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Climate Change Communication in Singapore

Summary

Climate change is not a new topic, but it remains an unsolved issue for most countries in the world. Singapore, a small island nation, is not spared from climate change. The issue is worsened because Singapore is not endowed with natural resources and the country is mainly dependent on imported fossil fuels to generate energy. The burning of fossil fuels releases carbon into the air, intensifying the greenhouse effect. Furthermore, the recurring episodes of haze in Singapore have posed a threat to public health. Realizing the importance of public perceptions on climate change mitigation, the Singapore government and academic researchers have conducted studies to understand public perceptions of climate change. Although the general public do not have great concern about climate change, research suggests that interpersonal communication, information campaigns, and mass communication may have an impact on public awareness of climate change. Attention to mass media, such as newspapers and television, has been found to shape public perception of climate change in Singapore and increase public knowledge of climate change. In addition, the Singapore government has introduced the topic of climate change into the education system to cultivate sustainability among the young generations. Campaigns and programs were funded and organized by the Singapore government as well as the non-governmental organizations to raise the awareness of climate change among Singaporeans. In order to sustain public awareness and concern about climate change, continuous communication strategies are necessary.

Keywords: climate change, communication research, Singapore, interpersonal communication, campaign, mass communication

Climate Change Communication in Singapore

Singapore

Singapore is an island city-state in Southeast Asia. With a land area of 719.1 sq. km, it had a total population of 5,535,000 residents in 2015—375,000 citizens and 527,700 permanent residents, translating into a population density of 7,697 per square km. Singapore is also a multiracial country, with majority of the residents being Chinese (74.3%), followed by Malays (13.3%), Indians (9.1%), and others (3.3%). Similarly, Singapore is a multi-religion country, with the Singapore government supporting religious freedom. A majority of the Chinese identified themselves as Buddhists or Taoists (44.2%), while the Malays are mostly Muslims (14.7%). Some of the Indians in Singapore are Hindus (5.1%), and the rest are Christians. Statistics show that there has been an increase in the proportion of Christians (18.3%) in Singapore since 2010 (Singapore Department of Statistics, 2010).

Singapore is also known for its world-leading education system. Singapore enforces a compulsory primary school education for children aged 7 to 12 years, and it is a criminal offense for parents not to send their children to school (Ministry of Education, 2015). In addition, the media also plays an important part in the rapid development of Singapore. Singapore is one of the key media centers in the Asia-Pacific region (Ministry of Communication and Information, 2015). However, the Singapore media is often criticized by media scholars in terms of its press freedom (e.g., Lee, 2010; Woodier, 2009). The Singapore media has been claimed to be non-directly controlled by the government (Forsyth, 2014; Lee, 2010; Woodier, 2009). According to Reporters Without Borders (RWB), a non-governmental organization (NGO) that promotes freedom of information and press, Singapore was ranked 153 out of 180 countries in terms of press freedom (Reporters Without Borders, n.d.).

Given that Singapore is a small island-nation with very few natural resources, the country is extremely vulnerable to climate change. It is worthwhile to explore Singaporeans' perceptions about climate change and how the education system and media in Singapore have been used to inform and communicate climate change issues to the general public.

Climate Change in Singapore

Climate change is currently a global environmental issue (Balbus, Boxall, Fenske, McKone, & Zeise, 2013). Countries around the world are aware of the issue, and people are concerned about the impact of climate change on their daily lives. Although the Singapore government dedicated resources to address climate change, surveys conducted by the Singapore government showed that few Singaporeans were concerned with climate change (Fang, 2014). Indeed, many Singaporeans might be confused between the words “weather” and “climate.” Climate refers to “both the average and range of weather conditions that occur over an extended period of time,” such as months, years, or decades (Abatzoglou, DiMento, Doughman, & Nespor, 2014, p. 13), whereas weather is the meteorological condition at a certain place and time (Abatzoglou et al., 2014). In another way, climate could be defined as the sum of several weathers across a particular period of time. Climate change, therefore, refers to the significant changes in global weather patterns that remain over an extended period of time (National Climate Change Secretariat [NCCS], 2013a).

In the next few sections we will briefly discuss the factors that gave rise to climate change in Singapore, especially the recurring haze outbreaks, followed by the impacts of climate change on Singapore. We will also describe some of the key mitigation actions taken by the Singapore government to tackle climate change. Next, we will focus on the communication aspect of climate change in Singapore, in which we will review the research findings of the Singapore government and researchers. Specifically, we will look into public perception about climate change, the role of education, and how interpersonal

communication, campaigns, and mass media can help to disseminate information about climate change. Finally, we will discuss the communication efforts of the Singapore government and NGOs.

