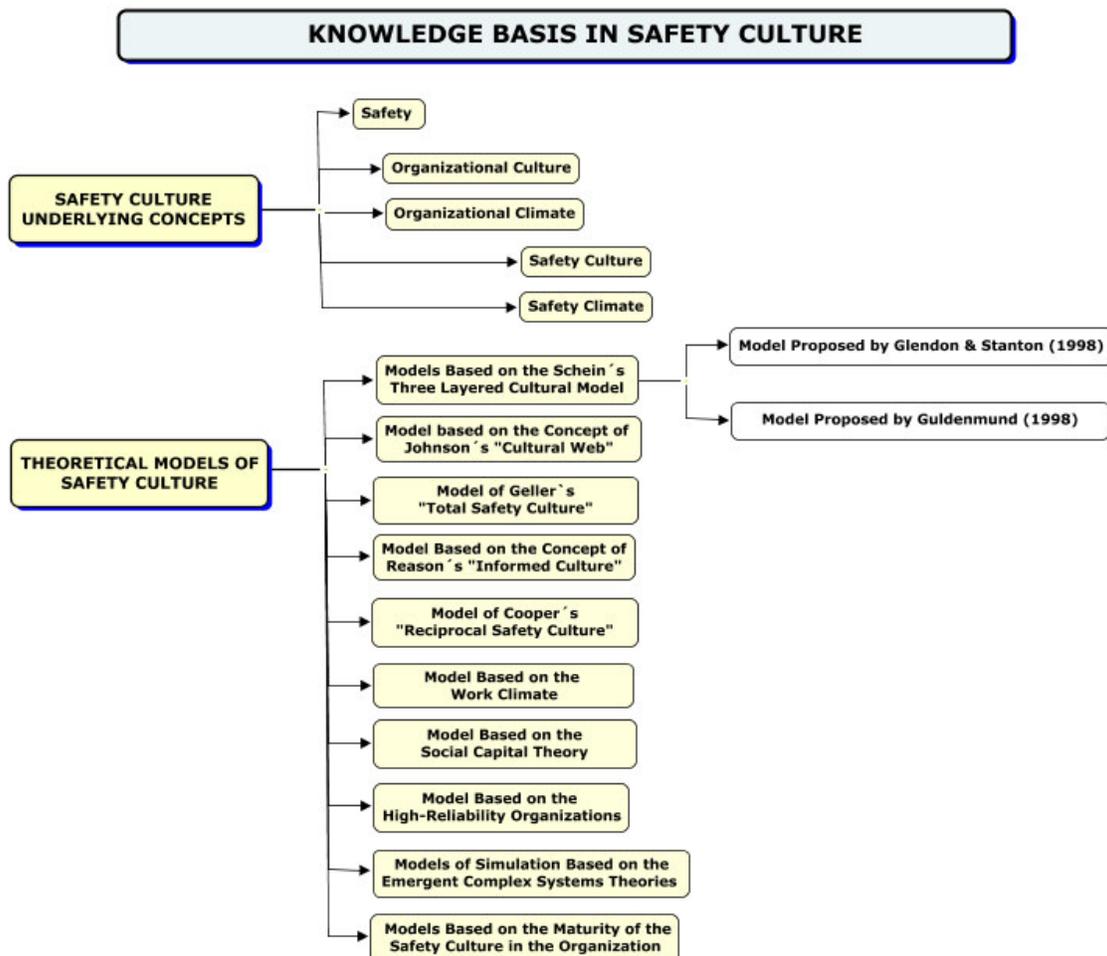
Figure 1. Portal of the First Stage of the Knowledge Basis in Safety Culture (Page 1)
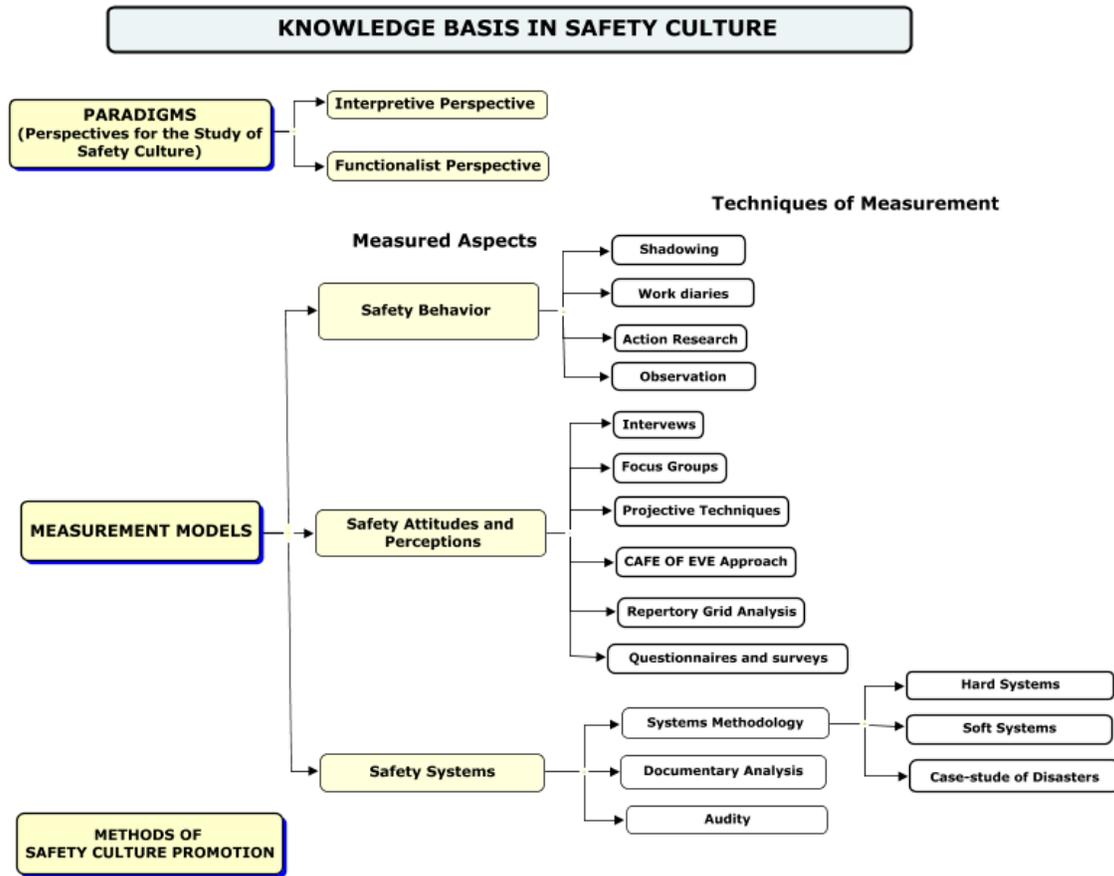
Figure 2. Portal of the First Stage of the Knowledge Basis in Safety Culture (Page 2)

