Antarctic values and Malaysia's involvement in Antarctica: perceptions among young citizens of Malaysia

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ABSTRACT. Lack of support and interest among the public is one of the major challenges in strengthening and sustaining the future national agendas on Antarctica. The main goal of this study is to identify the perception of Malaysia's public with regard to Antarctic values and Malaysian involvement in the region. A survey on Malaysia's young citizen perception on Antarctic has been conducted for mapping out the future landscape of Malaysian involvement in the Antarctic region. Surveys have been conducted on respondents from secondary schools and universities in Malaysia. A questionnaire was designed to seek respondents' knowledge and awareness on the values of Antarctica and their opinions on Malaysia's involvement. The results of the study showed that respondents had a high level of awareness of Antarctic environmental issues. However, general knowledge about the Antarctic region was still intermediate. On the other hand, the results of this study showed that the young citizens had positive and strong support for strengthening Malaysia's Antarctic involvement. This study hopes to contribute as baseline data on the matter. Such background information will reflect on the national strategy in strengthening Malaysia's current policy and future involvement in Antarctica.

Introduction

The Malaysian government has long held the belief that Antarctica and the southern ocean are a priceless human heritage of global stature. Historically, since 1982, Malaysia's foreign policy championed equitable access for the promotion of peace and science in Antarctica (Brady 2012; Hamzah 2011). Malaysia initiated its involvement in polar science by setting up a research and development programme in 1997, as the Malaysian Antarctic Research Programme (MARP). In 2006, MARP extended its scientific research interests to the Arctic to study the connections between the tropics and both polar regions. In the face of a rapidly warming world, it is becoming increasingly important for climate science to understand the dynamics of the polar atmosphere-ocean-sea ice system and the mechanisms that connect the tropics with polar regions (Yuan 2015). MARP as an R and D programme believes that it is progressively attaining achievements in its involvement in international arrangements and institutions (for example the Asian Forum for Polar Sciences (AFoPS), Scientific Committee on Antarctic Research (SCAR) and International Antarctic Institute), publications, local and international collaborations and in developing Malaysian human capital (Abu Samah and others 2013). At present, Malaysia is developing an Antarctic Act to underpin Malaysian Antarctic engagement for ratifying the Madrid Protocol; therefore, Malaysia will be able to become a consultative party in the Antarctic Treaty (Ismail and others 2012). In the near future, Malaysia plans to establish the National Science Polar Institute and a Malaysia Antarctica Station as a part of its strategy to strengthen Malaysia involvement. This is seen as a significant contribution by Malaysian polar science towards the development of the country's knowledge-based economy (K-Economy).

After 30 years of Malaysia public policy towards Antarctica in diplomacy and more than 15 years of involvement in Antarctic science, Malaysia needs an assessment through policy analysis (analytical and descriptive) to measure the needs and capacity for its involvement from various aspects, especially for MARP to avoid unnecessary constrains that could lead to the failure of this involvement. Quade (1975) stated that public policy analysis refers to any type of analysis that generates and presents information in such a way as to improve the basis for policy makers to exercise their judgment. In addition, policy analysis is a performance measurement tool for public policies and provides a

basis for policy modification by identifying the policy's weaknesses, strengths, and areas that need improvement (Dunn 2003). Notably, one of the critical elements of this assessment is to measure how the Malaysian public reflects on this public policy. According to Radin (2000), the public's interest is central to any public policy and that the government's role is just to oversee its implementation. Thus, the Malaysian government needs to know whether members of the general public are aware of and understand the roles of the Antarctic region, whether they know about Malaysia's involvement in the Antarctic region, and how much they care. Who knows or cares? Although the Antarctic region is remote from most equator-latitude residents' experience, this region has increasingly become prominent issues in terms of its connectivity with global climate change, melting ice, rising sea levels, and the human or the ecological impacts of environmental changes.

Assessment of public perceptions is important to understand better the Malaysia's public policy in Antarctica and to design strategies for Malaysia's involvement in the Antarctic region in the future. Policy makers need to know how the public is likely to respond to Antarctic region issues and they need to know what the public wants, to design policies that will strengthen and sustain the nation's Antarctic involvement. According to Hisschemöller and Midden (1999), studies on public reactions to science and technology may help policy makers who seek to involve the public in decision making on issues related to technological or scientific complexity. Leiserowitz (2007) highlighted the public perception of climate change and stressed the significance of realising public perception as it can create further impact towards the future development of policies relating to the environment. Meanwhile, Schmidt (2007) analysed the correlation between the concern for the environment and how it translates into a form of action toward preserving the environment. In addition, political decisions often determined scientific priorities placed on the agenda of national science or how national science policy is formed. Nuttall (2012) mentioned that Antarctic science requires enormous financial resources and long-term political commitment to sustain national an Antarctic programme. Hence, studies on public understanding and reasoning in their reaction on the roles of polar regions are meant to help decision makers in addressing key policy questions on the future of Malaysia's involvement. Shah (2015) stated that policy makers must act to protect the environment not only for the present public, but also in the interests of future generations.

