

Review

Role of Social Media as a Soft Power Tool in Raising Public Awareness and Engagement in Addressing Climate Change

Aleksandrina V. Mavrodieva , Okky K. Rachman, Vito B. Harahap and Rajib Shaw 

Graduate School of Media and Governance, Keio University, Fujisawa 5322, Japan;
okkykr@sfc.keio.ac.jp (O.K.R.); vitobh@sfc.keio.ac.jp (V.B.H.); shaw@sfc.keio.ac.jp (R.S.)

* Correspondence: almavrodieva@gmail.com

Received: 20 September 2019; Accepted: 11 October 2019; Published: 16 October 2019



Abstract: Climate change has been one of the most debated topics in the past few decades, but a number of challenges have hindered the development of robust policies and strategies by nations. At the same time, social media platforms—such as Instagram, Twitter, and Facebook—have given the opportunity for the general public to share opinions and engage with the issue of climate change like never before. This phenomenon is considered to be a new form of soft power which can provide input into the discussion and possibly affect the current international political mechanisms. The present paper aims to (1) define the forms and characteristics of social media as a soft power method, (2) analyze its influence on the awareness of societies, and (3) assess if increased public awareness could influence the official political and policy processes. In order to assess if social media has influence on people's relative awareness, we have focused on analyzing the links between a few highly visible climate change related events and the trends in people's searches on the Internet in connection to those events. The study finds that even though it is difficult to assess the effects of social media as a soft power tool with certainty, there are visible links between social media and changing public perceptions, with the possibility of public opinion influencing political decision-making.

Keywords: climate change; social media; public perceptions; soft power

1. Introduction

Climate change has been one of the most debated topics in the past few decades. Even though the majority of nations now agree on the basic ideas related to climate change and participate together in international initiatives, such as the Kyoto Protocol and the Paris Agreement, comprehensive and effective steps are yet to be taken. The political process has been stagnant and plagued by claims of national interest.

Feeling a sense of urgency, a number of bottom-up initiatives around the world have taken the initiative in their own hands. The recent few decades have seen a rise in public figures and pop culture products focused on raising awareness on climate change through effective campaigns, using the advances of technology. At the same time, social media platforms—such as Instagram, Twitter, and Facebook—have provided an opportunity for the general public to discuss and share opinions instantly with vast cross-border networks [1]. This phenomenon is considered to be a new form of soft power which can provide input into the discussion on climate change and possibly affect the current international political mechanisms.

Several studies have explored the links between social media and public awareness of the climate change issue. Anderson [2] analyzed the effects of social media on opinion, knowledge, and behavior, showing there is some evidence that information sharing through social media can raise awareness

and encourage more environmentally-friendly behavior in people, but cautioning that it can also lead to opinion silos and opinion reinforcement, which could be both positive and negative for the issue of climate change. Williams et al. [3] used a large dataset from Twitter to assess user attitudes towards climate change and found out that groups are usually segregated in like-minded communities, often on the extreme ends of the support/reject spectrum, with fewer people expressing less polarized opinions. Other studies paid attention to social media framing of the IPCC reports, and to the volume of climate change discussions on social media overall [3], or have tried to understand climate change skepticism in online discussions, such as in blogs [2]. Little research, however, has been done on the role of social media as a trigger, or a support tool, for bottom-up initiatives and the extent to which those are effective in leading to practical change in policy development and implementation.

In trying to answer some of these questions, the authors of the current paper took a new approach, looking at social media as a soft power tool, using the definitions from International Relations theory, in order to underline the potential power of social media as a driver of change in tackling the negative effects of climate change. In this effort, we first provide a short overview of the climate change negotiation process and its misgivings, leading to the search of alternative methods by community groups or individuals. We then provide a definition for soft power and why we consider social media as a potential soft power tool. Finally, we try to (1) analyze the influence of social media on public awareness, and (2) assess if increased public awareness could influence the official political and policy processes. In order to assess if media has influence on people's relative awareness, we have focused on analyzing the links between a few highly visible climate change related events and the trends in people's searches on the Internet in connection to those events. For the analysis, the Google Trends tool has been used, as Google is currently the primary search engine in the world, having reached 74.54% of the global population in 2017 and having 3.5 billion searches every day [4]. Secondary data from articles and publications is used to support the analysis and to provide additional information on the links between soft power mechanisms and social perception.

2. Social Media as a Soft Power Tool

2.1. The Climate Change Negotiation Process: An Overview

In December 2015, 195 nations adopted the first ever global, legally binding agreement on tackling the negative impacts of climate change—the Paris Agreement. The deal was celebrated as a huge success the world over. However, a number of issues have dominated the negotiation process long before and immediately after the agreement.

At the 1992 Rio Earth Summit, most developing nations promoted the concept of “common but differentiated responsibilities” and demanded that there should be no legally-binding emission-reduction quotas for developing countries. Seeing developed nations as main contributors of CO₂ emissions, a number of developing nations required special provisions, which do not hinder their own economic development, urging for developed countries to be the main financial contributors in climate change programs and initiatives. This concept was kept in the Kyoto Protocol, adopted five years later, in 1997, where industrialized countries were pressed to curb their carbon emissions, while developing nations were provided with certain incentives to advance their climate governance at home. The Kyoto Protocol became an international institutional tool for bringing states together and regulating collective action but left enough room for dissatisfaction and mistrust [5].

The 2008, world financial crises cooled down the initial push to strike a more compelling climate deal, especially with China and the US clashing over a number of foreign policy issues and excusing their inaction in limiting carbon emissions with the other's inactivity. Consequently, the 2009 Copenhagen Climate Summit failed to deliver a legally binding emission-cutting agreement and only deepened frustrations between developed nations and the fast-industrializing group of Brazil, South Africa, India, and China [5].

Several rounds of negotiations of varying success followed in the years after 2009 (consecutively in Cancun, Durban, and Doha) and a Green Climate Fund was established in 2010. A major breakthrough in negotiations, however, did not occur before 2015 when the Paris Agreement was adopted. The treaty was described as a “monumental triumph for people and our planet” by the then UN Secretary-General, Ban Ki-moon [6].

The new agreement required from countries to commit to keeping the global temperature within 2 degrees from pre-industrial levels, if possible closer to 1.5 degrees, and for the first time the same efforts were expected from both developing and developed nations [7]. This approach was more realistic in view of bringing nations together towards a common goal, as it also allowed for domestic decisions on how much each country could commit through making voluntary pledges. As the pledges are reviewed and compared internationally the intention has been that nations would strive to perform better because of the thus formed process of “naming and shaming”. This approach, however, meant leaving important provisions with unclear scope and the overall implementation of the treaty to the mercy of individual governments. Even if submitting reports would become obligatory to those acceding to the treaty, non-compliance with the commitments would not be a breach of international law [6].

Since reaching the agreement in 2015, countries have not been able to make significant progress on their pledged commitments. A United National Environmental Program (UNEP) Report from 2018 revealed that current plans by countries will not reach the goal of keeping temperatures within the 2 degrees but instead global temperature would rise to 3 degrees by the end of the century and will keep rising afterwards. The report prescribed that to prevent further rise, global emissions in 2030 will need to be cut by 25 percent from 2017 levels, which would mean significant efforts in reductions from the nations [7].

