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Evaluating Safety Culture Under the Socio-Technical Complex Systems Perspective

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Synopsis

Since the term "safety culture"was coined, it has gained more and more attention as an effort to achieve higher levels of system safety. A good deal of effort has been done in order to better define, evaluate and implement safety culture programs in organizations throughout all industries, and especially in the Nuclear Industry.

Unfortunately, despite all those efforts, we continue to witness accidents that are, in great part, attributed to flaws in the safety culture of the organization. Fukushima nuclear accident is one example of a serious accident in which flaws in the safety culture has been pointed to as one of the main contributors.

In general, the definitions of safety culture emphasize the social aspect of the system. While the definitions also include the relations with the technical aspects, it does so in a general sense. For example, the International Nuclear Safety Advisory Group (INSAG) defines safety culture as:

"The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receives the attention warranted by their significance"

By the way safety culture is defined we can infer that it represents a property of a social system, or a property of the social aspect of the system. In this sense, the social system is a component of the whole system. Where, "system"is understood to be comprised of a social (humans) and technical (equipment) aspects, as a Nuclear Power Plant, for example.

Therefore, treating safety culture as an identity on its own right, finding and fixing flaws in the safety culture may not be enough to improve safety of the system. We also needed to evaluate all the interactions between the components that comprise all the aspects of the system.

In some cases a flaw in the safety culture can easily be detected, such as an employee not wearing his/her individual protection equipment, e.g. dosimeter, or when they ignore basic safety procedures for operating equipment. However, when it comes to more subtle interactions between components of the system, it becomes harder to detect potentially hazardous situations that are hidden, and can lead the system to hazardous states.

For example, leaders can take decisions that are in conflict with decisions taken by other colleagues at a very different department, and without knowing, be contributing to future unintended consequences to the system. Such a situation may not be easily detected by direct observation.

This explains why having a good safety culture seems not to be enough to assure the safety of the system. According to STAMP principals, safety is a problem of flaws in the control of the interactions between components of the system, and not only a problem of failures of components of the system. Remember that safety culture defines a property of part of the system, which could be considered as a component of the system.

We can find examples of companies that, even having well evaluated safety culture, or organizational culture, fail to keep their high safety standards.

In this work we propose a methodology that integrates safety culture in the control structure of the system. It is based on STAMP _ Systems Theoretic Accident Models and Processes, and the Three Lenses _ Strategic, Political and Cultural Approaches.
It can help evaluate either the existing safety culture of a Nuclear Power Plant or the implementation of new safety culture projects.

STAMP is based on the assumption that accidents are a result of flawed control over the interactions between components of a system. Where, control structure is a model of the system in terms of control loops.
To understand how the control structure of a system can be corrupted, and therefore, leading the system to hazardous conditions, the methodology of the Three Lenses is applied.

By following this approach it would possible to keep all the safety culture traits but, instead of focus on the safety culture itself, as a quality of a social system, the proposed approach integrates the safety culture traits into the control structure of a broader system, the socio-technical complex system.

A practical example, based on the Davis-Besse Nuclear Power Plant head degradation event, is presented.

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