Factors Affecting Climate Change in Singapore

Carbon Emission

Singapore was ranked 123rd out of 137 countries in terms of CO₂ emission per dollar GDP, and it contributed less than 0.2% of global carbon emission (NCCS, 2012). However, when the small size and dense population was factored in, Singapore ranked 27th out of 137 countries in terms of carbon emissions per capita (NCCS, 2014). Although no agreement has been reached on what is the best indicator to measure carbon emission, most countries with large populations favored the per capita indicator, while small countries are against this way of measurement as their per capita indicator tends to be higher (NCCS, 2012). In the case of Singapore, the per capita indicator might not reflect the true circumstances due to the high population density and the dependence on imported fossil fuels.

Forest Fires and Haze

Forest fires constitute one of the factors behind climate change and the main cause of haze outbreaks in Singapore (Forsyth, 2014). Haze has been a major concern in Singapore since the late 1990s due to forest fires. The severity of the situation escalated when in 2013 and 2015 it seriously affected the daily routines of Singaporeans (Lee, 2015). The main cause of the haze outbreaks were the human-caused forest fires in Indonesia (Forsyth, 2014). Fires were set at several places either for land cultivation or land development. These forest fires produced a lot of smoke and released large amounts of carbon dioxide into the atmosphere, which exacerbated the greenhouse effect (Forsyth, 2014). Despite the Singapore government striving to prevent the recurrence of haze, efforts have not been successful.

Indeed, haze is not a new issue in Singapore. It can be traced back 40 years (Kok, 2015). Haze first plagued Singapore in October 1972, when it was caused by the land cultivation habits of farmers in Palembang, Indonesia. Three years later, on February 20, 1975, a mysterious red haze struck Singapore. It was attributed to the jungle clearing work for land development in Johor Bahru, Malaysia. In 1977, Singapore was again affected by haze caused by forest fires in Sumatra, Indonesia. In the 1980s, two hazardous haze episodes hit Singapore, one in April 1983 and another in September 1987. Both events were caused mainly by forest fires in Kalimantan, Indonesia. The highest pollutant standards index (PSI) recorded was 226, when haze struck Singapore again in September 1997. Haze became a perennial issue for Singapore in the 2000s (Kok, 2015). The most severe haze incidents took place in 2013 and 2015 (Kok, 2015). The public panicked when the three-hour PSI reached 401 in 2013, putting the air quality at a hazardous level, and people were lining up in front of pharmacies and convenience stores to buy N95 masks—a respiratory protection mask (Charissa, 2013). In 2015, primary and secondary schools were closed when the PSI exceeded the hazardous mark (Chan & Leong, 2015). The significant carbon emissions and recurring episodes of haze have aggravated climate change in Singapore, impacting the ecological system and public health.

Impacts of Climate Change on Singapore

Climate change has a great influence on every physical, biological, and ecological system on earth (NCCS, 2012). Singapore is not exempt from the effects of climate change. As an island-country that is not equipped with many natural resources, Singapore has to maintain the equilibrium of its ecological system while mitigating the effects of climate change. The National Climate Change Secretariat Singapore reported that Singapore will have to bear several serious consequences of climate change if the issue is not properly handled (NCCS, 2016a).

First, ice sheets are melting in the Arctic due to warmer temperatures caused by climate change, resulting in rising sea levels. This poses a direct threat to Singapore, a low-lying island with most of its land located only 15 m above the average sea level (NCCS, 2016a). Therefore, rising sea levels will be a challenge that the Singapore government has to tackle in the long term. Second, climate change could jeopardize the water management system in Singapore (NCCS, 2016a). Singapore has been struggling with a scarcity of water due to limited land to collect and store rainwater (PUB, 2017). Singapore's current water supply comprises water from local catchment, imported water, highly purified reclaimed water known as NEWater, and desalinated water (PUB, 2017). However, prolonged drought seasons might threaten water supply, while intense rainfall could cause flash floods. Third, climate change could affect the biodiversity and greenery in Singapore (NCCS, 2016a). The changing climate could affect the ecosystem in Singapore, putting plants and animals at risk. Fourth, climate change could affect public health (NCCS, 2016a). Climate change could cause heat stress and discomfort among the elderly and sick. Moreover, studies have shown that the climate factors have a positive impact on the increase of dengue cases in Singapore (Hii et al., 2009). Warmer climates provide a more favorable breeding ground for mosquitoes (Oki & Yamamoto, 2012). Fifth, climate change could jeopardize the food supply of Singapore as the country imports most of its food (NCCS, 2016a). The effects of global climate change, such as storms, floods, and droughts, could threaten Singapore's food supply.

To complicate matters, urban development in Singapore has caused Singapore to experience the urban heat island effect. This phenomenon occurs when the natural land is replaced with buildings and other infrastructures that retain or produce heat, causing urban areas to become warmer (NCCS, 2016a). Therefore, a cyclic process occurs where the higher the temperature in Singapore, the greater the use of air conditioning, and the higher the domestic carbon emissions, which exacerbates climate change. Singapore was once called the

air-conditioned island or nation for its proliferation of air-conditioned buildings and public transport (George, 2000).

