REPORT

Study on
'Institutionalizing Science Advice to Governments'

NATIONAL ACADEMY OF SCIENCES OF SRI LANKA
2023

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ABBREVIATIONS

AAA	Australian Academy of Science
AASSA	Association of Academies and Societies of Sciences in Asia
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian nations
ASM	Academy of Sciences Malaysia
ASM	The Academy of Sciences Malaysia
BAEC	Bangladesh Atomic Energy Commission
BAS	Bangladesh Academy of Sciences
BCSIR	Bangladesh Council of Scientific and Industrial Research
CBS	Central Bureau of Statistics
CSIRO	Commonwealth Scientific and Industrial Research Organisation
GII	Global Innovation Index
HTNC	High Tech Nation Council
IAP	Inter-academy partnership
IWMS	Integrated Water Management System
KAST	The Korean Academy of Science & Technology
KGUMS	The Khesar Gyalpo University of Medical Sciences of Bhutan
NASI	National Academy of Sciences, India
NASSL	National Academy of Sciences of Sri Lanka
NAST	Nepal Academy of Science & Technology
NASTEC	National Science & Technology Commission
NASTPH	National Academy of Sciences and Technology of the Philippines
NCST	National Council for Science and Technology
NHMRC	National Health and Medical Research Council
NSC	National Science Council
OCS	Office of the Chief Scientist
OECD	The Organisation for Economic Co-operation and Development
PM-STIAC	Prime Minister's Science, Technology, and Innovation Advisory Council
SLAYS	Sri Lanka Academy of Young Scientists
SOP	Standard Operating Procedures
STEM	Science, Technology, Engineering and mathematics
STI	Science, Technology and Innovation
STIP	Science, Technology, Innovation Policy
STIPAC	Science, Technology and Innovation Advisory Committee
TAG	Technical advisory Group
TGA	Therapeutic Goods Administration
TRSM	Top Research Scientist Malaysia
TÜBA	Turkish Academy of Sciences
TÜBİTAK	Scientific and Technological Research Council of Türkiye
TÜİK	Turkish Statistical Institute
TWG	Technical Working Group
UN	United Nations
WB	World Bank
YPL	Young physician leaders
YSN-ASM	Young Scientist Network – Academy of Sciences Malaysia

ACKNOWLEDGEMENTS

This report is the outcome of the study conducted by the National Academy of Sciences Sri Lanka (NASSL) on 'institutionalizing science advice to governments' with partner agencies representing 10 countries in the Australasian region (in alphabetical order with representative partner academy or institute given within parenthesis): Australia (Australian Academy of Science), Bangladesh (Bangladesh Academy of Sciences), Bhutan (KG University of Medical Sciences), India (Asian Chapter of the International Network of Government Science Advice), Korean Republic (Korean Academy of Science and Technology), Malaysia (Academy of Sciences, Malaysia), Nepal (Nepal Academy of Science and Technology), Philippines (National Academy of Science and Technology, Philippines), Thailand (Science Society of Thailand) and Turkey (Turkish Academy of Sciences).

The report is supported by proceedings of the workshop on 'institutionalizing science advice to governments' held in Colombo, Sri Lanka from 6 to 8 July 2023 with the participation of representatives of the partner agencies and discussions on 'situation analysis' of the status of science advice with subsequent drafting of the way-ahead in developing 'contextualized roadmaps' for science advice in partner countries.

The survey to gather data for the 'situation analysis' was conducted and coordinated by the NASSL spearheaded by the President, NASSL together with a core team of Council members of the NASSL. See detailed list in Annex 1.

The contribution and dedication of the team members, writers, editors, and advisors are appreciated. Assistance provided by Professor Lakmali Amarasiri, YPL scholar in compiling the report is greatly appreciated.

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EXECUTIVE SUMMARY

The provision of appropriate science advice to governments is of national, regional, and global importance. However, many countries, especially in the developing world, lack effective framework to provide science advice to governments, which was laid bare during the COVID-19 pandemic. Hence, there is an urgent need to describe and analyse the structures and processes providing science advice to governments with a view to strengthening science advice.

Science advice requires synthesizing and brokering valid, relevant, and reliable scientific evidence in respect of different policies. The National Academy of Sciences of Sri Lanka conducted a study on the status and processes of institutionalizing Science Advice to Governments in the Australasian region.

The aims of the study were to

a) propose and facilitate the development and strengthening of systematic science advice in member countries and its institutionalization
b) Improve awareness among partners on a range of laws and regulations that exist legitimizing institutions and the processes used for government science advice
c) develop capacities of participating academies in providing science advice
d) enable academies to play a role and be part of the science advice process

The methodology included a series of webinars with representatives from partner agencies (viz. Australian Academy of Science, Bangladesh Academy of Sciences, KG University of Medical Sciences, Asian Chapter of the International Network of Government Science Advice, Korean Academy of Science and Technology, Academy of Sciences Malaysia, Nepal Academy of Science and Technology, National Academy of Science and Technology Philippines, Science Society of Thailand and Turkish Academy of Sciences) to refine the methodology and administer a structured questionnaire to gather data for the *Situation Analysis* with respect to science advice in partner countries. As part of the project, *Case Studies* were developed by the partner agencies focusing on past scenarios in their countries on new policies introduced or policy changes made, and in turn reinforced the findings made through the situation analysis of each country's data. The workshop also agreed on the structure of developing a framework for the *Roadmaps* for science advice, a process, which is ongoing.

The questionnaire responses were categorized under several headings identified as the *'Colombo Framework'*: Selection of advisors, organizational structures to provide advice, the process followed to collate and synthesize advice (framing the questions etc), the process of communication, and evaluation of the process and impact of advice.

The results showed a diversity of responses indicating a range of structures and processes:

- The structures and types of advisors included, chief science advisor or advisors, a science advisory office or agency, science advisory boards, science advisory councils and ad-hoc arrangements during emergencies or crises, such as task forces.
- Selection of advisors varied from appointments by an executive authority to nominations by science organizations or selection processes based on academic credentials.
- The initial framing of questions requiring science advice were by policymakers, parliament committee or the President and advisory council.
- Collation and synthesizing evidence: The methods used included systematic reviews, meta-analyses, through surveys, consultative meetings, expert opinion, foresight tools and workshops and/meetings of the experts where the evidence was reviewed.
- The process of communicating science advice included reports issued by the science advisors, or advice directed to the Presidential Office, to Cabinet office, or submitted through Secretary of the Ministry of Science and Technology to the Head of State, or reports to the relevant minister and presidential secretariat.
- The impact of science advice on policy was rarely evaluated.
- Case Studies for individual countries supplemented the situation analysis for that country.
- A SWOT analyses was compiled based on each country responses to reflect the totality of responses and for guidance in drafting a framework for Roadmaps for each country.

As part of the project a three-day workshop was held in Colombo, Sri Lanka on 'Institutionalizing Science Advice to Governments' 6-8 July 2023 (See complete report in Chapter 3). There was wide physical and web-based participation from many science-related agencies including the Inter-academy Partnership (IAP), Association of Academies and Societies of Sciences in Asia (AASSA) and the Asian Chapter of the International Network of Science Advice to Governments (INGSA) and other distinguished local and international invitees.

The keynote speech and plenary talks added much value to the event and were delivered by subject experts. The data from the situation analysis of science advice was presented highlighting the strengths, weaknesses, opportunities, and threats (SWOT analysis) within their systems.

A descriptive '*Colombo Declaration*' was released calling on governments to partner with scientists and demonstrate stronger commitment in strengthening action to institutionalize science advice to governments (See Chapter 4).

The concluding session described future actions of developing Roadmaps and Case Studies by each partner country. The contextualized roadmaps will be developed through an iterative process and 'work in progress' submitted by most partner agencies were included in the report (see Annex 7).

The key outcomes of the Project were the following:

1. Documentation of Science Advice Systems in countries with situation analysis, reinforced with case studies and SWOT analyses and a framework for contextualized roadmaps that could form the foundation for further activities with support from the IAP and AASSA.
2. Developed and disseminated the 'Colombo Declaration' calling on governments to institutionalize science advice https://nassl.org/the-colombo-declaration-institutionalising-science-advice-to-governments-6-8-july-2023/
3. Availability of validated questionnaire and framework ('Colombo framework') to replicate similar studies elsewhere.
4. Development of a process for promotion of institutionalization of science advice to governments that could be replicated in other countries or regions.
5. Promoted awareness among public, public administrators and policymakers and younger generation of scientists to be part of this transformative process, particularly to ensure continuity of efforts.
6. Contextualized Roadmaps design process has been initiated that is meant to trigger further discussions.

CHAPTER 1

INTRODUCTION

The COVID-19 pandemic rapidly evolved from a health issue to become a social crisis of unprecedented proportions. This crisis laid bare the interconnected nature of human societies. The responses by the scientific community demonstrated the benefits of science-based advice to policymakers and governments when managing the pandemic. However, pandemic management often surfaced the disconnect between science advice and decision-making. The crisis and setbacks due to COVID-19 led many to reset their policymaking processes to meet the 'new normal'. Countries continue to address the pandemic, revive their economies and accelerate implementation of Sustainable Development Goals. These require sustained input from science at all levels of policy making through a systematic process of evidence-based science advice.

The goal of science advice is to evaluate the different policies scientifically using evidence that is respected as valid, relevant, and reliable. However, many countries lack effective structures and processes to provide science advice to governments. Only a few have a streamlined and transparent process to identify issues, review the scientific literature, weigh the costs and benefits, consult with stakeholders, and communicate their advice.

The lack of a 'proper' process for science advice is rather glaringly obvious in many developing nations; and as a result, the inputs from scientific bodies continue to be weak, disjointed, ad-hoc and fragmented. In some, there are formal structures to advise governments, but they are not used by the latter, for reasons of political expediency. In contrast, many developed countries have well- structured institutions and processes to give science advice to their governments.

The provision of appropriate science advice to governments is of national, regional and global importance. There is an urgent need to describe and analyse the structures and processes providing science advice to governments with a view to strengthening science advice.

It was in this backdrop that the National Academy of Sciences of Sri Lanka agreed during its Annual General Meeting of the NASSL held in 2021 to explore the importance in institutionalizing Science Advice to Governments. It subsequently applied for a Competitive Grant from the Inter-academy Partnership from the Inter-academy Partnership (IAP) through the Association of Academies and Societies of Sciences in Asia (AASSA) to conduct a study on the subject. The methodology included a series of webinars with partner academies to discuss the methods and tools used and data gathering using a structured questionnaire from member states.
The NASSL was particularly interested in sharing its experiences and learning from other sister academies regarding strengths, weaknesses, opportunities, and threats (SWOT) of different systems in place in each of the partner countries to identify a suitable model and maybe draft a roadmap for science advice for Sri Lanka.

The goals of the project were to

a. conduct situation analysis with respect to science advice in the countries represented by the academies
b. develop capacities of regional academies in providing science advice with improvement of awareness on range of laws and regulations that exist in legitimizing institutions and the processes used for government science advice
c. propose and facilitate the development and strengthening of systematic science advice in member countries
d. enable academies to play a role and be part of the science advice process

The Report is in two sections.

