Twitter Analysis of Public Acceptance between Seoul and Gori of Nuclear Power

Seungkook Roh
Senior Researcher, Policy Research Division, Korea Atomic Energy Research Institute (KAERI)
989-111 Daedeok-daero, Yuseong-gu, Daejeon, 34057, Korea
skroh@kaeri.re.kr

1. Introduction

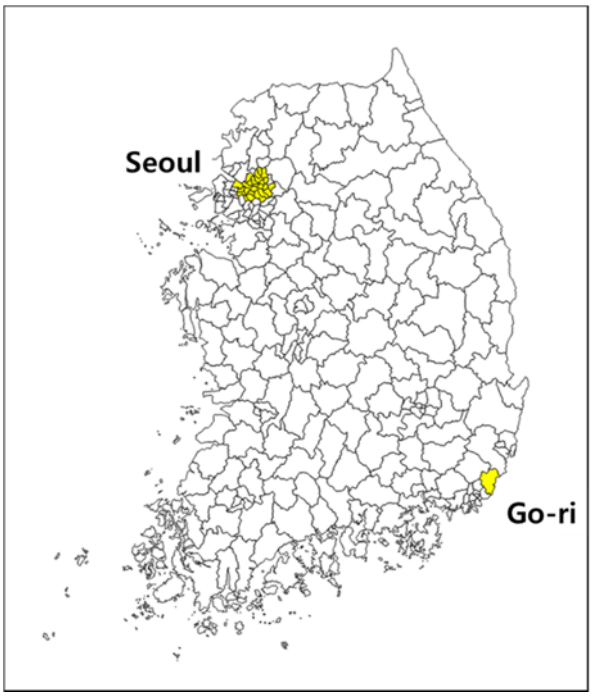
Public acceptance of the nuclear power is important for the government, the major stakeholder of the industry,because a consensus is necessary to drive government actions (Dunlap et al., 1993; Hammond, 1979; Otway et al., 1978; Wüstenhagen et al., 2007). It is therefore no coincidence that the governments of nations operating nuclear reactors are endeavoring to enhance public acceptance of nuclear power: better acceptance allows stable power generation (using nuclear) and peaceful processing of nuclear wastes produced from nuclear reactors (Dawson and Darst, 2006; Kim et al., 2013). In this context, public acceptance is critical for sustaining nuclear power, and researchers have devised various methods to measure it (Stritar, 1996). Existing literatures suggest that rationality, emotion, knowledge of nuclear technology, trust, policy executor, and risk perception variables affect public acceptance. These attempts, however, have been limited to epistemological measurements using methods such as the Likert scale (Sjoberg and Drottz-Sjoberg, 2009; Slovic, 2000; Tanaka, 2004). Because such methods are standardized, it is difficult to reflect on emotions latent in individuals within the public. Moreover, surveys can be conducted only on people in a specific region and time interval, and it may be misleading to generalize the results to represent the attitude of the public. For example, opinions of a person living in a metropolitan area, far from the dangers of nuclear reactors and enjoying cheap electricity produced by the reactors, and a person living in the proximity of a nuclear power plant and subject to tremendous damage should a nuclear meltdown occur, certainly differ for the topic of nuclear generation (Kim et al., 2013). To measure the public acceptance of nuclear technology precisely, one must devise a methodology that can collect massive data from large samples and analyze the "Big" data (Gantz and Reinsel, 2012; LaValle et al.,2013). Because big data methods are based on unstructured data, which contain the live experiences/opinions, and are virtually real-time with almost no delay between the events of concern and the data collection, big data analysis allows real-time identification of relationships among different variables and their significance (Graham and Shelton, 2013). In this research, we propose big data analysis as a solution and attempt to identify the attitudes of the public on nuclear energy using big data analysis.

