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Factor Analysis and Framework Development for Incorporating Public Trust on Nuclear Safety issues

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1. Introduction

1-1. Background

There have been increasing public concerns about nuclear safety after witnessing several adverse nuclear industry accidents, such as the Fukushima NPP accident in Japan (2011), consequent radioactivity of fishery products from the western Pacific, concealment of the Kori Nuclear Power Plant blackout, supply corruption scandals, and rising concern about exposure to radiation in daily life. It is believed that, considering the characteristics of nuclear safety issues, certain domestic and overseas situations and the demands of the times, there is public consensus about the need for improved nuclear safety and trust therein. The Korea Institute of Nuclear Safety (KINS), a regulatory expert organization in charge of nuclear safety in Korea, realized that a more fundamental and systematic analysis of activities is needed to actively meet the greater variety of concerns people have and increase the reliability of the results of regulation. Nuclear safety, a highly specialized field, has previously been discussed primarily from the viewpoint of the engineers who deal with the technology, but now "public trust in nuclear safety" has to be viewed from the standpoint of the general public and from the socio-cultural perspective. Specific measures must be taken to examine which factors affect public trust and how we can secure and reproduce those factors to gain it. Also, an efficient system for incorporating public trust in nuclear safety must be established.

1-2. Scope of the study and methodology

In this study, various case studies were examined to identify the factors that affect public trust in nuclear safety. First, nuclear safety laws and information disclosure systems of major countries were examined by investigating data and conducting in-depth interviews. To explore a public framework concerning nuclear safety, big data of social media were analyzed. Also, Q methodology was used to analyze the risk schemata of the opinion leaders living in areas near nuclear power plants. Several surveys were conducted to analyze the amount of trust the public had in nuclear safety as well as their awareness of nuclear safety issues. Based on these analyses, factors affecting public trust in nuclear safety were extracted, and measures to build systems incorporating public trust in nuclear safety were proposed.

This study addresses the public trust in nuclear safety on condition that the safety is ensured technically and mechanically.

2. Analyzing factors affecting public trust in nuclear safety

2-1. Examination of laws and systems related to nuclear safety information disclosure

This study examined how other countries are trying to ensure transparency, the very foundation of public trust in nuclear safety, and with what kinds of laws and systems. France stipulates and interprets the concept of nuclear safety from the viewpoint of the general public in accordance with their Act on Transparency and Security in the Nuclear Field (TSN Act). According to this process, emphasis is placed not only on contents, but also procedure. Also, France takes a very proactive, participatory attitude toward information disclosure and opinion gathering. The US Nuclear Regulatory Commission (NRC) thoroughly categorizes the information that can be disclosed to the general public through related laws and guidelines as well as the meetings in which the public can participate in, and stipulates in detail the procedures, responsibilities and authorities. However, the NRC allows the order of disclosure and participation to be adjusted in consideration of the situation of immediate concern, public interest and importance of issues. Japan's Nuclear Regulatory Commission has established very detailed information disclosure guidelines based on a law regarding information disclosure. In Korea, information regarding nuclear safety is disclosed according to the Official Information Disclosure Act, but it seems that this Act does not sufficiently reflect the special characteristics of public trust in nuclear safety and the changing needs of the general public's trust in nuclear safety. Accordingly, it is necessary to establish the 'Act on Public Trust in Nuclear Safety (tentative)' together with the 'Act on the Establishment and Operation of the Nuclear Safety Commission' and consolidate an operational foundation of public trust through a nuclear safety participatory system.

2.2 Analyzing the public' framework of nuclear safety through big data analysis

This study attempted to investigate what 'safety' actually means among the general public in Korea with regard to the discourse about nuclear safety through analyzing social data related to 'Nuclear' and 'Safety.' For example, the social media Twitter was searched for the terms 'nuclear & safety' and 'safety' and as a result, 720 terms and 95,279 terms were found respectively. They were analyzed by means of a Frequency Analysis, Sentiment Analysis, Semantic Network Analysis, and Interpretation and Insight Extracting .