1. Report on Situation Analysis and
2. Report on Workshop on Institutionalizing Science Advice to Governments

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CHAPTER 2

PROJECT REPORT ON SITUATION ANALYSIS

The National Academy of Sciences of Sri Lanka (NASSL) led the project by collaborating with selected science academies. For the purposes of this project we define 'Science for Policy' or 'Science Advice' as 'the scientific knowledge and expertise that can assist in developing and implementation of public policy across a broad range of issues' ' (Defined by the Australian Academy of Science. This contrasts with Policy for Science which is to 'influence the rules, regulations, programs and international commitments that affect how scientists work' and prescriptive policy making by the scientists.

We have focused on two key processes of science advice:

- **Evidence synthesis** aims to establish the state of available knowledge on a given issue through a range of methods including literature reviews, scientific assessments, and expert inputs.
- **Brokerage** is the process of dialogue between science and policy. Brokerage is essentially about bringing scientific evidence to bear by helping decision-makers to interpret scientific information, its meanings, implications, and limitations for the purpose of supporting their deliberations and decision-making.

1 AIMS

To conduct relevant studies and present a situation analysis, discuss and share best practices, and propose contextualised roadmaps towards a process that would enable the strengthening of processes to provide evidence-based and independent science advice.

2 METHODOLOGY

The project involved development of a questionnaire, selection of the respondents, interviews and conducting the survey from which a draft situational analysis report was compiled. This was shared among partner academies during the workshop along with a SWOT analysis done by each partner. Relevant case studies were also presented by Sri Lanka that reinforced the findings of the situation analysis. Based on the proceedings of the workshop, the situation analysis report and SWOT analysis, the final report was compiled. The future direction is to further develop the roadmap drafted in collaboration with other stakeholders.

2.1 Development of the questionnaire

The questionnaire (Annex 2) was developed based on a literature search and the objectives of the project. It was validated through pilot testing on experts in science advice and shared for comments with the participating academies. Zoom meetings were held with the key informants from each academy to explain the questionnaire and clarify any issues.

There were six sections in the questionnaire.
Section 1: Details of respondents
Section 2: Details of advisors of science advice
Section 3: Key issues in the standard advisory process
Section 4: Principles identified in science advice
Section 5: Opinion on how science for policy could be strengthened or institutionalized within countries
Section 6: Role of national science academies on science advice

2.2 Selection of respondents

A letter of invitation was circulated to academies and science institutions of AASSA member countries in the Australasian region. Based on the responses received, the following academies and agencies were invited to participate in the survey.

- Australian Academy of Science (AAA)
- Bangladesh Academy of Sciences (BAS)
- The Khesar Gyalpo University of Medical Sciences of Bhutan
- National Academy of Sciences, Bangalore, India (NASI)
- The Korean Academy of Science & Technology (KAST)
- Academy of Sciences Malaysia (ASM)
- Nepal Academy of Science & Technology (NAST)
- National Academy of Sciences and Technology of the Philippines (NASTPH)
- Science Society of Thailand Under the Patronage of his Majesty the King
- Turkish Academy of Sciences (TUBA), and
- the Sri Lankan situation was described by the NASSL in collaboration with the National Science & Technology Commission (NASTEC).
- The Asian Chapter of the International Network for Government Science Advice (INGSA)

3 FINDINGS AND ANALYSIS

This report describes the science advice situation in a total of 11 countries across a spectrum of levels of science led development and science advisory practices. The results of the report are classified under four sections.

1. **Science Policy Advice Process:** summarises the legislation and administrative process, structures and mechanisms used in the different countries (Sections 2-3 of the questionnaire)

2. **Principles of Science Advice** (Section 4 of the questionnaire)

3. **Strengthening and Institutionalising Science for Policy in Countries** (Section 5 of the questionnaire)

4. **The Role of National Academies in Science Advice** (Section 6 of the questionnaire)

3.1 SCIENCE POLICY ADVICE PROCESS

There is a range of science advisory models across countries and there may be more than one science advisory model within a country.

This section used a simple framework to describe the science policy process (Figure 1).

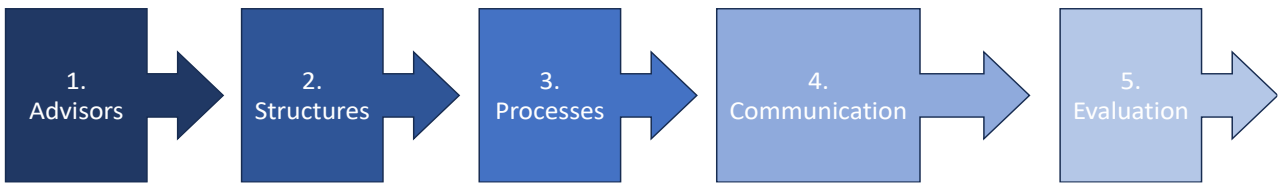

Figure 1: Framework to describe the science policy process

3.1.1 ADVISORS

The advisors in the science advisory models that exist/ coexist in countries include and are not limited to a:
- **chief science advisor or advisors** who is/are either seconded from academia or applied research institutes, but retain a small academic appointment or a senior appointment, following a career as a practising academic,
- **science advisory office or agency** which may not be attached to the government but is a separate administrative apparatus. In such cases, the director position may be a government appointee, sometimes by multi-party consensus or vetting,
- **science advisory board** who would include a mix of recognized experts in a variety of fields external to the organisation (e.g., outside a ministry or department) and provide advice on its activities and direction,
- **science advisory councils** like a board, with in addition to experts, will often include external stakeholders and partners (e.g., citizens, beneficiaries, and civil society groups), as well as executive members of the organisation receiving advice, and in some cases
-**ad-hoc arrangements** during emergencies or crises, such as task forces.

Australia, India, South Korea, Philippines, Sri Lanka, and Türkiye are reported to have a chief science advisor/ advisor. In addition, **Australia, India, Philippines, and Sri Lanka** also have a science advisory agency. **Australia, India, and Sri Lanka** also have advisory boards and ad-hoc appointments such as task forces when the need arises. Other countries apart from **Australia, India and Sri Lanka** that have at some point in time formulated task forces include, **Bhutan, Nepal, Philippines, and Thailand**.

In **South Korea**, the chief science advisor may or may not be appointed, though they have science advisory councils, as do **Australia, Bangladesh, India, South Korea, Malaysia, Sri Lanka, and Thailand**.
In **Malaysia,** these science advisory councils include the National Science Council (NSC), National 4IR and Digital Council and National Economic Action Council chaired by the Prime Minister and the High Tech Nation Council (HTNC) chaired by the Minister of Science, Technology & Innovation. **In India,** it is the Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC). The National Science and Technology Commission (NATSEC) of **Sri Lanka** is an apex body for advising the government on formulating science and technology policies, plans, and strategies. Only **Australia** reported the existence of a Science advisory office.

Nepal has a Prime Minister's advisor who is also the Chancellor of the Academy (NAST). In **Malaysia,** the President of the Academy of Sciences appointed by the King automatically becomes the Science Advisor to the nation by cabinet decision, and in **Bhutan,** advisories from international organisations such as WHO, UN or mandatory requirements of international protocols such as Kyoto or Montreal Protocols, Madrid Plan for Elderly, exist in mainly agriculture, livestock and forestry fields. In **Sri Lanka,** ministry level science advisors or committees are appointed by respective ministers.

3.1.2 WHETHER APPOINTEES ARE RESPONSIBLE FOR A SPECIFIC AREA OR DISCIPLINE

In **South Korea**, their existing models are given overall responsibilities. In **Bangladesh and Nepal,** they are responsible for advising governments in the formulation of Science and Technology policies and in **Malaysia**, all the responsibility cover all sciences which include, biological, agricultural, and environmental, chemical, engineering, information technology and computer, mathematics, physics and earth, medical and health sciences, and science and technology and development industry and social sciences and humanities. In **India, and Nepal** the appointees ascertain the status of challenges and recommend interventions needed in science and technology domain to advice the Prime Minister.

3.1.3 APPOINTING AUTHORITY

This section describes the appointing authorities, the methods of election or nomination and the number of members constituting the science advisory bodies.

The appointing authority for these science advisory models differs among countries and include the President (**Türkiye, South Korea, Sri Lanka**), the academic council (**Türkiye**), Prime minister (**Australia, Malaysia**) and Government or Ministries (**Bangladesh, Bhutan, India, Malaysia and Sri Lanka**).
The number appointed also varies from country to country. For example, **Türkiye** has 2 chief science advisors, approximately 200 representatives in the science advisory offices, 10 members in the science advisory board and 13 in the science advisory council. **Thailand** has 28 appointees in their science advisory council. In **Sri Lanka,** 7 members are appointed to the Commission from among those who have most distinguished themselves in the fields of science by H.E. the President of Sri Lanka with the consultation of the Subject Minister of Science and Technology. Within appointed task forces the appointed numbers would depend on the situation.

In **Türkiye,** members and the academic council elect appointees and in Thailand this is done by the cabinet. Science advisory members are nominated in countries such as **Bangladesh, South Korea, Malaysia, Thailand Türkiye and Bhutan**, whereas ad-hoc nominations are made in **Nepal.** In **Türkiye,** the nominations include 12 chief science advisors, approximately 45 representatives to the science advisory offices, 8 members to the science advisory board and 20 to the science advisory council. **South Korea** has 1 chief science advisor and 22 nominated to the science advisory council. **Bangladesh and Thailand** nominate approximately 50 and 10 members respectively to their science advisory councils. **Malaysia** nominates the top 3 members. **Türkiye, Nepal, and Bhutan** reported that sometimes ad-hoc nominations are made. In **Türkiye**, 1 chief science advisor, approximately 10 representatives to the science advisory offices, 20 members to the science advisory board and 3 to the science advisory council. The **South Korean** academy has appointed 1 chief advisor and approximately 22 to the science advisory council.

The ad-hoc appointments in **Nepal** depend on the Prime minister/ chancellor. In **Sri Lanka**, it is the presidential secretariat based on the directions received from the HE the President (and minister in charge) that makes the appointments and is gazetted. The other countries have not specified the appointment of ad-hoc appointments. In such cases where there are ad-hoc appointments, the appointing person or body includes the President/ chief advisor (e.g., **Türkiye, South Korea**), or the Prime Minister (e.g. **Nepal, Australia and Bhutan**) or the Science Advisory Council, as in the case of **Thailand**.

3.1.4 STRUCTURES AND PROCESSES

This section addresses key issues in the standard advisory process and includes details of

i. the laws, regulations or government circulars that have legitimised Science for Policy in countries
ii. organizations identified to provide science advice for policy
iii. how policy makers decide which questions they should ask their expert advisors and when in the policy cycle they should be asked
iv. how conflict of interests is avoided
v. who identifies the issues that require science advice, whether it is the end-users of the advice or the scientific experts and whether this process of advice is continuously happening as a routine
vi. who frames the question
vii. (a) the presence of standard operating procedures to develop science advice and
(b) specific strategies to convince policy makers in science advice
(c) the networks used in the government science advice system
(d) how the evidence is gathered: literature survey or through original research and analysis of data
viii. whether advice states the limitations and uncertainties of the advice
ix. the methods in which conflicting science advice is handled
x. the advice is publicly made available in a timely manner and the medium: reports, workshops/ seminars or media conferences, webpages, and who is responsible for communication
xi. budgetary constraints
xii. independence for science advisors
xiii. influence of legislative bodies on the process, and
xiv. formal assessment of impact of science advice

3.1.4 (i) LAWS, REGULATIONS OR GOVERNMENT CIRCULARS THAT HAVE LEGITIMISED SCIENCE FOR POLICY IN COUNTRIES

Several countries surveyed (**Türkiye, South Korea, Bangladesh, Philippines**), have some form of legitimised body for science advice for the Government. However, their functioning varies, for example, in **Türkiye**[1], regulation on the Establishment and Duties of Science, Technology and Innovation High Council" which aims to advise and make recommendations on science, technology, and innovation policies to the government. Additionally, the "Science, Technology and Innovation Strategy Document and Action Plan (Bilim, Teknoloji ve Yenilik Strateji Belgesi ve Eylem Planı)" sets out the framework for science, technology, and innovation policies in Türkiye. There are also various circulars issued by the government that promote science advice for policy-making purposes.