To accomplish this, the perception of Malaysia's public on issues related to Antarctic values, and Malaysia's Antarctic involvement is needed. To date, little information is available about the public's perception with regard to this matter. Therefore, it is very important to conduct a study to gather baseline data and evidence of Malaysia's public regard to this global issue. The Malaysian public's perception of Antarctic values and Malaysian involvement in Antarctica is needed to establish the scenario of the country's agenda. Accordingly, the aim of this study is to establish the perception of the young citizens (or youth, as defined in the 1997 National Youth Development Policy; youth in Malaysia range between the ages of 15 and 40) in Malaysia toward Antarctic values and Malaysian involvement in Antarctic region. The survey was conducted among secondary school and university students in Malaysia to map out the future landscape of Malaysian involvement in the polar regions, particularly in Antarctica. The school and university students have been identified as part of key group that becomes the feeder for this programme and they serve as the foundation for the development of national interest on the Antarctic in future. This research is among pioneer studies on the issue of the perceived awareness and understanding in regard to Antarctic region in Malaysia, focusing on young citizens. In general, as a strategic policy research, this study will advance scholarly understanding of the present scenario of Malaysian public policy on Antarctica. From a pragmatic perspective, the findings from this research will assist policy makers to understand more about the perceived awareness and to understand the crucial role of the young citizens regarding Antarctic region. This will ultimately assist them to inaugurate new initiatives to confront the challenges on issues such as global warming, climate changes, and rise of sea level. Besides, the result may provide impetus to integrate the decision making process of Malaysia's polar agendas with national science and technology policy, national environmental policy, foreign policy, and national climate change policy. Other than that, the results will provide relevant output for Malaysian involvement in international agreements, which are indirectly related to the Antarctic region such as Montreal Protocol and Kyoto Protocol. Lastly, it is hoped that the present study will serve as a reference for policy makers to establish a 'new' national polar policy for Malaysia as well as to design an adequate communication strategy for Malaysia's polar region's governance in the context of education, communication and outreach (ECO) to strengthen the public participation pertaining to this global issue.

Literature review

A wide range of surveys on public perceptions of the Antarctic have been implemented. In Argentina, del Acebo Ibánez and Costa (2010) conducted a study on attitudes and behaviours toward environmental problems in Antarctica among Argentine youths (aged 15 to 25 years old). In the Netherlands, Tin and others (2011) studied Antarctic wilderness and found that respondents clearly supported protecting Antarctica as a wilderness, acknowledged Antarctica's importance as part of the global climate system and as a science laboratory for the benefit of mankind. According to them, since the consultative parties to the Antarctic Treaty frequently state that they manage Antarctica 'for the benefit of mankind,'

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research on the general public's opinion on management issues should be considered relevant information for the decision making process within the member countries of Antarctic Treaty System. Meanwhile, the study conducted by Salazar (2013) aimed to provide an initial understanding of the core values and perceptions that a representative sample of the Chilean public may hold about Antarctica. Meanwhile, Summerson and Bishop (2012) studied the impact of human activities on wilderness and aesthetic values in Antarctica. This survey comprised 90 images of Antarctic landscapes and was posted on the internet to canvass as wide cross-section of people with an interest in Antarctica as possible on their perceptions of wilderness and their aesthetic preference. Hamilton and others (2012) found that the public's knowledge about the north and south polar regions significantly improved between 2006 and 2010, before and after the International Polar Year. In addition, respondents who know more about science in general, and polar facts specifically, tend to be more concerned about polar changes. More knowledgeable respondents also tend to favour reserving the Antarctic for science, rather than opening it for commercial development. To our knowledge, this kind of fundamental study about polar regions awareness is very limited and has not been exploited by any other Asian countries that participate in polar regions. In the context of Malaysia, Shah (2015) had studied and discussed the factors selected in determining the public perceptions of Antarctic value to the policy makers in constructing a state environmental protection policy.

