

Science Diplomacy in Malaysia

Boon-Kwee Ng¹

Universiti Malaya / Head of Department (Associate Professor)

Mohd Zakwan Mohd Zabidi²

MIGHT–Malaysian Industry Government Group for High Technology / Senior Vice President

Abstract

This article explores Malaysia's proactive engagement in science diplomacy, highlighting its innovative approaches and significant contributions in various domains. The article begins by elucidating the concept of science diplomacy, emphasising its role in facilitating dialogue and collaboration between nations to address pressing global issues. It underscores the importance of integrating science and diplomacy to tackle challenges such as climate change, public health, and energy security. The Malaysian government has embarked on a journey of international engagement by sharing its scientific expertise, forging research collaborations, offering international scholarships, and hosting global events to attract talent from around the world. This can be observed in several science diplomacy events, including its responses to Southeast Asia's haze episodes and its role in the Roundtable on Sustainable Palm Oil (RSPO). Malaysia's scientists' involvement in Antarctic research and the historic mission of sending the first Malaysian astronaut to the International Space Station (ISS) also illustrate its diverse contributions to global science diplomacy. Malaysia's proactive approach to science diplomacy underscores its commitment to addressing global challenges and fostering international cooperation, and its engagement in various scientific domains showcases the importance of science diplomacy as a tool for building bridges between nations and advancing collective efforts for a better future.

1. Background

Science diplomacy is generally understood as the practice of forging consultations, dialogue, and communication between regional governments or groups to achieve common goals in resolving regional conflicts and pressing global issues (see Galluccio, 2021; Royal Society, 2010; Ruffini, 2020). Because science is perceived as a systematic process to understand natural phenomena, whereas diplomacy attempts to forge dialogue and

cooperation between countries and citizens, the integration of both disciplines into a region as a whole can be efficient in facing global challenges whilst taking every opportunity to advance humanity.

Aligned with wider foreign policy goals, science—which is perceived as value-free³—serves as a soft power or platform to promote peace, cooperation, and mutual understanding between nations with clear differences in political ideologies, cultural, geographical, and level of socio-economic development. In fact, the importance

¹ address: Department of Science and Technology, Faculty of Science, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

² address: Malaysian Industry-Government Group for High Technology (MIGHT), 63000 Cyberjaya, Malaysia

³ In this context, value-free can also be referred to as value-neutrality of science. Robert K. Merton, who is considered a father of modern sociology, established the ethical standards that guide scientific research and practice. He saw science as a self-regulating community of researchers governed by a distinctive ethos. In his famous Mertonian Norm, one of the main principles is 'disinterestedness'—scientists should be motivated purely by the desire to advance knowledge, not by personal gain or recognition.

of science diplomacy has been rising in recent years, which coincides with the shifting global landscape in the realm of science where the epicentre of global knowledge production is moving towards Asia. Additionally, the key global issues surrounding the global community are heavily science-related and technology-driven, for instance, climate change, public health, energy security, and cybersecurity.

Nestled in Southeast Asia, a region with vast biodiversity, Malaysia has the potential to collaborate with technology-driven economies from Asia, Europe, and the US (Boon-Kwee et al., 2016). As such, realising the importance of science diplomacy, or the need for establishing a global network and collaboration for science and technology progress in general, the Malaysian Government has embarked on a journey of international engagement by actively disseminating its scientific expertise, forging research collaborations, providing international scholarships, and organising international events that not only attract but also retain talents and minds from around the world. In this regard, from a case study on Malaysia's participation in science diplomacy, we will be able to obtain insights into the nation's notable achievements as well as gather valuable lessons and strategies that can motivate other nations with a similar context of development, particularly in their quest to develop their science diplomacy-related initiatives and programmes.