In **Bangladesh**, the responsibilities, and rules of procedure for the formulation of science advice for policy are unclear. In **South Korea**, there is an Act for Presidential Advisory Council on Science and Technology. Other countries (**Nepal, Australia, Malaysia, Thailand, Bhutan, and Sri Lanka**) do not have a mandated agency but have other means of providing advice, e.g., in Bhutan – establishment of a society for STEM education, STEM premier schools, differentiated curricula, scholarships, and national level STEM festivals. Nepal formulated an existing National STI (Science, Technology, and Innovation) Policy 2019 which was endorsed by Nepal Government in 2019. **Sri Lanka** has an apex body, NASTEC, that advice on Government of Science and Technology Policies, Plans, and Trends (NASTEC) under the Act - Science and Technology Development Act[2].

Others (**Philippines**[3]) have cemented procedures (a republic act) to generate science advice into law to 'promote scientific and technological research and development, foster invention, and utilise scientific knowledge as an effective instrument for the promotion of national progress.'

In **Australia**, for example, it is not uncommon for specific mechanisms to be established in legislation for purposes, or within specific domains (e.g., health, environment etc.). In addition, there are government advisory bodies (e.g., the National Science and Technology Council, the Commonwealth Science Council, Office of the Chief Scientist, Department for Industry Science and Resources, CSIRO) which are institutionalised formats of science advice to the government.

Nepal[3]**, Thailand**[4]**, and Malaysia** have national science and technology policies; **Bhutan and Sri Lanka** do not have specific policies.

Multiple bodies in **Malaysia** (National Science Council (NSC), National 4IR and Digital Council and National Economic Action Council chaired by the Prime Minister and the High-Tech Nation Council (HTNC) chaired by the Minister of Science, Technology & Innovation)

Sri Lanka has a Science Advisor to the President, appointed by the President.

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3.1.4 (ii) ORGANIZATIONS IDENTIFIED TO PROVIDE SCIENCE ADVICE FOR POLICY

All countries surveys have an organization established by the statute for science and technology (table 1). An exploration of the functions of these agencies shows that there are two kinds of policy support: one on policy on science and technology development, and the other on policy advice to the Government.

Table 1: Agencies of countries established to provide science advice

Country	Organization
Australia[1]	**Innovation and Science Australia,** an independent statutory board is responsible for providing advice to government on science, research, and innovation matters **The National Health and Medical Research Council** has a public health advisory function, captured in the National Health and Medical Research Council Act 1992
Bangladesh	**National Council for Science and Technology (NCST)** that determines S and T policies, reviews the activities of different institutions, and provides direction towards S and T research and activities
Bhutan	None
India[2]	**Science, Technology, Innovation Policy (STIP)** leading to the establishment of a National STI Observatory that acts as a central repository for all kinds of data related to and generated from the STI ecosystem
Malaysia[3]	**The Academy of Sciences Malaysia** that analyses, develops, and provides scientific advice and policy solutions to the government
Nepal[4]	**Policy Research Institute** that reviews public policies, programmes and strategies through rigorous research and analysis and provide policy recommendations to the government
Philippines[5]	**The National Academy of Science and** Technology, Philippines (NAST PHL) that recognizes outstanding achievements in science and technology and is the advisory body to the President
South Korea[6]	**Presidential Advisory Council on Science and Technology** on major science and technology policies and R&D budgets, and reports major policy directions for national science and technology innovation to the President
Sri Lanka[7]	**National Science & Technology Commission (NASTEC)** advises the Government on policies and plans for the development of Science & Technology

Thailand[8]	**National Policy Higher Education, Science,** Research, **and Innovation Council (ormulating, deploying and monitoring national policy addressing higher education, science, research and innovation under the guidance and instruction of the Policy Council**
Türkiye[9]	**Scientific and Technological Research Council of Türkiye** for coordination of scientific and technological research activities), and (b) Science, Technology and Innovation Policies Board (provides science advice for policy

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[6] www.pacst.go.kr, In addition, we have two government-funded research Institutes
(http://kistep.re.kr and http://stepi.re.kr)
[7] http://www.nastec.gov.lk/objectives/objective, S & T development Act 1994/11:
http://www.nastec.gov.lk/files/nastec_act/English_Copy.pdf
[8] https://www.nxpo.or.th/th/en/
[9] https://www.tubitak.gov.tr/en

3.1.4 (iii) THE ROLE OF POLICY MAKERS AND RELATIONSHIP WITH EXPERT ADVISORS

All countries except Bangladesh have installed an institution that is responsible for the process of communication between science advisors and policy makers. In **Türkiye,** the process of deciding which questions to ask expert advisors and when to ask them can vary depending on the specific policy, the decision-making process in place and the urgency of the issue at hand. Organisations like TÜBA, TÜBİTAK and the Science, Technology, and Innovation Policies Council are responsible for communication between policy makers and science advisors. In **South Korea**, the President and the PACST collaborate on discussing issues that are highlighted by the President himself. The PACST also takes the initiative to discuss pending issues and presents documents and reports to the President.
In **Nepal**, the Parliament committee decides on what questions will be directed to their expert advisors and **Australia's** National Science and Technology Council establishes a work plan with Ministers and Council members for medium and long-term reports. And questions are shaped by policy makers at various points in the policy cycle. In **Malaysia,** the process involves constant input from advisors and stakeholder engagement, ensuring that new developments and challenges are strategically dealt with. The Science Society of **Thailand** has a list of experts that own and deal with the subject matter regarding advice for policies. The process in **Bhutan** is mostly delegated to qualified officials in the responsible Ministry, department, and divisions with individual experts and/or committees formed ad hoc on need basis. **NASTEC** has no formal holistic approach at this juncture; it depends on the issue that needs scientific advice. The **Philippines** promotes the idea that policymakers should ask their expert advisors all questions that they think are science-based or issues that need science-based solutions. Finally in **India,** policy makers tend to collaborate through discussion and consensus.

3.1.4 (iv) MECHANISMS TO AVOID CONFLICTS OF INTEREST

In **Türkiye**, the High Council for Science and Technology (BTYK) has established a guideline that requires expert advisors to declare any potential conflicts of interest related to the science advice process. Similarly, **Bhutan and Australia** require its advisors to have declared any conflicts of interest in a written statement prior to the consultation process. Once again, the **Philippines** has cemented its policy into law and states that affiliates shall not, during their continuance in office, engage in the practice of any profession, or intervene, directly or indirectly, in the management or control of any private enterprise which in any way may be affected by the functions of their office, nor shall they directly or indirectly be financially interested in any contract with the Government or any subdivision or instrumentality. Within **NASI (of India)** in the case of conflict of interest, that advisor refrains from being the part of discussion. The PACST and NCST (of **South Korea and Bangladesh**) state that conflicts of interest do not occur due to the advisory process being carried out by 'private experts from universities, public research institutes, and industrial companies' and 'stakeholders of the issue'. In **Nepal**, when the S&T nuclear bill related and allied subjects was tabled, the high-level committee, academicians, VC, Ministry were present to resolve the solution. In the case of **Malaysia**, any input by science advisors at a national level is given based on the collective voice of experts from all stakeholders, and thus eliminates any conflicts of interest. Within **NASTE**C there are no such formal procedures. However, conflicts of interest are one of the main barriers identified in the system to implementing scientific advice to the government.

3.1.4 (v) IDENTIFICATION OF ISSUES THAT REQUIRE SCIENCE ADVICE BY THE END-USERS OR THE SCIENTIFIC EXPERTS

In a few of the surveyed countries (**Türkiye, South Korea, Nepal and India**) issues that require science advice come from various processes and tend to be routine. It can be initiated by the policymakers, scientific experts who identify emerging issues or research questions that could have policy implications. In **South Korea**, there are two kinds of processes. There are two kinds of processes. First, the President asks some opinions on which he has a strong interest, Then PACST discusses the issues in detail, prepares for the document, and reports to the President. Second, PACST discusses and selects the pending issues on science and technology, prepares for the document and reports to President. In general, PACST will be asked in the planning phase of S&T policy. The advisory process is routinized. There are about 4~6 regular meetings, but there will be additional meetings, if there are pending issues. The end-user of PACST is the President of South Korea. But when he decides on S&T issues based on the advice, his decisions will be sent to relevant S&T-related ministries and are carefully planned as policies are implemented by these ministries. The end-user of PACST is the President of South Korea. The NCST in **Nepal** identifies issues that require scientific advice, and it is a continuous routine process. When needed, NCST takes the expert's opinion, although not regularly. Similarly, **NASI** identifies that the process of advice is continuous and will still refer to end-users or scientific experts when the need arises.

NASTEC identifies the presidential secretariat and relevant ministries as the mechanisms that list the issues that need advice. Issues that require science advice are identified by both the end-users of the advice and the scientific experts in **Australia**. Issues can be advanced for policymakers' consideration through engagement in communities of practice (such as National Environmental Science Program hubs). Similarly, through a top-down or bottom-up approach, **Malaysia** states that the identified issues are usually current issues; usually involving the ministries, cabinet, and the Science Advisor office in the Academy proactively provides input and advice based on gap analysis and needs of the nation. Furthermore, in the **Philippines** the policymakers request the Academy members to provide comments on the draft bills; they are also invited to committee meetings.
In **Bhutan**, most of the time, issues are identified by the responsible agencies and their technical officers. No formal government scientific body is specifically responsible for such issues.

3.1.4 (vi) FRAMING OF QUESTIONS FOR SCIENCE ADVICE

The process of framing the questions for science advice is typically initiated by policymakers in the countries, **Türkiye, South Korea, and Australia**. Policymakers identify the issues that require scientific input and formulate the questions that need to be answered. Similarly, the President together with the parliament representatives decide the priorities of the government and which areas/issues that need scientific advice according to **NASTEC**. While **Nepal, and India** foster a collaboration between policy makers and scientists when framing questions; B**angladesh** has no set mechanism for the process. The **Philippines** highlights the importance of scientists and policymakers framing the questions at the outset; and then having representatives of various sectors provide comments and advice on the subject presented. In **Sri Lanka**, the President together with the parliament representatives decide the priorities of the government and which areas/issues that need scientific advice. A committee for each issue is assembled with the representation of a team of scientists/ relevant ministry officials/ stakeholders/ policy makers. Lastly, in **Bhutan**, the process is mostly ad hoc or established whenever necessary. The need is identified during stakeholder meetings and meetings with community members.

THE PROCESS OF PRODUCING ADVICE

3.1.4 (viia) PRESENCE OF STANDARD OPERATING PROCEDURES (SOP)

Some of the surveyed countries (**Türkiye, South South Korea, Bangladesh, and Thailand**) confirm the existence SOPs within their systems, while countries such as **Australia and Bhutan** have SOPs, they are only required under certain agencies (Table 2).