Actions to Mitigate Climate Change in Singapore

Singapore has experienced climate change since the late 20th century, when the annual mean temperature increased from 26.6 to 27.7°C from 1972 to 2014 and the sea level in the Straits of Singapore increased 1.2 to 1.7 mm annually between 1975 and 2009 (NCCS, 2016a).

Aware of the impacts of climate change on the nation, the Singapore government has taken several actions to mitigate climate change. The National Climate Change Secretariat was established in July 2010 by the prime minister's office to develop and implement domestic and international policies to tackle climate change (NCCS, 2016f). According to the NCCS (2012), the first and most important mitigation strategy is to reduce carbon emissions. Carbon is emitted when fossil fuels are burned, and therefore, the Singapore government's strategy is to reduce fossil fuel usage by replacing fuel oil with natural gases. Next, the Singapore government emphasizes the importance of energy efficiency by encouraging the use of energy-efficient measures and technologies (NCCS, 2013c). The Singapore government is also trying to build up the country's capability to sustain energy efficiency, increasing the knowledge in energy management, and raising awareness among the public, households, and industry (NCCS, 2013c). In order to enhance Singapore's capability in energy-efficient technologies, the Singapore government also supports research and development efforts in this area (NCCS, 2013c).

The major source of greenhouse gas emissions in Singapore is the combustion of fossil fuels to generate energy (National Environmental Agency [NEA], 2016). Out of a total 47,125.64 gigagrams of CO₂ equivalent (Gg CO₂ eq) of carbon emissions, energy generation and supply contributes 43.39% of the emissions, followed by industry (40.02%) and transport (15.26%) (NEA, 2016). To promote energy saving and reduce carbon emissions in the

industry, since April 2013 energy users in the industry and transport sectors who consume more than 15 gigawatt-hours of energy per year must follow three guidelines (NCCS, 2016b). First, the related company has to appoint an energy manager. Second, the company has to monitor and report energy usage and greenhouse emissions. Third, the company must submit plans for energy efficiency improvements to the relevant agencies. In addition, green design buildings could contribute to energy saving. Singapore's Building and Construction Authority (BCA) launched a Green Mark Scheme (GMS) to encourage developers and owners to build and maintain green buildings (NCCS, 2016b). Starting in 2013, every new and existing building's cooling system that has undergone retrofitting has had to be audited every three years (NCCS, 2016b). According to Singapore's Second Biennial Update Report (2016), approximately 2,600 new and existing buildings had met BCA Green Mark standard, accounting for more than 30% of the total built-up area in Singapore (NEA, 2016).

In terms of transportation, private cars contribute the largest share of carbon emissions. According to a report from the Ministry of Transport (Poon, 2013), private cars contribute 35% of the total land transport carbon emissions in Singapore, followed by commercial vehicles (26%), taxis (17%), and buses (15%). As public transport is the most energy efficient transport, Singapore government aims to encourage at least 70% of the commuting public to use public transportation by 2020. To do so, the Singapore government increased its investments in the mass rapid transit (MRT) to build new rail lines and purchase more trains to increase the frequency of train trips (NCCS, 2016c). In addition, more buses have been purchased and additional bus stops have been introduced to encourage the public to use public transport instead of private cars (NCCS, 2016c). Singapore also has a stringent vehicle ownership system (NCCS, 2016c). There is a limit to the number of new vehicles that can be registered yearly in order to control the number of vehicles on the road.

On the other hand, household electrical consumption constitutes one-sixth of the total electrical consumption in Singapore, with air conditioners and water heaters accounting for the largest proportion of electrical consumption (NCCS, 2016d). In 2011, Singapore implemented the Minimum Energy Performance Scheme (MEPS), which restricted the sales of energy-inefficient appliances (NCCS, 2016d). Singapore's National Environment Agency (NEA) has also promoted energy efficiency and conservation through public education programs (NCCS, 2016d). Energy-saving tips are frequently disseminated through media publicity, road shows, and community outreach programs.

Through the years, the Singapore government realized that solely focusing on mitigation actions is not sufficient to tackle climate change. It is also crucial to understand the public's perceptions about climate change. This will enable the government to measure the effectiveness of initiatives that have been implemented and understand what more needs to be done. Hence, Singapore authorities have conducted surveys regarding public perceptions about climate change.

Communicating Climate Change to Singaporeans

Public Perceptions

Singapore residents are the primary target audience to ensure the sustainability of mitigation actions. It is essential to understand public perceptions about climate change before and after the implementation of mitigation actions. Forsyth (2014) found that attention to climate change was low among Singaporeans despite the government's efforts to communicate climate change issues to the public. To understand the public's perceptions about climate change, the NCCS conducted two comprehensive nationwide surveys in 2011 and 2013. The main objective of the surveys was to measure public awareness, attitudes, and behaviors about climate change-related issues in Singapore (NCCS, 2012).