2. Malaysia and Science Diplomacy: An Overview

2.1 Innovation Progress and Policies

Nestled The Global Innovation Index (GII) 2022 ranks Malaysia at 36th place among 132 economies' innovation ecosystem performance. This makes Malaysia ranked 2nd in Southeast Asia (after Singapore) and 3rd among the upper-middle-income economies (after China and Bulgaria). (WIPO, 2022). Like other developing economies, Malaysia experienced a great challenge in sustaining its high investment in research and development (R&D). According to the National Survey of R&D in the year 2021, Malaysia's R&D intensity, which is measured in the percentage of Gross Expenditure on R&D (GERD) over Gross Domestic

Product (GDP), was recorded at 0.95 in the year 2020. In terms of the headcount of researchers per 10 thousand labour force, the figure recorded was 33.42, and this has been a downward trend since the year 2016. Obviously, these figures are far behind the expected goals set in the new National Science, Technology and Innovation Policy (NSTIP) 2021-2030 in which Malaysia should achieve 2.00% and 33.42 for R&D intensity and headcount of researchers per 10 thousand labour force, respectively. Consequently, Malaysia must explore the potential of attaining international support and collaborations as one of the key strategies to increase its science and technology progress.

In fact, the previous Malaysia's National Policy on Science, Technology and Innovation (NSTIP) 2013-2020 has already highlighted the importance of enhancing strategic international alliances in advancing R&D and commercialisation. This entails consolidating both local and global networks for collaborative research, establishing strategic alliances, and fostering business connections. This strategy is particularly relevant to a circumstance where Malaysia actively participates in numerous international organisations and various forums on both regional and global scales, e.g., the Association of Southeast Asian Nations (ASEAN), the Asia Pacific Economic Cooperation (APEC), the Organisation of Islamic Cooperation (OIC), the World Trade Organisation (WTO), and various entities within the United Nations (UN) (MOSTI, 2013).

For the first time, the new NSTIP 2021-2030 launched by the Ministry of Science, Technology and Innovation (MOSTI) in December 2020 explicitly mentions science diplomacy as the main strategy to enhance Malaysia's global prominence in the field of science, technology, innovation and economy (STIE), and it should be led by MOSTI, the Ministry of Investment, Trade and Industry (MITI), and the Ministry of Foreign Affairs (MoFA). Among the key strategies determined are:

- establishing international collaboration through scientific diplomacy in foreign policy to resolve STIE-related issues and promote the country globally;
- optimising international collaboration in improving the quality of education, funding of R&D, good governance, and more transparent policies;
- establishing domestic organisations to oversee the international STIE collaboration ecosystem;
- identifying priority sectors and resource allocation that can attract international STIE partners;

- streamlining the global network across the STIE supply chain via Malaysian Representative Offices; and
- stimulating commercialisation of local innovation, development of technology transfer and knowledge that contributes to the increase in the country's STIE capabilities (MOSTI, 2021).

2.2 Malaysia in International STI Cooperation

In the present day, STI has emerged as an essential instrument for harmonising a nation's social, economic, technological, and financial assets in achieving the Sustainable Development Goals (SDGs). This is exemplified in the context of vaccines, where advancements in vaccine science play a pivotal role in bolstering the diplomatic efforts of nations. For instance, with the emergence of several infectious diseases such as the Middle East Respiratory Syndrome (MERS), Ebola, and Zika, the Epidemic Preparedness Innovations (CEPI) was established as an international funding organisation. Launched in 2017, CEPI serves as a global alliance between public, private, and community organisations, aiming to develop vaccines to stop future epidemics. For example, in response to the emergence of various infectious diseases like the Middle East Respiratory Syndrome (MERS), Ebola, and Zika, CEPI functions as a worldwide coalition comprising public, private, and community organisations, with the goal of creating vaccines to combat future epidemics. In 2020, Malaysia contributed \$3 million to CEPI to assist CEPI's efforts in advancing the development of vaccines. As demonstrated by the COVID-19 pandemic mitigations, Malaysia's financial commitment would contribute to the support of CEPI's initiatives. Additionally, Malaysia has become a participant in COVAX—a global initiative jointly led by CEPI, Gavi (the Vaccine Alliance), and the World Health Organisation (WHO)—to ensure equitable global distributions of 2 billion doses of safe and effective COVID-19 vaccines by the end of 2021.