In the context of young citizens, Chatterjee (2007) stated that children and young people also have the ability to be involved effectively in environmental monitoring and assessment, as well as in planning solutions and decisions. In fact, according to Rio declaration (principle 10), at the national level, each individual shall have appropriate access to information concerning the environment held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. In the context of Agenda 21 (Chapter 25), Children and Youth in Sustainable Development - it is imperative that youth from all parts of the world participate actively in all relevant levels of decision-making processes because it affects their lives today and has implications for their futures. In addition to their intellectual contribution and their ability to mobilise support, they bring unique perspectives that need to be taken into account.

A few studies have been conducted to measure the level of awareness on environmental issues. For example, Denniss (2005) conducted a study to determine the attitudes and concerns of young people in Australia to environmental issues. Meanwhile, the second Credit Suisse Youth Barometer survey was conducted in Switzerland by the gfs.bern research institute in 2011 and found that the Switzerland's young people are showing great concern on environmental issues and the result of this study will reflect the political situation (*Credit Suisse* 14 Ogos 2011). Furthermore, Utku Erzengin and Çetin Teke (2013) conducted a study on developing an environmental behaviour and attitude scales for university students students of Suleyman Demirel University in Kazakhstan. At the national level, Rahman and others (2014) conducted a study to identify the awareness and the impact of climate change as perceived by the young citizens in Malaysia, focusing on gender differences. Meantime, Meereh and others (2010) studied the levels of knowledge, attitudes, skills, and participation of Malaysian students in the context of environmental citizenship. A study by Ahmad and others (2012) found that generally, youth in Malaysia is aware of the environmental problems faced by the world. Even though technical understanding can be improved, the general understanding on the state of the earth and what can be done to preserve it is satisfactory.

Methodology

The surveys conducted between late 2013 and mid-2014 (duration for pilot study and main research study) involved secondary school and public university students in Malaysia. The purpose was to identify the perceptions of Malaysia's young citizens on Antarctic values and Malaysia's Antarctic involvement. The survey received full support and cooperation from the Ministry of Education (MoE), because this is a preliminary effort to study the awareness of young citizens on polar regions values in Malaysia. This kind of survey would provide an indicator for MoE to understand how concerned Malaysian students are about global issues. The sampling survey covered 20 selected secondary schools (day schools and boarding schools) in the northern region of the Malaysian peninsula from the states of Penang, Kedah, Perlis, and Perak. The school survey was conducted using the postal survey method, in which questionnaire forms were distributed by post to the selected schools. This method was used as it is a cost-effective method for collecting information from a large sample, covering a wide geographical area. The survey forms were distributed to school students with the assistance of teachers and guided by handouts given by the researcher. Meanwhile, data collection for university students was conducted by distributing the questionnaires by hand. The questionnaires were distributed to upper secondary students in Malaysia (aged between 16 and 17 years old). Altogether, 1,098 respondents ($n = 1{,}098$) were interviewed using the structured questionnaire survey. Meanwhile, for university students, the survey was conducted on 636 undergraduate respondents ($n = 636$) from three public universities in Malaysia, namely Universiti Sains Malaysia, Universiti Malaya, and Universiti Teknologi MARA.

For the survey design, the main part of the questionnaire was divided into three parts; part 1 consisted of demographic questions and the respondents were asked to provide some personal information such as gender,

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state, education level, and the institution they are from. In part 2, the respondents were tested on their common knowledge about Antarctic using 20 basic questions concerning geography, biodiversity, and ecology. Most of the questions structures were comparison questions comparing the Antarctic region to the Arctic region. For example, the South Pole against the North Pole, polar bear against penguin, and tundra against desert. The score of common knowledge on Antarctic region was divided as follows: High knowledge (100% to 80%), Intermediate knowledge (79% to 40%), and Least knowledge (39% to 0%). The level of knowledge is important for research on public perception on environmental issues. According to Vignola and others (2013), clarifying the level of public knowledge of climate change has been a major theme of research on public perceptions of climate changes. Antarctic knowledge scale was constructed by adapting the research from Koske and Ochieng (2013) on the level of climate change awareness and perception among primary school teachers in Kisumu Municipality, Kenya.