The first comprehensive survey was carried out between October and December 2011 by the Singapore government (NCCS, 2012). A total of 1,010 Singaporean residents aged 15 years and above participated in this survey. Almost 90% of the respondents felt that they were playing a part in taking action on climate change. A majority (73.8%) of the respondents were concerned about climate change, and more than 60% of the respondents thought that Singapore would be severely affected by climate change. Interestingly, only half of the respondents were keen to receive information about climate change. Among all types of information, the respondents preferred to receive information about the impacts and effects of climate change (70.2%), followed by the causes and science of climate change (69.2%) and measures that individuals can take to address climate change (69.2%). More than 500 respondents agreed that individuals were responsible for taking action to address climate change, while slightly more than one-quarter of the respondents thought that the Singapore government was responsible for addressing climate change in the country. Only a small number of respondents thought that businesses, NGOs, and others are responsible for mitigating climate change in Singapore. Most respondents agreed that it is everyone's responsibility to care for the environment and everyone needs to preserve the environment for future generations.

The survey also showed that a significant number of respondents practiced environmentally friendly habits, such as turning off electrical appliances when they were not in use (90.3%), practicing the 3Rs (Reduce, Reuse, Recycle) to minimize waste generation (80.3%), using public transport when possible (76.8%), and choosing appliances that had an "Energy Label" (72.3%), a mandatory label implemented by the Singapore government to allow consumers to compare household appliances' energy efficiency (NCCS, 2016d). However, less than 60% of the respondents thought that Singapore should take steps to reduce climate change even if this involved significant cost, while around one-third of the

respondents thought that only actions that are low in cost should be taken to reduce climate change.

Two years later in 2013, a similar nationwide survey was conducted to gauge Singaporeans' perceptions toward climate change (NCCS, 2013a). A total of 1,000 respondents took part in this study. The survey showed that the proportion of respondents who were concerned about climate change fell slightly from 2011 (73.8%) to 2013 (70.2%). Similarly, the proportion of respondents who thought they were playing a part in taking action on climate change decreased from 2011 (86.0%) to 2013 (62.9%). Yet, there was an increase in the number of respondents who felt that Singapore would be affected by climate change in 2013 (78.5%) as compared to 2011 (63.4%). Respondents agreed that there were several effects of climate change, such as severe weather events, impact on public health, impact on water supply, impact on food security, increased risk of seawater inundation and erosion of coastal areas, and loss of biodiversity and natural ecosystem. When asked about the factors involved in climate change, half of the respondents thought that clearing forest contributes to climate change, followed by the use of petrol and diesel in road vehicles, burning of fossil fuels, electricity consumption, and increase in water use and waste generation.

In 2011, most respondents thought that individuals were responsible for taking action on climate change, followed by the government. In contrast, in 2013 almost half of the respondents thought that the government was mainly responsible for taking action on climate change in Singapore, followed by individuals (39.2%). Around 63% of respondents felt that climate change would affect them personally. Among these (627 respondents), half thought that their health would be affected, 11.6% thought that they would be affected by the temperature, followed by a decline in living standards (9.5%). More than half of the respondents thought that climate change was an urgent issue, while 14.0% of the respondents

felt that climate change was not urgent. About 50.0% of the respondents felt that they could make a difference with regard to climate change. A great number of respondents practiced environmentally friendly behaviors in 2013, such as turning off electrical appliances when they are not in use (96.6%), using public transport or car pools when possible (89.4%), and avoiding food waste (83.9%). The least practiced actions were driving green vehicles (9.6%) and participating in environmental campaigns (26.6%). Respondents also stated that cost saving was the main reason for practicing environmentally friendly habits, while one reason preventing some people from taking action to address climate change was that they did not know what actions to take.

Public perceptions are crucial in tackling climate change issues, but understanding public perceptions about environmental problems is challenging (Forsyth, 2014). Although research has found that there has been an increase in the coverage of climate change news by the local Singapore newspaper (Schmidt, Ivanova, & Schafer, 2013), public concern about climate change has not increased concurrently. Research showed that Singaporeans perceived air pollution as the greatest environmental problem (e.g., Burger et al., 2003). The NCCS survey reports also indicated that a majority of Singaporeans thought that forest clearance was the main factor that contributed to climate change (NCCS, 2013a).

Moreover, a study has been conducted to identify the audience segments in the Singapore population based on their beliefs and responses to climate change (Detenber, Rosenthal, Liao, & Ho, 2016). This study aimed to develop a new model on how different segments of the Singaporean population perceive the climate change issue by categorizing the audiences based on relevant attributes, such as beliefs, attitudes, behavioral intention toward global warming, and demographics (Detenber et al., 2016). Detenber and colleagues found that Singaporeans can be divided into three segments in terms of climate change issue: the concerned, the disengaged, and the passive. Among 1,006 respondents, about half (50%) are

categorized under the concerned segment. People in this segment are those with high income and educational levels (Detenber et al., 2016). They are engaged in environmental communication, but they pay slightly above-average attention to global warming news in the traditional media. They are worried about global warming, and they believe that global warming will harm them personally. These people believed that Singaporean citizens should play a role in addressing global warming, but they also think that the government should prioritize global warming. They trust their friends, family, and the government as the source of information regarding global warming.