4.1. Underlying Concepts

Safety, safety culture and safety climate concepts, included in the knowledge basis, are summarized in the next sections.

4.1.1. Safety

Safety appears to be one of those terms that everyone has a sense of, but no one can quite define. However, two approaches stand out as proto-definition. The first approach considers:

"Safety is the absence of accident or incident."

This view only considers what happened until the moment and does not take into account what can happen in the future. The supporters of this concept usually use measures of safety performance based in "lagging indicators" such as, accident/incident rates, incident cost, etc.

This metrics tend to reflect what went wrong rather then suggest ideas to prevent these unsafe acts from taking place. Moreover, in organizations where there is a low probability of accidents, but where major hazards are present, like nuclear organizations, a low accident rate, even over a period of years, is no guarantee that risks are being effectively controlled.

The second approach considers safety as:

"Safety is the freedom from unacceptable risk." [19].

This internationally accepted paradigm effectively means that risk is the measure of safety and society accepts the fact that there is neither absolute safety nor zero risk.

This approach also includes the International Atomic Energy Agency definition of nuclear safety as: "The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards." [20]

The people that support this approach tend to use "leading indicators" (because they can lead to preventable solutions). Some examples of these "leading indicators" might be: proactive near-miss reporting, application of risk management, deferred maintenance, inspection and testing faults, etc.

