The Influence of Contextual Factors on Nuclear Risk Communication

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Abstract. The aim of this study is try to understand how nuclear risk communication context in the social process influence the integration of public opinions and expertise to satisfy citizens' economical and societal needs. This study used historical documents, literature review and data from previously reported cases, and developed a framework that consider how social feature is incorporated into the risk communication on nuclear development to address the gap between experts and the public in knowledge of technical topics.

Keywords: Nuclear, Risk communication, Public participation.

1. Introduction

Despite the rapid innovation of nuclear technology which solves many of its technological constraints and safety issues [1], social acceptance for nuclear energy has been relatively low. Despite the lower risks and safety assessments from experts, opposition groups remained untrusting of Government ability to safely monitor a nuclear operation. This phenomena stress the dilemma between public opinions and expertise. NIMBY (Not in My Back Yard) refers to a public that wants the benefits of technology but does not want to pay the costs associated with a facility in their backyard. It explains another dilemma between individual interest and public interest in society. The most important factor contributing to the NIMBY phenomenon is risk perception [2]. When people own life is threatened and much of the threat is beyond their control, they would have strong NIMBY to the nuclear, and struggle for the needs of Maslow's hierarchy [3]. A risk communication strategies should set which can clarify misconception of nuclear and increase the public's confidence in government's ability to manage risks and commitment to provide correct risk information [4][5]. In this way, public are better informed about nuclear issues and more aware of its benefits [6].

However, previous studies have not been fully discussed from a sociological point of view to identify critical factors influence risk communication. Lasker and Weiss [7] found the effect of stakeholder involvement in addressing policy disputes but his study didn't mention the communication context and the social process. Jun, et al. [8] estimate the social value of nuclear energy from consumers' willingness-to-pay, but still not identify critical factors affecting social acceptance management. The motivation of this study is try to understand how communication context in the social process influence the integration of public opinions and expertise to satisfy citizens' Maslow's hierarchy needs; and try to bridge the gap in the theory of successful risk communication on nuclear development. This study is conducted using historical documents, literature review and data from previously reported cases.

2. Factors influence on Nuclear Attitude

The most important factors that influence the nuclear policy implementation are risk and trust, and the antecedents of perceived risk and trust can summarized into human factors and institutional factors (Fig. 1). Human factors include outrage factors, which has identified how risk is perceived [9] [10], and Dominant Social Paradigm (DSP) [11], which is defined as the shared beliefs and values that make up a culture's worldview and that functions as ideology. People attending anti-nuclear activities can empower them to

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successfully master social or political systems [12]. Institutional factors include information distributed [6], community support economy development [8] [13], and act of public participation procedure [14]. Zimmerman et al. [12] indicated that the behavioural component of psychological empowerment make people to take specific actions to exercise influence on the social and political environment through participation in community activities. Credible information, high level and competence public participation and compensation can reduce perception of risk, reduce the NIMBY syndrome, and welcome the YIMBY.

Higher levels of trust in government leads to lower concern about the potentially harmful effects of the repository and as such they viewed the site and its potential related risks less seriously. So in keeping with the previous findings [14] [15] [16], we propose risk perception and distrust is the most important factor contributing to the NIMBY phenomenon is [2]. Stakeholder's involvement in nuclear energy policy is crucial in developing public support and influence the message [17]. Occasional media reports of scientific fraud add to this public scepticism and sense of uncertainty. Historical accidence occasionally mentioned by the media gave rise of fears of another nuclear disaster and increase perception of risk toward nuclear energy.
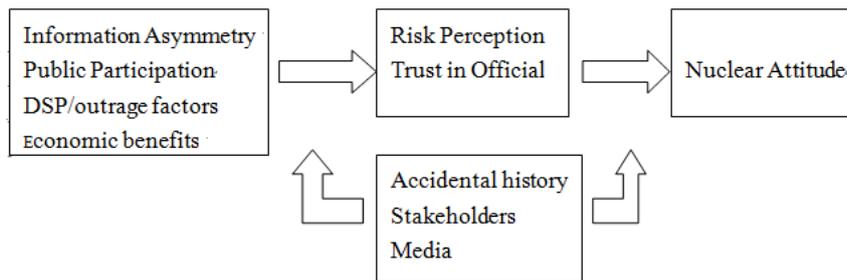

Fig. 1: Factors Influencing Attitude of Nuclear.

