OPEN SCIENCE FORUM FOR ASIA AND THE PACIFIC REGION 13 FEBRUARY 2020

Rapporteur report

Contents

1.0 Introduction

This forum was organised by the Academy to promote engagement and knowledge sharing among Asia Pacific countries by adopting the Open Science philosophy and provides an opportunity for Malaysia to learn the best practices on pursuing the Open Science agenda. This is also to chart the way forward for the Malaysia Open Science Platform (MOSP). The Malaysian Minister of Energy, Science, Technology, Environment, and Climate Change (MESTECC) through the Academy launched the MOSP in 2019. The platform was initiated in its efforts to enhance the national innovation ecosystem towards wealth creation and societal well-being. MOSP shall be a trusted platform that enables accessibility and sharing of research data, aligned with national priorities and international best practices to make Malaysia's research data as valuable national assets

The Academy of Science Malaysia (ASM) has been assigned an important role to lead the mission to develop the capacities among the research universities and government agencies and embedded them in the national intellectual infrastructure. In the future, MOSP is envisioned to be linked to other Open Science platforms globally. This digitally connected platform will be a channel for the industry to tap into the knowledge in the research space and enables open innovation.

2.0 Rationale

The world is in the throes of revolution where social, economic, and scientific landscapes have been reshaped by the tremendous information and knowledge generated, collected, analysed, and managed by the digital platforms.

A worldwide movement of 'Open Science' is being adopted by many in removing barriers to the free flow of knowledge across disciplines and regions as well as exploring the potential of this digital revolution, through the establishment of 'tools and platform' that provide supporting services. The idea captures a systemic change to the way science and research have been carried out for the last fifty years; shifting from the standard practices of publishing research results in scientific publications towards sharing and using all available knowledge at an earlier stage in the research process.

As a new approach to scientific process based on cooperative to work and a new way of disseminating knowledge, Open science commonly refers to efforts that make the output of publicly funded research more widely accessible by allowing all users, be it scientific community, the business sector or society to reuse the data, reproduce the research, and contribute back to all available knowledge of the research process. To address this global challenge of data deluge and knowledge tsunami in a collaborative manner, data needs to be FAIR (Findable, Accessible, Interoperable, and Reusable).

3.0 Objective

This forum aimed to promote engagement and knowledge sharing among Asia Pacific countries by adopting the Open Science philosophy. At the same time, it provides an opportunity for Malaysia to learn the best practices on pursuing Open Science agenda to accelerate economic growth

4.0 Welcoming remarks
By Professor Datuk Dr. Asma Ismail FASc
President, Academy Sciences Malaysia

In the last few decades, the nature of the investment has been gradually but significantly changing. The change isn't primarily about information technology but more about data. Data is now recognised as one of the most valuable assets in business through the open innovation concept that guides many decision-makers in deciding on a new product to launch, new initiatives to implement, and how to understand market trends. With this view, researchers must adapt to the change and start valuing our research data as an asset to be shared under this open science concept towards complementing the open innovation. As the research world becomes ever more connected, the volume of research data is only going to keep growing, and so does its potential, but it poses some key questions on how it is collected, stored, used, managed, and even valued.

The Academy studied a few open science platforms globally, CODATA, Australian National Data Service (ANDS), to best befit the model to be developed locally. We see the potential in developing our own open science platform after looking at our research landscape. We have been allocating around RM 17.6 billion in our research and development (R&D) funds since 2016, with more than 230,000 research papers indexed by Scopus with more than 1.7 million citations and more than 100 domestic patents filed between 2012 and 2018 involving 90,000 researchers in Malaysia.

With this landscape, and looking at the research data as an asset, and the potential to have more meaningful research collaboration, Academy of Sciences Malaysia mooted the idea to have the Malaysian Open Science Platform in 2019. The Academy of Sciences Malaysia has accomplished yet another milestone in charting Science, Technology, and Innovation (STI) forward with the Malaysian Open Science Platform (MOSP) being launched last year.

We hope that through this Open Science Forum for Asia and the Pacific Region, we can kick off the introduction and awareness among all stakeholders on the MOSP initiative. We also invited our distinguished experts from other economies to share their strategy, experience, and action plan of their initiative. I would like to welcome our keynote speaker today, Dr. Ismail Serageldin, Patron of ISC and Founder of Alexandria library and our panelists from CODATA, Australian National Data Service (ANDS), OECD, DiDi Chuxing Co. Ltd, and Wiley to share their experience and expertise towards planning and managing their Open Science initiative. Thank you for accepting our invitation and we appreciate your input and views on how Malaysia should strategize our action plan for MOSP.

The skills necessary for Open Science are identified and include; open access publishing, data management, and open data, enabling professional research conduct; citizen science. An overview of the current Open Science skills provision landscape is needed at all levels in Open Science. Providing Support for Open Science, including infrastructure, technical, legal, professional and implementational support from institutions

Career development for Open Science, such that Open Science activities are recognised by institutions as part of grant evaluation criteria, are accounted for in the recruitment and progression of researchers and are recognised and rewarded. Only through this policy, it will ensure open science initiative is well received and supported by the researchers.

The concept of open science, as it has emerged over the past several decades, is tightly linked with traditional scientific values and norms. At the same time, the digital revolution makes

possible restructuring of research practices and institutions built around the openness of publications, data, code, and other research products.

Open science is motivated by a number of actual and anticipated benefits. They include the availability of the results of publicly funded research to the public, as well as more reliable and efficient research. Openness also enables researchers to address entirely new questions and work across national and disciplinary boundaries. Open science supports expanded access to the research process itself through citizen science activities.

Despite the advantages and motivations for open science, significant barriers and limitations remain. These barriers and limitations include aspects of research culture and incentives that work against open science, insufficient infrastructure, resource constraints, disciplinary differences, policy and legal constraints, and lack of awareness.

As a concept, open science seems appealing. However, we must not forego the ethics and integrity of conducting open science. The issues that may arise from open science are plagiarism, cybercrime, and other scientific misconduct. The limit to which science should be open to the public should, therefore, be discussed among scientists and researchers, and the open science platform should be monitored and protected. Therefore, top-notch cybersecurity technology and highly trained cybersecurity personnel are required to monitor open science.

Moving forward, together through similar forums and workshops, a common guideline could be developed for open science initiatives for the Asia and Pacific region. The Academy believes that having the common guideline and policy, with effective collaboration, coordination and commitment, Asia and the Pacific region, will benefit from it and could create a more collaborative innovation ecosystem in the region. The Academy through the regional office of the International Science Council Regional Office of Asia Pacific has started this initiative. Undoubtedly, tomorrow will belong to those who are able to innovate the most with few resources.

5.0 Opening Remarks
By Datuk Ir. Dr. Siti Hamisah binti Tapsir
Secretary General, MESTECC

The mobility and availability of highly educated people have increased over the years. Strategic alliance and collaboration help us to create global solutions for global challenges, urging partners to make continuous contributions through international cooperation such as conferences, shared platforms, networks, and workshops. Open Science Forum is a good example to foster significant collaboration between economies. An international collaboration, in essence, plays a central role in representing an opportunity for all stakeholders, namely academia, government, and industry players.