Table 2: Process to develop science advice

Country	Process
Australia	There are no science advice specific procedures across the government. Several agencies have their own procedures or policies.
Bangladesh	There is a formulated an action plan with short, medium, and long-term perspectives
Bhutan	Differs from Ministry to ministry or organisation to organisation. There is no SOP for this but when required most of the time, the committees or groups have Terms of References to do the job in hand for the designated time period of their job.
India	There is a specified process. However, documents are not available in the public domain.
Malaysia	Not specified
Nepal	Nepal S&T Report[1]
Philippines	The NAST Publications Committee prepared and submitted guidelines in the preparation of NAST Statements, Science Advisories, and NAST Bulletins to the NAST Executive Council.
South Korea	The Presidential Office and PACST identify the agendas or issues which need advice and based on the reporting, the follow-on actions should be and will be taken by relevant S&T-related ministries.
Sri Lanka	There is an act on empowering the science advice system through legislation, the S & T Development Act 1994 of 11.
Thailand	Confirms that there is a specified process (no elaboration)
Türkiye	Standard operating procedures

[1] library@unesco.org and archives@unesco.org for more information: https://unesdoc.unesco.org/ark:/48223/pf0000380268

3.1.4 (viib) STRATEGIES TO CONVINCE POLICY MAKERS IN SCIENCE ADVICE

Türkiye identifies a 6-part process including scoping, evidence gathering, analysis, synthesis, review and communication to effectively produce science advice. **Thailand** also seems to have an established process, where advice is developed through policy process and foresight tools. **South Korea's** advisors prepare advisory contents (advice) of individual issues.

Bangladesh identifies the NCST as the advisory body that develops science advice with the help of ECNCST and other committees formed by NCST consisting of specialists/experts. NAST plays a similar role in **Nepal** where the science committee sits for meetings. Furthermore, in **Bhutan**, a committee, a technical working group (TWG) or Technical advisory Group (TAG) may be formed.

In **Australia**, the Department of Industry, Science, Energy and Resources will lead an annual meeting of relevant departments and agencies to support the Council secretariat in the development of the work plan.

In **India**[1], the process has a bottom-up approach, is decentralised, expert driven, evidence informed and inclusive in nature; and gives the 5th point in the National STIP 2020 of India as an example of this system.

Finally, in **Malaysia**, advice is produced through several factors such as stakeholder engagements nationally and internationally, data analytics, global horizon, benchmark analysis and surveys.

NASTEC outlines an extensive 10 step process through which advisors develop comprehensive science advice.

NASTPH presents a 4-step set of guidelines that include the collaborative efforts of the NAST science advisory council, the NAST executive committee and the NAST publications committee.

[1] Example: 5th National STIP 2020 of India. https://www.psa.gov.in/stip

Of the countries that were surveyed, a majority identified that the networks used within government science advice systems were both formal and informal.

3.1.4 (viiic) NETWORKS USED IN THE GOVERNMENT SCIENCE ADVICE SYSTEM

Table 3 shows the networks used in the government science advice within individual countries.

Table 3: Networks used within government science advice systems

Country	Networks
Australia	**Local and international experts** International networks and have several bi and multilateral science and technology agreements. An example of the networks includes the Government Scientists Group, led by the Chief Scientist, and the Forum of Australian Chief Scientists
Bangladesh	**Local and international experts** This is also true for the NCST as it is the only science advisory body (scientists and policymakers together) in Bangladesh
Bhutan	**Local and international experts** In Bhutan, networks of experts can be used in a government Science Advice system to provide advice to policymakers and these networks can be formal or informal. Therefore, the formality of the network is non-specific.
India	**Local experts** The advisory committee of each ministry is part of a network of experts which is substantiated through additional names required as per their expertise from time to time
Malaysia	**Local and international experts** A few examples being: ASM expert networks, Young Scientist Network – Academy of Sciences Malaysia (YSN-ASM), Top Research Scientist Malaysia (TRSM), academics, governments, civil society, and industries (nationally) and international platforms such as AASSA, IAP, ISC, ISTIC, APEC, ASEAN
Nepal[1]	**Local and international experts** The Government of Nepal formed the Policy Research Institute (2018), within which both formal and informal networks of experts are used
Philippines	**Local experts** The Philippines outlines formal stakeholder, Outstanding Young Scientists

South Korea	**Local experts** The PACST takes a more exclusive approach and selects several experts in diverse S&T areas and appoints special members.
Sri Lanka	**Local and international experts** NASTEC outlines the usage of available data in research institutes, publications and case studies, public experience and classical knowledge gained by the end users as networks used in the 'science advice' system
Thailand	Not specified
Türkiye	**Local and international experts** Networks of experts can be used in a government Science Advice system to provide advice to policymakers. These networks can be formal or informal and may include scientific societies, research institutions, universities, and individual experts. The specific networks used may depend on the policy area and the expertise needed for the issue at hand. The government may also establish formal advisory committees or task forces to gather input from a range of experts in a structured manner.

[1] https://pri.gov.np/

3.1.4 (viid) HOW EVIDENCE IS GATHERED

Evidence to decide issues requiring science advice can be gathered in diverse ways such as systematic reviews, meta-analyses, surveys, consultative meetings, evidence-based guidelines, reports: OECD, World Bank, United Nations, expert opinion or panels, policy papers, and other foresight tools, workshops and/meetings of the experts where the evidence is reviewed. Our survey revealed that in most countries surveyed evidence is gathered through either systematic review, meta-analysis, or both.

In **Australia**, NHMRC develops evidence-based guidelines which translate the existing body of knowledge in a particular area into rules, principles, or recommendations for the consideration of decision-makers. NHMRC guidelines provide information for achieving best practice in clinical practice, population health or ethics. They are developed by teams of specialists, including high level scientific experts, following a rigorous evidence-based approach, which includes literature review, public consultation, and independent review phases. The guidelines are designed as advice, but may be turned into policy instruments by government (e.g., in legislation) or non-government organisations (e.g. professional codes of conduct).

The Office of the Chief Scientist (OCS) performs knowledge translation through several initiatives. For example, the OCS Occasional Paper Series is a series of short publications that take relevant science from the research sector and translate it for a general audience. They bring to the public's attention scientific issues of importance to Australian society and conclude by discussing policy implications. The OCS also makes submissions to parliamentary inquiries that involve knowledge translation.

Bhutan gathers evidence from workshops and/meetings of the experts where the evidence is reviewed with a broader framework NO SM OR MA. **India** confirms the use of these systems but doesn't elaborate any further.

In the **Philippines,** NAST policies are prepared by experts on the subject matter. In **South Korea**, Advisors and special members gather and reviews lots of published information and literatures particularly from public policy research institutes. These institutes make intensive evidence-based policy research and publish relevant policy reports. Advisors rely on those reports.

Sri Lanka identifies various forms in which data is synthesised systematically from: Examples given include data on previous studies on the organic fertiliser usage, yield, challenges, availability of standards and infrastructure availability for testing and standardisation, publications/review reports/ case studies: Advisory committee and SWOT analysis data generation: Agrochemical industry statistics/ Research institutes under DoA/ End users.

In **Türkiye**, systematic reviews and meta-analyses are one way to gather evidence from published literature, but they are not always necessary or appropriate for every issue. **Nepal** takes information from the Central Bureau of Statistics (CBS), survey and consultative meetings. In **Malaysia** data is gathered from reports such as the OECD report, World Bank Report, United Nations Report, and Global Innovation Index (GII). In **Thailand**, reliance is on policy papers, expert panels, and other foresight tools.

There was no information regarding how evidence is gathered in **Bangladesh**.

When inquired regarding engagement of science advisors in original research or the analysis of data, the responses from the countries were varied (Table 4).

Table 4: Engagement of science advisors in original research and/or analysis of data

Country	Engagement of science advisors
Australia	Research organisations such as CSIRO provide advice based on original research or expertise of their researchers and Australian Government bodies that collect and analyse data. Australian Bureau of Statistics, which conducts the census, and colelcts data on a range of economic and social indicators Australian Institute of Health and Welfare collects datasets and conducts analysis on Australian's health and welfare NHMRC and ARC both collect datasets and do occasional analysis for purposes of metascience research
Bangladesh	The Science Advisory Committee (NCST) does not do original research or data analysis. NCST use information from science-related organizations [e.g., Bangladesh Council of Scientific and Industrial Research (BCSIR), National Institute of Biotechnology (NIB), Bangladesh Atomic Energy Commission (BAEC)] to generate and analyze data for policy formulation.
Bhutan	There is involvement of both research and analysis but there is a lack of resources, capacity, and time to conduct research. Field surveys and epidemiological surveys which are easy to do are often conducted, often sourced to local research consultants. [e.g., KAP Study on disability in Bhutan which was contracted to an international research consultant]. While international experts contribute in areas where there are lack of local experts, it is equally important to engage the existing local experts to accommodate the local sociocultural context in the understanding of problems. E.g., the Bhutan Epilepsy Project that was conducted by external experts resulting in the understanding and characterization of the problem, but not resulting any concrete development in the field of epilepsy management in the country. The project field tested a hand-held smartphone-based electroencephalography machine but it was never handed over to the local clinicians or technicians. The number of researchers is increasing in the country but there is a need to improve health research capacity. There is increasing external linkages as well.

India	**Various mechanisms exist within organisations, ministries, and industry to facilitate science advisors and provide data from time to time.**
Malaysia	Department of Census & Statistics, Ministries, Universities, etc…
Nepal[1]	The Ministry, NAST, existing data, survey, consultative meetings with stakeholders. E.g., Nepal S&T Report
Philippines	NAST gives concern to the experts on the subject matter and the experts conduct their own research
South Korea	If necessary, advisors do policy research together with PACST's special members
Sri Lanka	Science advisors are usually researchers. However, advisors are biased towards their research findings/individual opinions/ non-independent due various political and economic influences. As a result, scientific validity of their advice was unreliable, premature and not transparent
Thailand	Confirms that science advisors engage in original research and analysis of data
Türkiye	Science advisors may have access to organisations, structures, or mechanisms that facilitate their analysis of data. E.g: Turkish Statistical Institute (TÜİK)Generally speaking, networks of experts can be used in a government Science Advice system to provide advice to policymakers. These networks can be formal or informal and may include scientific societies, research institutions, universities, and individual experts. The specific networks used may depend on the policy area and the expertise needed for the particular issue at hand. The government may also establish formal advisory committees or task forces to gather input from a range of experts in a structured manner.

[1] [1] library@unesco.org and archives@unesco.org for more information: https://unesdoc.unesco.org/ark:/48223/pf0000380268

A. HOW EVIDENCE IS GATHERED: REFER TO ORIGINAL PAPERS

Most of the countries surveyed, confirmed that science advisors refer to original research papers (Table 5).

