Measuring Public Acceptance of Nuclear Technology with Big data

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1. Introduction

Nuclear power, despite various benefits it offers, has critical defects such as possibility of nuclear meltdown. This is why the public acceptance of the nuclear power is important for the government, the major stakeholder of the industry, because consensus is necessary to drive actions in the government (Zikopoulos & Eaton, 2011). It is, therefore, no coincidence that the governments of the nation operating nuclear reactors are endeavoring to enhance public acceptance of nuclear technology: better acceptance allows stable power generation (using nuclear) and peaceful processing of nuclear wastes produced from nuclear reactors (Kim, Kim, & Kim, 2014). In this context, public acceptance is a critical for sustaining nuclear technology, 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, were limited to epistemological measurement using methods such as Likert scale. Since the methods are standardized, it is difficult to reflect emotions latent in the individuals consisting the public. Moreover, surveys can be conducted only on people in 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 metropolitan area, far from the dangers of nuclear reactors and enjoying cheap electricity produced by the reactors, and a person living in proximity of nuclear power plants, subject to tremendous damage should nuclear meltdown occur, certainly differs for the topic of nuclear generation(Kim, Kim, & Kim, 2013; Roh & Kim, 2014). To measure public acceptance of nuclear technology precisely, one must devise a methodology that can collect massive data from large sample and analyze the "Big" data.(Gantz & Reinsel, 2012; LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2013).

2. Methods and Results

Recently, new customer survey/analysis methodologies using the big data in Social Network Service (SNS) have gained popular interest. Big data is defined to be the data sets with sizes of tens to thousands terabytes (TB), which include various unstructured formats of data. Since the generation, distribution, and consumption (usage) of the data is done in few seconds~hours, it is difficult to manage/analyze the data using traditional methodologies. By analyzing the unstructured data included in big data, we are able to identify the emotional state of the public and, furthermore, the process of diffusion. In addition, such big data analysis allows quick detection/visualization of major issues and is thus very effective to measure public acceptance of nuclear technology, an issue that is directly related to civil safety and welfare (Lohr, 2012; Lynch, 2008; McAfee & Brynjolfsson, 2012). The analysis reduces the distortion of parameters by allowing researchers to analyze the population's opinion rather than that of a small sample (Chen, Chiang, & Storey, 2012). In addition, the analysis allows discovery of new relationships among variables and real-time analysis. This research collected data by crawling the web for approximately 1.2 million sets of data from Jan.1st, 2009 to Jul. 31st, 2014.

```
setwd("C:/Rdata")
install.packages("KoNLP")
install.packages("wordcloud")
library(wordcloud)
library(KoNLP)

txt<-readLines("kaeri2.txt")
nouns<-sapply(txt,extractNoun,USE.NAMES=F)
head(unlist(nouns),30)
write(unlist(nouns),"kaeri2.txt")
rev<-read.table("kaeri2.txt")
nrow(rev)
wordcount<-table(rev)
head(sort(wordcount,decreasing=T),50)

library(RColorBrewer)
palete<-brewer.pal(9,"Set1")
wordcloud(names(wordcount),freq=wordcount,scale=c(5,0.5),rot.per=0.25,min.freq=1,random.order=F,random.color=T,colors=palete)
```

[Figure 1. Decomposing the gathered data]

The gathered data were decomposed by word class such as noun and adjective to extract SNS user's emotion then the noun of decomposed data was visualized following building 'word cloud' method (refer to Figure 1). The results indicate that SNS was dominated by positive terms such as "success", "growth engine", "renaissance" when Korea established export contract with UAE in 2009 (refer to Figure 1).

[Figure 2. SNS analysis in 2009]

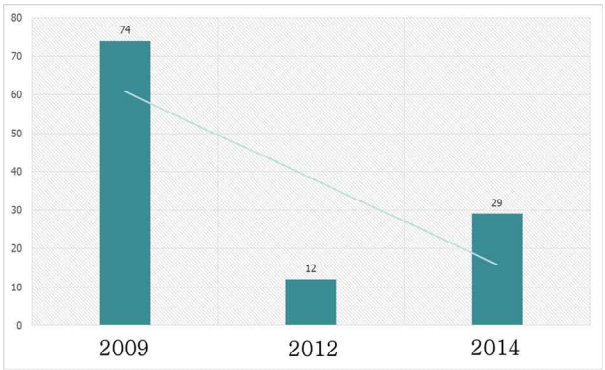
However, just an year after Fukushima accident, Korea Hydro & Nuclear Power fabricated documents regarding parts in nuclear reactors in 2012. The results also complied with the situation and showed that the SNS was dominated by negative terms such as “Fukushima”, “death”, “nuclear drive”, “danger”, “conceal”, “document fabrication”, and “trust”(refer to Figure 3).

[Figure 3. SNS analysis in 2012]

The SNS analysis on data of year 2014 indicated that the Korean society is still highly aware of the critical issues of nuclear technology such as safety and leakage. Moreover, one can observe that controversies such as nuclear fuel reprocessing, Korea-U.S. nuclear cooperation agreement, Kori reactor and Wolsong reactor are attracting public interest (refer to Figure 4).

[Figure 4. SNS analysis in 2014]

In order to measure public acceptance to nuclear using ‘Big data’ method, we analyze the data including extracted adjective words for chasing an emotion of SNS users. We established a dictionary and then the adjective words was applied to the dictionary to measure the level of an emotion of the public. For instance, though “clear”, “safe” get the plus points, “unclear”, “bad” lose the points. Eventually we calculate the overall points and then they were normalized (refer to Figure 5).



[Figure 5. Public acceptance to nuclear power]

According to the results of measuring public acceptance to nuclear power using the adjective words, it is strongly related to the result of word cloud using the noun words. In addition total public acceptance to nuclear power in Korea doesn’t look positive, so the nuclear industry and research fields may continue their efforts to increase the public acceptance to nuclear power to the public.

3. Conclusions

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 public acceptance of nuclear technology. Finally, the analysis identified opinion leaders, which allows target-marketing when policy is executed.

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