UNESCO defines Open Science as the movement to make scientific research and data accessible to all. It includes practices such as publishing open scientific research, campaigning for open access, and generally making it easier to publish and communicate scientific knowledge. Additionally, it includes other ways to make science more transparent and accessible during the research process. This includes open notebook science, citizen science, and aspects of open source software and crowdfunded research projects. Open Science utilizes the prevalence of the Internet and associated digital tools to enable greater local and global research collaboration.

In 2019, the Ministry, through the Academy of Sciences Malaysia, initiated the Malaysian Open Science Platform (MOSP). It is hoped that through this platform, we can reinforce open scientific enquiry that promotes research quality and integrity through reproducibility,

transparency, and accountability, and it can also democratize science nationally and globally. The MOSP would like to learn the best practices from other open science platforms, especially in three areas, namely policy, capacity building, and infrastructure.

The Malaysian government is in the midst of creating the open data policy and act, and it is hoping that the umbrella policy could define policy needed under this Malaysian Open Science Platform. Among the national policy that was looking into, all publicly-funded research is required to make the data available in an institutional repository, link, and curate research information. The policy has to also govern the confidential and restricted data for national security, for example, the satellite data. Non-sensitive data would be open to the public. Hence, under the national policy, there is a need establish a national guideline that covers the governance, standards and incentive.

Science is moving towards greater openness in terms of not just data but also publications, computer code, and workflows. Yet, researchers who are learning to navigate the open-science arena face issues. Many scientists, especially early-career researchers who are building a publication record worry that sharing their data too early could lead to their getting scooped by a competitor. To support them, there is a need to train the data scientists and librarians to become the data curator. This will ensure the data is well curated so it should align with the Findable, Accessible, Interoperability and Reusability (FAIR) principle. There is a need to develop training programmes for these skills and it was targeted to train 200 librarians and data scientists that play the role of data curators for MOSP. It is hoped that through this forum, best practices from other economies can be shared and learned for us to have an effective national policy and guideline.

Every new initiative requires buy-in from the people. As such, the right people to drive this open science initiative is crucial. This includes students, researchers, policymakers, and industry players. It was hope that through the forum, a discussion on strategies that can be developed in promoting awareness and capacity building for open science can be carried.

Open Science is transformative to the research landscape, allowing research to be carried out with a high degree of transparency, collegiality, and research integrity. For open science to become a reality, researchers need to be highly skilled in their respective scientific disciplines to practice Open Science. The overarching goal is to ensure that open science skills become an integral and streamlined component of the standard education, training, and career development paths of researchers, and if possible, even at earlier career stages in schools and universities.

In 2015, the Malaysian government launched the National Internet of Things (IoT) roadmap to take the lead in accelerating IoT adoption in Malaysia. The idea is to re-energize our industry as a premier Internet of Things (IoT) development hub with IoT as a new source of economic growth. This is aligned with the 11th Malaysia Plan that identifies IoT as a key technology area in enhancing productivity, among others.

The world today is seamless due to the advancement of IoT. It opens doors for many new breakthroughs in science and technology. This includes paving the way for the development of open access initiatives, namely open science, open data, etc.

The current discourse around Open Science has tended to focus on the creation of new technological platforms and tools to facilitate the sharing and reuse of a wide range of research outputs. There is an assumption that once these new tools are in place, researchers and at times, members of the general public will be able to participate in the creation of scientific knowledge in more accessible and efficient ways. While many of these new tools have indeed assisted in the ease of collaboration through online spaces and mechanisms, the narrowness of how infrastructure is imagined by open science practitioners tends to put the use of

technology ahead of the issues that people are actually trying to solve, while failing to acknowledge the systemic constraints that exist within and between some communities.

Additionally, abuse of information technology and the rise of cybercrime such as hacking, phishing, identity theft, and fake news are among the challenges that are surfacing with the advancement of IT. As such, cybersecurity is fundamental to protect civil rights and intellectual property.

Together, important actors in local, national, and global innovation systems need to be included in this initiative. Commitments from researchers at the forefront to promote open science are important.

Government ministries must develop national strategies for open science, either as stand-alone strategic efforts or as part of broader open government agendas. These agendas help to define national- level strategic priorities that can be translated into concrete initiatives by other innovation system actors.

Research funding agencies are key actors in the promotion of open science efforts, as they are responsible for defining the mechanisms and requirements to benefit from grants and funding for research.

Universities and public research institutes should formulate their own policies to support open science initiatives. In addition, universities and higher education institutions may play a role in training students and researchers to develop the necessary skills to enable open science practices. Business Enterprise constitutes part of the demand for open access publications and data that they use to develop new products and services.

Libraries, repositories, and data centers are key actors and fundamental enablers of open science. Libraries need to adapt their role and to be active in the preservation, curation, publication, and dissemination of digital scientific materials in the form of publications, data and other research-related content. Libraries and repositories constitute the physical infrastructure that allows scientists to share, use and reuse the outcome of their work, and they have been essential in the creation of the open science movement.

Through this movement, academia, government, industry players and civil society can work together to find solutions to cross-cutting issues in socio-economy that we are facing today, environment, and climate change to ensure continued sustainable growth for the Asia-Pacific region.

A note, If we fail to plan, we plan to fail. All forum participants were urged to take this opportunity to gain knowledge on open science, as well as to build networks for the advancement of STI locally and internationally.

6.0 Keynote Speech: Open Science for Shared Prosperity

By Dr. Ismail Serageldin
Emeritus Librarian of Alexandria,
Founding Director of the Bibliotheca Alexandrina and
Patron of International Science Council (ISC)

Open science is now a movement to make scientific research, data, and dissemination accessible to all levels of an inquiring society, amateur or professional, which is made possible

by the digital revolution. There are six principles implied in open science namely, open data, open-source, open methodology, open peer review, open access, and open educational resources. There were many frameworks developed for Open Science such as free software for scientists, free and open source, public/private workflows, seamless integrations, and promotes collaboration. Practicing open science brings lots of benefits to the participants. Just to highlight a few, manage your project, archive your data, quickly share files, control access and collaboration, and supercharge your workflow.

Current global research landscape and Open Science

Open Science was already started in Africa; joining the global movement, they established the African Open Science Platform (AOSP). All these had become possible due to the greatness of the internet. The internet had made it possible to connect people worldwide at a speed of light. Today, we are working in the global system of science. Newly discovered knowledge can be disseminated overnight to different regions and countries. Living in a world of global interactions and age of connectivity, information is available at the fingertips.

When data are organised, it becomes information, and subsequently, it becomes knowledge, but not to forget that society needs wisdom. Global knowledge and global science work hand-in-hand and practice collaboratively and globally. This can come true only through openness, dialogue, and collaboration.

