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学位論文の要旨

Global warming poses a serious challenge to the world for many years to come, and therefore mitigation actions need to be undertaken globally. Under the Kyoto Protocol, Annex I countries agreed to reduce their collective greenhouse gas emissions by 5.2% from the 1990 level. In order to achieve this commitment, several major mitigation measures have been undertaken such as ecologically friendly lifestyle programs, utilizing natural energy, participating in local environmental activities, and amending environmental laws, etc. These mitigation measures could be achieved if public responses are strong. As the internet has increasingly become an online platform for sharing environmental information, public responses to the need for reducing greenhouse gas emissions may be assessed using available ICT applications. In contrast to traditional online web surveys, I used Google Insights for Search (GIFS), Google AdWords Keyword Application, and Google Timeline View to assess public responses in Japan based on the search interest of five search terms that define global climate change and its mitigation measures. As a member of the Annex 1 countries to the Kyoto Protocol of the United Nations Framework Convention on Climate Change, Japan is committed to reducing 6% of the greenhouse gas emissions. Data on online search interests generated by Google Insights for Search from January, 2004 to May, 2011 were analyzed according to locations and categories. And data of periodical surveys from May, 2006 to April, 2010 were also used to analyze.

The purpose of this study is to find another way to assess public responses on climate change mitigation measures using mitigation measures having been promoted by Japanese government as case study. I used the online applications, namely GIFS, AdWords Keyword Application, Timeline View provided by Google Inc. The study method is based on concept of operational promotion public behavior model that the promotion will change in online search interests, change in public behavior, and finally make public conduct any desired action. This research uses the following points: (1) Content validity; (2) Face validity; and (3) External validity to validate GIFS data.

Climate change and its mitigation could be defined with one or more of the following eight Japanese terms, namely Kankyō Mondai (Environmental Issues), Chikyū Ondanka (Global Warming), Kankyō Bijinesu (Environmental Business), Kyōtogiteisho (Kyoto Protocol), Eko Pointo (Eco-point), Maibagu (My Bag), Shoene (Energy Conservation), Eko Jutaku (Eco House). While Baram-Tsabari and Segev chose three keywords (Global warming, Climate change, Pollution) to study the public interests in environment, here I chose five terms that are relevant to mitigation policy: Chikyū Ondanka, Kyōtogiteisho, Eko Pointo, Maibagu, Shoene. Chikyū Ondanka represents the current environmental problem. Chikyū Ondanka term is selected to assess the general public's awareness of the global environmental problem. Kyōtogiteisho was initially adopted by 39 industrialized countries in 1997, and became effective in 2005. It is the first international binding agreement to combat global warming by requiring Annex 1 countries to fulfill their obligations of reducing greenhouse gases emissions during the first commitment period (2008–2012). With this search term, I can evaluate the degree to which the Japanese public is interested in climate change mitigation measures. Eko Pointo is one of the many domestic measures aimed at both reducing greenhouse gas emissions and boosting stagnant consumption to fight against the economic recession. The Eko Pointo search term will help determine how effective this government measure is and the degree of public responses in such a measure. Shoene is the effort to reduce energy consumption to preserve resources for the future and reduce environmental pollution. I chose Shoene term because it has been

familiar to the Japanese public for a long time and it also relates to the search term “Eco-point”.

Content validity approach was used to validate whether it was possible to use the search query index data generated by GIFS through examining top searches of each selected term. The study found that search query index data of Chikyu Ondanka, Kyotogiteisho, Eko Pointo, Maibagu, and Shoene are appropriate to use because there is no confounding term found in top search list of selected five search terms.

Face validity approach was used to identify news or events which happened at any particular time. Google Timeline View was used for this purpose. Through this approach, I found that the search interests for the five chosen search terms dramatically increased, especially when new mitigation measures such as Eco Pointo, Maibagu campaign, etc. were introduced or when climate change related events such as G8 Hokkaido Toyako Summit, Kyoto Protocol summit, etc. were organized. Such rapid increase indicates that public is strongly responded to climate change mitigation measures. Another observation through GIFS data is that the search term Kyotogiteisho was mostly performed under the category of “Science” which is believed that this search term was performed by specialized users who may have better knowledge about climate change. On the other hand, search terms Chikyu Ondanka, Eco Pointo, Maibagu, and Shoene were mostly performed under the “Lifestyles”, “Shopping” category. These results suggested that public is more interesting in Chikyu Ondanka, Eco Pointo, Maibagu, and Shoene than in Kyotogiteisho because “Lifestyles”, “Shopping” categories are considered to have more relevance with public response.