2.2. *The Rise of Alternative Models of Soft Power in the Climate Change Process*

The success of the Paris deal was quickly diminished by the decision of the US administration to pull out of the agreement in 2017. A huge international response followed the announcement, expressing opposing opinions and adding new layers to both the support and mistrust in the climate change process. However, while governments have been struggling to come together and act in unison, global CO₂ emissions increased by 2 percent in 2018 [8] and atmospheric concentrations of greenhouse gas has been steadily on the rise for seven years in a row [9].

Feeling a sense of urgency, a plethora of bottom-up initiatives around the world have taken the initiative in their own hands. Large companies have strived to invest in low-carbon solutions and have changed their traditional way of work; the public has become more active in scrutinizing business activities and more demanding towards producers, increasingly opting for products that are manufactured in a more sustainable manner. Local authorities at places have also stepped in to support green initiatives and have pledged to fight climate change effects [6].

The recent few decades have also seen a rise in public figures and pop culture products focused on raising awareness on climate change through effective campaigns, using the advances of technology. At the same time, platforms—such as Instagram, Twitter, and Facebook—have given the opportunity for the general public to discuss and share opinions instantly with vast cross-border networks [1]. A single tweet by Arnold Schwarzenegger, encouraging people to live in a “smarter, healthier, more profitable energy future” generated over 125,000 responses [10], exhibiting the power of social networks.

What is even more impressive has been the multitude of initiatives by ordinary citizens. On 15 March 2019, tens of thousands of young people marched on the streets requesting governments and global leaders to take urgent measures to curb the negative effects of climate change [11]. An estimated 1.6 million students from approximately 120 countries decided to leave school for a day to protest against political inaction [12]. The “climate strikers” activities caught the attention of the UN Secretary General Antonio Guterres who called for a Climate Summit in September the same year. As most of the students were under legal age to vote they saw organizing themselves and taking to

the streets as the only option to raise their voice and be heard. The means for organizing the massive worldwide event was through social media. Where those students have received information on climate change and the policies related to it have to a large degree been through social media as well. In a year or two the participants of the climate strikes will be of age to go to elections. It is becoming more and more apparent that positions of leaders and decision-makers on climate change will have increasing effects on poll results.

This phenomenon is considered to be a new form of soft power, which can provide input into the discussion on climate change and potentially affect the current international political mechanisms. However, before we proceed with discussing the main questions in this research, we will look into the definition of soft power and the importance of social media in the climate change process.

2.3. Defining Soft Power and Focus on Social Media

- Definition: Joseph Nye's concept of "soft power"

The American political scientist Joseph Nye introduced the concept of "soft power" in the late 1980s, when, along with Robert Keohane, he developed the neoliberal theory and the concepts of asymmetrical and complex inter-relations between the foreign affairs actors. Soft power, as Nye defined it, is "the ability to influence the behavior of others to get the outcomes you want", which uses co-option rather than hard power enforcement. Soft power could be used by nations to influence other nations, but also by a number of non-state actors, such as international organizations and institutions. It aims to shape the preferences of others through employing assets such as attractive cultural or political values, or even through personalities revered by the public [13,14].

Even though the US has difficult political relations with a number of countries, American films and music are widely popular and names of American popular figures are known the world over. Japan is no longer a leading economic power, yet its culture and history has brought a record number of 30 million tourists in 2018 [15]. International aid provided by a number of countries after disasters or conflict have assisted states in creating a more positive image for themselves (e.g., Chinese aid and investments in Africa, US aid in South East Asia) [16]. Large non-for-profit organizations and think tanks, such as Amnesty International, have also used their vast network and influence to inform the public on pressing human rights issues and to put pressure on decision makers.

- Focus on social media as a soft power tool

More recently, with the fast and vast spread of the Internet technology a powerful tool of soft power has risen to prominence—the social media. Communication through social media, as well as news and opinion articles, is not only spread extremely quickly, but also extremely cheaply. A number of governments, from Obama and Trump to Xi Jinping, as well as not-state actors, such as terrorist organizations, are increasingly turning to social media to deliver their political messages and shape public opinion [17]. If soft power is the "second face of power" as described by Nye and media is the "fourth estate", then social media, as the new mass communication platform, is its new tool.

In the current paper, however, we are not looking into how states or designated organizations use the Internet and social media to influence people's opinions, but are instead interested in the opposite process—if a bottom-up approach, that is, if individuals or community groups, presumably not connected to any specific political body or fraction, could spark public reactions and increase awareness towards climate change, consequently leading to action at the political level.

The technological innovation and the spread of social media platforms have entirely changed the way soft power could be employed. The active public participation in societal and political discourses via online channels has overtaken the traditional diplomatic sources—"user-generated content" outlets, "where ordinary citizens, not government experts" share information and opinions, has started to dictate soft power dynamics [18]. In the period between 2005 and 2013, the percentage of people using various forms of online social communication in the United States grew from 8% to 72% [19] and

reached 81% by 2017 [20]. The number of Internet users worldwide in 2018 was a bit over 4 billion people [21]. The expectations are that by 2021, there will be about 3.02 billion active social media users per month worldwide, with Facebook, Youtube, and WhatsApp being the top three social media platforms as of January 2019 [22].

Not only do users spend more and more time communicating through social networks, but an increasing number of people report that they use social networks as a primary source for receiving news. In a Pew Research study from 2012, more than 6 in 10 millennials (61%) in the US indicated that they use Facebook to receive political news and approximately 32% reported that they use the platform to share information and opinions about government policy and politics. More importantly, 25% admitted that they had become more engaged in a given political issue after reading or discussing about it on social media [23]. As of March 2019, Facebook registered over 2.38 billion monthly active users [24] while Twitter is projected to reach 275 million active users in 2019 [25], revealing the enormous potential of these applications to reach out to a large audience and to support people in creating networks.

Never before has it been easier for the wide public to share its views on policy decisions. In many places political decision-making is closely related to the perceptions, understanding, and pressure put by the public on the political powers. As wide-scale activities such as reduction of carbon emissions and move towards more sustainable energy resources requires the active participation by private sectors and the community, perceptions of the causes and consequences of climate change are increasingly important in granting political mandates and forming political programs [26].

In the realm of climate change, a number of studies have reported that there is a link between social media use and changing opinions on the climate change issue, which could be both positive and negative [3]. Online platforms have been used for raising awareness, as well as for mobilization of volunteers and movements in favor of tackling the negative effects of climate change. However, the effects of climate change are not equally felt and realized throughout the different regions of the world. For many people, the idea and the possible consequences of political inactivity is still a rather abstract concept at the moment. Scientific articles using specific jargon and the fact that a number of academic and scientific research is restricted and shared mainly in the scientific community makes it more difficult for the wider public to have a more in-depth understanding of the underlying issues and possible outcomes. Social media, on the other hand, using visual and easy-to-understand messaging, reaches millions of people every hour. Visual representation adds an additional persuasive dimension. The more people seek, click on and share such information, the more search engines are bound to show related type of information [27].