Data showed that their tremendous number of collaborations happened locally and internationally. Even the interaction between countries in scientific research (multinational research) and collaboration between scientists locally and internationally is increasing, and research is still largely led by the developed countries (global leaders in the advancement of science) as the research outputs and achievements are still largely contributed by developed countries. However, based on the statistics, among the developing countries, Malaysia appears to be an emerging leader in advancing science.

Developing countries are not among the global leaders in the advancement of science today. However, Malaysia showed its potential to be a leader in contributing significantly to R&D. In Asia Pacific, the MOSP must be the platform to start for this region, advance, and eventually expand globally.

The south-south collaboration was established to enhance research capacity—for example, Africa. But Africa needs a lot more in the age of open science and integrates the global tapestry of science. However, this will take a lot of effort. A typical successful example is The World Academy of Science (TWAS), established by the late Abdus Salam, which was started as the Third World Academy of Science.

The global south is part of the World of global science. To be a significant partner for global science and advance globally, we need to strengthen the north-south collaboration. Bringing the north and south together is one of the important keys to a successful collaboration. To do this, we must address the cultural difference between the north and south, and bridge the two cultures. The debate on bridging the two cultures has a long history and was started by the late C.P Snow in 1950. The two cultures topic was written as a book by C.P Snow entitled “The Two Cultures and The Scientific Revolution.”. One of the success stories to address the two cultures was the establishment of the International Science Council (ISC). The two cultures should not just link by, and bridge but should be interwoven together, collaborate in inter-disciplines.

Collaboration among academics to achieve scientific excellence is not enough. Science should also be integrated with society. Society needs the scientist to bring their output to

influence the policies and regulations. Collaboration, in some cases, can be built capacity but not all, especially the lagging ones. Capacity building for science, technology and innovation (STI) is crucial, and only if we are building capacity, then Science would fulfill its promise for effective transformation.

Transformation in Science, technology, and innovation:

Today, STI is experiencing an enormous transformation like we never see before, namely, (i) New Knowledge Revolution, (ii) Big Data & Internet Explosion, (iii) Social Connectivity, (iv) Evolutionary Programming, and (v) Artificial Intelligence (AI).

(i) The New Knowledge Revolution
- Shifting from knowledge in a book to internet as an interconnected knowledge base; other features of the knowledge revolution includes image and text, human and machine, complexity and chaos, computation and research, convergence and transformation between disciplines (transformation of research fields, e.g., Bioinformatics Nanotechnology), pluri-disciplinary
- shifting from the traditional view of the branches of science to a new map of knowledge with merging of natural science and social sciences and humanities and applied field (technology, education, law, etc.)

(ii) Big Data & Internet Explosion
- In 2007, it was estimated that the entire amount of knowledge was 256 exabytes.
- Today, the capacity of the Internet is increasing at a speed of >2 Exabytes per day.
- We are in the age of big data, and more change in the future is to be expected.
- Smartphone IP Traffic will overtake Global IP Traffic
- Big data privacy and cybersecurity should be the main focus
- It was predicted that the global IP traffic would increase nearly threefold over the next 5 years, smartphone traffic will exceed PC traffic in 2020 (30% of total traffic), all devices will be interconnected.

(iii) Social Connectivity
- The marriage of the internet and the mobile phone has changed everything and give rise to a new hyper-connected generation.
- It is changing the way of human communication.

(iv) Evolutionary Programming
- Increasing capacity of the internet enables more complex and complicated programming that lead to artificial intelligence (AI)

(v) Artificial Intelligence (AI)
- "AI is contributing to a transformation of society that is happening ten times faster and at 300 times the scale, or roughly 3,000 times the impact of the industrial revolution." The McKinsey Global Institute (Cited in the Economist 25 June 2016)
- The increasing labor cost and decreasing in robot price will one day reduce the need for a human in many industries.
- The new paradigm is that AI could handle more complex reality and enormous data
- Robots and AI enhances agriculture, medicine (surgery), art and music, etc. Robots are now learning to work alongside humans.
- One example would be IBM's Watson. Watson won Jeopardy over humans in 2011. It was then used to work for management decisions in a lung cancer treatment in New York (2013). 90% of the nurses at that time gave feedback that they will follow its guidance because it is always right.

In view of what robots can do, a survey done by PwC on US manufacturers finds that the manufacturers see robotic technology as generating new high-skilled jobs while at the same

time displacing workers. It was predicted that 35% of new job opportunities would be created, but only 28% replacement of workers. There were fears about robots replacing humans. From the other angle, robots will seduce us. We will invite them to our lives such as smart phones, driverless cars and many more.

Benefits and importance of Open Science:

The digital revolution helps open science. AI would be able to handle ever more complex reality and the enormous tsunami of big data. Open Science is a vital enabler for countries to minimize risks and maximise seizing opportunities. It also helps in maintaining the rigor and reliability of science, allows creativity integrating diverse data resources to address complex modern challenges. It also facilitates engaging with other societal actors as knowledge partners in tackling shared problems.

Open Science will be fundamental to the realization of the SDGs by making good use of data across disciplinary fields and countries. These can be achieved by defining desirable frameworks for data, i.e., FAIR and STREAM:

Findable	**S**overeignty
Accessible	**T**rusted
Interoperable	**R**eusability
Reusable	**E**xchangeability
	Actionable
	Measurability

There is also a need to bring data to the market as a public good. To do this, a data market infrastructure needs to be established with the corporation and networking from different stakeholders, i.e., exchanges, connectors, catalogs, brokers, and a trusted framework. Establishment of corporation and networks can be achieved by addressing the seven Strands, (i) creating a portal that could links websites, (ii) setting up network of computing facilities, (iii) software tools and advice on research data management, (iv) build a data science institute, (v) work on priority programmes, e.g., cities, disease, biosphere, agriculture, (vi) create a network for capacity building, and (vii) create a network for open science access and dialogue. However, we are competing with the dominance of the top tech companies and other commercial companies in dealing with data.

ISC believes that science is for the global public good. Working together there is so much that we can do for the whole generation and the World. But, the new world is being invented by a small number of Tech Giants. The capitalisation of some of the companies listed in the top 10 of the industry is even larger than some countries in the world. However, science and scientific knowledge must remain a global public good. This is the mission of the ISC as stated clearly in the ISC 2019-2021 action plan.

A common question often arises, can a group of well-meaning scientists compete with those who want a proprietary commercial future? The answer would be, “Yes.” The scientists respect IPR and patents but adhere to the principle where knowledge must remain available to all as a global public good. It was believed that increasing capabilities, access, and collaboration across the planet would benefit all of humanity. Our group may look small in size with limited resources and might face fierce competition, but we will surprise the world.