4.1.2. Safety culture and safety climate

A lot of safety culture and safety climate definitions are presented in the literature. Most of them include the concept that safety culture is formed by beliefs, values, and attitudes that are shared by a group. In the knowledge basis many of them are included, for the user to analyze similarities and nuances. In this work, we will present only two of them because of their historical importance and popularity in the literature. The first definition comes from International Atomic Energy Agency, that says:

 "Safety culture is that 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" [21].

The other definition comes from the UK Health and Safety Commission (HSC) which states that safety culture is:

"… 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." [22].

Qualitative methods are generally used to measure safety culture, including interviews, focus groups, audits, expert ratings, repertory grid analysis and observation.

For safety climate also there are a large number of definitions in the literature. Many of them are included in the knowledge basis. One of the most mentioned definitions is presented by

Zohar:

Safety climate is "… a summary of molar perceptions that employees share about their work environments" [23].

As observed in the literature, many authors use the terms safety culture and safety climate in an interchangeable way [24]. Moreover, there seems to be a degree of overlapping the definitions of the two concepts. Indeed, most of the definitions of safety culture and safety climate have common elements. Whereas safety culture is characterized by underlying beliefs, attitudes, perceptions, and values that employees share at work (collective commitment to safety), safety climate is characterized by everyday operations, perceptions of the working environment, working practices, organizational policies, and management. Thus, safety culture and safety climate appear to operate on different levels.

Safety climate best describes employees´ perceptions, attitudes, and beliefs about risk and safety, typically measured by questionnaire surveys and also provides a "snapshot" of the current state of safety.

4.2. Theoretical Models of Safety Culture

There are many theoretical models that try to represent how safety culture works in an organization. Most of them are included in the knowledge basis. In this paper we are describing just some of them.

The models of safety culture developed by Glendon and Stanton [25], Guldenmund [26], are both adaptations and enlargement of Schein´s [9] "three layered cultural model" that considers: a) core underlying assumptions (layer 1); b) espoused beliefs and values (layer 2); and c) artefacts and behaviours (layer 3). However, as Cooper [27] states, these models do not contemplate the dynamic nature of culture. Instead, they seem to indicate that the core assumptions dictate people´s beliefs and values, which in turn dictates behaviour and artefacts that reflect the core assumptions. This supposition has been shown to be inadequate by some social psychology theories (ex. Festinger [28] and Bandura [29]) that demonstrate that many times changing behavior produce changing attitude.

Johnson [30], based on both Schein´s [9] and Hofstede`s [31] culture models, proposed a new approach to address organizational culture called "cultural web". According to Cooper [27] this model was applied by Buchman to qualitatively examine the prevailing safety culture in the offshore petrochemical industry.

Geller [10] proposed a model, based on a behavioral approach to safety, which demonstrated three interactive dimensions among person, behavior, and environment in safety.

Cooper [27] proposed a model that embeds several aspects of the models previously described. This model called "Reciprocal Safety Culture Model" reflects the dynamic nature of safety culture emphasizing the interplay among three components:
a) Safety climate (person) – psychological factors relating to the person which reflect how people feel about safety (can be assessed using safety climate questionnaires);
b) Safety behavior (behavior) – ongoing safety-related behavior aspects which are concerned with what people do (can be measured through observation);

c) Safety management system (situational) – organizational polices, practices, procedures, work environment (can be measure with objective safety audits).

4.3 Perspectives of the Researcher and Practitioners

Based on the studies of Burrell and Morgan on social research [1], it is possible to identify two great perspectives for the study of safety culture: the functionalist and interpretative perspectives. A detailed definition is included in the knowledge basis.

The interpretive perspective assumes that organizational culture is an emergent complex phenomenon of social groupings. This perspective intends to interpret safety culture and its main characteristics (attitudes, beliefs, and behaviors) using general qualitative methods.

The functionalist perspective assumes that organizational culture is something that the organization has and can be manipulated to serve to the corporate interests.

5. CONCLUSIONS

The knowledge basis in safety culture, in the current stage, is not yet deep and comprehensive enough for its envisioned purposes. Nevertheless, it can be of great help for those people that are beginning in the area. Moreover, even researcher and practitioners with experience in the area of safety can be benefitted with information that allows explaining some aspects of interest.

Finally, it is important to highlight that the key factor for the success of this project is the collaboration of experts who could contribute with suggestions and critics to the improvement of the knowledge basis.

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