Social media could, however, be used just as much for nurturing a skeptical perception of the climate change process and the human impact on it [19]. As anyone can post content online, it is extremely easy to spread false or incorrect information and create mistrust. Online networks and information sharing work on the principle of user personalization, which means people receive only a selected and limited amount of information, based on user preferences and usually shared by their close contacts. This could lead to forming a more biased perspective or simply to enhancing an already existing opinion, rather than developing more in-depth knowledge [28].

As the future of climate action initiatives is closely linked to public opinions and action/inaction, it is worth trying to assess to what extent this statement is true and what are the interdependencies.

3. Social Media Trends Analysis

Studies on social media have shown that public discourse on platforms such as Facebook and Twitter spike around certain events or news articles. Public opinion has fluctuated throughout the years, usually around specific events, such as the release of the *An Inconvenient Truth* film in 2007 (referring to climate change as a negative to society) [2] and the so called 'Climategate' affair in 2009, where e-mails from the University of East Anglia's Climate Research Unit (CRU) led to widespread skepticism about the science of climate change in the public eye. In 2004, the release of the film *The Day After Tomorrow*, where a disaster strikes as a result of climate change, generated 10 times more media

coverage in the US than the 2001 report of the Intergovernmental Panel on Climate Change, and was viewed by over 30 million people in the US alone [26].

In this section, we will try to analyze public responses to some of the popular figures and designated events which have sparked the largest amount of interest in climate change, in order to assess if such interventions could constitute a positive approach for raising public awareness and subsequently for influencing policy decision-making. For this purpose, we use the Google Trends platform to look at the number of people searching “climate change” as a keyword in various platforms, including news, images, literature, and videos.

The usage of Google data is increasingly becoming common practice in quantitative studies of digital media, especially to gain insight into human behavior and societal trends [29]. It is important to note that Google Trends does not provide the absolute volume of searches. Nonetheless, the available data is still useful for the purpose of highlighting short-term spikes or patterns in searches. The tool has been used in prediction of flu breakouts [30], disease outbreaks [31], to understand public interest in conservation biology [32], for unemployment trends [33], and for understanding people’s response to extreme weather events [34]. Furthermore, the features of Google Trends also provide us with the opportunity to examine broader data capture, since it considers multiple language searches correlated with the searched term for climate change, e.g., ‘klimawandel’, ‘cambio climático’, ‘changement climatique’, ‘cambiamenti climatici’.

By looking at Figure 1 below, we can identify some spikes and lows for the 2013–2018 period related to the topic of climate change in Google’s search engine. There are various events and public figures contributing to those changes. In this paper, we have highlighted several interesting spikes generated by soft power methods which have potentially impacted the level of awareness towards the climate change issue.

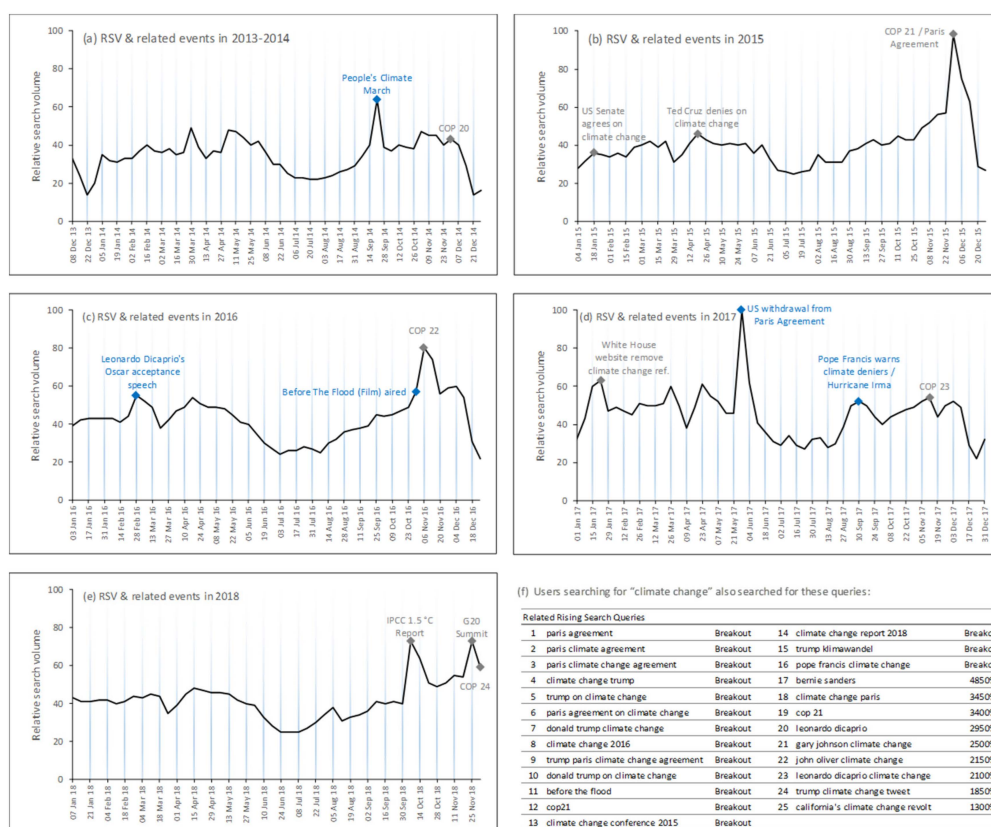


Figure 1. Relative searches volume (RSV) trends of the Google searches for the keyword “Climate Change” and several identified events in the year of (a) 2013–2014; (b) 2015; (c) 2016; (d) 2017; (e) 2018. The y axes are unit-less and express the relative changes in search volumes, where 100 represents the

week in which the highest absolute number of searches for the search term in the 5-year period was carried out. The table in (f) is showing the related queries with the biggest increase in search frequency since the previous period. Results marked “Breakout” had a tremendous increase (grew more than 5000%). Data sources: Google Trends (<https://www.google.com/trends>).

3.1. Public Figures—Leonardo DiCaprio Speech at the Academy Awards Ceremony

On 28 February 2016, Leonardo DiCaprio, while receiving his Best Actor award for the film *The Revenant*, gave a memorable speech on the strong correlation between climate change and human activity:

Climate change is real; it is happening right now. It is the most urgent threat facing our entire species, and we need to work collectively together and stop procrastinating. We need to support leaders around the world who do not speak for the big polluters, but who speak for all of humanity, for the indigenous people of the world, for the billions and billions of underprivileged people out there who would be most affected by this. For our children’s children, and for those people out there whose voices have been drowned out by the politics of greed . . . Let us not take this planet for granted. I do not take tonight for granted [35].

This speech attracted the attention of millions of people across the world towards the issue of climate change. As it can be seen at the graph, there was an increase of 25% (44–55 RSV) in the relative searches value within the five-year period relating to ‘climate change’ after DiCaprio’s speech at the Academy Awards event. A more detailed study by Leas et al. [35] has found that one hour after DiCaprio spoke, searches increased by 261%, the day after the speech the values stayed at 78%, and steadily crawled down to 39% in the next 4 days. When compared to the COP and Earth Day, the study identifies that the searches volume at the day of his acceptance speech were 3.8 and 4.3 times higher than the daily average during those previous events, respectively [35].

