



Evaluation of Climate and Energy Programme for Sustainable Development using Text Mining technique: A comparative study across 65 countries

Haein Cho, Green Technology Center, Republic of Korea (hcho@gtck.re.kr)¹

EXTENDED ABSTRACT

This study evaluates the economic, social and environmental dimensions of climate and energy programmes, and identifies countries demonstrating a holistic approach integrating three dimensions. Applying Python-based text mining technique to Voluntary National Reviews (VNRs) collected from 67 countries between 2015 and 2021, this study identifies fragmented governance for climate and energy in Korea. Strategies are developed for the Korean government to enhance sustainability of climate and energy programmes.

Introduction / background

The Sustainable Development Goals (SDGs) adopted by the United Nations in 2015 commit every country to take actions to meet the goals. International concerns about climate change have pushed countries to implement climate and energy programmes in a manner to achieve sustainable development. Voluntary National Reviews (VNRs) intend to facilitate sharing of experience and knowledge among countries to accelerate implementation of SDGs. Text mining techniques are applied to analyze VNRs from 67 countries aiming to enable effective learning across countries. Assessment of domestic and global programmes allows us to compare key trends and patterns of schemes to implement SDGs. This study provides insights into governance for climate and energy programmes in Korea and strategies to run the programmes sustainably.

Methodology

This study applies text mining-based methods to analyze VNRs. Among 247 VNRs available between 2015 and early 2021, the study selected 67 VNRs that are written in English and published most recently if multiple VNRs are found by one country. The Natural Language Processing (NLP) library in Python is used to extract texts and word pairs, and identify the most informative word pairs. By measuring how frequently the word pair appears in one sentence (term-frequency, *tf*) and across all documents (inverse term frequency, *idf*), the level of informativeness of the word pair is determined. The collected VNRs are transformed into networks of keywords and we calculate the similarity between documents using the Cosine Similarity algorithm. The identified word pairs with *tf-idf* score are applied to an open-source software, Gephi, to compute indicators including 'Degree Centrality' and 'Between Centrality' to discover connections among keywords, identify the central words in the network and the clusters of words.

Results

The results are used to cluster countries with similar challenges and strategies and analyze linkages between three dimensions. Applying the international standard classification of countries, we find that countries

¹ This study was supported by National Assembly Futures Institute in the Republic of Korea

in Europe or with high-income economies show relatively higher levels of document similarities than other country groups. Countries with high-income economies are focused and keyword networks of individual countries are established. The Republic of Korea demonstrates a significantly fragmented governing scheme for climate and energy programmes where economic, environmental and social impacts are separately treated (Fig 1). While ‘Economy’, ‘Environment’ and ‘Society’ are certainly the most influential words displaying highest betweenness centrality, the linkages between them are weak and ‘climate’ and ‘energy’ do not appear as keywords. In other countries including Canada, France, Germany and Italy, ‘climate’, ‘energy’ and ‘environment’ display similar levels of betweenness centrality showing linkages with ‘society’ and ‘economy’ through ‘rights’ or ‘access’ and ‘employment’, respectively. The network analysis reflects the sustainable development strategies in Korea that put emphasis on economic growth without consideration of social and environmental consequences.

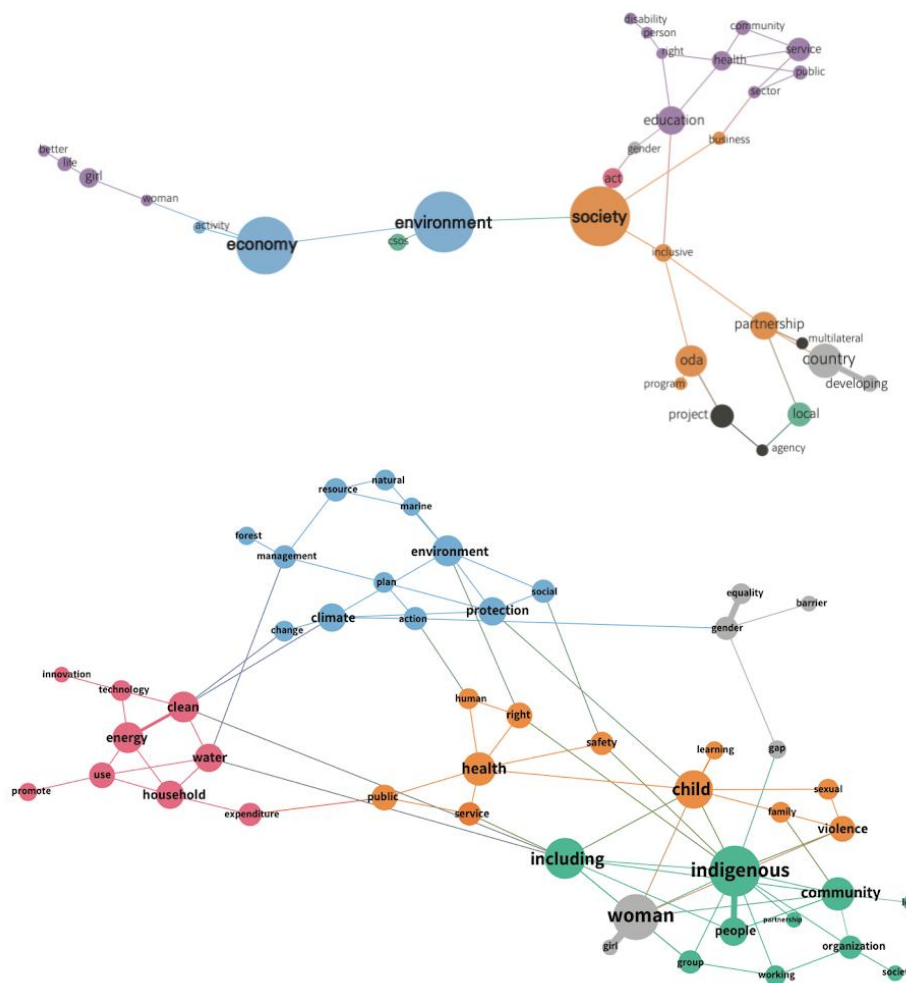


Figure 1. Visualization of keyword networks of the Republic of Korea (top) and Canada (bottom)

Conclusion & discussions

In spite of country’s ambitious plan to achieve carbon neutrality by 2050, country’s focus on climate and energy is still very narrow highlighting mainly techno-scientific approach without strengthening environmental and social factors. Best practices found in Canada and Germany including capacity building of local communities and resilience building of marginalized groups should be considered to be incorporated into climate and energy programs in the Republic of Korea to achieve inclusive and sustainable development.