In fact, Malaysia's involvement in science diplomacy can be traced back to 1978 when the Malaysian Technical Cooperation Programme (MTCP) was established during the inaugural Commonwealth Heads of Government Meeting (CHOGM). The MTCP places a strong emphasis on nurturing human resources by offering training in diverse fields that are crucial for a nation's progress such as education,

investment, finance, governance, and poverty reduction. The Newton Ungku Omar Fund (NUOF) is another example for which Malaysia is in the global Newton Fund that aims to foster economic and social welfare development among the alliance economies through STI partnerships. The Malaysian Industry-Government Group for High Technology (MIGHT) is currently the central coordinating body that serves as a facilitator of eight ministries and agencies in Malaysia and a delivery partner of NUOF. MIGHT's counterparts in the UK include the Research Councils, national academies, the British Council, Innovate UK, and Met Office.

Malaysia was also involved in cross-border collaboration with Türkiye. In carrying out its mandate to strengthen the cooperation between Malaysia and Türkiye in STI, MIGHT was involved in implementing various programmes that aim to increase Malaysia's capability and capacity in high technology by using co-creation and collaboration as key strategies. To kickstart this programme, MIGHT has partnered with TÜBİTAK, a Turkish government agency that supports and conducts research and development activities in various fields. MIGHT and TÜBİTAK launched a call for COVID-19 Proposals on Post-Pandemic Impact on 23 November 2020 with education, food security, and emerging technology being the focus areas. The strategic intention of the collaboration is aimed at strengthening the STI collaboration between Malaysia and Türkiye and developing a product/innovation that will benefit people moving into the New Normal. Two projects were identified, and the bilateral transnational research has given out RM700,000 matching grants for each project for the duration of two years, as follows:

- “Smart Nanocrystal Enabled Light-Emitting Diodes Lighting for Sustainable Controlled Environment Agriculture”. Türkiye Partners: UNAM-Bilkent University and NANOME. Malaysian Partners: Xiamen University Malaysia and Kairos Agriculture Sdn Bhd

- “Battery-Less/Assist Technology for a Wearable Device in Health Care Monitoring Systems During Pandemic or Post-Pandemic of Covid-19,” Türkiye Partners: Izmir Katip Celebi University and INV Garden. Malaysian Partners: Universiti Malaya and INFINECS Sdn. Bhd.

MIGHT and TÜBİTAK then signed an MOU in July 2022 for a second call of the co-funding programme and launched it in August 2022. Accordingly, 84 proposals

were submitted, and these proposals are now in the midst of the reviewing process. The number of proposals has even doubled from the first call, and this shows not only a positive relationship between Malaysia and Türkiye but also a lot of benefits that can be harnessed from both countries.

Besides TUBITAK, the Malaysia-Türkiye (MY-TR) Technology Collaboration Programme has likewise been developed to co-design strategic and value-added technological programmes in the agreed focus areas, namely space, aerospace, maritime, and other associated industries. This programme involves improving capability and capacity building by leveraging each country's strengths, in addition to serving as a strategic platform to enhance existing and new bilateral projects. Turkish Aerospace (TUSAS) has also been selected as the launch industry partner for this programme, and the objective of this programme is to explore opportunities for co-creation between Malaysia and Türkiye in targeted technologies and products. The two strategic platforms identified for initial exploration are Unmanned Aerial Systems (UAS) and Space technology.