3.2. Films—Before the Flood

Before the Flood is a documentary film about climate change produced by Leonardo DiCaprio in cooperation with the National Geographic channel. It premiered in the Toronto International Film Festival in September 2016, was released in theaters on 21 October, and aired on the NatGeo channel on 30 October. The film showed a strong commitment to bring the issue of climate change to the forefront of the global conversation and aimed to inspire viewers to take action. For a documentary film, *Before the Flood* made an impressive record of 60 million views worldwide on the multi-platform of NatGeo network [36]. The data on Figure 1f shows that the term ‘Before The Flood’ is strongly correlated with the ‘climate change’ search topic (categorized as the >5000% of increase in search frequency). It can also be seen from the comparison record on the Google search trends (Figure 2) that a significant spike occurred at the time of the film release on the NatGeo network, affecting the entire search trend for the ‘climate change’ topic.

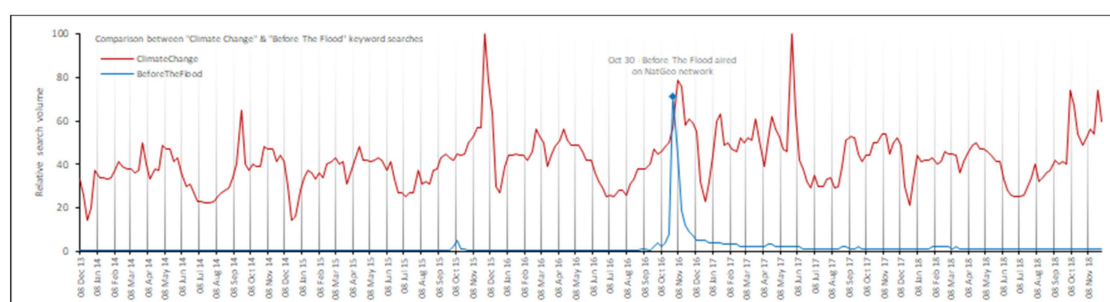


Figure 2. Comparison between Relative Searches Volume (RSV) trends of the Google searches for the keyword ‘Climate Change’ and ‘Before the Flood’. Data sources: Google Trends (<https://www.google.com/trends>).

3.3. News Engagement—Role of Media in the Climate Change Dialogue

As more traditional information outlets, such as newspapers and television channels, are nowadays using social media to share content with their audiences, we have included those in the analysis as well. News, both from television or newspapers, as well as incoming through the current forms of social media, has also played a prominent role in increasing people's awareness of the climate change discussions [37–39]. One clear example can be seen in Figures 3 and 4 below which exhibit two data trends from two different platforms, Google and Buzzsumo. The latter platform records data only from the last 2 years and has been used by other studies to calculate users' sentiment [40].

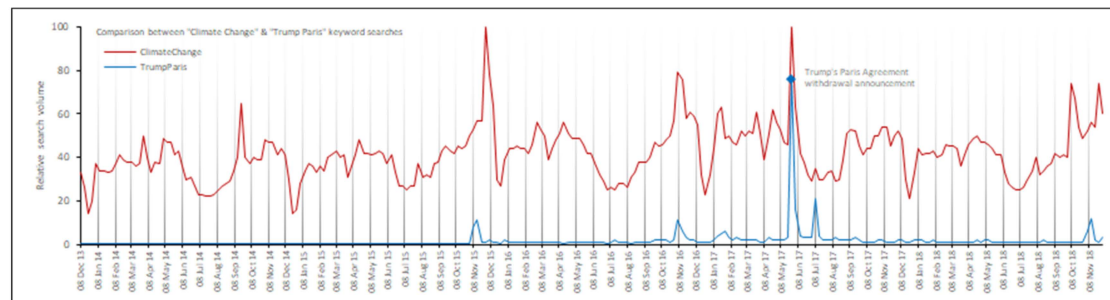
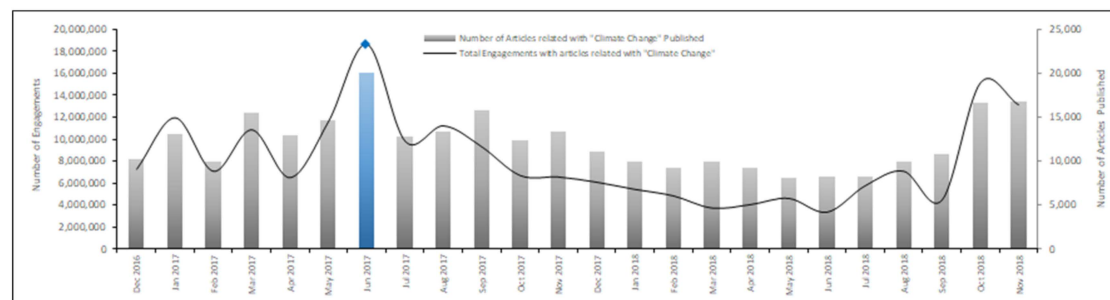


Figure 3. Comparison between Relative Searches Volume (RSV) trends of the Google searches for the keyword 'Climate Change' and 'Trump Paris'. Data sources: Google Trends (<https://www.google.com/trends>).



Rank	News Title	Author(s)	Published Date	Published Site	Facebook Engagements	Twitter Shares	Pinterest Shares	Reddit Engagements	Number of Links	Total Engagements
1	Holy Shit, Arizona	-	Jun 23, 2017	buzzfeed.com	612.7K	1.3K	79	0	21	614K
2	350 mayors adopt Paris climate accord after U.S. pulls out (updated)	Alissa Walker	Jun 1, 2017	curbed.com	202.6K	8.1K	15	149.5K	119	360.3K
3	DELINGPOLE: Global Warming Study Cancelled Because of 'Unprecedented' Ice	James Delingpole	Jun 13, 2017	breitbart.com	272.9K	4.9K	0	487	81	278.3K
4	Bucking Trump, These Cities, States and Companies Commit to Paris Accord	Hiroko Tabuchi	Jun 2, 2017	nytimes.com	254.2K	18.4K	61	120	333	272.8K
5	An Iceberg the Size of Delaware Just Broke Away From Antarctica	Jugal K. Patel	Jun 9, 2017	nytimes.com	222.9K	12.7K	40	8	71	235.7K

Figure 4. The top chart compares the trends of engagement and articles published related with 'climate change' topics. The bottom table lists the most popular articles on the 'climate change' topic in regard to the highlighted blue-colored bar in the upper chart (1 June 2017–30 June 2017). The number of 'engagements' is based on the sum of likes, comments, shares, upvotes, attributed to a piece of content, a web page, or other web source, on to a social media channel (e.g., Facebook, Twitter, Pinterest, Reddit). Data sources: BuzzSumo (<https://buzzsumo.com>).

Both charts depict nearly the same condition in June 2017, when people's engagement with the climate change issue soared significantly. There are several possibilities for this occurrence: first, the United States decision to pull out from the Paris Agreement which attracted enormous public attention to the climate change negotiation process; second, based on NASA's analysis, June 2017 was

considered as the fourth-warmest June in 137 years of modern record-keeping, with temperatures higher with at least 0.79 °C than in June 2016 [41]. This phenomenon, alongside with other climatic anomalies, triggered people's attention towards the impacts of climate change on their daily life.