7.0 Dialogue: Open Science for Shared Prosperity in Asia and the Pacific

Moderator
Academician Professor Emerita Dato' Seri Dr. Malan Othman
Director, International Science Council (ISC) Regional Office for Asia and the Pacific

The dialogue session was moderated by Academician Professor Emerita Dato' Seri Dr. Malan Othman. She started the session by providing the rationale of organising the event. Malaysia as the host of APEC 2020, would like to take this opportunity to propose to APEC to adopt a positive position on open science and move the agenda through the formal structure of APEC including PPSTI. The Open Science forum was organised in conjunction with the PPSTI meeting held on 13 – 14 February 2020 at the Palm Garden, Putrajaya. In order to push the agenda forward, the Malaysia Open Science Platform (MOSP) Committee had successfully secured a slot to speak in the PPSTI meeting on the 14 February 2020 to inform the importance of Open Science. Through this forum, a forum statement will be finalised and presented at the PPSTI meeting on 14 Feb 2020.

7.1 Panel Session

Panel 1

Professor Dr. Barend Mons
President, Committee on Data of the ISC

Professor Dr. Barend Mons started with a statement that the machines and people have to continuously work together in the era of "the internet for social machines" and we shall make our data AI-ready. This statement is in line with the event's keynote speech delivered by Dr Ismail Serageldin. The meaning and practice of data sharing have evolved since its inception and it is no longer understands the way we know. Traditionally, data was shared by storing in a repository where the location was far, and the owner might lose control of the datasets. This gave rise to data privacy issues concerning the data owner. However, recent practice has changed. Data visiting is the common practice nowadays where data will stay where they are with full control by the data owner and the virtual machine "come" to the data and learn on the data.

As the senior author of the FAIR principle paper, he expressed that the summary of FAIR is "the machine knows what I mean.". There is a global consensus on FAIR digital objects which described the minimal standard that everyone should keep to make sure that the machine can operate independently on the data.

Numbers of false agreements were shared as follows:

(a) FAIR

There is a side context on FAIR and being FAIR on social sense. FAIR is about findable, accessible, interoperable, and reusable. The current practice hindered the reusability of the data due to the licensing condition. Thus, end machines are not able to reach and reuse the data. The goal of the "F", "A", and "I" in the FAIR principle is to make the data reusable by others, a very important principle for Open Science.

(b) STANDARD

There are lots of standards and vary in guiding principles to achieve FAIR.

(c) OPEN

Need to stop using the word “Open” because there are many conditions that make “open” impossible such as patient personal data. Therefore, FAIR would be more appropriate since the data are accessible under a well-defined condition. These conditions can be understanding by the human and machine. Verification criteria can be set before a dataset can be accessed.

FAIR is different from OPEN. Many people, e.g. researchers, pharma companies tend to shy away from OPEN data. However, when FAIR is used, buy-in increased due to the concept of “Accessibility”.

(d) Data Management

Data stewardship is preferred as compared to data management. It is important to keep the produced data in a longer period. Data management would only be able to address short term management plan (during the project period).

(e) Data sharing and data visiting

There are psychological barriers that needed to overcome. Virtual machines come to your data, asking politely what they can do with the data.

Lastly, data is not the new oil. Because oil is not renewable, but data is renewable, multiple when we share (like love). We must see the value of open science and open data. The concept is “as open as possible and close as necessary, accessible”.

Panel 2

Professor Dr. Shahbaz Khan
Director
Regional Science Bureau for Asia and the Pacific United Nations Educational, Scientific and Cultural Organization (UNESCO) Jakarta

Professor Dr. Shahbaz Khan started by stating that UNESCO is building a global consensus on Open Science by getting commitments from the Governments through inter-government processes. Open science is not a new initiative in UNESCO. Since 2011, UNESCO had started the open access discussion. This topic was discussed in (i) the 2011 UNESCO 36th session General Conference entitled UNESCO Strategy on Open Access to scientific information and research, and (ii) the 2017 UNESCO 39th session General Conference entitled UNESCO recommendation on Science and Scientific Researchers. The two discussions had led to a study of the technical, financial, and legal aspects of the desirability of a UNESCO recommendation on Open Science.

Open Science at the service of SDGs, pressing planetary and socio-economic challenges, sustainable and innovative solutions require an efficient, transparent and vibrant scientific community not only stemming from scientists but from the whole of society, living no one behind.

Open Science allows scientific information, data, and outputs to be more widely accessible (Open Access) and more reliably harnessed (Open Data) with the active engagement of all the stakeholders especially the Society. Data are open to Society by making science more

connected to societal needs and by promoting equal opportunities for all (scientists, policy-makers and citizens). Thus, can be a true game-changer in bridging the science, technology, and innovation gaps between and within countries and fulfilling the human right to science.

Professor Shahbaz also explains what are the needs of Science, Technology and Innovation nowadays. It needed (i) for data, information, knowledge, technologies, (ii) for evidence-based decisions and policies, (iii) for global STI standards and governance, and (iv) to close the STI gaps. We need commitments to form the highest authority in order to address the above mentioned needs.

Open Science embodies the movement to transform and democratize the entire scientific process to ensure that science truly drives and enables the achievement of the United Nations Sustainable Development Goals for the benefits of all.

Is it time for us to answer “How to realise open science, open data, and leaving no one behind?”? No, the question now is no longer on whether Open Science is happening, but rather how everyone can contribute and benefit from the movement.

However, in the fragmented scientific and policy environment, a global understanding of the meaning, opportunities, and challenges of Open Science is still missing. That is why, at the UNESCO 40th General Conference, 193 Members States tasked UNESCO to develop an international standard-setting instrument on Open Science in the form of a UNESCO Recommendation on Open Science and credible way forward.

UNESCO had prepared the inclusive UNESCO recommendations to address questions such as (i) how to ensure proper awareness and understanding of open science, (ii) how to develop a multi-stakeholder approach for an Open Science Scientific Committee, and (iii) how to lead the World into this big challenge of Open Science and Open Data.

Briefly, the inclusive UNESCO Recommendation aimed at building a global consensus on Open Science**,** the development of the UNESCO Recommendation on Open Science will rely on an inclusive, transparent and consultative process involving all countries and all stakeholders. The Recommendation is expected to define shared values and principles for Open Science and point to concrete measures on Open Access and Open Data with proposals for action to bring citizens closer to science, and commitments for better distribution and production of science in the world. During the two years of consultations, UNESCO will support and open debate on Open Science awareness, understanding and policy development, leading to the adoption of the Recommendation by the UNESCO Member States in 2021. Guided by a multi-stakeholder Open Science Advisory Committee, the process will be supported by a global comprehensive Open Science Partnership and will lead to the development of a vibrant Open Science community of practice across the world.

Professor Shahbaz shared the Global roadmap of the recommendation on Open Science, from the creation of awareness to the development of a transparent framework. The adoption of the Recommendation was scheduled to happen in November 2021 by the Member States.

In conclusion, Professor Shahbaz emphasis that the real challenge in Open Science was not the Science and Scientists who take part, but how do we provide a global legal basis for Open Science and how to take it to global and recognise properly.