Part 3 of the questionnaire was concerned with respondent's awareness about current issues in the Antarctic and their opinions about Malaysian involvement in Antarctica. Questions in this section addressed three of the key global issues affecting the Antarctic today and in the future such as mining activities, climate change and global warming, and diplomacy and international cooperation. Meanwhile, for the respondent's opinion, the questions were related to Malaysia's involvement in Antarctica and the way forward. The responses were measured using a 5-point Likert scale adapted from the research conducted by Utku Erzengin and Çetin Teke (2013) who studied the development of an environmental behaviour and attitude scale for university students, where 1 = *Strongly disagree*, 2 = *Disagree*, 3 = *Neither agree nor disagree,* 4 = *Agree*, and 5 = *Strongly agree*. Data were analysed using descriptive statistics and statistical analysis was performed with the aid of the SPSS software. Data were summarised using means and standard deviations for quantitative variables, and frequencies and percentages for qualitative variables.

Results and discussion

Details of demographic information have been captured in Table 1. This shows that the descriptive analysis involved 1,734 samples. In terms of gender of the school students, 46.9% were males and 53.1% were females. In terms of their school types, 52.2% of the school respondents were from boarding schools, while 47.8% of them were from day schools. In the case of university students, 36.8% were males and 63.2% were females. On their field of undergraduate studies, 50.9% of the respondents was studying science courses, while 49.1% studied in non-science courses. The results from this study provided a view of the perception of a miniature cross-section of a predominantly young and educated Malaysian population. Malaysia is a multiracial, multicultural and multireligion country with a population of about 30 million people. In that respect, the findings from this study provided some information on the views of Malaysian young citizens and how they might connect with the main objective of the Antarctic Treaty System (ATS) is to ensure:

> .... in the interests of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord.

Tin and others (2012) stated that since Antarctica is a global commons, the findings from the study on public opinion provide some unique information on the views of a small part of humankind, which can potentially benefit from the management of Antarctica. Thus, the respondents' views could be considered relevant information that represents the voice of young citizens in Malaysia about the Antarctic region and global environmental issues.

Literally, the roles of young citizens are important, particularly in shaping the direction and future of Malaysian involvement on the Antarctic regions. They constitute a key group that serves as feeder and 'potential human capital' for the development of national interest in the Antarctic in future. Particularly, young citizens are a part of the grassroots for the future development of national Antarctic programme; they are its building blocks, its foundations; and they drive its progress. This is why creating the best environment for local public development and encouraging good strategies are an integral part of a national agenda on Antarctica. In addition, engaging key groups at an early stage can help shape the development of the future national Antarctic agenda to make it more meaningful and useful to these groups. Kirk (2010) suggested that today's youth are going to be the policy and decision makers of the future. Hence, to understand the future resolution of environmental concerns, the effects of adolescent environmental attitudes, knowledge, and self-efficacy on environmental behaviors must be studied. Notably, the obtained results may help to identify future directions of formal education activities to improve the personal environmental responsibility of young citizen in Malaysia towards sustainability of the polar regions.

Based on the survey, a majority (more than 60%) of the respondents obtained information about the Antarctic region from the internet and print media (newspapers, magazines, and books). Notably, the media has high potential in successfully influencing public opinion and actions (McCombs 2002). Thus, to ensure a policy can be successfully implemented, the media needs to play a strong role to educate the public and create their awareness regarding sustainability issues of the polar regions, besides the government policy and expeditions of local scientists. Meanwhile, the research findings by the scientists on the polar regions should be widely covered by the local electronic and print media. The media also has the ability to influence public opinion and the ability to change public consciousness, making it a

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Table 1. Composition of survey samples

School students			University students		
Gender (%)	Male	46.9	Gender (%)	Male	36.8
	Female	53.1		Female	63.2
Type of school (%)	Boarding	52.2	Type of course (%)	Science	50.9
	Day	47.8		Non-science	49.1
Source of Information (%)					
Internet	Yes	68.2	Internet	Yes	88.4
	No	31.8		No	11.6
Newspaper/Magazine/ Book	Yes	68.5	Newspaper/magazine/ book	Yes	76.1
	No	31.5		No	23.9
Television/Radio	Yes	58.5	Television/radio	Yes	67.6
	No	41.5		No	42.4
Class	Yes	33.6	Lecture	Yes	35.7
	No	66.4		No	64.3

powerful tool that can persuade the public into taking appropriate actions (Azmi and others 2015). Instead of stressing that Malaysians are exploring the polar regions, the Malaysian government needs to emphasise its strong commitment to preserving them and finding solutions to global climate change through its scientific research in the region as a responsible and mature nation. In fact, what Malaysia seeks to gain from its Antarctic activities is to inspire Malaysians with not only the spirit of patriotism, but also the consciousness of global citizens.

