

A Preliminary Study on the Measures to Assess the Organizational Safety: The Cultural Impact on Human Error Potential

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1. Introduction

The Fukushima I nuclear accident following the Tohoku earthquake and tsunami on 11 March 2011 occurred after twelve years had passed since the JCO accident which was caused as a result of an error made by JCO employees. These accidents, along with the Chernobyl accident, associated with characteristic problems of various organizations caused severe social and economic disruptions and have had significant environmental and health impact. The cultural problems with human errors occur for various reasons, and different actions are needed to prevent different errors. Unfortunately, much of the research on organization and human error has shown widely various or different results which call for different approaches. In other words, we have to find more practical solutions from various researches for nuclear safety and lead a systematic approach to organizational deficiency causing human error. This paper reviews Hofstede's criteria, IAEA safety culture, safety areas of periodic safety review (PSR), teamwork and performance, and an evaluation of HANARO safety culture to verify the measures used to assess the organizational safety.

2. Review Criteria on Organizational Characteristics

2.1 Hofstede's Cross-Cultural Criteria

Culture is, in short, a mental program or software of minds (1995 Hofstede). It can be characterized for a group of persons regardless of the degree of civilization. It differs from human nature and the psychological characteristics of a person (i.e. personality). Cultural comparisons have frequently shown biased conclusions about the strength and shortage of a culture compared to another culture. This was overcome by virtue of the cultural relativism after Claude Levi-Strauss and others.

Hofstede suggested a set of review criteria for a cross-cultural study among various countries. He utilized a set of data obtained from the questionnaire survey about the personnel engaged in IBM during the 1970s. The criteria suggested to characterize a national culture consist of four indices about the power distance, individualism against collectivism, masculinity to femininity, and uncertainty avoidance of the population in a country.

- PDI : power distance index
- IDV : individualism index
- MAS : masculinity index
- UAI : uncertainty avoidance index

Asian countries were easily discriminated from Western countries by the review criteria. Asian countries show a weak individualism and a big power distance. Japan shows a relatively large MAS, although Korea shows a tendency of femininity. Hofstede added another criterion of LTO (long-term orientation) based on CVS (china value survey). So-called "Confucian Dynamics" reveals very strong tendency of LTO which might specify the recent progresses of the some oriental countries. Hofstede's studies were inevitably limited to an international comparison based on cross-cultural relativism rather than organizational characterization. However, this early study could be regarded as the first systematic approach on the characterization of an organization including a statistical verification, and the criteria 4+1 can be considered as a starting reference for studying the organizational impact on human error potential.

2.2 IAEA's Criteria for Safety Culture

The concept was further expanded in the 1988 INSAG-3 report, Basic Safety Principles for Nuclear Power Plants, and again in 1991 in the INSAG-4 report ("Safety Series No.75-INSAG-4, Safety Culture, 1991"), Safety Culture. Recognizing the increasing role that safety culture is expected to play in nuclear installations worldwide, the Convention on Nuclear Safety states the Contracting Parties' desire "to promote an effective nuclear safety culture." The concept of safety culture is defined in INSAG-4 as follows: "Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance." Table 1 shows the research trends on safety culture dividing into three categories.

Table 1 Research trends on Safety Culture

Theory	Technique	Training
· CRM training · Training of non-technical skills for emergency management · Safety Management Challenges and Tensions	· Team skills · Measuring the quality of group interaction · Safety climate questionnaire · Safety critical organizations.	· Team Skills Training · Guidelines for Simulator Training · organization and staffing · Systematic Approach to Training (SAT)

2.3 Technical Review Items in PSR

A Periodic Safety Review (PSR) of a nuclear power plant, typically, results in a number of identified issues

of different types. According to the current IAEA's referential PSR guiding document, the overall review is divided into fifteen review areas, termed 'safety factors', which range from 'plant design' to 'human factors' to 'safety culture', for example. The method for ranking identified safety issues must characterize the safety importance of the issues coming from different review areas or factors on the same scale and consistent basis. Through PSRs in Korean NPPs, the status of various human factors in the operation of NPPs has been reviewed by human factor experts and operation experts outside of the plants. Many points that are not suitable in a human factors sense have been revealed, and remedies for these have also been discussed between the reviewers and plant personnel. Table 2 shows human factor review items defined in the enforcement regulation of the PSR act and IAEA safety guidelines.