On the other hand, 35% of the respondents in this study are categorized into the disengaged segment. The disengaged people are slightly older and less educated as compared to people from the concerned segment. They are the ones with below-average incomes. They pay very little attention to global warming in the traditional news media and have adopted very few pro-environmental behaviors (Detenber et al., 2016). In general, they are not worried about global warming, and they do not think that global warming puts them at personal risk. Interestingly, they do not believe that Singaporean citizens should take further action to mitigate global warming, yet it should be a high priority of the government. They have the least trust in their friends, family, and the government as sources of information about global warming (Detenber et al., 2016). The passive segment, 15% of the respondents in the study (Detenber et al., 2016), consists of people with the lowest income and educational levels. In contrast to the disengaged segment, the passive people are the ones with the highest attention to global warming issues in traditional news media. They are also the ones who are highly involved in pro-environmental communication. They worry moderately about global warming and also moderately believe that global warming will cause them personal harm. They strongly believe that the government plays an important role in

addressing global warming. Passive people also think that friends, family, and the government are trustworthy sources of global warming.

Based on the Singapore government survey reports, the public's concern about climate change not only remained low but fell from 2011 to 2013 (NCCS, 2013a). A number of people do not engage in pro-environmental behaviors (Detenber et al., 2016). Therefore, the Singapore government has efforts in place to narrow the knowledge gap among the public by incorporating climate change into the education system, organizing campaigns and activities, and supporting climate change-related research. In addition, researchers are also conducting studies to examine the effectiveness of climate change education in Singapore and the role of news media and communication mediums in mitigating climate change.

Education System

The education system serves as an important channel to inform the young generation about climate change (Chang, 2012). It is also an important platform to cultivate sustainability practices among future generations (Chang, 2012). The Singapore government realizes that long-term strategies to mitigate climate change and other environmental problems are to educate the younger generation and to introduce children to environmentally friendly habits. To accomplish this, teaching and learning geography is necessary (Chang, 2012). Scholars have argued that teaching geography in schools provided a platform to address environmental sustainability issues (Tan & Chang, 2008). Geography was introduced into the education system even before Singapore gained its independence (Chang, 2011). Over six decades, the subject had undergone several national-level curricula reviews (Chang, 2011). Now it is taught (as a subject called social studies) in primary schools. Geography is also taught as an individual subject in secondary schools in Singapore. It is a compulsory subject for lower secondary students, but is offered as an elective subject for upper secondary, junior college (pre-university), and university students. The syllabus includes information about climate

change, such as global warming, the causes and impacts of climate change, and adaptation and mitigation strategies.

Despite several rounds of review, researchers found that there were still misconceptions about climate change among Singaporean students (Chang & Pascua, 2014). Chang and Pascua (2014) suggested that the most common climate change misconceptions among the Singaporean students included the ozone-related models, the nature of the greenhouse gases, and the source and type of heat trapped in the atmosphere. Other studies showed that communication between teachers and students, especially the way of refuting the misconceptions, is essential in correcting students' misconceptions about climate change (e.g., Pascua & Chang, 2015). In order to investigate and correct the misconceptions about climate change, Pascua et al. (2015) conducted a study among secondary school students in Singapore. The objective of the study was to simultaneously implement an intervention and evaluation targeted at selecting pedagogical approaches that helped to refute misconceptions about climate change. The researchers used a three-stage time series design to collect data from both teachers and students. The results of the study showed that through communication with researchers, the teachers were aware of the misconceptions about climate change held by their students even before class discussions (Pascua & Chang, 2015). The teachers' instructional approach played an important role in correcting students' misconceptions (Pascua & Chang, 2015). A reactive refutation approach did not reduce students' misconceptions, but a pro-active refutation approach improved students' understanding of climate change. Identifying and correcting the misconceptions change directly (pro-active approach) was a better approach than correcting the misconceptions when they surfaced (reactive approach). Hence, communication between teachers and students is crucial in untangling the misconceptions about climate change among Singaporean students.

Interpersonal Communication and Campaign

In light of the two surveys indicating the misconceptions and a decrease in public awareness pertaining to climate change in Singapore, communication plays an important part in overcoming these. The Singapore government, NGOs, and industry players are using all types of communication channels to transmit information about climate change and to inculcate a pro-environmental mindset among the public. However, each individual has his or her own preference as to how they would like to receive information. Researchers are striving to investigate the most appropriate communication channel that allows the government to reach the general public. Studies showed that both interpersonal communication and campaigns are effective in disseminating information about climate change (e.g., Chib, Chiew, Kumar, Choon, & Ale, 2009; Kamilaris, Neovino, Kondepudi, & Kalluri, 2015; Kua & Wong, 2012).