Based on survey results, very few respondents agreed that classes (school students) and lectures (university students) have exposed them to the information on Antarctica: 34% and 36%, respectively. To date, formal teaching about the polar regions through the curriculum in the school syllabus and university courses in Malaysia is still lacking. For example, very few of the issues on polar regions have been taught in the school science syllabus; even then, the issues are related only to climate change and sea level rises. Meanwhile, at university level, the current polar regions studies focus on research activities. In view of Malaysia's position as a nonconsultative party in the Antarctic Treaty since 2011, and the possibility of achieving ATCP status in the near future, the Malaysian government and its educational institutions need to develop a framework of pedagogy with holistic insights to promote the roles of polar regions to ensure global sustainability through the national education curriculum among its young citizens.

In general, by providing knowledge and awareness about Antarctic values and making the public understand its role might contribute to inform it on the scientific and policy discussions of Malaysian involvement in the Antarctic region. Notably, knowledge and awareness about the polar regions can create a new understanding and respect from the young citizens for our planet. Besides, it can broaden the perspective about the earth as a global ecosystem. The results can become a part of the benchmark of Malaysian young generation's readiness toward achieving the Malaysia Vision 2020, to create a scientific and progressive young generation, able to think and be concerned about global issues. This is parallel with one of the challenges that Malaysia must overcome to achieve the Vision 2020; the establishment of a progressive society and become an innovative contributor to science and technology development of the future. Malaysia Vision 2020 is identified as providing an impetus for change, increasing Malaysian scientific interest in Antarctic (Tepper and Haward 2005) and the establishment of MARP is a big step toward the realisation of this goal. Table 2 shows the results of the survey on the level of general knowledge. The results showed that the general knowledge of young citizens in Malaysian schools and universities about the Antarctic region is intermediate (more than 60%). Meanwhile, approximately 30% of the respondents had a high level of knowledge, while 5.5% of them had least level of knowledge on Antarctic region. Surprisingly, most of respondents could not differentiate between the Antarctic and the Arctic about their geographical characteristics, biodiversity, and ecology. As mentioned previously, schools and universities in Malaysia are still lacking of the formal curriculum on polar regions. This brief definition and exploration about the knowledge level is not an indicator of unsuccessful dissemination of Malaysia's public policy on Antarctica among Malaysians. Nonetheless, the indicators of knowledge about the Antarctic region is well developed at the national level.

Table 2. Level of General Antarctic Knowledge Among School and University Students in Malaysia

Student	Least (%)	Intermediate (%)	High (%)
School	6.3	64.1	29.6
University	5.0	65.7	29.2

Meanwhile, the questions regarding the awareness level about Antarctic issues and challenges that were asked to young citizens were divided into three themes, namely mining activities, climate changes and global warming, and diplomacy and international cooperation. Research outcomes showed that respondents had high level of awareness about the Antarctic regions, especially issues related to climate change. The result in Table 3

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Table 3. Antarctic awareness and opinion on Malaysian involvement in Antarctica

Evaluation Survey	Strongly Disagree (%)	Disagree (%)	Neither agree nor disagree (%)	Agree (%)	Strongly Agree (%)	*n*	Mean	*SD*	*SE*
Awareness									
Antarctic continent is rich in mining resources which generate a lot of global interest.	27.9	18.2	33.1	12.9	7.9	1734	2.5	1.2	0.0
Mineral resources, oil and natural gas in the Antarctic region need to be mined.	29.4	22.1	29.8	13.4	5.3	1734	2.4	1.2	0.0
Climate change affects the Antarctic region.	8.0	8.5	20.5	26.6	36.4	1734	3.8	1.3	0.0
Global warming affects the process of melting of ice in the Antarctic region.	1.5	2.5	8.1	22.4	65.5	1734	4.5	0.9	0.0
Ice melt affects the sea level and coastal ecosystem.	1.4	2.5	10.0	27.8	58.3	1734	4.4	0.9	0.0
Ozone depletion affects the biodiversity and ecosystem of the Antarctic region.	1.5	3.6	14.2	27.6	53.1	1734	4.3	0.9	0.0
Antarctica is for Science and Peace.	2.7	5.0	24.0	34.0	34.4	1734	3.7	1.0	0.0
Antarctic region as a zone of “weapon-free,” “nuclear-free,” and “military-free.”	4.6	3.8	18.7	23.2	49.7	1734	3.7	1.1	0.0
International cooperation in Antarctic raised awareness to preserve the Antarctic region.	1.2	2.8	16.8	34.8	44.3	1734	4.2	0.9	0.0
Antarctica continent belongs to the global community and every country in the world has the right on Antarctica.	8.4	10.7	34.0	24.6	22.4	1734	3.7	1.2	0.0
MALAYSIA’S ANTARCTIC INVOLVEMENT									
1. Malaysia should be actively involved in the agenda of international cooperation and scientific research in the Antarctic.	1.7	2.5	19.7	41.2	34.8	1734	3.7	0.9	0.0
2. The active participation of Malaysia in Antarctic gives return in advancement of R&D.	1.6	5.0	23.4	34.3	35.8	1734	4.0	1.0	0.0
3. Young generation are interested to involve in the Antarctica educational visit.	1.7	3.2	14.8	35.5	44.8	1734	3.7	0.9	0.0
4. Antarctic education in school/university needs to be improved.	2.1	4.6	19.4	39.6	34.3	1734	3.7	1.0	0.0