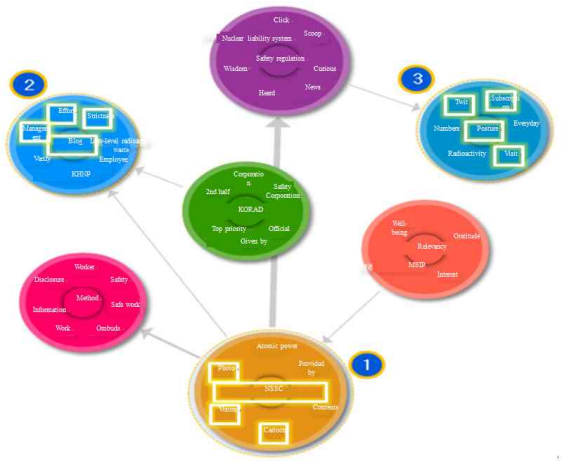

Fig. 1. Semantic Network Analysis

It is true that nuclear safety lacks specificity as an object of public trust. Accordingly, people's trust in nuclear safety may vary depending on how they trust the principal agents of nuclear safety. Through the big data analysis, it was found that the public ascribe more meaning to how hard the principal agents of nuclear safety try to secure nuclear safety than to nuclear safety itself. In addition, it was found that they are more concerned with how incidents and accidents affect them in reality than to how safely nuclear power plants are operated. They were found to be more concerned with the steps that they needed to take themselves to be safe rather than vaguely hoping that the government would keep them safe, and it was confirmed that they want the government to explain transparently, systematically and in detail what was examined in any investigation related to nuclear safety, how the investigation was conducted, what the results were, and whether there is any danger on the basis of the findings.

2.3 Using Q methodology to analyze the risk schemata of opinion leaders in areas around nuclear power plants

The local residents who live around the nuclear power plants are the principal agents who are directly affected by nuclear safety, and the environment supervisory organization are the principal agents of information diffusion as an opinion leader. Accordingly, this study attempted to understand through what framework they view nuclear safety. Q methodology, which is most useful for studies involving subjective criteria such as public opinion, attitudes, culture and decision-making was used to analyze their risk schemata. Risk schema refers to their own framework, socio-culturally structured through experience with, information and knowledge of risk issues, and interaction with the outside.

The purpose of the Q methodology is to make subjective experiences rich rather than to generalize its result. But, the limitation of this study is that the sample size is small. The attention is required when the result of the study is generalized considering the result is deduced from the small sample of the opinion leaders in the vicinity of nuclear power plants.

The survey questionnaire has 60 statements based on the theory of risk society that such sociologists as Giddens and Luhmann have developed recently. The 31 opinion leaders from environment supervisory organization were subject to the investigation with the 5 level of question sort from 'strongly agree' through 'strongly not agree'.

The collected Q classification results were then analyzed using CENSORT (a data analysis program). Members of the private environment supervisory organization were divided into three types.

1) Type 1. Risk unavoidable-national interest oriented risk schema

2) Type 2. Concern of risk results-forced risk denied risk schema

3) Type 3. Emphasis on perceived risk-risk averse risk schema

The characteristics of each type are as shown in the following table. Table 1.

Table I: Characteristics of each schema type of opinion leaders living near

Classification	Characteristics
Type 1	· Trust risk control through regulations and systems · Local residents take risks on their own for the sake of national interests. · Request justification for risk controllability and risk acceptance
Type 2	· Need explanations of results in advance in case of a risk · Request the procedure for participating in related discussions · Local residents who want to decide themselves whether to take risks
Type 3	· Think that influence on the ecosystem and future generations is more important than the influence on individuals · Citizens who want to directly participate in policy-making. · Express their will to accept personal burdens to avoid risks

When the three types of risk schemata are taken into consideration, to efficiently communicate with local residents, it was confirmed that a prior understanding of the positions of local residents and a discussion procedure in consideration of this are necessary. The most effective communication method turned out to be face-to-face communication. Also, it is desirable to rationally institutionalize local residents' direct participation in the process of policy-making. More than anything else, preparations must be made so that local

residents can understand processes and goals before a procedure is carried out.

2.4 Analyzing the level of public awareness of trust in nuclear safety through surveys

To analyze the levels of awareness and trust the public had with regard to nuclear safety, 1,000 male and female adult Koreans were surveyed. First of all, the level of awareness of regulatory agencies was such that they were relatively trustful considering information disclosure transparency (2.97), efforts of regulatory agencies to protect the public from risk (3.50), satisfaction with regulatory agencies' explanation of risks (3.59), and trust in the measures announced by regulatory agencies (3.50). With regard to the importance of the role of the principal agents of nuclear safety (5-point scale), news media was ranked No. 1, civil society organizations No. 2, the KHNP No. 3, the NSSC No. 4, nuclear experts No. 5, regulatory agencies No. 6, and the government No. 7. This survey revealed that opinions of media and civil society have a considerable influence on public trust in nuclear safety. In addition, it is believed that a wider range of efforts need to be made to enable the public to fully understand the role of regulatory agencies. On the other hand, to the question asking whether they know how to find information on nuclear safety, 37.9% of the respondents answered "yes" while 19.7% answered "no", the remaining 42.4% answered "neither" (3.22 on a 5-point scale). To the question asking whether there is a channel for making suggestions about nuclear safety, 52.6% answered "yes", 12.4% answered "no", with the remaining 35.0% answering "neither" (3.50 on a 5-point scale). To the question asking whether they are willing to participate in discussions about nuclear safety, 25.1% answered "yes", 25.2% answered "no", 49.7% answered "neither" (3.01/ on a 5-point scale). As a result of this survey, it was confirmed that the level of public awareness of information accessibility is above average.