It is important to understand energy consumption behaviors prior to the implementation of any energy-efficient strategies, especially in organizations. A case study was conducted by researchers in Singapore in order to determine the influence of office workers on the energy consumption at their desk. It aimed to examine the effectiveness of eco-feedback strategy (intervention) and combinations of interventions on promoting energy saving in the office (Kamilaris et al., 2015). The study took place in a National University of Singapore building with 18 office workers. The study took around 23 weeks, involving three phases. The first phase was the baseline measurement stage, where the use of personal computers were measured using a sensor mode without informing the occupants. The second phase was the intervention stage, in which feedback messages were given to participants. A survey was conducted at the end of this phase. The last phase was the monitoring stage, which evaluated the lasting behavioral change of the participants. The results of the study showed that electronic mail was the most effective and preferred communication in providing feedback regarding energy saving in the office, as it is the primary communication channel in

offices nowadays (Kamilaris et al., 2015). Moreover, this study found that giving specific advice on energy-saving methods and explaining the impact of energy saving on the environment were the most useful methods to promote energy saving, while the most desirable eco-feedback methods were self-monitoring, personal advice, and education (Kamilaris et al., 2015).

Kua and Wong (2012) conducted an experiment among households in Singapore to study the effectiveness of information and feedback in promoting household energy conservation. This study was a pilot study prior to the community energy conversation program funded by the Singapore government. The study examined the effectiveness of the communication channels (or combination of the communication channels), such as pamphlets, stickers, and face-to-face interactions, in promoting energy saving. These instruments were used to provide information and feedback about the energy conservation of each household. Energy intervention was carried out for four months, from August to November 2008, with 125 households in the southwest district of Singapore. Among the 125 households, 62 were the treatment group and 63 were the control group. The results of the study showed that the intervention program was successful in motivating energy saving among the households who received the outreach education (Kua & Wong, 2012). The results also revealed that money saving was not the strongest motivation for energy consumption reduction (Kua & Wong, 2012). Instead, counseling was found to be the strongest factor motivating energy-saving actions when compared to other instruments. This might be due to the face-to-face interactions where members of the households were able to communicate and ask questions about the recommended actions when they had doubts (Kua & Wong, 2012). Researchers suggested that the trust of the public about the information provided through the outreach instruments was important in order to ensure the effectiveness of the energy

intervention program (Kua & Wong, 2012). In addition, the energy-saving actions should be simplified so that these actions could be easily picked up by the general public.

Besides the personal outreach instruments, studies also showed that the social campaign was effective in influencing individuals' behavior, especially among youths (e.g., Chib et al., 2009). Chib and colleagues (2009) conducted a study to explore how a social campaign, in terms of time frame and incentives, could affect youths' perception of pro-environmental attitudes. They examined how campaign messages could influence changes in youths' attitudes based on the stages-of-change model. This study was conducted in three stages, with a total of 450 respondents in five months. The first stage of the study was a focus group discussion conducted with tertiary students to gain a preliminary understanding of the audience. The researchers also interviewed experts in the field of environmental management in Singapore. The second stage was another round of group discussions with tertiary students. The third stage was the evaluation stage, where two surveys were conducted before and after the campaign, "[minus] plastic," held in Singapore. This study revealed that the campaign messages, including both time frames and incentives, affected pro-environmental attitudes among youths. A well-crafted campaign message could change youths' behavior from stage to stage according to the stages-of-change model. In terms of encouraging youths' pro-environmental behavior, communicating campaign messages through the Internet is the best approach. The results also showed that campaign messages significantly influenced the study subjects' stage migration.

Mass Communication

Mass media is widely used by the Singapore government to disseminate information and educate the general public about climate change. It is a communication channel that enables the senders to reach a mass audience. Media researchers have been conducting studies to

explore the role of mass media, either formal or informal, offline or online, in addressing climate change issues.

A study has been conducted in Singapore to examine media effects on climate change knowledge acquisition (Yang & Ho, 2017). Yang and Ho (2017) investigated public acquisition of climate change knowledge using the knowledge gap hypothesis. They proposed that level of education, attention to climate change news in newspapers, and attention to climate change news on television are associated with the public's knowledge about climate change (Yang & Ho, 2017). They also suggested that the knowledge gap on climate change issues between better and less educated people depends on their attention to climate change news in newspapers and on television. The results of the study revealed that people who received better education have greater climate change knowledge compared to those who are less educated. Similarly, people who paid more attention to climate change news in newspapers and on television are more knowledgeable compared to those who paid less attention. Yang and Ho (2017) also found that the knowledge gap between better educated people and less educated people was reduced when all paid more attention to climate change news on newspaper and television. They suggested that more effort should be put into media messages about climate change to impart climate change knowledge, which in turn could motivate the public to engage in pro-environmental behaviors.