Panel 3

Dr. Ross Wilkinson
Former Executive Director
Australian National Data Service (ANDS)

Dr. Wilkinson had an opinion that this is about getting the best partner for moving the Open Science initiative. In the Australian context, partnership was obviously better than competition. The next question, where your partner is and how do you, partner, with then either within and outside the country?

Let us start with internal partnership development. All stakeholders i.e. the Government, industries, Universities, researchers, and potential funding bodies got to sit together and develop a national consensus. A quality collaboration from all stakeholders is important as Open Science can't be done by individual or a single entity i.e. policymaker. It was suggested that Malaysia Open Science develop a consensus within the Malaysian context and quality partnership among the stakeholders for the success of the movement.

The second point made by Dr. Wilkinson was on the quality and quantity of data. As per the keynote Speaker, the Exabyte of data was created daily. However, there was no information on the quality of data that was created. Now, how to preserve quality in Open Science is important to be acknowledged.

The third point was thought versus action. Dr. Wilkinson advised that Malaysia should get started early, and it is found to fail. As per Australian, there was a study carried out national wide and asking what was the value of having open data in Australia economy? The Economists said that somewhere between 1.3 – 6 billion Australian dollars were invested. The converse was even scary for not being Open as it risk to irreproducible research. Half of the major areas within Medical Science were not reproducible and cost billions of dollars.

Lastly, the identification of international partners was important too. A good partnership strategy and how to sustain partnerships are essential to success.

Panel 4

Mr. Simon Goudie
Co-Chair
Research Data Alliance
Data Policy Standardisation & Implementation Interest Group
Senior Journal Publishing Manager, Wiley

Mr. Simon shared Wiley's Open access, Open Collaboration, Open Data, Open Practices, and Open Recognition and reward. Briefly:

- Open access is built on the principle that the world's knowledge is more powerful when it is shared. Research and data must be available, so other researchers, professionals, and the public can use it to do real good in the world.
- Open collaboration discussed collaboration amongst researchers. Research is becoming more collaborative. Researchers work together across disciplines to find solutions to global challenges, and we are working with the best minds at the best organizations to deliver exciting new tools and solutions that make this easier. Wiley provides platforms for content sharing and getting in touch with collaborators. Facilitate collaboration among authors.
- Open practices addressed transparency in the publishing process. Transparency is key especially in peer view, to maintain the quality of data.
- Open recognition and reward stressed the need to address the credit to researchers for their data which could make Open Science sustainable. The research community is constantly under pressure to demonstrate its impact. The publication is a cornerstone of this impact, which means we need to ensure there are tools and programmes to capture that work easily so researchers can get credit for their work.

The Research Data Alliance (RDA) had formed a data policy and standardization interest group where Mr. Simon was one of the Co-chairs in 2019. The Co-chairs were across different publishers. The group was started due to the lack of consistency in research data policy and practices among the different publishers. This had created a lot of confusion among the authors. By consolidating all the different policies and practices, it makes easier for authors, researchers, and funders to understand the requirements.

The objectives of the interest group are as follows:

- Define common frameworks
- Identify priority areas
- Provide guidance and facilitate a greater understanding of research data policies
- Increase adoption of standardised research data policies

The interest group had prepared a framework from 14 journal research data policy features arranged as 6 policy types or tiers. The details of the policy can be varied depending on the tier of the policy. A summary of items that can be described within the policy are:

1. Exceptions to policy
2. Embargoes
3. Supplementary materials
4. Data repositories
5. Data citation
6. Researcher/ author support
7. Data availability statements
8. Data formats and standards
9. Mandatory data sharing
10. Peer review of data
11. Data management plan

A journal can easily form a policy from the designed framework. The final step was the implementation and adoption of plans by the publishers, universities.

Lastly, collaboration with other initiatives, RDA looks forward to (i) FAIR Sharing of data, (ii) Data availability statement standardisation, and (iii) funder policy standardisation.

7.2 Q&A Session

There were 8 questions posed as follows:

1. If not “OPEN”, what can be used?
2. How to come to an international standard-setting? And how private sector sees it?
3. Tangible benefits of OPEN science. What wouldn’t happen if not having Open Science? What are the unexpected benefits?
4. Trust framework in open science, how federation plays a role in open science?
5. How to address issues like missing stakeholders/reluctant to Open Science?
6. How to reward people who practice Open Science?

Q1. If not “OPEN”, what can be used?

Professor Barend Mons emphasis that “OPEN” can be used but in a well-defined condition to avoid wrong and different connotations as there were more than 200 definitions on the internet.

It should include FAIR where people and machines can find the data, access it, interoperate , and finally reuse it. However, the “A” of FAIR was always under-defined, and scientists turn against Open Science as they were concern about the loss of their intellectual property and no reward on their sharing. Therefore, it is very important to emphasize that under open science, all data must be as open as possible and as close as necessary. Funding bodies play a very important role in the implementation of Open Science. In Europe, the funders had to make compulsory for those who obtain public funding to make their data open. Otherwise, strong justification must be provided in the data management plan on why the data should not be opened.

Dr. Ross Wilkinson thinks that getting the intent right is important. A clear intent would enable the researcher to practice open science confidently. Creating a platform to address “as open as possible and as close as necessary” is relatively more attractive for researchers.

Dr. Ismail Serageldin emphasis that open science is for the public good. He quoted Adam Smith in 1776, published a book entitled the wealth of nation. Adam defined public and private good; private good is excludable, and the public good is non-excludable. This had related to who should financially support matters related to the public good. In this case, if Open Science was meant for the public good, the public authorities like the Public Government will be the one who pays the implementation of Open Science for the public good.

Q2. How to come to an international standard-setting? And how private sector sees it?

Professor Shahbaz stressed that a Standard is important as a basic guideline and can be approached from the consensus of a nation. Standard can address many issues such as investment and answer to many questions such as what is the definition of Open Science, what is the consensus at the level of the nation, and what should be the mechanism for implementation of Open Science. It is possible to set a Standard for Open Science. The criteria for its success would be the collaboration of all related stakeholders and experts from the relevant field of expertise such as finance, legal, and subject matter experts. The discussion should come to the level of principle by using a constructive ambiguity approach to encourage positive dialogue on the subject matter and progress. A Standard should also address equality in accessing knowledge, information, and data regardless of age, race, and nationality.

Mr. Simon Goudie shared that the publishing industry can contribute by standardizing policies and guidelines in relation to research data of the publications. The standardization of policy is ongoing, as presented earlier. Rising awareness among the journals under the care of Willey was another initiative that is currently ongoing. The initiative was focused on data publications and linking and encouraging the use of data availability statement. Aligning the publishing policy with the funding bodies' policy is essential. Consistency, in this case, is very important. However, flexibility in data management must not be forgotten for the transdisciplinary type of research works. There are different expectations across the disciplines.

Dr. Ross Wilkinson thinks that in the world of the internet, agreements and standards would work well: “You shouldn’t try to standardise what you can agree, and you don’t just agree with the standards.”. Questions that need to be addressed are:

1) How fast you need to go and on what?
2) What are the basic rights in the context?
3) Where and who do you need to get the agreement?
4) What do you need to agree with?
5) Where do you need standards?
6) How do you go through that process?