Table 5: Whether science advisors of countries refer to original research papers

Country	
Australia	Government reports often refer to research papers, both Australian and international.
Bangladesh	Advice is made by referring to original research and data reported by scientific organisations/institutes.
Bhutan	There are no proper means of delivering the message or recommendations to the policy makers, even if there is evidence. The policymakers are duty-bound to acknowledge such evidence and act on them because the program managers nor policymakers have the capacity to consume scientific evidence.
India	Various mechanisms exist within organisations, ministries, and industry to facilitate science advisors and provide data from time to time.
Malaysia	Referring to both primary and secondary research
Nepal	Do not use original research papers
Philippines	The present practice is to refer the concern to the NAST experts in the field, including NAST awardees, and other identified experts.
South Korea	Most advice is very practical. PACST and its members (advisors) prefer policy reports to research papers.
Sri Lanka	Research papers support the process of advice
Thailand	Do use original research papers
Türkiye	Original research papers may provide the most up-to-date and relevant information on a particular topic

B. HOW EVIDENCE IS GATHERED: RELIANCE ON EXPERTS

Except for NASTEC identifying that advice may sometimes be obtained from biased advisors, all other countries surveyed agree that advice is obtained in their respective countries by requesting experts. (Table 6)

Table 6: Whether experts are consulted during gathering of evidence

Country	Experts involved
Australia	Chief Scientist and the National Science and Technology Council, CSIRO, and the Australian Academy of Science
Bangladesh	To formulate science policy, NCST asked for experts' opinions and accumulated experts' advice
Bhutan	Expert opinions form a big chunk of the advice in technical matters. Deemed experts are evaluated poorly and may lead to out-of-date recommendations towards policy making.
India	The office of the Principal Scientific Advisor, considers amendments to policies and makes the final decisions.
Malaysia	The mandatory stakeholder engagement will involve the quadruple helix representation (government-academia-industry-civil society)
Nepal	Confirms that advice is obtained through asking experts
Philippines	Prior to the consultation, the advisory is released to the experts
South Korea	Advisors rely heavily on experts when they and PACST prepare the advisory agendas, contents, and documents
Sri Lanka	Research papers support the process of advice
Thailand	Confirms that in certain issues, some of the advisors themselves are experts
Türkiye	The system involves a network of experts from various fields who can be consulted for advice on specific issues. The advice obtained from experts may be in the form of written reports, briefings, or presentations

C. HOW EVIDENCE IS GATHERED: ADVISOR'S KNOWLEDGE AND EXPERTISE

Most countries surveyed agree that the advisor's own knowledge/expertise is used when producing advice in their respective countries: (Table 7)

Table 7: Whether advisor's knowledge and expertise is used for science advice

Country	
Australia	The government of the day often shapes and calls upon the expertise of science advisers as it sees fit.
Bangladesh	NCST committee members (especially scientists included in the committee) have knowledge or expertise used for advising science-related policies.
Bhutan	things are dependent on the advisor's knowledge and expertise especially when there is no advisory group to advise and work on. This comes with a lot of subjective bias.
India	the Chief Science Advisor uses their personal experience and the information recommended by other experts to form advice.
Malaysia	Science advisor chairs Science, Technology, and Innovation Advisory Committee (STIPAC) under the Academy of Sciences Malaysia
Nepal	During the establishment of Biotechnology Research Center experts were consulted.
Philippines	The present practice is to refer the concern to the NAST experts In the field, including NAST awardees, and other identified experts.
South Korea	PACST appoints experts in diverse S&T areas including S&T policies as committee members (advisors).
Sri Lanka	-
Thailand	-
Türkiye	Advisors are typically selected based on their expertise in a particular field, and their knowledge and experience are valuable in informing the advice they provide.

3.1.4 (viii) WHETHER ADVICE STATES THE LIMITATIONS AND UNCERTAINTIES OF THE ADVICE

All the countries surveyed seem to agree that science advice should specifically state the limitations and uncertainties of the advice produced: (see Table 8)

Table 8: Whether advice states the limitations and uncertainties of the advice

Country	
Australia	Where evidence is uncertain, this is clearly stated.
Bangladesh	Advice should specifically state the limitations and uncertainties of the advice
Bhutan	Largely dependent on the nature of the advice. Limitations are mostly mentioned.
India	Limitations and uncertainty of certain products are given to the public.
Malaysia	Input provided will be continuously monitored and given the latest input that addresses the current challenges that are faced.
Nepal	Most paper works were finalised though implementation was poor.
Philippines	The expert provides their written advice and the limitations are already included in their write-up.
South Korea	With fully discussed advice the possible conflicting scientific evidence can be identified and removed in the process of preparing the advisory agenda.
Sri Lanka	SWOT analysis was provided with all recommendations.
Thailand	-
Türkiye	Considered good practice for science advice to explicitly state the limitations and uncertainties of the science advice, it can be made more transparent and credible.

3.1.4 (ix) THE METHODS IN WHICH CONFLICTING SCIENCE ADVICE IS HANDLED

A. EXAMPLES OF THE GOVERNMENT FOLLOWING SCIENCE ADVICE

In 2018, the **Australian** Government asked the Therapeutic Goods Administration (TGA) for advice. The TGA conducted a public consultation on prescription opioids in 2018; 80% of the recommendations published in these reports have been taken up by the government and the Academy continuously monitors the progress of the recommendations and gives inputs to the government.

Bangladesh outlines the formulation of National Science and Technology Policy, National Biotechnology Policy, etc

Bhutan references the management COVID-19 is one example where scientific advice from the Technical Advisory Group was followed by the National COVID-19 Management Taskforce.

Similarly, **NASI** outlines that the case of implementing the Covid-19 vaccine required a National Action Group for COVID-19.

In **South Korea**, when the advisory agenda is reported to President and discussed in PACST meeting, major policy contents are sent to relevant ministries. PACST monitors the progress of actions in relevant ministries and, if necessary and when the issue is very important, organizes another meeting to discuss the progress of the actions.

In **Türkiye**, an example would be the advice provided during the COVID-19 pandemic. The government established a Scientific Advisory Board at the beginning of COVID-19 pandemic that was composed of experts from various fields in health in order to provide guidance on the management of the pandemic. The advice included all recommendations on topics such as testing, contact tracing, and social distancing measures.

As there is an SOP and scientists and policymakers together decide about science for policy, the conflicting scientific evidence are discussed in the **NCST** meeting and resolved. If required, in consultation with the experts in the field.

In **Nepal**, scientists advanced to establish indigenous technology, as per the National Nuclear Policy, 2064 (2007).

The management COVID-19 is one example where scientific advice from the Technical Advisory Group was followed by the National COVID-19 Management Taskforce.

During the COVID-19 pandemic, the decision on instituting national lockdown, travel restrictions and the duration of quarantine of travellers were based on the scientific advice of the TAG. However, it must be understood that the handling of COVID-19 was in a pandemic situation where everyone was receptive of ideas. In other areas of scientific discipline, it is after very rare that the government listen to the scientific advises. This is mainly because the technical officers of the government offices either do not understand the scientific literature or they are two powerless to make policy changes.

One of ASM's flagship studies is Science Outlook with reports that are being produced biennially since 2017. This study aims to present insights supported by relevant data on **Malaysia**'s STI landscape. 80% of the recommendations published in these reports have been taken up by the government and Academy continuously monitors the progress of the recommendations and give inputs to the government.

While the **Philippines** acknowledges that most conflicts came from conflicts of interest, the importance of disclosing all aspects of research to stakeholders. E.g: PAGTANAW 2050, mentioned in the Philippine Development Plan (2023-2028) and the Universal Health Care Law enacted in 2019.
Most of the conflicts came from a conflict of interest. To minimize the conflict of interest, all the aspects of the research should be or only disclosed to relevant stakeholders.

Sri Lanka, and Thailand did not elaborate.

[1] https://transactions.nast.ph/?p=1792, https://pdp.neda.gov.ph/wp-content/uploads/2023/01/PDP-2023-2028.pdf

B. EXAMPLES OF THE GOVERNMENTS NOT FOLLOWING SCIENCE ADVICE

Australia outlines two instances:
Renewable energy and energy security: The government position – that renewables are a threat to energy security – bore no relation to advice as to the causes of the South Australian blackout of 2016.

Kosciuszko National Park: The scientific evidence supports an active program of removal of horses (a feral horse species known as Brumbies), including culling. This evidence was ignored and disregarded by the government. It also passed a Wild Horse Heritage Act 2018 which downgraded the role of science advice as an input into the management plan for the KNP, elevating a "Community Advisory Panel" which explicitly excluded scientists.

The National S&T Research Fund was not established in **Nepal**.

In **Malaysia**, the integrated Water Management System (IWMS) is accepted by the central agency but faces challenges in implementation at state level because of different jurisdiction between federal and state governments. The government in Bhutan is usually receptive to ideas and advice especially if given by international organisations and international advisors.

India reported the emergency approval of covid-19 vaccines which did not follow the routine process of science advice.

Bhutan was unable to provide specific examples.

In the **Phillipines**, the advice being provided by the Academy is based on the current issues and concerns of society. These are unsolicited as such the adoption will be based on the need and appreciation of the policy makers.

NASTEC explains that within the instances of conflicting views, all views that do not support the existing political interests were ignored.

The **NASTPH** explains that the advice being provided by the Academy is based on the current issues and concerns of society. And thus, these are unsolicited as such the adoption will be based on the need and appreciation of the policy makers.

Bangladesh, South Korea, Thailand, and Türkiye did not cite any examples.

C. THE METHODS IN WHICH THE SCIENCE ADVISORY PROCESSES ARE MADE TRANSPARENT

When inquired whether there are in-built consultative processes that are followed by those developing government science advice, the different countries cited different methods (Table 9).

Table 9: In-built consultative processes followed during science advice

Country	Methods	Source
Australia	There are no specific guidelines for science advice, but often the provision of science advice may fall into a range of guidelines Where the procurement of advice may lead to legislation (primary and delegated), there may be requirements in the Legislation Act which need to be satisfied around consultation. The Office for Impact Analysis in the Department of Prime Minister and Cabinet has prepared a guidance note on best practice consultation.	https://oia.pmc.gov.au/resources/guidance-obpr-procedures/best-practice-consultation
Bangladesh	No such process, but Policy reports, such as "Science & Technology Policy, 2011," are available on the Internet and Ministry Website.	https://most.portal.gov.bd
Bhutan	No such formal process	However, public consultations may be carried out as required depending on the agencies. - It is mostly decided by the agencies responsible. The processes are after not transparent. The amount of information given to the public often is limited to media coverage of the event or the topic. The general public do not usually get to see the full document or the strategy plan document of. The relevant agency in most cases do not upload their document on the website and there is limitation of the reach of printed materials.

		- While it is assumed that sharing of online document among a closed circle of policy makers maybe adequate, it makes it practically difficult for others to access information. This rather creates more questions in the mind of the public as to what resource material or what advice had the policy makers received.
India	There are processes, however in emergency cases, the consultative process may be overlooked.	
Malaysia	Through stakeholder engagement	
Nepal	Science Policy, Science Council, working committees are formulated	
Philippines	The Academy annually conducts a national scientific meeting, participated in by scientists and researchers all over the country. The Academy annually conducts a national scientific meeting, participated in by scientists and researchers all over the country. During this activity, scientific research are presented to the public for their information. The event also becomes a venue to conduct public consultation since the audience are also given. a chance to ask and comment during the open forum. Prior to the Annual Scientific Meeting, Regional Scientific Meetings are conducted in different parts of the country.	

South Korea	PACST has three sub-committee, i.e. S&T Infrastructure Sub-Committee, S&T Innovation Sub-Committee, and S&T Society Sub-Committee. Each advisor should belong to a sub-committee. In addition, as mentioned, PACST appoints about 10 special members who is not only preparing the advisory agenda but also consulting the advisory the quality of agenda and process.	
Sri Lanka	The process is entirely not transparent	
Thailand	None	
Türkiye	In some cases, governments may have a formal public consultation process in place for developing science advice, where the public can provide input on the questions being asked, the scope of the advice, and any potential impacts of the advice on society. Additionally, some governments may publish the names and affiliations of the scientific advisors providing the advice, the methods used to develop the advice, and any conflicts of interest that may exist. Open access to scientific publications and data sources used to develop the advice can also increase transparency and accountability. It's worth noting that transparency in the scientific advisory process can help build trust between the government and the public, particularly when controversial or contentious issues are involved.	