showed that majority (46%, mean = 2.5, *SD* = 1.2) of respondents disagreed that the richness of mining resources being one of the factors for Antarctica receiving much global interest. In fact, Malaysia's keen interest in continuously sustaining its presence in the Antarctic was based on the quest for knowledge (science for science's sake) and this has been demonstrated through the works of the Ministry of Science, Technology, and Innovation (MOSTI) (Ebin 2013). MOSTI is the government agency responsible for Malaysia's overall interests in Antarctic region. Its responsibility is to ensure that the legislative and institutional frameworks are put in place to support the research interests of the nation. Moreover, according to the results, mining activities for mineral resources, oil and natural gas in Antarctica are currently not supported by the Malaysian young generation. More than 50% of the respondents (mean = 2.6, *SD* = 1.2) disagreed with any mining activities in Antarctica; however, it is not possible to know whether they will hold the same stance in the future. Currently, new evidence has emerged indicating that many countries are interested in exploiting Antarctica's minerals despite an international agreement (Madrid Protocol) preventing it (as discussed by Atkin (2015) and *The Sydney Morning Herald* 21 October 2013). Historically, the Madrid Protocol again fuelled Malaysia's optimism in helping to protect the Antarctic environment from the increasing threat of pollution and in prohibiting mining operations in Antarctica (Tepper and Haward, 2005). This has become a significant influence on Malaysia's public policy on Antarctica (Hamzah 2011). The Madrid Protocol provides a different path to Malaysia's Antarctica critics in 'Antarctica.' One again, the Madrid Protocol raised Malaysia's optimism, to be seen as helping to protect the Antarctic environment from the increasing threat of pollution (Chiang and others 2012). In the year 2048, the Madrid Protocol (signed in 1991 and enforced in 1998) which protects Antarctica from governments looking to drill and mine for its currently valuable resources will be put up for review. Therefore, Malaysia has developed a strategy to produce the apprentices with new talents in the field of policy, geopolitics, and international relation, regarding the polar regions for Malaysia to continue its 'legacy' in this forthcoming debate.

Respondents were asked about issues related to climate change and Antarctic region. The result showed that 63% of the respondents (mean = 3.8, *SD* = 1.3) believed that climate change affects the Antarctic region. Concurrently, respondents highly agreed that global warming leads to ice melting in the Antarctic. About 88% of the respondents agreed (mean = 4.5, *SD* = 0.9) with this fact. Besides, respondents showed high concern, with about 86% agreeing that excessive and consequent impact on ice melting can lead to a 'worrying' rise in global sea levels and coastal ecosystem problems (mean = 4.4, *SD* = 0.9). These results clearly showed that the majority of respondents were aware of and understood the interconnection between Antarctic region, climate change, and global sea level. They understood that global warming in the polar regions is likely to have major repercussions to the rest of the world. In fact, warming of the climate system is well-documented and is evident from increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising of global average sea levels (Solomon 2007). According to Awang and Hamid (2013), three main factors contributing to the rising seas are ocean thermal expansion; melting of the Greenland and Antarctica glaciers, and ice sheets; and changes in terrestrial storage, with ocean thermal expansion as the dominant factor. However, they stressed that new data on rates of deglaciation in Greenland and Antarctica suggest greater significance for glacial melt, and a possible revision of the upper-bound estimate for sea level rise in this century.

Furthermore, the survey results showed that 81% of the respondents (mean = 4.3, *SD* = 0.9) agreed that ozone depletion affects the biodiversity and ecosystem of the Antarctic region. Although climate change and ozone depletion issues are separate, they are indirectly connected in some interesting ways (Climatesight 2011). These findings validated the contention that there is indeed an increasing significant concern in the judgment of the young citizens in Malaysia about the issue of Antarctic region, climate change, and sea-level, and its possible impact on Malaysia's coastal ecosystem. In that regard, the respective department of the government, schools, and universities must take initiatives to increase their awareness about sustainability issues of Antarctic region at all levels of the public.