Q3. Tangible benefits of OPEN science. What wouldn't happen if not having Open Science? What are the unexpected benefits?

Dr. Ross Wilkinson shared an example of work by CSIRO on a project called PULSAR research. The astronomic data of the PULSAR work were made accessible. This move was led to a collaboration with a group of Chinese researchers who also work on PULSAR research, which brings in lots of investment from China. This data was also discovered by the school teacher in Queensland, Australia, and taught classes around it. Now, the public benefited from the shared research data, which was not planned in the first place.

Professor Barend Wilkinson shared two more examples, (i) the data that London city makes available which led to many applications were built around it and enhance the efficiency of transport in the city; (ii) Another one was the control of Ebola epidemic in Africa. All the related data collected went to the donors, and the African cannot even access the data. FAIR wasn't applied in this case. All the data was not findable, accessible, and thus not reusable.

Q4. Trust framework in open science, how federation plays a role in open science

Dr. Ross Wilkinson believes that trust is vital in the open and sharing of research data. Information on who is using and how the shared data is being used is important. Data sharing has the element of the partnership; thus, a requirement to cite the data is a must. The infrastructure that needs to put in place must be able to support trust. Apart from infrastructure, investment in the partnership, time, and relationship is vital. These investments would lead to a larger impact, such as the example given earlier in CSIRO.

Professor Shahbaz added that sharing space data has increasingly important in the last 2 years, particularly in remote sensing, open GIS. This had enabled the World to do works/things that we were never able to do before this. For example, UNESCO promoted a global cloud monitoring system that helps in developing the capacity of many countries, such as those in the Africa region.

Q5. How to address issues like missing stakeholders/reluctant to Open Science?

Professor Barend Wilkinson shared that big data nowadays is not a big issue but complex data. The data stewardship will be across different disciplines. How to make the data interoperable within the different disciplines is a challenge that needs to be addressed. He also shared that although getting stakeholders buy-in is a challenge, his experience told him that the industries are moving faster towards open science than the public sector. Lots of industries, especially the pharma companies, had started to make their data FAIR. In other words, FAIR is the key to engage stakeholders.

Dr. Ross Wilkinson believes that trust was the largest obstacle in open science, especially researchers. The researcher does not trust that they will be benefiting by practicing open science.

Q6. How to reward people who practice Open Science?

Professor Datuk Dr. Asma Ismail shared that the University management could assist in rewarding their researcher by aligning the KPI and promotion criteria with the Open Science policy.

Professor Barend Wilkinson stressed that the traditional performance evaluation criteria such as the impact factor of the journal must be changed. Judging the researchers with the journal impact factor and quantity of publications will hinder Open Science tremendously

8.0 Adoption of Forum Statement

Moderator
Academician Professor Emerita Dato' Seri Dr. Malan Othman
Director, International Science Council (ISC) Regional Office for Asia and the Pacific

The final version of the Forum Statement is as follow:

On the occasion of the 15th APEC Policy Partnership on Science, Technology and Innovation Meeting that supports the development of science and technology cooperation and policy recommendations in the Asia Pacific region, the Open Science Forum for Asia and the Pacific was convened on 13 February 2020 and issued the following joint statement:

The Policy Statement on Science, Technology and Innovation Communication endorsed by the 2017 APEC PPSTI-10 in Vietnam recognized the importance of open science and open access and the need to set clear policies that will help increase the returns from public and private investment, reinforcing open scientific inquiry and promoting research in new areas, which can have regional and global benefits.

Open Science represents an approach to the scientific process based on cooperative work and new ways of disseminating knowledge by using digital technologies and new collaborative tools. The idea captures a systemic change to the way science and research will be carried out in the future, shifting from the standard practices of publishing research results solely in scientific publications towards sharing and using all available research assets through the research process.

Open Science does not require that all data are fully open access. They should be available under well-defined conditions, and we support the FAIR guiding principles, rendering data Findable, Accessible, Interoperable, and Reusable.

Pursuant to this, we recognize that Open Science can play a vital role in fostering sustainable and inclusive socio-economic growth and development, bringing with it the full benefit of innovation which can best be realized by increasing public and private involvement in open science and collaboration amongst countries of the Asia and the Pacific region.

Additionally, we recognize that Open Science would enable seamless access to data and provide interoperable services for the research data cycle, including discovery, mining, storage, management, analysis, and reuse across borders and scientific disciplines.
Therefore, we call on all countries and stakeholders of Asia and the Pacific to support Open Science with the aim to make data-intensive science as a fundamental resource to address national and regional challenges and to advocate for Open Science in fostering sustainable, innovative, and inclusive socio-economic growth.

9.0 Working Session

Moderator
Dr. Ross Wilkinson
Former Executive Director
Australian National Data Service (ANDS)

This session is divided into three sections to discuss three different important topics for Open Science, namely, policy, infrastructure, and capacity building and awareness.

9.1 Policy

Panel 1
Professor Dr Barend Mons
President, Committee on Data of the ISC

Professor Dr. Barend starts the session by sharing the Sin of Open Science: (i) age factors, (ii) people ignore complexity and existing data, (iii) disrespecting other disciplines, (iv) publish without supplementary data, (v) poor data quality for machine, (vi) infrastructure investment and (vii) no data stewardship plan. Therefore, the vision for data fundament is on 4 focuses: i) laws and ethics, ii) FAIR usage, iii) IT infrastructure architecture, and iv) DCC-Data stewardship. One must be remembered that data-intensive science needs the classical human to human (H2H) communication, Human to Machine (H2M), and Machine to Human (M2H). But not forgetting the crucial one, Machine to Machine (M2M) communication. For the latter, Fair Digital Object (FDO) is needed where when the computer encounter digital object, it will know what to do with it and what he can do with it (controlled), and these will also serve H2M, M2H and finally also H2H communication (data, results, insights, etc.).

Some data is not being used in the regions only as science is a global topic, and it should be internationally available. The process should start from the bottom at the institutional level where it is recommended that 1 data steward will manage at least 20 Data Stewardship Competence Centres (DSCC) and form the Data Stewardship Competence Centre Hub where the connection is made to the domain for Inter-institutional DSCC. The Inter-institutional DSCC is then contributing/connected to the national level and by contributing/linking the open data to the 'Federating Core' and linking it to the Open Source Platform regionally or internationally.

By forming the DSCC, it will automatically drive the forming of the Open Science Platform. It is also envisioned that creolization will happen with minimal standards set so that there will be more voluntary participation in the Open Science Initiatives.

Internationally, there are 4 agencies involved in the Open Science Initiative:

i) CODATA – supporting the development of data and protocol agreements;
ii) RDA – Setting international research data and protocol agreement & standards ;
iii) GO FAIR – Agreements and joint implementations for fair data and
iv) ICSU-WDS – Long term access to data services, products & info.