3.1.4 (x) WHETHER THE ADVICE IS MADE PUBLICLY AVAILABLE.

In **Australia**, Typically, where advice is determined through public consultation, it is common practice to make submissions available following the consideration of advice or the conclusion of the consultation process. To meet Privacy Act obligations, permission is required for publication. More broadly speaking, science advice to government is not, by rule, made publicly available. However, advice which is not subject to deliberative processes (i.e., cabinet decision making) may be made available by government departments, freedom of information requests or as a result of parliamentary processes. Science advice provided by the Chief Scientist is typically published eg rapid reports[1]

Other countries that make the advice publicly available include **Malaysia[2], Bangladesh[3], South Korea, Nepal[4], India, Philipines[5], Sri Lanka (sometimes) and Türkiye**.
It is not mandatory in **Bhutan, and Thailand** does not.

[1] https://www.chiefscientist.gov.au/RRIF
[2] https://www.akademisains.gov.my/publication-category/all/
[3] Annual Report of the Ministry of Science and Technology
[4] Nepal S&T Report. library@unesco.org and archives@unesco.org : https://unesdoc.unesco.org/ark:/48223/pf0000380268
[5]https://www.nast.dost.gov.ph/index.php/13-news-press-releases/593-nast-phl-science-advisory-on-african-swine-fever-in-the-philippines

A. WHEN INQUIRED WHETHER THE ADVICE IS MADE PUBLICLY AVAILABLE IN A TIMELY MANNER

In **Türkiye**, it is not clear whether there are specific guidelines or protocols in place for making this advice publicly available in a timely manner. However, the Turkish government has made efforts to increase transparency, through the adoption of the Law on the Right to Information in 2003 and the establishment of the Open Government Partnership in 2016. After the PACST meeting (reporting to President), all advisory reports (documents) are opened in PACST homepage. After final approval from the relevant authority, it is made publicly available on time through the Ministry website.
Nepal conducts the public distribution of such information through press releases, interviews, consultative meetings. Where advice is determined through public consultation, it is common practice to make submissions available following the consideration of advice or the conclusion of the consultation process. To meet Privacy Act obligations, permission is required for publication, through publication of reports and other channels such as social media and townhall. In India, information is brought to the public domain through press reports, websites, and general media coverage.
In **Bhutan**, it is not mandatory or not required by the systemic process but may be undertaken.
According to **NASTEC**, some decisions are communicated in a timely manner while certain decisions are taken overnight, whereas in contrast; the members of **NAST** almost immediately start a round table discussion or create an ad hoc committee in the sudden need for advice on a certain topic.

All countries except **Thailand,** confirm that the advice produced is disseminated in a webpage. The available links are given as foot notes of the table 10.

Table 10: The mechanisms that science advice is made public

Country	REPORTS	TOWNHALL	WORKSHOPS / SEMINARS	SOCIAL MEDIA	MEDIA CONFERENCES AND ENGAGING	INTERVIEWS/ CONSULTATIVE MEETINGS	DEPARTMENTAL/ MINISTRY WEB SITES	EXHIBITIONS, VIRTUAL CONFERENCES, FOCAL GROUP DISCUSSION
Australia	√						√	
Bangladesh[2]	√		√		√		√	
Bhutan[3]	√		√		√		√	
India[4]	√				√		√	
Malaysia[5]	√	√	√	√	√		√	
Nepal[6]	√		√		√	√	√	
Philippines[7]	√						√	√
South Korea[8]	-	-	-	-	-	-	√	
Sri Lanka[9]	√						√	
Thailand	-	-	-	-	-	-	-	-
Türkiye[10]	√		√		√		√	

[1] When science advice is made public it is usually published on departmental websites. NSTC reports are published on the website of the Chief Scientist. For example, a rapid research report on the space industry is published at https://www.chiefscientist.gov.au/news-and-media/2021-rapid-report-space-industry-and-stem-workforce

[2] Through the publication of reports. *E.g: "Science and Technology Policy, 2011" report, Annual Report of the Ministry of Science and Technology. http://most.gov.bd*

[3] Mostly as reports and publications that are put up publicly on the agency websites or as hard copy publications. The contents of many such public reports make headlines in the newspapers. When the national statistics Bureau published the Bhutan Poverty Analysis Report 2023, many of the newspapers and the national news broadcaster covered it in detail

[4] National Solar Mission

[5] ASM reports are made available online. https://www.akademisains.gov.my/publication-category/all/

[6] Nepal S&T Report Nepal S&T Report. ISBN: 978-9937-9493-9-2. For full text Contact: library@unesco.org and archives@unesco.org for more information
https://unesdoc.unesco.org/ark:/48223/pf0000380268

[7] gives an example link on Science advice shared via website regarding 'African swine fever in the Philippines Sample Link: https://www.nast.dost.gov.ph/index.php/13-news-press-releases/593-nast-phl-science-advisory-on-african-swine-fever-in-the-philippines

[8] www.pacst.go.kr

[9] Government Gazette notification

[10] made available through the publication of reports, ÜBA's website and other channels. Yes, in Türkiye, science advice is often made available through the publication of reports. For Instance, TÜBA (Turkish Academy of Sciences) is another prominent organization in Türkiye that publishes reports on various topics related to science and technology, including science advice. These reports are often made available to the public through TÜBA's website and other channels, and they serve as valuable resources for policymakers, scientists, and the general public. For example, the Scientific and Technological Research Council of Türkiye (TÜBİTAK) publishes reports on various topics related to science and technology, including those related to policy issues. These reports are often made available to the public through TÜBİTAK's website and other channels. In addition, the Ministry of Health and other government agencies often publish reports on science advice related to health policy issues, which are also made available to the public.

B. THE COMMUNICATION PROTOCOLS USED IN THE PROCESS OF COMMUNICATING ADVICE

Australia, Bhutan, India, South Korea, and Thailand did not have any communication protocols, or a responsible person nor any specific strategies to convince policy makers in science advice. **Bangladesh, Bhutan, Nepal, South Korea, Sri Lanka and Thailand** too did not have any strategies.

In **Türkiye**, communication protocols may vary depending on the specific context and audience. Common strategies include using:

1. clear and concise language
2. avoiding technical jargon
3. framing the advice in a way that is relevant to the intended audience

Bangladesh follows a specific communication protocol that is followed to communicate science-related advice to the end user.

The Ministry in **Nepal** writes letters to NAST and NAST sends responses to the ministry. Finally, the ministry sends the NAST response to the cabinet.

In **Malaysia**, by presenting to respective ministries putting up council papers follow through with the cabinet. Annually, the Academy reports all the science advice activities by the science advisor and ASM to the parliament (annual report). **NAST** uses quad media to communicate its policy recommendations and science advice to various stakeholders.

Sri Lanka accomplishes this process via direct communication to the president, reports and electronic media.

Finally, **Bhutan** has no dedicated or formal communication protocols to deliver scientific information to the government.

C. SPECIFIC STRATEGIES USED TO CONVINCE POLICY MAKERS IN SCIENCE ADVICE

In **Türkiye,** there are many strategies:

1. Highlighting potential benefits of implementing evidence-based policies
2. Providing concrete examples of how scientific advice has been successfully implemented
3. Building relationships with policymakers and other stakeholders
4. Using targeted messaging and communication strategies that are tailored to the specific audience and context
5. Involving stakeholders in the development and implementation of scientific advice

The chairperson of PACST is President of **South Korea** so that the results of reporting and discussion in PACST are very authoritative and relevant S&T-related ministries should and tend to follow the results of the reporting.

In **Bangladesh**, no specific strategies are used to convince policymakers of science advice, as the advice is generated through NSCT.

For **Malaysia**:

1. Bringing in representatives of the ministry to be part of the committee and science advisor and his office becomes the strategic partner of the policy being developed
2. The Academy is always seen as an independent body that gives recommendations and advice to the government based on evidence and analysis.
3. Presentation to the policy makers is customised

There are no specific protocols in **Bhutan**. It is mostly agency based, and may be different for various organisations. After a research project is complete, findings are disseminated through:

- Official reports, meetings and workshops
- Published in international journals
- Media outlet cover interesting scientific papers from local journals

The **NASTPH** Secretariat coordinates with the concerned stakeholder or legislator or agency where policy recommendations and resolutions were sent.

Within the **NASI** system, the PSA is responsible for communicating the information to the Prime Minister.

D. EXISTING POLITICAL DECISIONS THAT WERE SUPPORTED BY SCIENTIFIC EVIDENCE

In **Australia**, often scientific evidence can be used to justify policy positions or decisions. *E.g: debate around the Climate Change Act in 2022 and Maeve's law (mitochondrial donation) in 2021.*

Scientific evidence is used to support the election manifestos and decisions of the Government of **Bangladesh**.

In **Bhutan**, this is partly applicable and may be true in some decisions but not all the decisions.

In **India**, though the COVID19 vaccine was approved as an emergency case. However, this political decision was supported by the fact that a large Indian population was vaccinated against coronavirus and protected it from the disease.

In **Türkiye**, scientific evidence may be used to support political decisions that have already been made. But the approach can be problematic if the scientific evidence is used selectively or if it is misrepresented to support a decision that has already been made. It is best to practise to involve science advice early in the policy-making process. In some cases, scientific evidence may be used to support political decisions that have already been made. This may happen if there is a need to justify or explain the decision to the public or stakeholders. However, this approach can be problematic if the scientific evidence is used selectively or if it is misrepresented to support a decision that has already been made. It is generally considered best practice to involve science advice early in the policy-making process, so that the scientific evidence can inform the decision-making process from the outset.

PACST monitors the political decisions of relevant ministries and, when the issue is important, makes the progress of the issue as an agenda and discusses it in the committee and reports to the President of **South Korea**.

According to **NASTEC,** most of the time political decisions are made prior to synthesising scientific advice.

Nepal offers a few examples such as the Flora of Nepal, the Climate Change Knowledge Management Center etc without further elaboration.

All new policies in **Malaysia** must be aligned and supportive of the current policies. The Science Advisor office through ASM monitors 51 national policies and roadmaps that are related to the STIE directly and indirectly. The government is often accused of making policies with short term vision of gaining political mileage and often this regarding the long-term development of the country. Since they have no capacity to perform our own independent groundbreaking research as well as generate our own data in terms of technical capacity and human expertise, they may be mostly using regional and international data.

The government is often accused of making policies with short term vision of gaining poison political mileage and often this regarding the long-term development of the country. In this narrative, it may be interpreted that some of the government policies are made merely for gaining political popularly. This also shows how political parties like the capacity to scientifically analyse problems. For example, the current ruling political party promised to provide economic monetary benefit transferred to mothers who gave birth. However, this was neither based on scientific evidence that direct benefit transfer would result in positive outcomes nor a financial assessment whether the government has enough budget to provide such a money to the benefits.

NASTPH outlines 'Executive Order No. 164', based on a comprehensive study that led to the crafting of a policy that covered a wide range of issues. Executive Order No. 164 "Adopting a National Position for a Nuclear Energy Program and for Other Purposes was enacted in February 2022. EO 164 was based on a comprehensive study that led to the crafting of a policy encompassing a wide range of issues.