2. Methods and Data

We were able to identify the emotional state of the public, and furthermore, the process of diffusion using big data analysis. This allows a quick detection /visualization of major issues and is thus very effective at measuring the public acceptance of nuclear technology, an issue that is directly related to civil safety and welfare. The analysis reduces the distortion of parameters by allowing researchers to analyze the population's opinion rather than that of a small sample (Lohr, 2012). In addition, the analysis allows discovery of new relationships among variables and real-time analysis (Barlow, 2013). In this context, we employed common big data analyses to analyze consumer opinions in SNS. We compared the awareness of nuclear energy for two different groups of people: people living far from a nuclear reactor (Seoul) and people living in the proximity of a nuclear reactor (Gori). This is because nuclear reactors are subject to NIMBY (Not In My BackYard) objections, and the awareness of nuclear reactors is expected to decrease as the distance from a nuclear reactor increases (Wolsink, 2006). To analyze this, we collected data by crawling Twitter with keywords "nuclear", "nuclear power plant," and "smart nuclear reactor"(Java et al., 2007; Kwak et al., 2010) Tweets from Jan. 1st, 2015 to Apr. 30th, 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 Gori Nuclear Reactor as samples of these two groups of people.

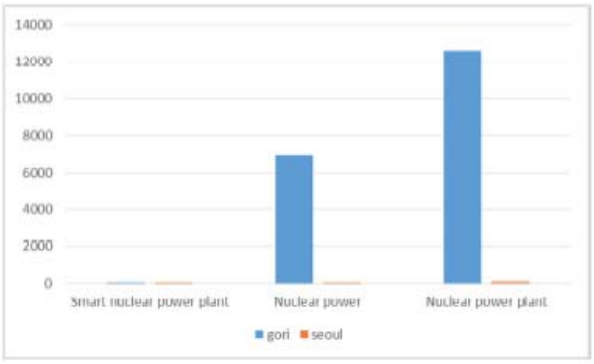
3. Results

This research compared the differences of attitudes of people in Seoul and the people in Gori using data from the social network. Seoul is the capital city of Korea with a population of 10 M (the total population in Korea is 51 M) and consumes a significant amount of electricity (Kim et al., 2012; Park et al., 2000). As figure 1 indicates, Seoul is far from a nuclear reactor.



[Figure 1. Location of Seoul and Gori in Korea]

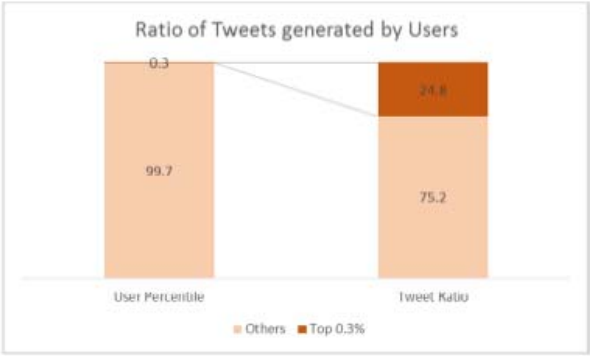
The figure below graphically shows the results of the comparison of tweets in Seoul and Gori.



[Figure 2. Number of Tweets generated in Gori and Seoul]

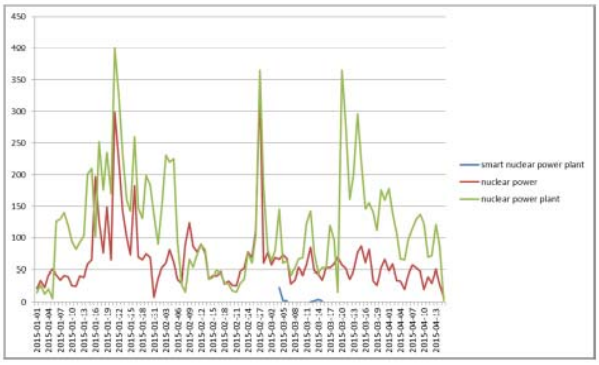
The analysis indicates that Gori generated 153-times more tweets with keywords "smart nuclear reactor," "nuclear power," and "nuclear power plant" than Seoul. The tweets in Gori also indicated that there were twotimes more tweets about nuclear power plants than tweets about nuclear power, which is sensible when taking into account that Gori is in the proximity of a nuclear reactor. The number of tweets in Seoul was very small and did not show any statistically significant difference. In any case, there were small numbers of tweets on a "smart nuclear reactor."

The results also indicate the domination of twitter opinions by few opinion leaders. Figure 3 shows that the top 0.3% (19 users) of users (6,203 users) generated 24.8% (4,811 tweets) of tweets (19,345 tweets).