External validity approach was used to justify search query index with online survey result. Based on online survey results, it is clear that most of Japanese knew well about Chikyu Ondanka problem and they were very much concerned with this matter. To deal with such problem, many Japanese people believed that Chikyu Ondanka problem can be solved by using energy-saving appliances (Shoene), electricity saving, and eco-bag (Maibagu). Most people understood and knew clearly about the eco-point system, and

take eco-points into account when they make decision to purchase energy efficient products. Even though, Japanese government introduced this system in order to combat against the global warming, many people believe that the effectiveness of this system is limited. Even though online survey results have no significant correlation with term Shoene, but these results can be used to support search query index for terms: Chikyu Ondanka, Kyotogiteisho, Eko Pointo, and Maibagu.

In this study, the effectiveness of mitigation measures have resulted in CO₂ emission reductions, about 790,000t-CO₂, 1,260,000t-CO₂, and 650,000t-CO₂ can be reduced yearly from the use of air condition, refrigerator, and TV respectively, and about 900t-CO₂ can be reduced from adopting Maibagu measure.

Therefore, we conclude that online applications could be used to assess the public responses to mitigation measures.

Yahoo Japan started to use Google search technology to power its internet search engine and search advertising platform from 2011. Under the agreement, Yahoo Japan is served both paid and algorithmic search results generated by Google technology on the backend. This deal may help searches received by Google increase to about 5 billion searches, or 90% of total search shares in Japan. The market shares and functionalities will help GIFS become a promising candidate as an alternative to traditional public surveys.

論文審査の結果の要旨

日本は、京都議定書の削減目標を達成するために、国内削減対策（0.5%）、森林炭素吸収対策（3.9%）と海外での削減プロジェクトに対する京都メカニズムでの対策（1.6%）の方針で行っている。1997年に決定した削減義務は、1990年比6.0%だが、2007年比較すると、14.6%になり、多くの国内削減をしなければならない。国内削減対策方針には、温室効果ガスをあまり排出しないライフスタイルプログラムの、マイバッグ、スーパークールビズ、スマート・ムーブ、ウォームビズやエコポイント、省エネ対策や再生可能エネルギー対策などがある。この国内削減対策を成功させるため、大衆反応や住民参加が必要となってくる。本論文では、ICTツールを活用し、この大衆反応を評価することを目的としている。

以上の背景から、本論文では、第1章の背景と研究の目的、第2章の国内対策方針に関する記述、第3章では、ICTツールで活用した研究、成果に関する先行研究の解析及び論文の研究手法の説明である。ICTのGoogle Insights for Search, Adwords (Google Keyword Tools), Timeline Viewのツールを活用し、Google検索エンジンで多く検索されている地球温暖化、京都議定書、エコポイント、マイバッグ、省エネのキーワードを解析した結果を、公表しているオンラインアンケート調査の結果と比較した上で、研究結論をまとめた。

第4章では、上記の各キーワードに関する2004年から2011年の間、月間検索数のデータを収集・解析した。検索数の変化と国内対策に関する政治的な動きを解析すると、インターネット上の反応は、国内対策の導入やその地球温暖化削減に関わるイベント等の開催により、検索数が多くなったことが示されている。このICTツールを活用した研究成果を、政府財団や新聞社が行った定期的なオンラインアンケート調査の成果と比較し、信頼性が高いと判明した。また、国内対策の有効性を解析し、年間約270万tCO₂以上が削減していることが判明した。

第5章の結論は、伝統的なアンケート調査方法やテレ調査方法以外のICTツールを活用することで、大衆反応の評価ができることが示された。また、21世紀はICT時代に入り、ICTツールを活用することで、研究時間や研究経費の削減ができ、今後もICTツールは研究や社会貢献にできると期待される。

以上の観点から、本論文は博士（応用情報科学）の学位授与に値すると認める。