It is also important to get the global consensus on the FAIR usage of data, especially on what the machine should know what can be done and what should be done with data. The basic idea of the `internet of FAIR data and services/hourglass model should ideally be the guiding principle forming the Open Science Platform. Regional clouds have to come together and work together for the Global Open Science Initiative, and Asia should be one of the important members. MOSP can be part of the regional cloud.

Panel 2
Dr. Michael Keenan
Organisation for Economic Cooperation and Development (OECD)

Dr. Michael Keenan started his talk by showing a few reports published by OECD in the past. The Organisation for Economic Co-operation and Development (OECD), in its recent policy report entitled Making Open Science a Reality published in 2015, mapped the open science landscape and shared case studies on open science policies. In 2020 the OECD included digital skills for data-intensive science, and in 2021 they will do the revision to recommendation on enhanced access to research data.

OECD Principles and Guidelines for access to research data from public funding was adopted in 2006 with the aim to improve international data sharing and access abiding with the laws and regulations.

Ongoing digital skills project maps what skills are needed and how to fill the gaps, education, and training of data scientists and rewarding data scientists. Now, OECD is looking at filling in the digital skills analysis framework. The framework looks at various roles of data skills and role in data ecosystem (management, access, analysis, etc). This extends and deepens the FAIR principle.

Universities, funders, government, and networks should come together and build the eco-system for digital skill networks via descriptive measurement on the landscape and policy we have in the nation via mixed-method or survey followed by analysis and inform other countries and policymakers on the analysis result.

A survey result from 2018 showed that much data isn't being shared. The respondents were also asked about the barriers that were limiting them from sharing their data. The main barriers were cost, ethics, privacy, IP, and formal sharing requirements.

The latest OECD on Digitalisation of science and innovation policy (DSIP) Project aimed to policymakers makers and researchers with the means to make an informed assessment of the transformational potential and possible pitfalls of the use of digital tools and sources in science and innovation policy-making design an informed assessment of data sharing. A system similar to the open science platform was created from the study.

Dr. Michael summarised a few common issues in implementing and using of the DSIP systems that could be a lesson to learn for the MOSP as follows:

1. Access to quality data
2. Sustainable funding
3. Data interoperability
4. Lack of coordination
5. Skills ad organizational capabilities
6. Private sector roles
7. Realistic expectations of use
8. Responsible use of data

There were 3 questions for the panels:

1. How do we overcome the issues on proper/good data without the influence of geographical bias in policymaking?
2. Problem with open science for Malaysia researcher is on the IP issues, could you comment on that?
3. The need for the Data Steward is very difficult to be created in Malaysia as it involves new positions/professions.

4. Research manager, not a profession, in future maybe research steward will come true, EU open science challenge is on standardizing the different policies. Malaysia has no open science policy to refer, but we have some guidelines related to it, like open access, etc. How do we start from here?

Professor Dr. Barend Mons believes that there is no technical barrier if it is related to the internet. Unless it is political bias as political will/is the one does not want to expose/review it. It's also true with social barriers and not technical barriers. As per IP, he thinks that IP is something of the past. The mindset on IP is still important is over. It is now about open data and the only way for rapid growth. Trying to keep things secret is not a wise move in the current modern world. Who owns the data is not important; who is responsible for the data is more important.

Dr. Ross added that the question should fall on who has responsibility to the data and not who owns the data as responsibility comes with obligations. As per the talent for stewardship, he believes that it depends, and in reality, retrain the current librarian for human talents is one possible move.

Professor Dr. Barend Mons shared that in the process of building the Data Stewardship Centre, they need about 60 talents, but 40 were actually trained from the current staff we have in the institution.

Dr. Michael Keenan shared that there are more than 300 policies internationally on the open policy. Malaysia will need fundamental and systematic changes in the process of developing open science policy.

9.2 Infrastructure

Panel 1
Mr. Simon Goudie
Co-Chair
Research Data Alliance
Data Policy Standardisation & Implementation Interest Group
Senior Journal Publishing Manager, Wiley

Mr. Simon started by putting an opinion that on Infrastructure such as repository are largely publically supported. In this forum, many discussions had focused on public aspects such as publically funded infrastructure, and its role would come in the near future. However, the practice and the view of private or industry could also be explored. The industry could give good insight regarding the time and nature of a commercial operation. This could lead to potential public-private infrastructure projects.

Panel 2
Mr. Leju Ma
Director of Government Affairs
DiDi Chuxing Co. Ltd

Mr. Ma shared that the company developed its business and expanding its market based on the idea of sharing. They are working together with universities, research institutes, and leading industries to develop their business, sharing data with collaborators and stakeholders.

Besides working within China, DIDI Chuxing Co. Ltd also works with international organisations. They identified leading players to expand their network beyond China.

Mr. Ma discussed and shared information on the company projects with the audients. One of the highlighted projects was smart transportation. The company worked with vehicle developers, universities, and local governments in this project. A DIDI platform was shared and used in more than 20 cities in China to collect data and support the project. The data-sharing model used in the project has successfully reduced 10-15% of congestion in the most congestion city of China, helping the citizens and Government to improve the traffic control. This project was also expanded to its business in South America such as Brazil, Chile, Santiago and Mexico. However, there were challenges in cross border data transfer due to local policies and rules. To solve this issue, DIDI had invested in an infrastructure located outside China.

The other project was the DIDI GAIA initiative. This project is still under the pilot study stage. In collaboration with the industries, DIDi managed to collect 30 million rides traffic data from the front and rear cameras of vehicles in China. These data are very useful in analysing the city traffic condition and safety. The collected data were clean and free from any private information. These data were managed using the FAIR concept. It is now being used in more than 20 countries. Their data partners were mainly from North America and Europe. The GAIA project is consistently providing training on how to use the data for engineers and students.

There were 4 questions, as follows:

1. What are the major challenges in establishing partnerships for the private sector?
2. What are the challenges in sharing data with universities? Do you have to set up an agreement with each university?
3. This morning UNESCO indicated that they have to set an international setting instrument. How the private sector gets involved in that?
4. What strategy should MOSP follow? We have data we used to publish, and we have large raw data. Which type of data should we focus on first? Data published or we move to the raw data?

Mr. Ma emphasis that as a relatively young company it is a challenge to convince the large companies and universities to collaborate and invest. It is also not easy to keep the balance between business and sharing policy because sharing and open science requires infrastructure and platforms which would cost a lot. Other than that, data sharing across the border was also a big challenge even just to run a demo overseas.

Universities are consistently looking for more partners with industries to get more funding. Researchers at DIDI are also alumni of Universities. DIDI uses the alumni approach to reach the Universities.

In order to get more buy-in from the private sector, Mr. Ma suggested that it would be work if the benefit and more business opportunities can be demonstrated. Professor Barend suggested bringing three parties together without ranked is important. All stakeholders should share equality in terms of contribution and importance.