NASI approved the distribution of the COVID-19 vaccines as an emergency case, a political decision supported by the concept of herd immunity.

Finally, in **Sri Lanka**, most of the time political decisions are made prior to synthesising scientific advice.
Scientists are requested to attest political decisions that have been made with no scientific basis. Unfortunately, most of the scientists attest such decisions in order to gain personal advantages from politicians. For example, most of the scientists supporting the organic fertiliser shift in the country were aware of its unsustainability, but the majority in the advisory team applauded the suggestion.

3.1.4 (xi) BUDGETARY CONSTRAINTS

In Australia, until recently, there was only ad-hoc funding for centralised co-ordination of science advice. As a result of the 2022-23 budget, a specific source of funding has been allocated to the Office of the Chief Scientist for this purpose. Otherwise funding the provision of advice is handled on a case-by-case basis. For example, the Rapid Research Information Forum, reports were produced by Learned Academies without any additional public funding.

Bhutan has budget constraints at all levels of research programs, and there is no independent government body to provide research grants or research endowment funds.

Nepal and the Philippines confirm the existence of budgetary constraints, but do not elaborate any further.

In Türkiye, as with any government program or initiative, there may be past spending budgets.
The specific budgetary situation is determined depending on the country and the government department or department responsible for science advice. PACST has a sufficient budget. It has a supporting office, special members to support advisors (committee members), enough resources to do research on important issues.

Bangladesh, India, Malaysia, South Korea, and Sri Lanka declared that there are no serious budgetary constraints. In Malaysia, The Science Advisor office and ASM's fully operating budget is from the Malaysian government, and income revenue from ASM is used to do flagship studies to give inputs back to the government. Additional studies commissioned by the government will be funded by the government.

3.1.4 (xii) INDEPENDENCE FOR SCIENCE ADVISORS

When questioned as to whether science advisors are allowed to work independently without any interference from political quarters, there were mixed responses.

Science advisors in government are limited by the requirements of the **Australian** Public Service and existing public comment policies of their organisations and are rarely able to speak explicitly to policy recommendations to the public. Academics in universities who contribute to science advice are protected by notions of academic freedom in both primary legislation and through staff enterprise agreements.

In Bangladesh, within NCST, the Science advisors, especially the scientists, were allowed to work independently without any interference from the Bangladesh government or other quarters.

In Bhutan, academics in universities who contribute to science advice are protected by notions of academic freedom in both primary legislation and through staff enterprise agreements. All researchers perform the research as secondary to their primary responsibilities. Research funds, especially when huge, should always be routed through the government channel. Spending of research grants must follow the government's structural layout for finance disbursement.

The ASM President is an independent science advisor to the nation of **Malaysia.**

The **NASTPH** members are only required to work in their personal capacity to provide advice to policymakers.

In South Korea, advisors do not have full-time jobs but they normally have an important position in universities, public research institutes or industrial companies. So, they can do their work independently.

Nepal admitted to independence but did not elaborate.

In Türkiye, the independence of science advisors may be influenced by a variety of factors, including government policies, funding sources, and the level of support from political leaders. Administrative positions may be influenced by some factors but their academic issues and academic staff are not influenced by political situations.

Finally, according to **NASTEC** there was heavy influence to agree on the political decisions without adhering to the scientific process. Similarly, within **NASI**, science advisors are expected to work in the interest of the reigning government.

Thailand refrained from commenting.

3.1.4 (xiii) INFLUENCE OF LEGISLATIVE BODIES ON THE PROCESS

As of recent, science advice is now attracting the attention of scrutinising institutions in **Australia**. Tools that are used to scrutinise science include Parliamentary processes (committee inquiries, estimates, orders for the production of documents), freedom of information (FOI) laws, information disclosure mechanisms (i.e. contract registers). Examples include a committee inquiry into science around the Great Barrier Reef in 2019. FOI and other mechanisms are being used to obtain documents by activists on policy issues like climate, vaccines, animal welfare, etc which creates pressure for internal science advice to become opaquer and more hidden from view. One example of how legislative scrutinising mechanisms act to examine the underlying evidence behind science advice is the annual CSIRO GenCost report which began in 2018. The report has been used to inform energy and climate policies. Since 2019 the assumptions in the report have been challenged in the public domain, but also in Parliamentary proceedings – mainly by politicians who are pro nuclear or pro coal. This scrutiny has required science advisers in the CSIRO to be transparent as to its methodology and processes and key assumptions. Overall, however, because of the trust in the brand of the CSIRO the report has become an annual trusted update in policy circles.

Bhutan declared that there is increasing involvement of the parliaments in such decision making and consultations. The Members of Parliament are supported by research officers who help them in collecting data and doing analysis. However, most of the research for the parliamentarian revolve around policy analysis and its social impacts. Regarding, scientific research or a formal scientific review of evidence, the parliamentarians work through House Committees as mentioned earlier.
The House Committees undertakes consultations with the expert groups specific to the task in hand.

In **Malaysia**, the science advisor through the ASM will give feedback to the Parliamentary Advisory Committee (PAC) when called upon for things related to science. Parliament members can also engage with the science advisor through ASM if they need special briefing by the parliament.

In **Türkiye**, Legislative bodies like the Parliament play a role in the science advice process. They may establish committees or task forces to provide advice on specific issues or to review the advice provided by scientific advisors. This can help ensure that the advice is relevant to policy decisions and that it is communicated effectively to policymakers. However, the level of influence of scrutinizing institutions like the Parliament on the science advice process can vary depending on the political and social context of a country. It is important to have clear guidelines and principles in place to ensure that the science advice process remains independent, transparent, and objective.

In contrast, in countries such as **Nepal, Philippines and South Korea**, the influence depends on the current political party's priorities or there is no pressure from Parliament or other legislative bodies, respectively.

Bangladesh, India, Sri Lanka and Thailand did not report on this matter.

3.1.4 (xiv) FORMAL ASSESSMENT OF THE IMPACT OF SCIENCE ADVICE

Most of the countries surveyed do not have tools to formally assess the impact of science advice (excluding Malaysia). However, they do have other non-specific processes available (Table 11).

Table 11: The process used to assess the impact of science advice

Country	Process	Web links
Australia	No current formal process	The Australian Government has recently established an Office for Impact Analysis in the Department of Prime Minister and Cabinet to work with departments and agencies to produce detailed, evidence-based assessments of complex policy issues. The OIA publishes impact analysis of major policy changes, such as the recently announced Nature Repair Market. The current Reef Futures roundtables project, delivered by the Australian Academy of Science on behalf of the Department of Climate Change, Energy, Environment and Water includes an independent evaluation of roundtables by CPAS which will be published.
Bangladesh	None	None
Bhutan	None	There is no routine formal assessments of impacts Many of the scientific advises from the technical comedies come in the form of recommendations or key performance indicators. In Bhutan the government follows the Annual Performance Agreement, system where task is linked up with your performance assessment as an individual as and organisation/agency. For example, if the government wants all mortality in the hospital to be reported, this task is linked up to the performance assessment. The doctors are assessed on their timely reporting of mortality and the hospital is assessed weather such reports are submitted on time to the Ministry. However, it is often difficult to accommodate all the essential implementation points into keep performance indicators. It is also noted that the performance indicators are sometimes decided upon by the agency for the individual keeping it open for lowering the threshold of compliance in order to achieve higher performance reading.
India	None	Data collection at pre and post policy stage for impact of an implemented advisory. Analysis of data in terms of population, age, gender sex and society Example: impact of Polio eradication in the country.https://main.mohfw.gov.in/sites/default/files/Pulse%20Polio%20Programme.pdf

Malaysia		Science Outlook Annual report – assessment on the advisory role of science advisor to the nation. Economic Planning Unit (EPU), - Midterm Review to review ASM's policy implementation.
Nepal	None	
Philippines	None	
South Korea	None	PACST monitors the process of policy making or implementing when the issues are very important. Ant it can discuss the progress of the issue again as a committee agenda. In this process, PACST can assess the impact of science advice.
Sri Lanka	None	
Thailand	None	
Türkiye		Assessing the impact of science advice is an important aspect of ensuring that the advice is effective and valuable. In some countries, there are formal processes for assessing the impact of science advice, while in others, it may be less structured. In Türkiye, there is no specific formal process for assessing the impact of science advice. However, the impact of government policies, which may have been informed by science advice, is assessed through various mechanisms, such as monitoring and evaluation studies, performance reports, and audits. For example, the Turkish government has established a Performance Assessment and Monitoring System (PAMS) to monitor and evaluate the implementation of government policies and programs. The PAMS is designed to assess the impact of policies and programs based on their objectives, targets, and expected outcomes. In addition, the Turkish Court of Accounts conducts audits of government programs and projects to assess their effectiveness and efficiency. These audits may include an assessment of the scientific basis of policies and programs, and their alignment with scientific evidence. Overall, while there is no specific formal process for assessing the impact of science advice in Türkiye, the impact of government policies and programs, which may have been informed by science advice, is assessed through various mechanisms.

3.2 PRINCIPLES OF SCIENCE ADVICE

In the process of science advice, it is important that certain principles are maintained including the matters of conflicts of interests, how to reduce uncertainty and address diversity, importance of independence and transparency, and effect of bias.

This survey assessed this via questions related to

1. independence of the process as to whether most of the scientists were appointed or identified by the policymakers.
2. the mechanism to ensure that science is legitimate and trustworthy.
3. how science advice is assured of access to policy maker
4. how the process of science advice ensured diversity of evidence encompassing roader perspectives e.g., social, cultural, and economic considerations
5. reducing uncertainty.
6. how scientific evidence incorporated into decision-making about so-called "wicked" problems, which lack clear definition and cannot be solved definitively.
7. whether there are any strategies to communicate policy makers about uncertainty about the facts or precautionary principles mentioned in the advice given.

3.2.1 INDEPENDENCE OF THE PROCESS

In Australia, Bangladesh, Bhutan, India, and Sri Lanka, science advisors are appointed by policymakers. Policymakers will often define the questions and frame parameters of the way advisers operate – although this can be a fluid process with scientists – especially when they are trusted advisers – able to influence the framing of requests for advice. In **Australia,** where advice is sought from outside of government, in particular the learned academies, while the organisation providing the advice is selected, the scientists and researchers they draw on is independent.

In Bhutan there are no formal appointments or positions as a scientist. There is a notion that the country is backward in terms of scientific capability and all scientists need to be International, hence there is a bias in selectively listening only to international advisors. An example is from the national newspaper where a nutrition advisor was invited to provide expert guidance on improving diet of the population. The advisor had advocated increasing the intake of coconut oil, which was not translatable to the population the use of coconut oil is not a common practice. This advice was solicited from an outside expert, despite presence of a nutritionist in the country.

Malaysia, South Korea, Nepal, Philippines, Thailand, and Türkiye revealed that scientists are appointed by science committees.

3.2.2 LEGITIMACY GIVEN TO THE SCIENCE ADVICE PROCESS

In Bangladesh, the NCST composition is such that its policies are trustworthy and reliable and **Australia** states that the level of political and civil service control in the Australian system is the desire by policymakers to receive advice from advisers and institutions who have a reputation for trust and independence. For example, despite that fact that the Chief Scientist is a government appointment, there is a widespread understanding that the individual in that position has a high degree of integrity, honesty, and independence. Similarly, the CSIRO has a strong brand for excellent and trusted science.