Furthermore, Malaysia is currently engaging with Spain for international cooperation through the Malaysia Spain Innovating Programme (MYSIP), which is an international matching grant to motivate market-oriented R&D between the two countries. Recently, a consortium of Malaysian industry players, academia, and Spanish industry partners has collaborated to work on a project entitled Innovative, Ecological and Low-Cost Solution for Organic Waste and Wastewater Treatment, which uses the black soldier flies to recycle organic waste in landfills. Specifically, the extracted chitosan from the black soldier flies will be used in the sewage treatment plants. This research project is particularly designed to achieve a circular economy and Sustainable Development Goals (SDG). The innovative industry-academic project is also expected to improve the operation system of organic waste management to make it more sustainable and environmentally friendly as well as to improve waste management policies in the country.

3. Science Diplomacy Events in Malaysia

As suggested by the Science Policy Centre of the Royal Society, science diplomacy takes place in three dimensions, namely science in diplomacy, diplomacy for science, and science for diplomacy (Royal Society, 2010)⁴. The following subsections provide examples of the science diplomacy events in relation to Malaysia and its international counterparts.

3.1 Malaysia's Responses to Southeast Asia's Haze Episodes

Southeast Asia's recurring haze crisis, which is mainly caused by land and forest fires, has led to multifaceted challenges to the region's environment, health, and economy in Malaysia, Indonesia, and Singapore. Since the early 1990s, haze in the region has reached alarming levels in a frequent manner with the 1997 and 2015 episodes being remembered as among the worst ever. In many occurrences, the Malaysian government was forced to declare an emergency in Sabah and Sarawak, including in the Peninsular of Malaysia, due to the hazardous levels of the air pollution index. The regional economic losses were also huge. For instance, the direct regional economic loss in the 1997 episode was estimated at US\$9 billion, while another report suggested that the 2015 episode had caused Indonesia approximately US\$16 billion in losses, which is about double the damage and losses inflicted by the 2004 tsunami. Not to forget the cost to human health and biodiversity; the figures would reach a stunning high if these losses can be quantified.⁵

Since the impacts of haze are borderless and have emerged as a critical regional issue, efforts to mitigate such impacts are complicated and require collective efforts and consensus among Malaysia, Indonesia, and Singapore, which are the three countries that were affected the most. In this regard, we witnessed the potential roles played by the scientists and diplomats to solve this repeating regional issue and at the same time avoid confrontation between the regional members.

⁴ Science in diplomacy aims to inform foreign policy objectives with scientific advice. Diplomacy for science facilitates international science cooperation. Science for diplomacy attempts to use science cooperation to improve international relations.

⁵ The study by scientists from Harvard University and Columbia University estimated 100,000 premature deaths from Indonesia's haze. See <https://www.nst.com.my/news/2016/09/174356/study-estimates-100000-premature-deaths-indonesia-haze>

Concomitantly, the Malaysian government has taken several active and pragmatic efforts, joining the regional committees, taskforces, and programmes that are aimed at forging productive collaborations and solving the regional crisis based on the spirit of ASEAN.

In 1997, the Regional Haze Action Plan (RHAP) was launched by ASEAN as a soft regulatory platform to prevent and mitigate the haze crisis. In general, the RHAP is driven by the spirit of volunteerism and no-fault findings, and it provides specialised assistance based on the proficiency of ASEAN member states (Florano, 2004). Subsequently, we witnessed a number of main events and programmes that have been introduced and implemented under the ASEAN setting in which Malaysia has allocated and contributed its resources to address the haze crisis in Southeast Asia. Listed below are selected key contributions of Malaysia:

- **ASEAN Agreement on Transboundary Haze Pollution (AATHP):** Together with Indonesia and Singapore, Malaysia signed the AATHP, which is a legally binding environmental agreement. The goal of AATHP is to tackle the transboundary haze pollution collectively. The AATHP is a regional collaborative platform in which all the signatories' countries are committed to preventing and controlling haze-causing fires, sharing information and technology, and offering help during haze emergencies.
- **Regional Haze Monitoring:** Malaysia shares its meteorological data, satellite imagery, and air quality information to track the movement of haze. This information-sharing is vital for early warning systems and coordinating responses to haze events. The system was developed by Singapore in October 2013 with a cost of US\$100,000 (Zengkun, 2013).
- **Firefighting Support:** Malaysia has provided firefighting assistance that includes firefighting teams, equipment, and aircraft to Indonesia during several haze episodes to control the spread of fires and mitigate the effects. For instance, Malaysia helped combat fires in Sumatra and Kalimantan in 1997 to bring the fires under control (Ram, 2019).⁶