As a global commons, diplomacy and international cooperation are important elements to ensure the sustainability of the Antarctic region, as discussed by Kim (2014) and Berkman (2010). About 70% of the respondents (mean = 3.7) agreed with the statement 'Antarctica for science and peace' and 'Antarctic region is weapon-free, nuclear-free and military-free.' The findings fit well with Malaysia's foreign policy on Antarctica. For instance, Malaysia's foreign policy clearly calls for the Antarctic continent to be used for science and peace for the whole world, and that Antarctica should be used to promote 'disarmament, denuclearization,' and 'demilitarization.'

Meanwhile, 47% of the respondents (mean = 3.7, *SD* = 1.2) believed that Antarctica belongs to the global community and every country in the world has rights on Antarctica. This has been written in the official statement in Malaysia's foreign policy about the rights of Antarctica. The survey results also showed that almost half of the respondents disagreed and were unsure about the current situation. As of 2015, 51 countries have signed the Antarctic Treaty, which represents about 80% of the world's population. These countries have rich and varied cultural backgrounds.

Additionally, Table 3 shows that from the results of this survey, about 80% of the respondents believed that international cooperation in the Antarctic has raised

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awareness to preserve this region. This result reaffirms that the management and use of Antarctica should be conducted in accordance with the purposes and principles of the Charter of the United Nations. It must be in the interest of maintaining international peace and security, and promoting international cooperation for the benefit of humankind as a whole. This also reflects the need for concerted international cooperation to protect and safeguard Antarctica and its dependent ecosystems from external environmental disturbances for future generations (United Nations 1993).

Respondents in the survey were also invited to express their opinions on Malaysia' Antarctica involvement and future way forward. Young citizen`s opinions are crucial to build the way forward with a bright future, especially in the aspect of Malaysia's Antarctica participation. From this research, the opinion of young citizens on Malaysia`s participation in Antarctic region, which is related with the science programme and education has been identified. Generally, the respondents supported strongly Malaysia`s participation in Antarctic science. Based on the result, about 76% of the respondents (mean = 3.7, *SD* = 0.9) agreed that Malaysia should be actively involved in the agenda of international cooperation and scientific research in the Antarctic. Malaysia's scientific endeavour is facilitated by a number of bilateral scientific agreements with countries such as United Kingdom, Chile, New Zealand and Australia, that have kindly offered the use of their Antarctic logistic and facilities. This has reduced the cost of project implementation on Antarctic research (Abu Samah and others 2013).

Meanwhile, about 70% (mean = 4.0, *SD* = 1.0) agreed that Malaysia's active participation in the Antarctic has provided in return the advancement of research and development. In fact, the efforts in polar science have provided a strong foundation for international collaboration and the adoption of new research cultures among Malaysian scientists (Mat Zin and others 2008). The achievements and knowledge obtained from these programmes will be the basis of Malaysia's future economic development, publishing research papers, and obtaining patents. In particular, MOSTI Flagship Program 2013–2016 has approved the application of the polar research programme under the theme connectivity between equatorial, polar regions and climate change (Abu Samah and others 2013). The knowledge and new data obtained from this kind of research may be translated for further development and applications in various industries and contribute significantly to the wealth of knowledge and humanity in dealing with the tropical-polar connectivity in changing environment caused by global warming and climate change. These would be the prior steps toward industrial development. Consequently, this kind of knowledge may contribute to the development of Malaysia's knowledge-based economy which runs parallel with the new economic agenda of Malaysia.