3.4. People's Climate March—World-Wide Activist Event

An example for a bottom-up movement advocating for immediate response to climate change is the world-wide campaign 'People's Climate March'. The movement was started by Bill McKibben, an author and environmentalist who strongly criticized world leaders' inaction in tackling the issue [42]. Most of his criticism was in the form of articles which spread all around the world through media and the Internet. His campaign reached its momentum during the 2014 UN Climate Summit in New York, when his environmental organization 350.org, along with other 1500 international organizations, conducted a march in New York city as a protest against the negligence of world leaders who had gathered at the summit [43]. After the event, the exposure of People's Climate March has increased, as shown in Figure 5. This initiative can be seen as a grass-roots movement triggered by one particular action and campaign, which still continues to engage a multitude of people from across the world providing them with guidelines on how to organize their own campaigns, essentially using the tools of soft power.

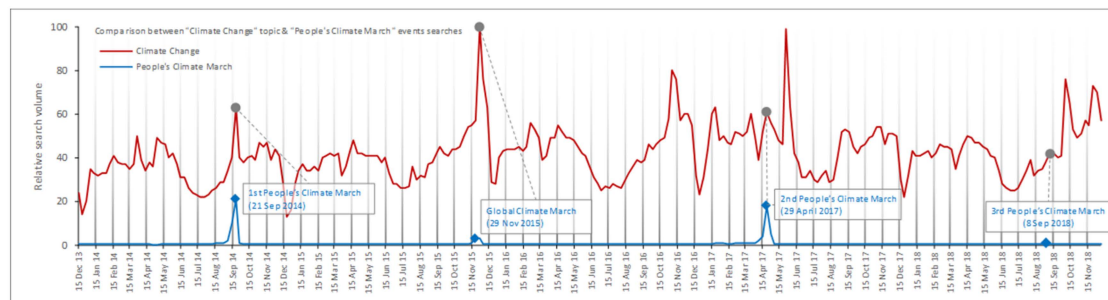


Figure 5. Comparison between Relative Searches Volume (RSV) trends of the Google searches for the keyword 'Climate Change' and 'People's Climate March'. Data sources: Google Trends (<https://www.google.com/trends>).

4. Discussion

The trends represented in the previous section show that particular events and public figures can have prominent impact on the dynamics of climate change awareness among Google's users around the world. It is important to mention, however, that those events do not represent the entire trend of public opinion and behavior in relation to the climate change discussion among world citizens. Thus, prior to discussing the relevance of the findings for soft power diplomacy and our understanding of the effects of the methods, we need to address the limitations of our study.

First, most of the online content on the Internet is filtered for each individual based on his/her personal preferences and close group of contacts, which in turn may influence the way opinion is formed and spread. Second, the articles and online commentary could also have negative connotation and can be easily manipulated, not all content related to climate change aims at improving policies or increasing awareness of the issues. Third, strong differences in Internet usage exists between demographic groups, particularly in relation to age and socio-economic status.

Moreover, the literature review on links between social media and climate change perceptions and surveys which are available in English are largely focused on perceptions of the public in countries—such as the US, the UK, Canada, Australia, and some European countries—and are thus excluding large portions of the world. Lastly, the information synthesized from Google does not provide us with understanding of the individual positions of people towards climate change-related policies, which would be better assessed through other methods of data collection, such as polling, interviews, and qualitative surveys.

However, Google searches data can bring advantages over more conventional survey methods that may be limited by their infrequency or by the number of participants. Its search queries can provide some insights on users' behavior and can assist in assessing the relative level of awareness in regard to an issue. Ideally, the two types of data collection approaches could be used together in a mixed-method approach to both quantitatively and qualitatively communicate knowledge on climate change awareness. As technology and the Internet become more available, leveraging Google search data to further analyze public perceptions could be a valuable tool alongside other methods of assessing climate change awareness.

The events used for this research exhibit a number of similarities, namely: all of the events or initiatives were promoted by non-state actors or persons presumably not affiliated with any governmental bodies; all have used non-traditional soft power methods to promote their idea of the importance of tackling the negative effects of climate change; all use social media to attract people's attention [44]. Finally, all of the activities were shared with the public in a form which is relatively easy to understand and accept by non-experts, and which had a close relation to people's daily life [45,46]. This approach is different from the traditional, more formal, or more scientific, negotiation process [47].

4.1. Impact on People's Perception

Schafer conducted an extensive literature review of the available studies on online climate communication between stakeholders and found that online communication and news shared online indeed do, to a certain level, increase the level of awareness and knowledge of the audience [48]. A 2009 US General Social survey showed that respondents believed that their general knowledge on climate change was positively influenced by reading online content, coupled with news in traditional media [49]. A 2011 Eurobarometer study, conducted among 13,000 people in 12 EU countries indicated that respondents believed that information on the Internet improved their knowledge of the causes and consequences of climate change, and the possible ways to tackle those [50].

The effects of increased awareness on people's behavior, however, are less clear. The 2009 study mentioned above found that people who actively use online and social media for information are also more likely to continue searching climate change related information but that their intentions to engage in actual activities are rarely put into practice [49]. Nonetheless, another study indicated that in times of crisis, online and social media channels might be able to prompt the more active citizens to engage in actual activities [51]. The current study illustrates that popular figures or products might also have some similar effects.

The observed phenomena in Section 3 of this paper: the influence of public figures as illustrated by Leonardo DiCaprio's speech at the Academy Awards ceremony, the success of *Before the Flood* as a documentary film promoting environmental issues more widely, and using the intense publicity generated by news related to the world's current climate change policy processes, indicate that specific initiatives which are closer to people's daily life activities can effectively increase people's attention towards the discussion on climate change and the international negotiation process.

Studies have shown that information shared by opinion leaders, such as popular figures, does have the potential to shape public perceptions. Anderson [2] considers opinion leaders to have an important role in influencing public discourse on climate change, and could influence consumer behaviors and encourage engagement in policy processes. Such figures could use online networks to spread ideas on how individuals could participate in discussions or mobilize others to build their own initiatives [2]. Contemporary actors and artists—such as Mark Ruffalo, Emma Thompson, and Robert Redford—enjoy immense popularity and have a fan base of thousands of people across the world. They have used this popularity to share concerns on the issue of climate change and to try to spark action from both citizens and policy makers. This means that when such people share information on social media, this message is seen and discussed by millions of followers [10]. To neglect this fact would be to risk misinterpreting an important factor which can influence the climate change discussions, as individuals, communities and political entities do respond and adapt to changing public perceptions [26].

Leonardo DiCaprio's and other public figures' initiatives show that dissemination of information can take place completely outside the context of a political campaign and may even produce more public engagement than any planned events. The scientific community is starting to discover that messages from bottom-up communication channels (e.g., Facebook, Twitter) can even surpass, weaken, or diminish the productiveness of planned messages [52,53].

The experience from the release of *Before the Flood* has proved that momentum for an increased public awareness could be built around popular products because audiences are more likely to obtain and preserve scientific knowledge when it is translated in easier to understand narrative setups such as documentaries [54,55]. Discovering and retaining new information is also facilitated by the fact that people can identify themselves in the characters of film products much more than with the statistics in a scientific paper [56].