3.2 Malaysia in Roundtable on Sustainable Palm Oil (RSPO)

Southeast Asia is the main world's producer of palm

oil. In response to the pressing worldwide call for the sustainable palm oil industry, RSPO was formed in 2004 with the Malaysian Palm Oil Association (MPOA) as one of the founding members. Together with plantation companies, palm oil traders, banks, and environmental non-governmental organisations, RSPO developed a set of sustainability standards for the palm oil industry to reduce the negative impact of the industry on the environment, wildlife, and local communities. In fact, unsustainable palm oil farming practices such as land clearance by burning are a major cause of forest and peatland fires in Southeast Asia, which eventually causes the regional haze crisis. This is clearly stated in RSPO principles—No Deforestation, No Peat, No Exploitation (NDPE). As one of the largest palm oil producers and exporters, Malaysia's active participation in RSPO is crucial for the sustainable development of the industry on a global scale. Since 2020, it has been mandatory for all Malaysian-produced palm oil products to obtain the Malaysia Sustainable Palm Oil (MSPO) certificate—the national level of sustainable palm oil standard in Malaysia, which was launched in 2013 (Bernama, 2023). Malaysia's participation in RSPO involves various stakeholders, including government agencies, palm oil producers, and NGOs. The Ministry of Plantation Industries and Commodities is the key ministry that plays a vital role in coordinating government policies and initiatives related to palm oil sustainability. The ministry develops and implements action plans and regulations that align with RSPO's sustainability standards. At the same time, government agencies provide technical support, guidance, and incentives to local palm oil companies applying for the RSPO certification.

3.3 Malaysian Scientists in Antarctic Research

Despite its extreme and remote environment, Antarctica is an attractive place for many countries for several reasons, especially in scientific exploration and biodiversity. Antarctica is a unique natural laboratory for scientific research, which offers a wide range of research activities in environmental science, astronomy, biology, and oceanography. It is also an excellent venue for eco-tourism, science education, and outreach programmes. Given the importance of preserving and safeguarding Antarctica, the Antarctic Treaty, which was

⁶ The portal—ASEAN Specialised Meteorological Centre (ASMC) is in Singapore and can be accessed at <http://asmc.asean.org>

signed on December 1, 2019, and enforced on June 23, 1961, serves as the main document to outline the essential principles for the peaceful use of Antarctica as a global commons. Besides providing key provisions on environmental protection and freedom of scientific research and cooperation in Antarctica, the document also prohibits military activities and territorial claims in Antarctica.

Malaysia's involvement in the diplomatic initiatives on the Antarctic began in 1983 by initiating a debate on the Question of Antarctica during the 38th United Nations General Assembly (UNGA), and the concerns on Antarctica and the Southern Ocean have been the main element of Malaysia foreign policy since 1984 (Shabudin et al., 2020). Besides, since 2011, Malaysia has become a non-consultative party of the Antarctic Treaty System (ATS). The ATS acts as an excellent example of the science diplomacy platform in which Malaysian scientists—whose Antarctic research is relatively limited compared to some other countries with more established and comprehensive Antarctic programmes—have the opportunity to join the Antarctica scientific explorations. In 2012, the Cabinet of Malaysia established the Sultan Mizan Antarctic Research Foundation under the purview of the Ministry of Science, Technology, Environment and Climate Change (MESTECC). In 2016, Malaysia hosted the Delegates Meeting and Open Science Conference on the Scientific Committee of Antarctic Research (SCAR), which was the first in Asian Country (Shabudin et al., 2020). Generally, the focus of research on the Antarctic by Malaysian scientists entails the fields of life, physical, and geosciences, as well as the national institutional and legal framework. The National Antarctic Research Centre (NARC) Malaysia, a research facility created under the Academy of Sciences Malaysia (ASM), houses the Malaysian Antarctic Research Programme (MARP), which oversees these projects (Goh et al., 2019).⁷