3. The Contextual of Communication for Nuclear Issues

The successful risk communication can know the context of the NIMBY reaction and proposed project to formulate the best response. Kovacs and Gordelier [6] found that people living in countries with nuclear power plants are more supportive of nuclear energy because they are more familiar with it, better informed about it and more aware of its benefits. Any new nuclear program should not proceed until it has been discussed thorough a process of citizen and stakeholder engagement on the issue of radioactive waste including social issues that arise [18]. The lower part of Fig. 2 shows the communication process for nuclear issues, which has 3 parts. The risk communication context has elements of sender, receiver, media, and message [19]. This model underscores the key factors in effective communication. Sender must interpret their messages in a way that takes into account how the public perceived the message. Communicator must develop feedback channels so that they can know the public's response to the message.

From a perspective of democratic review, whether the public opinion is carried out depend on whether the citizen competence, information asymmetry, and consensus formation have met [20] [21]. The quality of deliberation has implication on citizen competence, effective decision making; the rules of procedure rules involved legitimacy, effective of decision making, while the representative of participant would affect the information asymmetry and just for the interest involved among various stakeholders.

4. A Model of Successful Risk Communication for Nuclear Issues

We integrate Section 2 and Section 3 to build the successful risk communication model for nuclear issues, as depict in Fig. 2. Similar to Cohn [22], the most important factor is trust and credibility. But our model emphasize the social decision-making process, which incorporating both formal processes － institutionalized by law, and informal ones－social interaction by local context. This can enhance the smooth of the interface between technology and society.

4.1. Trust and Credibility

The trust variable is actually more important than previously considered [14] [16]. With an issue such as nuclear waste placed in the community or area, trust at the local level is extremely crucial to continue the communication process. Mushkatel et al. [16] also found that citizens' trust in officials affected citizen

attitudes toward waste repositories. Canada derive the conclusion from the guidance of a discussion by an independent commission is a qualitative requirement and importance to gain the trust and participation of the population [14]. Cohn [22] indicated that trust and credibility of the message are elements of successful communication, showing the accuracy information and trust in the bureaucracy is the precondition of successful risk communication. Therefore, this study proposes:

P1: Higher trust in officials and information credibility can increase higher citizen participation level in communication process.
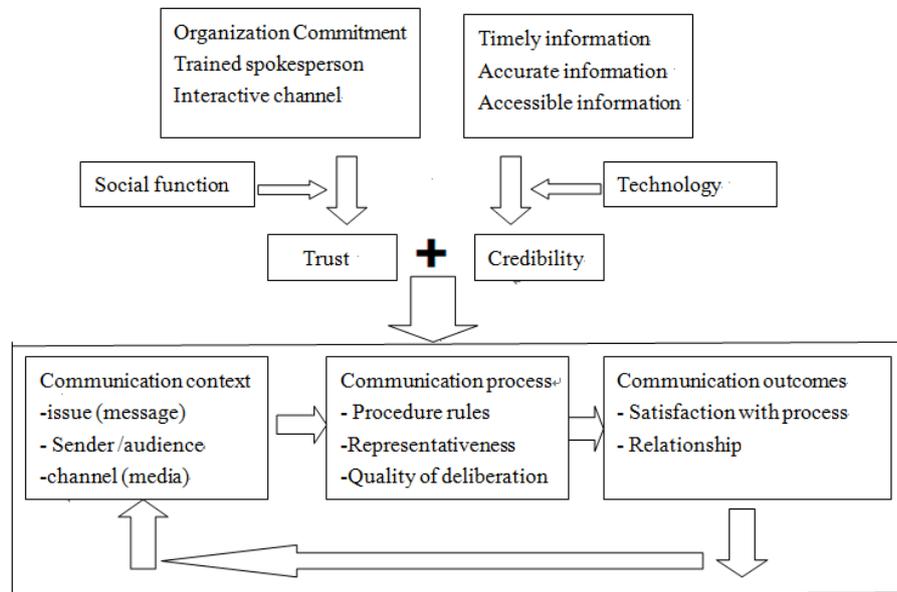

Fig. 2: The Model of Successful Risk Communication for Nuclear Issues.