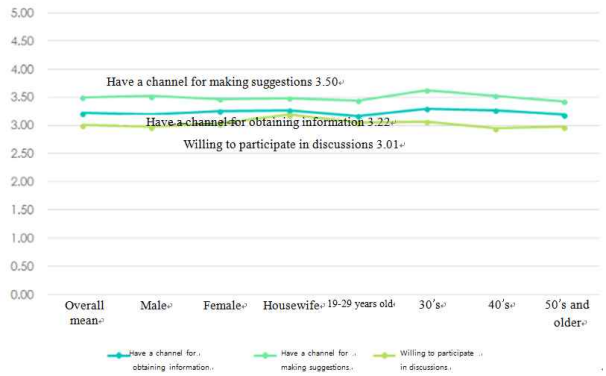

Fig. 2. Level of awareness of information accessibility related to nuclear safety

The level of public trust in media for nuclear safety communication, is as follows: broadcasting (51.1%), Internet news sites (16.7%), newspapers (10.7%), SNS (9.9%), websites of related agencies (8.0%), others (3.3%), and PR materials (0.3%).

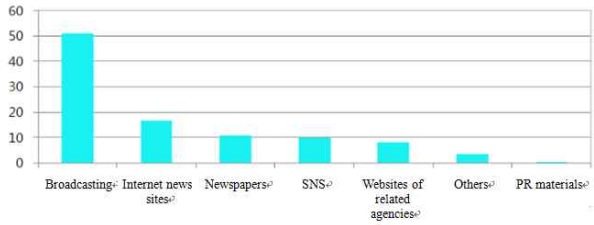

Fig. 3. Trust in the ability of public news media to communicate issues regarding nuclear safety

This survey confirmed that the most trusted media for nuclear safety information communication was broadcasting, followed by Internet news sites. In that the websites of related agencies are Internet-based, meticulous management seems necessary. In addition, SNS is becoming more important. As the level of trust varies a little depending on the characteristics of the respondents, it seems desirable to adjust communication channels for different targets. Considering a high level of reliability in broadcast news media and Internet-based news sites is high, it was found that constant communication with the journalists is essential and very important.

3. Analyzing factors affecting public trust in nuclear safety

The results of the survey for the public, local residents, and nuclear industry officials were Q-sorted, and value similarity, authenticity, responsibility and expertise were extracted as factors affecting public trust.