Although Malaysia has no permanent research facilities in Antarctica, Malaysian scientists and researchers have occasionally participated in research expeditions led by other organisations and countries such as the UK, Japan, and South Korea. In this context, science diplomacy

is perceived as a tool to reduce geo-political tensions and facilitate diplomatic negotiations. This enables the interested countries to concentrate on scientific collaborations rather than disputes.

3.4 First Malaysian Astronaut

The relationship with Russia reached a new high when the first Malaysian Astronaut was sent to the International Space Station (ISS) in a Soyuz spacecraft in 2007 (Saravanamuttu, 2012). This historical event was part of a diplomatic agreement and scientific collaboration between the Malaysian and Russian governments, facilitated by the Russian space agency—Roscosmos. The first Malaysian Astronaut project has since made space exploration a reality for Malaysia. As part of the Malaysian government's multi-billion-dollar purchase of 18 Russian Sukhoi Su-30MKM jet fighters, Roscosmos agreed to send one Malaysian to the ISS. Historically, the first Malaysian astronaut, Dr. Sheikh Muszaphar, who is also an orthopaedic surgeon, spent 10 days at the International Space Station (ISS) and conducted several scientific research (Landau, 2020).

In this Astronaut Programme (in Malay—Program Angkasawan), the National Space Agency under the purview of the Ministry of Science, Technology and Innovation was given the responsibility for selecting the candidates. The two candidates then received their intensive 18-month training under the Cosmonaut Training Programme in Star City, Russia. As a newcomer to international space research, the success of the programme has created awareness among Malaysians regarding the importance of science, technology, and the space industry to the country. Furthermore, this programme has revived the interest and enthusiasm of Malaysian society in space scientific research and industry, regardless of age (Zainuddin et al., 2019).

Although the programme received criticisms on its cost and long-term benefits to the country, the Astronaut Programme has, to some extent, created a spirit of national pride. Such a programme has potentially inspired young Malaysians to take up careers in science, technology, engineering, and mathematics (STEM) and

⁷ For excellent account on Malaysia's Antarctic research, please read: [1] Shabudin, A. F. A., Rahim, R. A., & Jamil, H. (2020). Evaluating governance of national Antarctic programme: Universities' role in influencing the evolution of Malaysia's engagement on cross-border research of the Antarctic. *Polar Science*, 24, 100527; and [2] Goh, H. C., Wahab, N. F. A., Alias, S. A., Yusof, K., & Komaruddin, A.T.M. (2019). The influence of Malaysia's involvement in Antarctica on the awareness of Antarctica and its values amongst Malaysian citizens in state capital cities. *Polar Science*, 20, 92-99.

provided a role model for students with a keen interest in space and scientific-related fields. Notably, it has also strengthened Malaysia's diplomatic relations with other countries engaged in space exploration and the international space community.

4. Moving Forward

Science diplomacy plays a crucial role in contemporary society, and it is imperative that all nations acknowledge the challenges in forging a strong science diplomacy. Strategies to tackle these challenges may differ from one country to another, shaped by the political and cultural contexts within each nation. As such, the strategies should also take into consideration the national systems for scientific advisory services that exhibit diversity and cater to distinct needs. Besides, since the organisational frameworks and methodologies for providing scientific advice in one country may not be directly transferable to another, it is essential to contemplate, at the outset of any advisory process, a model or structure that is the most appropriate in the national context.

Malaysia is among the few countries that established the post of Science Advisor in the government more than 39 years ago. One of the key roles includes prioritising and facilitating science to create wealth and provide job opportunities for the people. However, the challenge faced by science advisory bodies serving governments is how to effectively coordinate research endeavours and collectively address these issues while incorporating scientific insights alongside broader social, political, and economic perspectives. One critical point to underscore when developing an approach to international science advice is that it is a gradual process that cannot be accomplished overnight, as the progress must be incremental, step by step.