Past research showed that audience motivations heavily influence how and what people learn from media [57]. Messages which affect people's emotions are internalized and can be transformed into long-term memory. A more emotional message processing can encourage responses to the content [58,59]. By focusing on these techniques, documentaries have the capacity to attract and influence a broader audience than either informational or entertainment media could do alone.

The other type of soft power method that had been discussed in Section 3 is news articles as the representative of mainstream media in shaping people's perception toward one particular issue. It is important to mention that most of the perceptions formed by news articles are often indirect and to a degree unintended, at times not planned or even foreseen by the media itself [60]. Therefore, the impact of news on people's perceptions is often a result of personal trust towards the specific media outlet.

4.2. Do Public Perceptions Affect Policy and Decision Making?

Dolšák & Houston [61] have examined subnational climate change policy making in the US by using newspaper coverage to explain policy output and have analyzed how climate change was portrayed in the news. They concluded that legislative activity was increased when consequences of climate change were discussed in the media. Likewise, another study by Oehl [62] showed that public demand, measured in terms of overall media coverage and claims for or against climate change mitigation, mattered for the total number of climate change mitigation policies adopted. Furthermore, they argued that public opinion and demands also significantly influenced the scope of adopted policies and thus influenced how comprehensive or broad legislative activity on climate change was.

Even though there is no up-to-date comprehensive data on the links between social media and public activism it has been observed that advocacy organizations, such as 350.org, have managed to use social media to spread their message and attract a large number of followers and active members. Citizens have also used online platforms, such as Facebook and Twitter, to share information and organize activities and protests around major climate events, such as the COP 15 in Denmark in 2009 and the COP 21 in 2015 in Paris [2]. What started as a solo protest by a Swedish schoolgirl Greta Thunberg in 2018 has become a worldwide campaign, with more than 20,000 students joining the initiative and Thunberg being invited to speak on behalf of children at various international tribunals [63]. In April 2019, climate activists have organized themselves to block the entrance to several commercial buildings of companies, accusing them of links with oil and gas industries, which they saw as polluters, and putting pressure on the French government to address climate change issues [64]. Anderson [2] reports that even though studies on the links between social media and climate change activism are scarce, a number of them suggest that there is a correlation between frequent usage of online information shared through social media and increased public engagement.

Here we need to mention that there are a number of other factors which may or may not affect public perceptions and engagement in the climate change process. Declines in public involvement were, for example, observed in the late 2000s and around the financial crisis of 2008, when people were concerned with what might have been considered more pressing issues of the day. Wang and Kim [65] found out in their study on Korea that climate change skepticism also depended on factors

such as religiosity, hierarchy, gender, age, education level, and social class. To add to this, a number of media outlets report false or confusing information related to climate change, usually serving private or political interests, creating mistrust in the science of climate change. Strong lobbies and/or public mistrust or lack of interest could dissuade political decision-makers from adopting legislation that might not be popular or might hurt powerful economic interests [26]. After all, the economic development of nations has been possible due to countries' exploitation of resources such as coal, oil and gas, and is still largely perceived to be dependent on these resources [6].

Finally, soft power—and especially soft power delivered through social media—is hard to control or predict. Public perceptions and engagement depend severely on socio-economic realities and cultural constructs. Nonetheless, we can observe that the increasing information-sharing and trans-nationalization of climate initiatives, has forced leaders to consider the inclusion of climate change policies more thoroughly into domestic agendas, has helped spread low-carbon policy approaches and technologies around the world, and is stimulating a growing interest in innovative global solutions [6]. What is more, social media could be used as a public tool for demanding increased transparency and scrutiny of political activities, acting as a public watch dog. As political efforts are still sporadic and not efficient enough, it may be precisely the action or inaction of individuals that will make the change. The more such initiatives are spread and known, the more followers they could gain. As Joseph Nye [13] simply puts it: “Politics in an information age may ultimately be about whose story wins”.

Author Contributions: A.V.M. was responsible for the overall coordination among the authors, for the body and flow of the paper, and for all editing. She has provided the majority of the input in Section 1, Section 2, and Section 4, and some input in Section 3. O.K.R. and V.B.H. have provided almost equal contributions, providing the majority of input in Section 3, including all tables, charts, and graphs and the relevant analysis, and have provided some input in Section 1, Section 2, and Section 4. R.S. has provided overall coordination and guidance for the structure, flow, and focus of the paper.

Funding: This research received no external funding.

Acknowledgments: The first author is thankful to the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) of Japan for the provided scholarship to conduct research in the field of disaster risk reduction. The second and third authors are thankful to the Pusbindiklatren Bappenas Programme, Government of Indonesia, for the provided scholarship. The authors also acknowledge the support received from the Disaster Resilience and Sustainable Development Program of the Graduate School of Media and Governance, Keio University, Japan, in conducting this study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Fernandez, M.; Piccolo, L.S.G.; Maynard, D.; Wippoo, M.; Meili, C.; Alani, H. Talking Climate Change via Social Media: Communication, Engagement and Behavior. In *WebSci '16 Proceedings of the 8th ACM Conference on Web Science*; Conference Paper; ACM: New York, NY, USA, 2016; pp. 85–94. [CrossRef]
2. Anderson, A.A. Effects of Social Media Use on Climate Change Opinion, Knowledge, and Behavior. *Clim. Sci.* **2017**. [CrossRef]
3. Williams, H.T.P.; McMurray, J.R.; Kurz, T.; Lambert, F.H. Network analysis reveals open forums and echo chambers in social media discussions of climate change. *Glob. Environ. Chang.* **2015**, *32*, 126–138. [CrossRef]
4. Mangles, C. Search Engine Statistics. 2018. Available online: <https://smartinsights.com> (accessed on 17 January 2019).
5. Hofmeister, W.; Rueppel, P. *Climate Change Diplomacy—The Way Forward for Asia and Europe*. EU-Asia Dialogue. *Shaping a Common Future for Europe and Asia—Sharing Policy Innovation and Best Practices in Addressing Common Challenges*; Konrad-Adenauer Stiftung and European Union: Singapore, 2014. Available online: https://www.kas.de/c/document_library/get_file?uuid=d0a986ce-1308-1a71-96b3-c565fa8e39a3&groupId=252038 (accessed on 3 April 2019).
6. Falkner, R. The Paris Agreement and the New Logic of International Climate Politics. *Int. Aff.* **2016**, *92*, 1107–1125. [CrossRef]