Risk communication have to ensure that a diverse range of people share a common, understanding about an adverse outcome and the probability of that outcome occurring so as to make discussion based on the best information available [5]. To that end, bureaucratic has to ensure the transparency to the public of the process by which missions are chosen, designed and operated; Make information available and easily accessible, as early as possible; Communicating early, communicating often, and clarity. Sharing control of the research process with diverse stakeholders can make research more focused, relevant, and widely understood. Consensus-building and joint fact-finding can make future research outcomes can be made more useful to decision-makers and more credible to the broader public. Therefore, this study proposes:

P2: Higher accuracy of information on nuclear safety data can results in higher credibility.

The NRC is organized in a way that emphasizes the importance of communicating with a wide range of stakeholders at both the national level and in the field [4]. Risk communication is not a top-down communication from expert to the public, but rather a constructive dialogue between all those involved in a particular debate about risk and build mutually trust [23]. It's required organizational commitment and listens respectfully and responds constructively to critics, and supporters. They should provide more opportunities for citizen learning and expanded channels of risk communication, while also providing new opportunities for stakeholders to influence the message [17]. Citizens reach the information from variety communication channels, feeling the organization high level of empathy and caring to the public would increase the trust in government. Therefore, this study proposes:

P3: Higher organizational commitment can results in higher trust

4.2. Social Function

The formal process is institutionalized and it has little flexibility to adapt to the context and situation of each case. The informal process is an ad hoc participatory process to handle specific needs in the complicated context of the local area. Juraku, et al. [13] found a very effective informal process in Maki-machi, and suggest an interface between formal and informal processes. Public concern over a risk assessment is not just a statistical data, but the societal motivation and interest behind a technological risk.

Local social and ethical involved nuclear issues should include in risk assessment and communication agenda. Juraku, et al. [13] indicated take social function into account in considering decision making and utilization of participatory methods is very important. All stakeholder groups should be involved from the start. Partner relationships should be developed in advance of the risk communication. One of the best methods of building partnerships is to start building relationships informally through community and social networks. Strong, collegial relationships can be very helpful when emergency coordination is required. Partnerships should be based on the partners' common purpose of serving the community. Research indicates that community leaders and institutions can be valuable partners in gaining support for public policy, distributing information, or countering rumors surrounding an emergency event, and may be more likely than media alone to motivate the public to take recommended actions. Therefore, this study proposes:

P4: Engagement the local social functions can reinforce the influence of organizational commitment on public's trust.

4.3. Technology

Scientific facts, no matter how well technically supported, may not be considered credible by all stakeholders, because interpretations of data and a study's limitations legitimately vary. Without shared understanding of a study's analysis, assumptions, interpretations, and limitations, the public has no way of fairly comparing one study with another. Besides the scientific evidence, sustained economic growth and stable improvements in the operation of nuclear power plants with good operation records can change the social climate toward nuclear energy [13]. When the technology support the program and scientific facts can reduce the risk assessment, it can enhance the communication effectives. Formal process encounters unexpected problems need technology to support and clarify the questions. Therefore, this study proposes:

P4: Applied the scientific evidences in nuclear safety can reinforce the accuracy of information on public's credibility.

4.4. Openness and Transparency in communication process

Risk communication procedure should be discussed and agreed upon between risk communicators early in the process to ensure two-way communication. Through openness and trenchancy communication process would let the affected residents feel respect and not feel threatened their survival and safety needs of Maslow's nee hierarchy [3]. At the same time, this communication mechanism can encourage continuous dialogue between pro- and anti-nuclear witnesses and visitors, in the end, reducing the nuclear perception risk and changing attitude toward nuclear safety. In this way, the intrapersonal component of psychological empowerment enlightens people to think about their capacity to influence social and political systems [12]. It is a self-perception that includes domain-specific perceived control, self-efficacy, motivation to exert control, and perceived competence. Therefore, this study proposes:

P6: Effective risk communication can results in lower risk perception.

P7: Lower perception of risk is associated with a higher positive nuclear attitude

5. Conclusion

The risk communication build in this study is a comprehensive and process-driven preconditioned on trust and credibility. Our communication model emphasize the social decision-making process with interface between technology and society, which incorporating both formal processes and informal ones. Based on lessons from the past, the key component of this model is increase public and stakeholder involvement. It has been viewed by the public as fair and trust to include diverse stakeholders from the beginning of the nuclear program and involved them in decision making. With input from experts in the fields of risk communication and public involvement, this model can focus on improving how and what is communicated, tailoring presentations to the public, and improving explanations of technical information.

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