References

- Bernama (2023, August 25). RSPo helps smallholders market sustainable Palm Oil to the global market, *New Straits Times*, www.nst.com.my/news/nation/2023/08/947105/rspo-helps-smallholders-market-sustainable-palm-oil-global-market
- Boon-Kwee, N., Thiruchelvam, K., Chan-Yuan, W., & Chandran, V. (2016). Innovation for inclusive development in Southeast Asia: the roles of regional coordination mechanisms, *The Pacific Review*, 29(4), 573-602
- Florano, E. R. (2004). Regional environmental cooperation without tears or fear: The case of the ASEAN regional haze action plan, *International Environmental Governance Conference*, Paris
- Galluccio, M. (2021). *Science and Diplomacy: Negotiating Essential Alliances*, Springer Nature
- Goh, H. C., Wahab, N. F. A., Alias, S. A., Yusof, K., & Komaruddin, A. T. M. (2019). The influence of Malaysia's involvement in Antarctica on the awareness of Antarctica and its values amongst Malaysian citizens in state capital cities, *Polar Science*, 20, 92-99
- Landau, E. (2020, August 19). NST175: The doctor who went to space, *New Straits Time*, www.nst.com.my/news/nation/2020/08/617670/nst175-doctor-who-went-space
- MOSTI (2013). *National Science, Technology and Innovation Policy (NSTIP) 2013 – 2020*, Ministry of Science, Technology and Innovation
- MOSTI (2021). *National Science, Technology and Innovation Policy (NSTIP) 2021-2030*, Ministry of Science, Technology and Innovation
- National Research Council (2002). *Knowledge and Diplomacy: Science Advice in the United Nations System*, Washington, DC, The National Academies Press
- OECD (2015). *Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists*, OECD Science, Technology and Industry Policy Papers, No. 21, OECD Publishing, Paris, <https://doi.org/10.1787/5js3311jcpwb-en>
- Ram, B. S. (2019, September 9). Malaysia offers help to Indonesia to put out fires, *New Straits Times*, www.nst.com.my/news/nation/2019/09/519986/malaysia-offers-help-indonesia-put-out-fires
- Royal Society (2010). *New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power*, The Royal Society
- Ruffini, P.-B. (2020). Conceptualizing science diplomacy in the practitioner-driven literature: a critical review, *Humanities and Social Sciences*

Communications, 7(1), 1-9

- Saravanamuttu, J. (2012). Malaysia-Russia Relations: Revving up a Distant Relationship, In V. Sumsky, M. Hong, & A. Lugg (Eds.), ASEAN-Russia: Foundations and Future Prospects (pp. 184-195), Institute of Southeast Asian Studies
- Shabudin, A. F. A., Rahim, R. A., & Jamil, H. (2020). Evaluating governance of national Antarctic programme: Universities' role in influencing the evolution of Malaysia's engagement on cross-border research of the Antarctic, *Polar Science*, 24, 100527
- The Royal Society (2011). Knowledge, Networks and Nations: Global scientific collaboration in the

21st century, ISBN: 978-0-85403-890-9

- WIPO. (2022). Global Innovation Index 2022: What is the future of innovation-driven growth?, World Intellectual Property Organization
- Zainuddin, M. Z., Mohamad, N. S., Asillam, M. F., Mastor, M. Z. S., Hashim, M. H., & Radzi, Z. M. (2019). Space Science Education in Malaysia: A review based on performance improvement framework in complex systems, *ASM Science Journal*, 12(Sp. 2), 172-182
- Zengkun, F. (2013, October 9). Asean leaders approve haze monitoring system, *Straits Times*, www.straitstimes.com/singapore/asean-leaders-approve-haze-monitoring-system?itemid=771