7. The Japan Times. Step up Japan's Role in Fighting Climate Change. *The Japan Times*, 4 December 2018. Available online: <https://www.japantimes.co.jp/opinion/2018/12/04/editorials/step-japans-role-fighting-climate-change/#.XLb0FegzY2x> (accessed on 17 April 2019).
8. The Economist. Global Carbon Emissions Hit Another Record. *The Economist*, 12 June 2019. Available online: <https://www.economist.com/graphic-detail/2019/06/12/global-carbon-emissions-hit-another-record> (accessed on 19 June 2019).
9. Harvey, F. Latest Data Shows Steep Rises in CO₂ for Seventh Year. *The Guardian*, 4 June 2019. Available online: <https://www.theguardian.com/environment/2019/jun/04/latest-data-shows-steep-rises-in-co2-for-seventh-year> (accessed on 19 June 2019).
10. Climate Reality Project. Nine Celebrities Changing the Conversation on Climate Action. *Climate Reality Project*, 26 December 2015. Available online: <https://www.climate realityproject.org/blog/nine-celebrities-changing-conversation-climate-action> (accessed on 19 June 2019).
11. Guterres, A. The Climate Strikers Should Inspire Us All to Act at the Next UN Summit. *The Guardian*, 15 March 2019. Available online: <https://www.theguardian.com/commentisfree/2019/mar/15/climate-strikers-urgency-un-summit-world-leaders> (accessed on 19 June 2019).
12. Haynes, S. 'It's Literally Our Future.' Here's What Youth Climate Strikers Around the World Are Planning Next. *Time*, 20 March 2019. Available online: <https://time.com/5554775/youth-school-climate-change-strike-action/> (accessed on 19 June 2019).
13. Nye, J. *Soft Power: The Means to Success in World Politics*; Public Affairs: New York, NY, USA, 2004.
14. Nye, J. *Bound to Lead: The Changing Nature of American Power*; Basic Books: London, UK, 1990.
15. The Japan Times. Foreign Tourists in Japan Set to Hit Record 30 Million in 2018. *The Japan Times*, 14 December 2018. Available online: <https://www.japantimes.co.jp/news/2018/12/14/national/foreign-tourists-japan-set-hit-record-high-30-million-2018/#.XQoqr4gzY2x> (accessed on 19 June 2019).
16. Mensah, J. 21st Century Diplomacy—The Role of Soft Power. *Mun: Planet*, 31 May 2016. Available online: <https://www.munplanet.com/articles/soft-power/21st-century-diplomacy-the-role-of-soft-power> (accessed on 19 June 2019).
17. British Council. The Soft Power of Twitter. January 2016. Available online: <https://www.britishcouncil.org/research-policy-insight/insight-articles/soft-power-twitter> (accessed on 19 June 2019).
18. Anguelov, N. *How the New Digital World is Changing How We Conceive of Soft Power*; LSE US Centre: London, UK, 2017. Available online: <https://blogs.lse.ac.uk/usappblog/2017/04/11/how-the-new-digital-world-is-changing-how-we-conceive-of-soft-power/> (accessed on 19 June 2019).
19. Brenner, J.; Smith, A. 72% of Online Adults are Social Networking Site Users; Pew Research Center: Washington, DC, USA, 2013. Available online: <https://www.pewinternet.org/2013/08/05/72-of-online-adults-are-social-networking-site-users/> (accessed on 19 June 2019).
20. Statista. Social Media Statistics & Facts. 28 March 2019. Available online: <https://www.statista.com/topics/1164/social-networks/> (accessed on 19 June 2019).
21. Chaffey, D. Global Social Media Research Summary 2019. *Smart Insights*, 12 February 2019. Available online: <https://www.smartinsights.com/social-media-marketing/social-media-strategy/new-global-social-media-research/> (accessed on 19 June 2019).
22. Statista. Most Famous Social Network Sites Worldwide as of April 2019, Ranked by Number of Active Users (in Millions). 27 May 2019. Available online: <https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/> (accessed on 19 June 2019).
23. Lee, J.; Myers, T. Can Social Media Change Your Mind? SNS Use, Cross-cutting Exposure and Discussion, and Political View Change. *Soc. Media Stud.* **2016**, *2*, 87–97. [CrossRef]
24. Zephoria. The Top 20 Valuable Facebook Statistics—Updated May 2019. May 2019. Available online: <https://zephoria.com/top-15-valuable-facebook-statistics/> (accessed on 19 June 2019).
25. Statista. Number of Twitter Users Worldwide from 2014 to 2020 (in Millions). July 2019. Available online: <https://www.statista.com/statistics/303681/twitter-users-worldwide/> (accessed on 19 June 2019).
26. Capstick, S.; Whitmarsh, L.; Poortinga, W.; Pidgeon, N.; Upham, P. International trends in public perceptions of climate change over the past quarter century. *Wires Clim. Chang.* **2015**, *6*, 35–61. [CrossRef]
27. Fortuna, C. *Social Media + Climate Change + The Power of the Algorithm*. CleanTechnica, USA 2017. Available online: <https://cleantechnica.com/2017/12/30/social-media-climate-change-power-algorithm/> (accessed on 19 June 2019).