Liao, Ho, and Yang (2016) conducted a study to investigate the motivators of pro-environmental behavior by applying the influence-of-presumed-media-influence (IPMI) model. Liao and colleagues (2016) studied the influence of mass media on people's incentive to adopt pro-environmental behavior. They posited that people who pay greater attention to media messages tend to assume that others are also exposed to and influenced by media messages (Liao et al., 2016). Liao et al (2016) also proposed that people's perceptions of media influence on others will have both direct and indirect effects on attitudes, social norms,

and pro-environmental behavioral intentions. They suggested that people who expect others to be influenced by pro-environmental media messages are more likely to have a positive attitude toward pro-environmental behavior and will in turn be more prone to engage in pro-environmental behaviors (Liao et al., 2016). The presumed media influence on others may also pressure an individual to adopt pro-environmental behaviors in order to meet social expectations (Liao et al., 2016). The results of the study were consistent with Liao and colleagues' suggestions, in which attention to pro-environmental media messages, attitude toward pro-environmental behavior, perceived social norms, and perceived media influence on others are factors influencing pro-environmental behavioral intentions. The results showed that people who perceive greater media influence on others are more likely to perceive others as pro-environmental (Liao et al., 2016). These people believe that other people expect them to adopt pro-environmental behaviors, and therefore they are more likely to wish to adopt pro-environmental behaviors. Liao and colleagues (2016) suggested that cultivating people's perceptions that others will be motivated to adopt pro-environmental behaviors as a result of exposure and influence to media messages may be a way to encourage pro-environmental behaviors.

In addition, Ho, Liao, and Rosenthal (2015) conducted a study to explore the factors contributing to Singaporeans' pro-environmental behavior intentions. By applying the theory of planned behavior and media dependency theory, Ho and colleagues (2015) examined the effects of social-psychological factors on pro-environmental behaviors among Singaporeans. They proposed that individuals' attention to pro-environmental messages on the Internet and traditional media are associated with the intention of green-buying and civic engagement (Ho et al., 2015). They also suggested that interpersonal communication about the environment will encourage green-buying and civic engagement behavior (Ho et al., 2015). The results showed that paying attention to pro-environmental messages on traditional media, such as

newspapers and television, promoted green-buying among Singaporeans, but they did not promote civic engagement behaviors. In contrast, paying attention to pro-environmental messages on the Internet encouraged civic engagement behaviors among Singaporeans but not green-buying. Moreover, media dependency and interpersonal communication predicted both green-buying and civic engagement behaviors among Singaporeans. The results were expected, as mass media in Singapore plays an important role in shaping public opinion and behaviors pertaining to environmental issues (Ho et al., 2015). Meanwhile, the Internet encouraged civic engagement among Singaporeans as it is convenient for people to participate in and support pro-environmental activities through donations and signing petitions (Ho et al., 2015).

Another study was conducted to explore climate change information-seeking behaviors among Singaporeans (Ho, Detenber, Rosenthal, & Lee, 2014). Ho and colleagues (2014) proposed that attitude toward information seeking, seeking-related subjective norms, and perceived information-seeking control are associated with media use. They also suggested that media use will mediate the relationship between perceived knowledge and attitude toward information seeking, subjective norms, and perceived seeking control (Ho et al., 2014). Based on a nationally representative survey of adult Singaporeans, the results of the study revealed that individuals' attitudes toward risk information seeking, seeking-related subjective norms, and perceived information-seeking control were associated with media use. Media use partially mediated the relationship between perceived knowledge and attitude toward information seeking, subjective norms, and perceived information-seeking control. The results also showed that media use has a greater influence on negative affect as compared to risk perception. Ho et al. (2014) argued that climate change tends to be perceived as an impersonal risk that should not involve emotions. Yet, it is possible that people who are concerned about climate change might seek additional information regarding climate change

(Ho et al., 2014). Results also revealed that media use was indirectly associated with seeking intention via perceived knowledge, negative affect, and sufficiency threshold (Ho et al., 2014). The researchers argued that media could create feelings of anxiety, worry, and tension pertaining to climate change, which could be alleviated by information seeking (Ho et al., 2014).

Besides evoking feelings, media reports could also reveal how public concerns and criticism are voiced (Forsyth, 2014). Haze caused by forest clearance in Indonesia is one of the hot topics frequently reported by the Singapore media. Forsyth (2014) conducted a study to identify how public concerns about the transboundary haze had been expressed in newspapers in Indonesia, Singapore, and Malaysia. Data were collected using the content analysis method in which the researcher analyzed news reports of haze in Indonesia, Singapore, and Malaysia from July 1997 to June 2013. The study analyzed 901 stories from Indonesia, 2,082 from Singapore, and 2,406 from Malaysia. The results revealed that all stories showed a rapid increase in “blame” in the three countries after 1997, asserting direct responsibility for the haze. Surprisingly, the relationship between haze and climate change was rarely mentioned in the news reports from any of the countries (Forsyth, 2014).