[Figure 3. Domination of opinion by opinion leaders: Nuclear power and nuclear power plants]

In other words, only a few users generated a large number of tweets and lead the opinion on the SNS. It is worth noting that the top 19 users are all living in Gori, which indicates that it is difficult to find people living in Seoul interested in the issues related to nuclear power. These results demonstrate that the people distant from a nuclear reactor (Seoul) are not aware of nuclear issues and it is people/organizations living in proximity of a nuclear reactor that lead the opinions on nuclear power and nuclear power plants.



[Figure 4. Daily variation of tweets on Smart nuclear reactors, nuclear power and nuclear power plant]

Figure 4 indicates that tweets on "nuclear power" and tweets on "nuclear power plants" are highly correlated and exhibit similar patterns. That is, although the concept of a nuclear power plant is just a subset of nuclear power, the public perceives both as equivalent concepts. Wednesday and Friday were the dates with the most tweets generated, while fewer tweets were generated on the weekends. This finding, along with the domination of opinion leaders, suggests that the majority of the top users have jobs that utilize Twitter (hence, fewer tweets on the weekend).

4. Discussion

A direct comparison of tweets in Seoul and Gori showed that people in Gori generated 153-times more tweets than the people in Seoul. Disregarding the

demographic differences, which is out of the scope of this research, the results suggest that people living in Seoul are less affected by nuclear reactor than people living in Gori, due to differences in physical distance from a nuclear reactor (i.e., people living in Gori are more emotionally affected by nuclear power plants because they live in proximity of the reactors). It is worth noting that only 0.3% of twitter users generated 24.8% of tweets, and that the majority of these users are related to NGOs and political organizations. The nuclear industry should actively interact with these opinion leaders by providing necessary information and engaging them in public discussions. Overall, the negative image of nuclear power and nuclear power plants has persisted since 2011, and people/organizations living in the proximity of nuclear reactors are hostile toward nuclear power. This is reflected in the recent (Jun. 2015) rejection of the extension of the Gori nuclear reactor operation due to strong objection by the local citizens and political organizations. Despite the reactors' excellent performance and safety certification by a government-accredited organization, extension of operation was denied. This recent event shows that the sustainability of nuclear power is mostly determined by the acceptance, the image, and the feelings on nuclear power by the public rather than technological excellence and economic feasibility. Taking the reality into account, we propose two strategies to enhance the image of nuclear power. First, an application of nuclear technology must be developed so that nuclear power can contribute to the national economy and the welfare of society. Second, Korea should apply nuclear technology to other fields/industries so that the public can perceive the benefits of nuclear technology. With the image of nuclear power enhanced, it will be easier to implement nuclear power in Korea.

5. Conclusion and Research Limitation

To conclude, big data is a useful tool to measure the public acceptance of nuclear technology efficiently (i.e., saves cost, time, and effort of measurement and analysis), and this research was able to provide a case for using big data to analyze the public acceptance of nuclear technology (Berman, 2013; Burns, 2014; Cook, 2014). In addition, the analysis identified opinion leaders, which allows target-marketing when the policy is executed. In particular, the trends and opinions of opinion leaders on SNSs should be monitored and responded to in real time. As demonstrated from the rejection of the extension of the Gori nuclear power plant, image and feeling are more important than the performance of the safety technology on the operation of a nuclear power plant. Because Korea has many aging reactors, evaluation of projects to extend the operation of old reactors and build new reactors will take place in the near future. In this context, it is crucial to collect and analyze data regarding the image of nuclear power. The big data analysis will allow the nuclear industry and the government to proactively respond to the public, which will lead to rational decisions and interaction with the public. Evaluation and prediction of nuclear policies will be made more reliable by using the big data methodologies and the results of this research. Nevertheless, there are certain limitations. First, this research did not analyze the individuals directly, but their group in an SNS. Applying the results to the individuals directly may create an ecological fallacy (Schwartz, 1994). Second, using only Twitter data could limit the scope of this research (Li et al., 2012). Nevertheless, the research collected ample datasets for the analysis, and the overall trend of opinions is not expected to differ even in other SNSs. Lastly, as noted in Figure 2, there were very small numbers of tweets generated from Seoul. As a result, we did not compare the emotions of Gori and Seoul because the results would lack statistical significance.

