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Original Article

Big Data Analysis of Public Acceptance of Nuclear Power in Korea

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ABSTRACT

Public acceptance of nuclear power is important for the government, the major stakeholder of the industry, because consensus is required to drive actions. It is therefore no coincidence that the governments of nations operating nuclear reactors are endeavoring to enhance public acceptance of nuclear power, as better acceptance allows stable power generation and peaceful processing of nuclear wastes produced from nuclear reactors. Past research, however, has been limited to epistemological measurements using methods such as the Likert scale. In this research, we propose big data analysis as an attractive alternative and attempt to identify the attitudes of the public on nuclear power. Specifically, we used common big data analyses to analyze consumer opinions via SNS (Social Networking Services), using keyword analysis and opinion analysis. The keyword analysis identified the attitudes of the public toward nuclear power. The public felt positive toward nuclear power when Korea successfully exported nuclear reactors to the United Arab Emirates. With the Fukushima accident in 2011 and certain supplier scandals in 2012, however, the image of nuclear power was degraded and the negative image continues. It is recommended that the government focus on developing useful businesses and use cases of nuclear power in order to improve public acceptance.

1. Introduction

Nuclear power, despite its various benefits, has critical drawbacks such as the possibility of a nuclear meltdown, as was seen in Fukushima [1,2]. Public acceptance of nuclear power is important for the government, the major stakeholder of the industry, because a consensus is necessary to drive government actions [3]. It is therefore no coincidence that the governments of nations operating nuclear reactors are endeavoring to enhance public acceptance of nuclear power: better acceptance allows stable power generation and peaceful processing of nuclear waste produced from nuclear reactors. In this context, public acceptance is critical for sustaining nuclear power, and researchers have devised various methods to measure that acceptance. The existing literature suggests that rationality, emotion, knowledge of

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nuclear technology, trust, policy executor, and risk perception variables affect public acceptance. Recent attempts at evaluation of degree of public acceptance of nuclear power, however, have been limited to epistemological measurements using methods such as the Likert scale [4,5]. Because such methods are standardized, it is difficult for them to reflect the emotions latent in individuals within the public. Moreover, surveys can be conducted only with participants in a specific region and time interval, and it may be misleading to generalize these results to represent the overall attitude of the public. To measure public acceptance of nuclear technology precisely, one must devise a methodology that can collect a massive amount of data from large samples and analyze this "big" data. This is because big data methods are based on unstructured data, which contain live experiences/opinions, and because big data are collected virtually in real time with almost no delay between the events of concern and the data collection [6]. In this research, we propose big data analysis as a solution to these problems and attempt to identify the attitudes of the public toward nuclear power using big data analysis.

2. Literature review

2.1. *Public acceptance*

To measure the public acceptance of nuclear power, scholars from many fields have suggested and used various methodologies. It has usually been the fields of sociology and public administration that have investigated the public acceptance of nuclear technology; survey results have been analyzed using several methodologies. The results indicate that trust, knowledge, and economic benefit are required to enhance public acceptance of nuclear technology. Such analysis, despite convincing results, has four limitations [7]. First, the data analyzed do not necessarily represent the opinions of the entire population because, owing to various constraints, researchers have analyzed citizens in limited geographical regions. Second, because anonymity has to be guaranteed in a survey, it is difficult to identify opinion leaders in networks of people. Third, a real-time analysis is almost impossible because of the time taken to acquire and process data. Surveys and face-to-face interviews require significant time to complete and may not be suitable for situations that require fast decision making. Lastly, as traditional methodologies are structured, it may be difficult to induce unstructured opinions from the respondents. As described above, the traditional methodologies of surveys and face-to-face interviews have various limitations. This research proposes big data analysis as an alternative.

2.2. *Big data*

Big data is a concept that encompasses "large-scale data" and, initially, the definition of big data consisted of attributes such as a large volume, high velocity (speed of data creation and distribution), and variety of data. The value of big data from social networks (e.g., Twitter and Facebook) is growing because the data can be used to overcome the limitations of traditional methodologies (e.g., surveys). Social data can be used not only to overcome the constraints of space and time, but also to reflect various opinions in unstructured forms and to identify networks among people. Such characteristics make social big data suitable for analyzing public acceptance of nuclear power, in which a diversity of opinions across regions exists and opinions are susceptible to rapid changes. To overcome the limitations of traditional methodologies and to view the public from a new perspective, this research analyzed the Korean public using social big data analysis.

3. Methodology and data

As noted in the previous section, using big data analysis, we were able to identify the emotional state of the public and, furthermore, the process of diffusion. This allows a quick detection/visualization of major issues and is thus very effective at measuring public acceptance of nuclear technology, an issue that is directly related to civil safety and welfare. This analysis reduces the distortion of parameters by allowing researchers to analyze the opinion of the overall population rather than that of a small sample. In addition, the analysis allows discovery of new relationships among variables and real-time analysis. In this context, we used common big data analyses to analyze consumer opinions in SNS (Social Networking Services) via keyword analysis.

3.1. *Keyword analysis*

Keyword analysis identifies sentences with keywords of concern and extracts nouns from the sentences. The ratio of nouns determines the overall consumer opinion. To conduct the analysis, we collected data by crawling the Web, Twitter, and Naver.com, for approximately 1.2 million sets of data from January 1, 2009 to July 31, 2014. The gathered data were decomposed by the word class, such as nouns and adjectives, to extract SNS user emotions, and the nouns of the decomposed data were visualized following the building of a "word cloud."

3.2. *Comparison of nuclear power awareness: Seoul and Kori*

We compared the awareness of nuclear power for two different groups of people: people living far from a nuclear reactor (Seoul) and people living in the proximity of a nuclear reactor (Kori). This is because nuclear reactors are subject to "Not In My Backyard" objections, and the awareness of nuclear reactors is expected to decrease as the distance from a nuclear reactor increases. To analyze this, we collected data by crawling Twitter with the keywords "nuclear," "nuclear power plant," and "smart nuclear reactor" Tweets from January 1, 2015 to April 30, 2015 with location information (both longitude and latitude) were filtered. Among the filtered data, we selected tweets written in a 10-km radius of Seoul City Hall and tweets written in a 20-km radius of the Kori Nuclear Reactor as samples of these two groups of people.

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