28. O'Malley, I. The Internet and Climate Change Denialism. *The Weather Network*, 14 September 2018. Available online: <https://www.theweathernetwork.com/news/articles/climate-change-science-knowledge-internet-online-skepticism-denial-social-media/112373> (accessed on 19 June 2019).
29. Ladle, R.J.; Correia, R.A.; Do, Y.; Joo, G.J.; Malhado, A.C.M.; Proulx, R.; Roberge, J.M.; Jepson, P. Conservation culturomics. *Front. Ecol. Environ.* **2016**, *14*, 269–275. [CrossRef]
30. Burler, D. When Google got flu wrong. *Nature* **2013**, *494*, 5–6. [CrossRef]
31. Mellon, J. Internet search data and issue salience: The properties of Google Trends as a measure of issue salience. *J. Elect. Public Opin. Parties* **2014**, *24*, 45–72. [CrossRef]
32. Proulx, R.; Massicotte, P.; Pépino, M. Googling trends in conservation biology. *Conserv. Biol.* **2014**, *28*, 44–51. [CrossRef]
33. Bakker, K.M.; Martinez-Bakker, M.E.; Helm, B.; Stevenson, T.J. Digital epidemiology reveals global childhood disease seasonality and the effects of immunization. *PNAS* **2016**, *113*, 6689–6694. [CrossRef]
34. Sisco, M.R.; Bosetti, V.; Weber, E.U. When do extreme weather events generate attention to climate change? *Clim. Chang.* **2017**, *143*, 227–241. [CrossRef]
35. Leas, E.C.; Althouse, B.M.; Dredze, M.; Obradovich, N.; Fowler, J.H.; Noar, S.M.; Allem, J.P.; Ayers, J.W. Big Data Sensors of Organic Advocacy: The Case of Leonardo DiCaprio and Climate Change. *PLoS ONE* **2016**, *11*, e0159885. [CrossRef] [PubMed]
36. Calvario, L. 'Before the Flood': Leonardo DiCaprio's Climate Change Doc Gets Record 60 Million Views. 2016. Available online: <https://www.indiewire.com> (accessed on 5 December 2018).
37. Garai, J. Mass Media and Climate Change Induced Disaster Risk Reduction and Mitigation in Coastal Area of Bangladesh: A Sociological Study. In *Handbook of Climate Change Communication*; Filho, W.L., Manolas, E., Azul, A.M., Azeiteiro, U.M., McGhie, H., Eds.; Climate Change Management; Springer: Cham, Switzerland, 2018; Volume 1, pp. 273–292. [CrossRef]
38. Tume, S.J.P.; Jumbam, M.S.; Nsoseka, N.A.; Nyarka, N.D.; Yenla, L.J.; Njodzeka, N.G. Role of the Media in Climate Change Communication in the Northwest Region of Cameroon. In *Handbook of Climate Change Communication*; Filho, W.L., Manolas, E., Azul, A.M., Azeiteiro, U.M., McGhie, H., Eds.; Climate Change Management; Springer: Cham, Switzerland, 2018; Volume 2, pp. 47–60. [CrossRef]
39. Dalimunthe, S.A. Rural Indonesian Insight on Mass Media Role in Reducing Climate Change Risk. In *Handbook of Climate Change Communication*; Filho, W.L., Manolas, E., Azul, A.M., Azeiteiro, U.M., McGhie, H., Eds.; Climate Change Management; Springer: Cham, Switzerland, 2018; Volume 2, pp. 61–67. [CrossRef]
40. Korda, P.; Vidanovic, P. Machine Learning Techniques for Social Media Analysis. M.Sc. Programme in Computer Science and Engineering, Department of Electronics, Informatics and Bioengineering, Politecnico Di Milano. 2018. Available online: <https://www.politesi.polimi.it/bitstream/10589/137564/1/Machine-Learning-Techniques-for-Social-Media-Analysis.pdf> (accessed on 13 January 2019).
41. NASA's Goddard Institute for Space Studies. June 2017 was Fourth Warmest June on Record. 14 July 2017. Available online: <https://climate.nasa.gov/news/2607/june-2017-was-fourth-warmest-june-on-record/> (accessed on 19 June 2019).
42. Brodine, M. Environmental News Roundup: Massive People's Climate March at UN Sept. 21. *People's World*, 2 July 2014. Available online: <https://www.peoplesworld.org/article/environmental-news-roundup-massive-peoples-climate-march-at-un-sept-2/> (accessed on 15 January 2019).
43. McKibben, B. A Call to Arms: An Invitation to Demand Action on Climate Change. *Rolling Stone*, 21 May 2014. Available online: <https://www.rollingstone.com/politics/politics-news/a-call-to-arms-an-invitation-to-demand-action-on-climate-change-92885/> (accessed on 15 January 2019).
44. Yavuzaslan, K.; Cetin, M. Soft Power Concept and Soft Power Indexes. In *Business Challenges in the Changing Economic Landscape—Vol. 1: Proceedings of the 14th Eurasia Business and Economics Society Conference*; Bilgin, M., Danis, H., Demir, E., Can, U., Eds.; Springer International Publishing Switzerland: Cham, Switzerland, 2016; Volume 1, pp. 395–409. [CrossRef]
45. Nerlich, B.; Koteyko, N.; Brown, B. Theory and language of climate change communication. *Wiley Interdiscip. Rev. Clim. Chang.* **2010**, *1*, 97–100. [CrossRef]
46. O'Neill, S.; Nicholson-Cole, S. "Fear won't do it": Promoting positive engagement with climate change through visual and iconic representations. *Sci. Commun.* **2009**, *30*, 355–379. [CrossRef]
47. Wessler, H.; Lück, J.; Wozniak, A. Communication, Negotiation, and Influence at International Climate Change Meetings and Summits. *Policy Politics Gov. Commun.* **2017**. [CrossRef]

48. Schafer, M.S. Online communication on climate change and climate politics: A literature review. *Wires Clim. Chang.* **2012**, *3*, 527–543. [CrossRef]
49. Zhao, X. Media use and global warming perceptions. *Commun. Res.* **2009**, *36*, 698–723. [CrossRef]
50. Eurobarometer. Special Eurobarometer 364—Public Awareness and Acceptance of CO2 Capture and Storage. Brussels: Report. *Eur. Comm.* 2011. Available online: https://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_364_en.pdf (accessed on 10 October 2019).
51. Hakala, S.; Seeck, H. Crisis and web-enabled agency in practice. In *After the Tsunami: Crisis Communication in Finland and Sweden*; Kivikuru, U., Nord, L., Eds.; Nordicom: Goteborg, Sweden, 2009; pp. 171–187.
52. Mohanty, S.; Leader, A.E.; Gibeau, E.; Johnson, C. Using Facebook to reach adolescents for human papillomavirus (HPV) vaccination. *Vaccine* **2018**, *36*, 5955–5961. [CrossRef]
53. Allem, J.; Escobedo, O.; Chu, K.; Soto, D.W.; Cruz, T.B.; Unger, J.B. Campaigns and counter campaigns: Reactions on Twitter to e-cigarette education. *Tob. Control* **2016**, *26*, 226–229. [CrossRef]
54. Dahlstrom, M.F. The role of causality in information acceptance in narratives: An example from science communication. *Commun. Res.* **2010**, *37*, 857–875. [CrossRef]
55. Glaser, M.; Garsoffky, B.; Schwan, S. What do we learn from docutainment? Processing hybrid television documentaries. *Learn. Instr.* **2012**, *22*, 37–46. [CrossRef]
56. So, J. Uses, gratifications, and beyond: Toward a model of motivated media exposure and its effects on risk perception. *Commun. Theory* **2012**, *22*, 116–137. [CrossRef]
57. Eveland, W.P. The cognitive mediation model of learning from the news: Evidence from nonelection, off-year election, and presidential election contexts. *Commun. Res.* **2001**, *28*, 571–601. [CrossRef]
58. Hendrickx, L.; Vlek, C.; Oppewal, H. Relative importance of scenario information and frequency information in the judgment of risk. *Acta Psychol.* **1989**, *72*, 41–63. [CrossRef]
59. Moyer-Gusé, E. Toward a theory of entertainment persuasion: Explaining the persuasive effects of entertainment-education messages. *Commun. Theory* **2008**, *18*, 407–425. [CrossRef]
60. Tsifti, Y.; Cohen, J. Perceptions of Media and Media Effects. The International Encyclopedia of Media Studies: Media Effects. In *The International Encyclopedia of Media Studies*; Hobbs, R., Mihaiudis, P., Eds.; Blackwell Publishing Ltd.: Hoboken, NJ, USA, 2013. [CrossRef]
61. Dolšák, N.; Houston, K. Newspaper coverage and climate change legislative activity across US states. *Glob. Policy* **2014**, *5*, 286–297. [CrossRef]
62. Oehl, B. Public Demand and Climate Change Policy Making in OECD Countries from Dynamics of the Demand to Policy Responsiveness. Ph.D. Thesis, ETH Zurich Research Collection, Zurich, Switzerland, 2015. [CrossRef]
63. Carrington, D. ‘Our Leaders are Like Children,’ School Strike Founder Tells Climate Summit. *The Guardian*, 4 December 2018. Available online: <https://www.theguardian.com/environment/2018/dec/04/leaders-like-children-school-strike-founder-greta-thunberg-tells-un-climate-summit> (accessed on 19 June 2019).
64. FRANCE 24. Hundreds of Climate Activists Block Access to Paris Business Quarter. 19 April 2019. Available online: <https://www.france24.com/en/20190419-french-climate-activists-protest-la-defense-total> (accessed on 19 June 2019).
65. Wang, J.; Kim, S. Analysis of the Impact of Values and Perception on Climate Change Skepticism and Its Implication for Public Policy. *Climate* **2018**, *6*, 99. [CrossRef]