REFERENCES

[1] Barlow, M., 2013. Real-time big data analytics: emerging architecture. " O'Reilly Media, Inc.".
[2] Berman, J.J., 2013. Principles of big data: preparing, sharing, and analyzing complex information.
[3] Newnes. Burns, R., 2014. Rethinking big data in digital humanitarianism: practices, epistemologies, and social relations. GeoJournal, 1-14.
[4] Cook, T.D., 2014. "Big Data" In Research On Social Policy. Journal of Policy Analysis and Management 33, 544-547.
[5] Dawson, J.I., Darst, R.G., 2006. Meeting the challenge of permanent nuclear waste disposal in an expanding Europe: Transparency, trust and democracy. Environmental Politics 15, 610-627.
[6] Dunlap, R.E., Kraft, M.E., Rosa, E.A., 1993. Public reactions to nuclear waste: Citizens' views of repository siting, Most of the chapters in this book are revised and updated versions of papers presented at the 1989 annual meeting of the American Association for the Advancement of Science in San Francisco, CA. Duke University Press.
[7] Gantz, J., Reinsel, D., 2012. The digital universe in 2020: Big data, bigger digital shadows, and biggest growth in the far east. IDC iView: IDC Analyze the Future 2007, 1-16.
[8] Graham, M., Shelton, T., 2013. Geography and the future of big data, big data and the future of geography. Dialogues in Human Geography 3, 255-261.
[9] Hammond, R.P., 1979. Nuclear wastes and public acceptance. Am. Sci.;(United States) 67.
[10] Java, A., Song, X., Finin, T., Tseng, B., 2007. Why we twitter: understanding microblogging usage and communities, Proceedings of the 9th WebKDD and 1st SNA-KDD 2007 workshop on Web mining and social network analysis. ACM, pp. 56-65.
[11] Kim, S., Ko, W., Lee, Y.H., 2012. The economic effects of the deferred disposal of spent fuel in Korea.

Progress in Nuclear Energy 59, 12-18.
[12] Kim, Y., Kim, M., Kim, W., 2013. Effect of the Fukushima nuclear disaster on global public acceptance of nuclear energy. Energy Policy 61, 822-828.
[13] Kwak, H., Lee, C., Park, H., Moon, S., 2010. What is Twitter, a social network or a news media?, Proceedings of the 19th international conference on World wide web. ACM, pp. 591-600.
[14] LaValle, S., Lesser, E., Shockley, R., Hopkins, M.S., Kruschwitz, N., 2013. Big data, analytics and the path from insights to value. MIT sloan management review 21.
[15] Li, R., Lei, K.H., Khadiwala, R., Chang, K.C.-C., 2012. Tedas: A twitter-based event detection and analysis system, Data engineering (icde), 2012 ieee 28th international conference on. IEEE, pp.1273-1276.
[16] Lohr, S., 2012. The age of big data. New York Times 11.
[17] Otway, H.J., Maurer, D., Thomas, K., 1978. Nuclear power: The question of public acceptance. Futures 10, 109-118.
[18] Park, Y.J., Shin, K.-H., Park, J.-G., 2000. Risk of gastric cancer in hereditary nonpolyposis colorectal cancer in Korea. Clinical Cancer Research 6, 2994-2998.
Schwartz, S., 1994. The fallacy of the ecological fallacy: the potential misuse of a concept and the consequences. American journal of public health 84, 819-824.
[19] Sjoberg, L., Drottz-Sjoberg, B.-M., 2009. Public risk perception of nuclear waste. International Journal of Risk Assessment and Management 11, 248-280.
Slovic, P.E., 2000. The perception of risk. Earthscan publications.
[20] Stritar, A., 1996. Public Acceptance, a Key Issue of Nuclear Energy. Nuclear Society of Croatia:
Nuclear Option in Countries with Small and Medium Electricity Grid, Opatija 1996, 134-140.
[21] Tanaka, Y., 2004. Major psychological factors determining public acceptance of the siting of nuclear facilities. Journal of Applied Social Psychology 34, 1147-1165.
[22] Wüstenhagen, R., Wolsink, M., Bürer, M.J., 2007. Social acceptance of renewable energy innovation:
An introduction to the concept. Energy policy 35, 2683-2691.
[23] Wolsink, M., 2006. Invalid theory impedes our understanding: a critique on the persistence of the language of NIMBY. Transactions of the Institute of British Geographers 31, 85-91.