Table 2 Human Factor Review Items in PSR

IAEA safety guide	Selected Items for PSR in Korea (Nuclear Acts)	HF
12. Human factors (a)Staffing levels (b)Availability of qualified staff on duty at all times (c)Programs for initial, refresher and upgrade training (d)Operator actions (e)Human factors in maintenance (f)Adequate competence requirements (g)staff selection methods (h)Fitness for duty (i)Policies for maintaining the know-how of staff (j)Adequate facilities and programs for staff training	9. Human factors (a)Staffing levels for the operation of a nuclear power plant with due recognition of absences, shift working and overtime restrictions (b)Availability of qualified staff on duty at all times (c)Programs for initial, refresher and upgrade training, including the use of simulators (d)Information requirements and workload of staff (e)Man-machine interface (MMI)	O O O Δ X
9. Use of experience from other plants and of research findings	6. Use of experience from other plants and of research findings	Δ
11. Procedures	7. Procedures	Δ
10. Organization, the management system and safety culture (a)Policy statements of the operating organization (b)The documentation of the management system (c)The adequacy of arrangements for managing and retaining responsibility (d)Roles and responsibilities of individuals (e)Processes and supporting information	8. Organization and administration (a)Safety system including safety purpose (b)The documentation of the management system (c)The adequacy of arrangements for managing & retaining facilities (d)System for utilization of individuals managing (e) Planning & facility of training (f) Planning for QA	O O O O O O

2.4 Evaluations of Safety Culture of HANARO

HANARO has emphasized and implemented a safety culture as one of the safety management activities for the reactor operation and utilization. HANARO safety culture indicators, which are composed of 15 evaluation areas such as safety policy, safety practices, highlighting safety, definition of responsibilities, etc, including 48 detail factors for measuring safety attitudes were developed in 2007. The indicators have been developed based on IAEA's documents and the safety culture indicators for Korea nuclear power plants prepared by KINS (Korea Institute of Nuclear Safety). The survey using the indicators would be helpful to understand the overall safety status of the employees in

HANARO. It is quite beneficial for capturing the gradual improvement of the HANARO operation.

2.5 Criteria on the Teamwork and Team Performance

A few indicators for measuring team performance in MCR crews were developed, especially during the simulator training. The indicators mainly consist of selected attributes or the overall level based on the timeline responses and others. Therefore, KAERI utilizes the Organizational Personality Type Indicator (OPTI), which was developed to identify the relationship with validity, immersion and satisfaction, based on relationship and propensity correlation between the personality types of individuals and organizations in organization diagnosis, development, personnel administration, and psychology. The assessment, in particular, guaranteed an applicative possibility in business for the suitability assessment of department assignment through analyzing the factors needed in preliminary applications after investigating the relationship of propensities within organizations, team administrators, and individuals.

3. Comparisons and Critiques

We examined several precedent researches as objects the research on organization safety after the suggestion of the Hofstede's criteria, IAEA safety culture, safety areas of periodic safety review (PSR), HANARO safety culture study, and teamwork and performance. Some cases show good methods and measurements for the overall safety status of nuclear organization in a systematic and comprehensive manner. However, evaluations are different between the overall organizational status and the characteristics of a unit.

4. Conclusion and Discussions

In this paper we reviewed several sets of review criteria related to the evaluation of organizational aspect in nuclear safety. The only review chance of PSR on organizational safety is normally carried out once in a 10-year period and cannot substitute other regulatory and plant routines or occasional reviews. Therefore, we need to verify various methods about each criterion for the evaluation of safety conviction. For example, we have to conduct a safety inspection preferentially on control factors affecting human error potential.

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