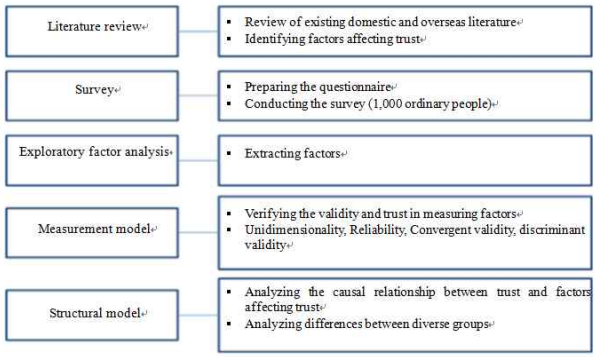

Fig. 4. Procedure for verifying factors affecting public trust in nuclear safety

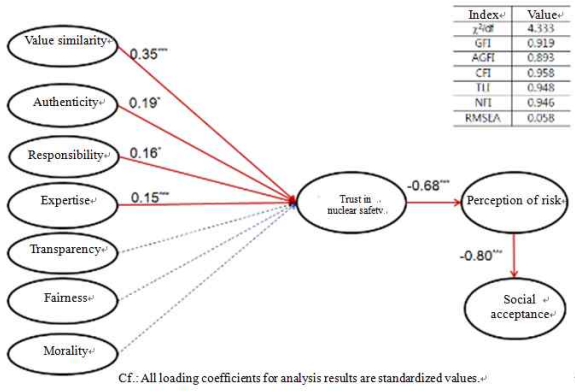

Fig. 5. Structural equation model analysis

The analysis found that, depending on the level of awareness of the importance of nuclear safety, level of perceived knowledge, and trusted media group, the factors affecting public trust in nuclear safety varied a little. However, in all cases, value similarity was extracted as a common factor. Value similarity turned out to be the most influencing factor on public trust in nuclear safety. Value similarity means "whether regulatory agencies are making efforts to ensure nuclear safety and reinforce it with the same thought and value as the general public." In order to secure public trust in nuclear safety, the first thing to do is to understand what values the public have with regard to nuclear safety, how they think about nuclear safety, what measures they want to be taken, and what they believe the goals of nuclear safety should be. Also, it is more important involve the public in the regulatory authority's decision and principle-making processes rather than delivering the message that nuclear technology is safe. In addition, in the long term, it is necessary to let the public know which competencies are needed to ensure nuclear safety, and to show that regulatory agencies themselves have sufficient competency and what efforts they are taking to continuously improve.

4. Conclusion and suggestions – building a nuclear safety system that incorporates public trust

In the process of analyzing factors affecting public trust in nuclear safety and studying ways to build a system incorporating public trust in nuclear safety, the nuclear safety laws and information disclosure systems of major countries were examined, and it was found that it is necessary to establish a legal system for consolidating the foundation of public trust in nuclear safety programs. And, through big data analysis, a public framework for nuclear safety could be analyzed. Also, the risk schemata of we regional opinion leaders re analyzed to identify different types, and information for developing customized, face-to-face communication was accumulated. A survey was also conducted to analyze the level of public awareness of their trust in nuclear safety and find effective ways to enhance their level of trust.

On this basis, factors affecting public trust in nuclear safety were analyzed, and it was confirmed that factors affecting public trust in nuclear safety, i.e. value similarity, authenticity, responsibility and expertise, must underlie the regulatory agencies communication process.

This study established a plan to build and operate a system incorporating public trust in nuclear safety. The two pillars of the system are the information disclosure program and a citizen participation program. For starters, all official documents related to public trust in nuclear safety must be systematically organized and disclosed online so that everyone can easily access the information they are seeking. It seems that for an information disclosure program to be effective that the public and media should have easy and open access to information disclosure websites, media briefings, emails, newsletters, social media and education. Also, it is expected that communicating closely with local residents through presentations, public hearings, city councils, county councils and village foremen meetings will be very effective. It is also important to give advance notices and communicate on a regular basis while avoiding intermittent information disclosure.

The other pillar (the public' participation program) may be divided into observance of meetings related to nuclear safety, participation, suggestions, recommendations, direct participation of local residents, experts' advisory committee, stakeholders' meeting and listening to the opinions of the public. It is also important to maintain exchange with regional private environment supervisory organizations. On the other hand, even if there be a perfect system, if the persons operating it do not completely understand the system and are fundamentally incompetent at operating it, the goals cannot be achieved. Accordingly, an education and training manual for proper communication and a program specifying the responsibilities and authorities of people in charge must also be developed.

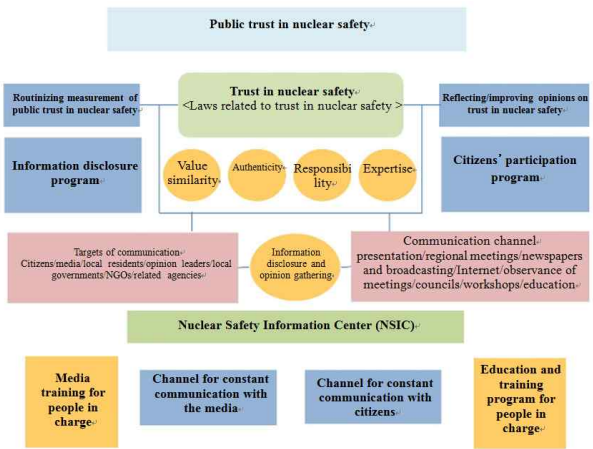

Fig. 5. Plan to build and operate a nuclear safety system incorporating public trust

Through this study, the concept of public trust became more obvious considering the public understanding in nuclear safety. In addition, the study proves that the public trust in nuclear safety can be structured with continued and reliable public information as well as public participation in the decision-making process. The information disclosure and citizen participation program are to be more important mission of regulatory bodies and addressed with philosophical and cultural sympathy. The more public trust is, the less risk consciousness is. In light of its influence of the public trust, the social cost can be reduced considering reduced misunderstanding, exaggeration, and deterioration. The regulatory body is to transparently open regulatory process to the public through various communication channels which will help the public trust to be developed and the risk consciousness to be lowered.

In this regards, KINS took the first step in building a system incorporating public trust in nuclear safety with aims to enhance public trust and to develop communication channels and methods. If the methodology in this study is applied to public communication, it is expected that the transparency and reliability of nuclear safety regulations can be further reinforced.

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