Respondents were also asked about their interest to visit Antarctic and their opinion about Antarctic curriculum as way forward to strengthen Malaysia's involvement in Antarctica in the interest of education. Majority of respondents (80%, mean = 3.7, *SD* = 0.9) agreed and showed interest to participate in Antarctica educational visit. At this moment, no education visit has been conducted by Malaysia for school students because of many restricting factors such as logistics, funding, and stations. However, in 2015, for the first time this year, the collaboration between the Canadian-based 'Students on Ice' and the Sultan Mizan Antarctic Research Foundation (YPASM) sent four students and two teachers from Malaysia secondary schools to the Arctic for two weeks from 27 July to 10 August 2015. According to chief executive of YPASM, 'it is important to encourage young Malaysians to enter this line of research, not just in terms of capacity building. Where there is new blood, there will be new ideas' (*The Star* (Kuala Lumpur) 5 April 2015). Meanwhile, at university level, many postgraduate students have been sent to participate in scientific expedition to the Antarctica and Arctic. To date, no undergraduate student has participated in any polar regions education trips. Besides, it is noted that 74% (mean = 3.7, *SD* = 0.9) respondents agreed that curriculum related to the Antarctic region should be implemented at the school or the university level. The results showed that respondents are interested to learn about the Antarctic, such that they have suggested for Malaysia to improve the curriculum related to the Antarctic at the school and the university level. These might influence the national curriculum strategy to integrate the elements of the polar regions concept to develop better understanding and skills that may help students to become voters and decision-makers faced with socioscientific issues such as climate change. In particularly, Malaysia should move toward becoming a developed nation. Therefore, it requires young citizens to appreciate the roles of science and technology in the globalised world and how the key roles are played by this in handling issues of sustainability in the society, the environment, and the economy. In fact, McFadyen (2011) noted that the Antarctic continent has the potential to spark an array of learning that can foster awareness of students around the world and potentially drive local action in the issues of sustainability, citizenship, enterprise, and globalisation. This will benefit wider parts of the world, including Antarctica, for the future. Therefore, to move beyond, Malaysia necessarily needs for a national awareness policy strategy on polar regions that focuses on academia and teachers as key stakeholders in the education sector to ensure that knowledge and awareness about the polar regions are disseminated among the young citizens.

Conclusion

This study has shown that the knowledge and awareness of Malaysia's young citizens about Antarctic's value is well developed. On the other hand, the result also showed the positive and strong support from the young Malaysian citizens for Malaysia to strengthen the future involvement

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of the nation in the Antarctic region. Results from this study have provided a snapshot scenario of the future landscape of Malaysia's involvement in Antarctica and may contribute to the policy making process for Malaysian involvement. The outcome of this research will assist the policy makers to understand the overall perceived awareness of the younger citizens in Malaysia on the role of the Antarctic region and Malaysian involvement. On the other hand, this study offers decision makers insights regarding public knowledge, awareness and opinion regarding the polar regions that could potentially assist them to promote a greater awareness of climate change, global warming and sea-level rise issues and to gauge the public response related to policies and strategies regarding these issues. The researchers believe that these few ideas about this particular segment will assist them to introduce new initiatives to strengthen Malaysian young citizens' involvement in the polar regions.

Reccomendations

Public knowledge and awareness, especially in the global issue such as climate change, and rise of sea level can become a part of the elements that are necessary for Malaysians to gain an appreciation and interest in science at the global perspective. Thus, national polar governance and researchers have to contribute more of their energy and enthusiasm toward promoting the roles of the polar regions in terms of global sustainability, research activities, and scientific innovation to the local public especially for young citizens. Besides, the respective agencies, both local and private, need to circulate accurate and reliable information about the connection between the polar regions and climate change among the members of the society to create the initiative to face the challenges of sea level rises.

Malaysia needs to strengthen and sustain the bottom-up approach to ensure the deliverability of knowledge and awareness toward the local public regarding the roles of polar regions in global sustainability. A bottom-up approach such as through public engagements activities may provide the opportunity for the public to explore the polar region values, meaning of research, and shape the national polar agendas. Grimmette (2014) notes the effects of environmental education programmes on youths, to include creating environmental awareness, building a connection to the environment, and changing the perceptions youths have on the environment. In the case of young citizens, public engagement is an effective way of stimulating interest in subjects on the polar regions. It can also encourage them to consider polar careers in the future. In addition, engaging key groups at an early stage can help shape future the development of the national polar agenda so that it can be more meaningful and useful to these groups. The programme does not only highlight Malaysia's accomplishments in polar research, but also fosters love for knowledge and motivation among the next generation.

Malaysia needs to concentrate on building up its base of researchers. The growth of this base depends on Malaysian young citizens ensuring that Antarctica's legacy is sustained and strengthened in future. Effective ways of the bottom-up strategy in the context of education are needed as a part of national policy strategy on Antarctica to ensure public regard, appreciation, and understanding of the Antarctic region's role for peace, science and sustainable future improve. Notably, collaboration among various stakeholders such as government, schools and universities are important to strengthen this bottom-up strategy. Consequently, it will ensure the national interest in Antarctic is sustained. Furthermore, this will also strengthen the foundation needed to establish a science and technologically competent, dynamic, and innovative society for the future development of the Antarctic region.

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