Dr. Ross shared there is a need for infrastructure to bridges the gap between data management and research. So, it was suggested that MOSP has to start from intersection data and research. Do not focus on one thing first and go down the rabbit hole.

9.3 Capacity building and awareness

Panel 1
Dr. Ai Sugiura
Programme Specialist for Science Policy and Capacity Building
UNESCO Jarkata

Dr. Ai started by sharing with the audiences the development of a global normative instrument on open science. As an overview, UNESCO was tasked with producing a recommendation on open science that would be adopted by 2021. The recommendation will be translated into the various languages in the region to promote capacity building in the region and raising awareness in the region. Stakeholder engagement sessions were conducted to map the landscape since November 2019.

Dr. Ai shared some of the preliminary findings of the UNESCO Survey on Open Science conducted since November 2019 as follows:

- 88% of the people indicated that Open Science is crucial going forward, indicating that the awareness is there. But it could also mean that the people that are answering the survey are those that are already sold on Open Science.
- 60% of the people surveyed indicated that their institutions are not doing any programmes related to open science. This is a stark percentage, indicating that institutions are not doing enough/any capacity building related to Open Science.
- At the national level, 40% indicated their countries are not doing any programmes.
- There is a lack of Awareness, Policy, Human, infrastructural, and financial resources in promoting open science in-country and institution.
- Capacities needed to empower Open Science in Asia and the Pacific region include:
    - Data science (including network, computer science) related skills development,
    - Raising awareness for scientists to change their cultural norms and attitudes
    - Training teachers of STEM education (primary and secondary level) to use open science in the classroom
    - Training on use and general public awareness of open science through citizen science

Besides the project on the preparation of recommendation for Open Science, a workshop on Open Science Societies was held on September 16, 2019, in conjunction with the Science to Enable and Empower Asia Pacific for SDGs Meeting. During the workshop, several risks and challenges were identified as follows:

- Funding and resources.
- Publishing costs for Open Access.
- Risk of lower quality (predatory journals)
- New suitable and consensual research evaluation metrics.
- Unconscious biases.
- Human resistance to change.
- Disparity of science levels and capacities at the regional and global levels.

- Purpose, dual-use with ethical implications (e.g., virus, genome editing).

The workshop also listed the opportunities for partnership in Open Science, such as open educational resources at a win-win situation and public-private partnership. There were also needs for capacity building and enhancement for success in Open Science. The workshop identified a list of tasks to be done in capacity building for Open science as follows:

- Data science (including network, computer science) related skills development,
- Raising awareness for scientists to change their cultural norms and attitudes
- Training teachers of STEM education (primary and secondary level) to use open science in the classroom
- Training on use and general public awareness of open science through citizen science

Last but not least, the workshop layout the way forward for the Member States in Open Sciences as follows:

- The Member States are encouraged to develop Open Science policy and legal frameworks, particularly to guide the dissemination of publicly funded research.
- Establish a regulatory framework or a platform to negotiate for equitable pricing for publication and access.
- Develop and adopt suitable and consensual research evaluation metrics. Altmetric and narrative and descriptive evaluation research methods of research could be explored further.
- Develop effective tools for continuous monitoring of open science nationally and regionally.
- Cultural change in academia is desired to promote inter-disciplinarily in reporting to pave the way for the openness of science.
- Identifying new funding ways/mechanisms to incentivise Open Science.

Panel 2
Ms. Christina Schonleber
Director for Policy and Programmes
Associate of Pacific Rim Universities (APRU)

Ms. Christina stressed the need for open science to solve the global changes that involved various countries and regions. Open science maximizes network effects, new collaborative approaches and increases Impact. Awareness of Open Science should not just limited to natural sciences but need to be expanded to social science. There is also a need to promote new/ alternative types of open collaboration, and open data is encouraging.

Panel 3
Professor Dr. Noorsaadah Abdul Rahman
Chairperson
Malaysia Open Science Alliance

Professor Noorsaadah started by highlighting the Malaysian research landscape and amount of research data produced over the years. To ensure the success of the MOSP, a national alliance comprises of government departments, government agencies, public, and private universities, and international agencies were formed.

In order to understand the Malaysia context better, the MOSP/ UM embarked on research to study the readiness of researchers to open science, and the survey highlights the following:

- Awareness - the adoption of open science approaches in universities has been quite limited, confined to openness to the scientific community and funders.
- Practices - confined to open access publishing disseminated to the scientific community;
- Data sharing as a publication requirement; no policies that mandate discourages data sharing
- Open science as positive, but has important drawbacks (esp.fundings)
- Indicates a lack of guidance, training to help researchers learn how to open up their research within a particular domain or research environment
- Implicate that open science readiness and skills are increasingly essential for researchers to undertake responsible research and innovation.

To ensure that researchers are ready and Open Science becomes the norm, Professor Noorsaadah suggested that there must (i) be a support to culture change through an outcome-oriented training programme, (ii) be consolidated and sustain training support network from research performing institutions, and (iii) strengthen the training capacity, address current skills and content gaps on the practical implementation.

There were 3 questions posted to the panels as follows:

1. How does a network like APRU assists in capacity building for lagged countries?
2. Capacity building for open science
3. How do you strategize a capacity building programme on the data from the survey? If you are going to be developing global standards, you have to build capacities in each country. How are you going to address this?

Ms. Christina emphasised that capacity building is important in the advancement of science. The establishment of networks such as APRU has provided a good base to accelerate capacity building for open science and broader scopes. Rather than training new people, we should upskill the people that we already have. In the short term, we need to look into the capacity that is already there, and we need to see how we can retrain them (existing talent). There is a need to stop sourcing talent and support from outside of the country but to first identify and source internally to promote local talent.

Professor Dr. Noorsaadah added that universities in the network are more willing to work together, it will not work overnight, but there is a lot of initiatives. It will take a lot of time. But therein lies the importance of having partnerships, having networks, collaborations that the people in those networks would then be more trusting to work with other people in the network. Having the network could be the first step in making people more open. She added that capacity building activity should not focus just on scientists but be expanded to the non-academics such as librarians to increase and diversify talents required for open science. The responsibility to develop open science should not be put on just a researcher, but there is a need to identify and establish different talents and professions such as data scientists, data custodians, etc. for open science. Librarians are very important and very keen to do open science. And librarians are a very big source of experts that would need some reskills, and they have the background in data curation.

Dr. Ai suggested that institution/ nations could come up with the short term and long term capacity building plan:

- Identify and source from available talent pool such as librarians as data steward
- Training of young researchers/ scientists such as data scientists
- Create a network and partnership and promote collaboration.

Make sure to ask other countries that have done this before, where the gaps are, where the problems are, and how we can address them. There is no fault in asking people for help, do not have to make the same mistakes that other countries have done.

Prepared by

Dr. Tan Hsiao Wei
Dr. Chai Lay Ching
Mr Ahmad Sufyan Mohamed Aslam
Dr. Manraj Singh Cheema
Dr. Hadieh Monajemi
Mr. Chang Lee Wei