Communication Efforts by the Singapore Governments and NGOs

Aside from climate change research, the Singapore government also allocated funds to support campaigns and activities aimed at raising the awareness of climate change among Singaporeans. Below are some successful campaigns and activities organized by the Singapore government and NGOs.

Clean & Green Singapore (CGS) is a nationwide campaign co-organized by the National Environment Agency (NEA), Community Development Council (CDC), Public Utilities Board (PUB), and National Park Singapore (NPark). The aim of the CGS campaign

is to inspire Singaporeans to protect the environment (“Green and Clean Singapore,” 2016). The CGS campaign is aimed at encouraging Singaporeans to practice three pillars in their daily life—Clean Environment, City of Gardens and Water, and Energy Efficiency and Resource Conservation. There are many programs and activities held under the CGS campaign, for example, the “Bright Spots Challenge.” A “Bright Spot” refers to a place in Singapore shared among communities, organizations, schools, interest groups, and individuals. These people are in charge of the cleanliness of the “Bright Spot” and are responsible to educate and encourage pro-environmental behaviors among the members in their community or organization. This activity was launched in September 2012 and aimed to achieve 500 “Bright Spots” by end 2015. There were 526 “Bright Spots” in Singapore by December 2015. Moreover, the Eco Music Challenge, with a slogan titled “A Clean and Green World Begins with Your Song,” is an annual event organized by the NEA. It serves as a platform for music lovers to showcase their talents and to express their appreciation for the environment through songs (“Eco Music Challenge,” 2015).

The “No Waste Days Challenge” was another program held under the CGS campaign. This program invited individuals in Singapore to challenge themselves, their friends, and family to adopt “No Waste Days” by changing their lifestyles to reduce waste. This program aimed to raise the awareness of reducing waste, such as food waste and plastic waste. Individuals, groups, and organizations were invited to choose a day within the challenge period (between November 8, 2014, and December 31, 2015) and adopt it as a “No Waste Day.” On the chosen date, participants made an effort to reduce as much waste as possible. They were also encouraged to adopt “No Waste Days” once a week or a month. Participants were asked to share photographs of their “No Waste Days” on Instagram, Facebook, or Twitter. This served as proof of participation and a way to encourage more individuals, groups, and organizations to adopt the habit of reducing waste. Participants had the chance to

win prizes by sharing their photographs on social media, tagging their friends on the photographs, and answering a few questions.

In addition to all the efforts in communicating climate change–related issues, the Singapore government took one more step by engaging the public in a series of dialogues. This engagement series was launched on January 7, 2016, by Singapore’s National Development Minister and the Environment and Water Resources Minister (Lim, 2016). The objective of this project was to provide Singaporeans a platform to voice their opinions and share their ideas for a cleaner, greener, and smarter home. The dialogues were based on the following topics: City in a Garden, Vibrant Community Spaces, Eco-Smart Towns, and Gracious Living, and A Green and Conserving Culture (“A Cleaner, Greener, and Smarter Home,” 2016). According to the National Development Minister, the Singapore government sought to work with individuals to translate their ideas into actions (Lim, 2016). Seventeen dialogue sessions were held in January 2016 at several locations in Singapore, including Gardens by the Bay, Bishan-Ang Mo Kio Park, and HortPark.

Besides the Singapore government, NGOs are also playing their role in encouraging the general public to take part in pro-environmental activities. World Wide Fund for Nature (WWF) Singapore is one of the NGOs that actively organize events and activities to raise the awareness of climate change issues. The theme of the Earth Hour 2015 was “Use Your Power to Change Climate Change” (WWF, 2016a). The Earth Hour is an annual global event held to take a stand against climate change organized by WWF. The annual Earth Hour is held on March 28, starting at 8.30 p.m. It started in Sydney, Australia, in 2007 and has been adopted by more than 162 countries today. Singapore has been organizing this event since 2011. Basically, everyone is encouraged to switch off their lights for one hour on March 28 every year. In addition, Earth Hour also encourages the general public to take five steps to tackle climate change (WWF, 2016b): (1) turn the air conditioner temperature up by 1°C; (2) say no

to plastic bags; (3) recycle one's e-waste; (4) switch off all unnecessary switches; (5) donate to climate change initiatives.

In conclusion, Singapore is one of the countries that strive to mitigate and adapt to the impacts of climate change, especially through communication. The Singapore government and NGOs have been organizing campaigns and activities to educate the public about the climate change issue. Studies have been conducted in order to identify the best communication medium to disseminate relevant information and to identify the role of education and media in mitigating climate change. The communication efforts by the Singapore government and relevant authorities are noteworthy. Despite these efforts, continuous communication strategies are necessary in order to sustain public awareness and concerns about climate change. Finally, leveraging on its economic influence in the Asia-Pacific region, Singapore can play a crucial role in raising public awareness of climate change in the region

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