The level of scientific research in **Bhutan** is minimal or not existent. All advice and recommendations come from international publications or data from the region. Even in many of the World Health Organisation reports, the data from Bhutan is extrapolated and there is lack of normative data. The country understands the importance to generate its local data and scientific evidence for an informed policy decision making. However, until adequate local data and scientific expertisees is available in the country, Bhutan has to depend on the proxy scientific indicators from else. This poses multiple challenges including the advice itself not getting right. One example is the implementation of Direct Benefit Transfer to individuals detected with tuberculosis in India. While this initiative under the RNTCP is found very effective in case detection and completion of treatment in India, this advice is not at all applicable for Bhutan. This is because the treatment in Bhutan is provided free of cost for the Government, the size of population is small that the program is practically able to follow up all patients. Currently there are no specific mechanisms to establish to verify the validity of scientific statement and to assess weather search advises or recommendations are relevant Bhutan. At the level of the Technical Advisory Groups for various topics, the group makes a decision and recommendation to the relevant agency. However, the members of the Technical Advisory Group do not get to meet each other or set in conferences together. This has a major impact on the timely assessment of scientific and prices and timely delivery of appropriate advice. Whether or not to trust the advice is often left to the understanding of the technical officers all the ministers. For example, when the minister for health in Bhutan was a public health expert, there were many public health in preventions and programs that were planned. Though this maybe a subject assessment, it is clear that the public health understanding of the Minister help expedite the implementation of such program. It was also seen in the Ministry of Agriculture that a minister from a technical background was able to reduce the time to decision making on policy matters. This reflects that the decision on whether to trust the scientific advice depends on individual capacities.

In India, NASI ascertains the legitimacy of the science used by the advisory body depending on the primary and secondary data obtained before it is used in policy framing. Learned academies are similarly valued for their reputation for independence.

Malaysia draws attention to ensuring that reports cite and refer to credible sources and peer review. Apart from ensuring that all the reports cite and refer to credible sources, there is an internal process through the council through STIPAC, Water, Energy, Health, Agriculture and Biodiversity (WEHAB++), subject matter committee and peer reviews internationally and nationally within ASM expert network to ensure the legitimacy.
For example, Science Outlook was peer-reviewed by international review from OECD and South Korean Academy of Sciences.

Nepal also adds on to this point by highlighting that scientific values, standard methodology, standard and ethics uphold high levels of transparent publication.

In the Philippines, NASTPH is mandated by Executive Order No. 818 to recognize outstanding achievements in Science and Technology and provide meaningful incentives to those engaged in scientific and technological research.

In Sri Lanka, NASTEC identifies that there is no formal mechanism, and as a result there have been many failures due to false data/ premature decision making.

In Türkiye in general, the mechanism to ensure that science is legitimate and trustworthy involves several steps, including rigorous peer review, replication of experiments, transparency in data and methods, and adherence to ethical standards. Peer review is a process in which scientific papers are reviewed by experts in the same field to ensure accuracy, validity, and relevance of the research. Replication of experiments by other researchers also helps to establish the reliability of findings. Transparency in data and methods, such as making data publicly available and clearly documenting the methods used in research, helps to increase the credibility of scientific findings. Adherence to ethical standards, such as obtaining informed consent from research participants and avoiding conflicts of interest, also plays a key role in establishing legitimacy and trustworthiness of science. In addition to these steps, there are also organizations and initiatives that aim to promote transparency, reproducibility, and ethical standards in science, such as the Open Science Movement, the Center for Open Science, and the Transparency and Openness Promotion (TOP) Guidelines. Overall, a combination of rigorous scientific methods, transparency, ethical standards, and accountability through peer review and replication helps to ensure that science is legitimate and trustworthy.

Thailand and South Korea have not commented.

3.2.3 ACCESS TO OBTAIN EVIDENCE

In general, a combination of formal (science advisory committees or councils) and informal (personal relationships or networks) channels, effective communication strategies, and transparency can help to ensure that science advice has access to policy makers.

In and of itself science advice has no privileged access to policymakers in **Australia.**

The Ministry of Science and Technology of **Bangladesh** is responsible for ensuring its access to the policy makers.

In Bhutan, depending on the level at which the size advisor is positioned, they have differential access to sources, information, and government. If the scientific advice needed to be generated based on data from the field, pending on the availability of time and resources, the scientific advisor is given access to the government records. The scientific advisor or the advisory team may go on field visit, consultation meetings with the relevant policy makers on technical officers of the agency and carry out research. If the scientific advisor had prior approval to collect data, the technical officers and the policy maker are ready to share them with the advisor. In some situations, policy makers are involved from the inception of the advisory process.

In India, to ascertain legitimacy and ascertain that the science used by the advisory is legitimate and trustworthy depends upon the primary and secondary data obtained as well as the evidence thereof which are taken into consideration before policy framing.
In Nepal, media coverage, seminars and delegations are used to brief policy makers with convincing evidence.

Science advisor has access to more than 1000 experts in the Academy of Sciences **Malaysia** with 100 management staff nationally and access to 22 international platforms.

In **South Korea**, the PACST's science advice to the President is opened and diffused to all S&T-related ministries.

However, in **Sri Lanka**, policy makers tend to pay less attention to the scientific advisory since political influences usually over-rule the science advice that is produced. The level of access in the Philippines is quite transparent since NASTPH disseminates its advice to policymakers. The Science advice is also published to give access to the general public. Similarly, NASI ensures that the draft reports of the science advice to be used for policy framing is made available to the policy makers along with recommendations.

In Türkiye access to policy makers can be assured through various mechanisms, including a combination of formal and informal channels, effective communication strategies, and transparency can help to ensure that science advice has access to policy makers.

Thailand has not commented.

3.2.4 DIVERSITY OF THE PROCESS

The process of science advice can ensure diversity of evidence through various mechanisms such as conducting systematic reviews, consulting with experts from various fields, and considering a range of data sources. The inclusion of diverse perspectives, including social, cultural, and economic considerations, can be ensured by involving experts and stakeholders from a variety of backgrounds in the science advisory process. Overall, ensuring diversity and broader perspectives in science advice is important for producing robust and effective policy recommendations that consider the complex social, cultural, and economic factors that influence decision-making.

Australia is of the opinion that, science advice mechanisms must first and foremost rely on scientific evidence. However, there is a broad understanding that most requests for advice require multidisciplinary input. So, for example, Rapid Research Information Reports to the NSTC usually require the lead learned academy to seek expertise from all learned academies. Another example is that the CSIRO, while a science agency, has long invested in social science capability to build social licence for its activities.

In **Bangladesh,** NCST members consist of experts in different fields and are involved in various ministries and organisations, thus it ensures diversity and a broader perspective. By addressing the process of science through a consulatory multi-disciplinary approach,

Bhutan presents having a group of technical experts providing advice ensures diversity in the ideas, opinions, and approaches to understanding a problem as a viable way to ensure diversity in the evidence. For example, the Parliament's House Committee on environment assessed the impact of allowing international vehicles to travel freely in Bhutan, the multi stakeholder meeting and consultations brought about many themes for discussion ranging from impacts on environment, economy and and the society. The advantage of having a group of technical experts providing advice is that there is always diversity in the ideas opinions and approaches to understanding a problem. During technical advisory group meeting there is always debate on different perspective and different points of views. This is particularly important to a accommodate ideas that help in producing advisory that are more practical and lightly to yield positive results. For example, the Parliament's House Committee on environment assessed the impact of allowing international vehicles to travel freely in Bhutan, the multstakeholder meeting and consultations brought about many themes for discussion ranging from impacts on environment, economy and and the society.
India – yes but no description

In Malaysia, since 2016, ASM includes social sciences & humanities as one of the disciplines for ASM fellows. We focus all our policy studies not only in S&T but also socioeconomic perspective. An example is the 10-10 MySTIE Framework that provides a systematic approach to transform Malaysia into a knowledge-based economy by linking science, technology and innovation (STI) with socioeconomic sectors.

Nepal addresses the inclusion of ethnic and marginalised groups and the gender gap. Nepal - In the case of the NAST, it is through the collective experience of experts/members to give advice (interdisciplinary, multidisciplinary, and transdisciplinary).

In **South Korea**, for this purpose, PACST appoints special experts as special members, who are working diverse areas, universities, public research institutes, and industrial companies. There are about 20 special experts (called special members) to support committee members (advisors).

In Sri Lanka, diversity, inclusion and the effect on minorities are not addressed with sufficient depth during the advisory process; whilst in the case of the NASTPH, it is through the collective experience of experts/members to give advice. While NASI confirms that there is a diverse range of experience used in processing science advice. It does not elaborate further with examples.

Furthermore, PACST appoints special experts as special members, who are working in diverse areas, universities, public research institutes, and industrial companies.

The involvement of TUBA in advising and consulting with experts from various fields (government agencies, bodies and committees, scientific institutions), promotion of scientific education and research and considering a range of data sources an by the "Science, Technology and Innovation Policies Board" which is another organisation established by statute in **Türkiye** that provides science advice for policy.

Thailand did not volunteer any information.

3.2.5 REDUCING UNCERTAINTY

In Australia, science advice mechanisms seek to provide clear guidance about certainty. *For example, in the production of Rapid Research Information Reports through the NSTC there is an expectation that the IPCC methodologies for expressing uncertainty (Chapter 1: Framing, Context and Methods (ipcc.ch), pp. 169-170) will be adopted.*

When there are uncertainties in the evidence and uncertainty in the applicability of the evidence in **Bhutan,** the information and advice are often laid out to the policy makers. The policy decisions and then based on the local capabilities and local factors on following opportunity advice.

In Türkiye, scientific uncertainty is science itself. In this context, all kinds of knowledge that emerge because of scientific methods and tools are considered scientific knowledge and play a role in reducing the uncertainty to some extent. Nepal combats uncertainty through strong documentation of information, ensuring that it is well planned and accredited.

NASTEC highlights that the SWOT analysis is not done in sufficient depth and NASTPH identifies that advisories develop from the current societal problems or societal issues. NASI puts a considerable amount of responsibility on the Chief Scientist Advisor, as it is their responsibility to clarify factors that are known and unknown prior to providing definite science advice. However, in the case that there is insufficient information, the Chief Science Advisor may seek more evidence or explanation from other scientists (including stakeholders).

In India, the primary responsibility of the chief scientific advisor prior to giving science advice is essentially to clarify known, able and unknowable about any issue in his report prior to providing a definite answer. In case of insufficient data, he seeks more evidence or explanations from the scientists including various stakeholders.

Bangladesh, Malaysia, Nepal, South Korea, and Thailand have not described such processes.

Nepal advocates that advisories develop from the current societal problems or societal issues.

3.2.6 HOW SCIENTIFIC EVIDENCE IS INCORPORATED INTO PROBLEMS THAT LACK CLEAR DEFINITION AND CANNOT BE SOLVED DEFINITELY

In Australia, by and large the adaptation of evidence into complex, wicked or adaptive problems is an evolving process. Many policymakers seek to incorporate scientific evidence at the formulation or anticipation stages of policy development. However, the nature of wicked problems is such that science advice should only ever be seen as one input into the policy process. The responsibility of policymakers is to make decisions based on a multiplicity of factors including but not limited to science, and for example, can refer to legal/constitutional, cultural, social, political variables.

In the field of Social Sciences, **Bhutan** is ahead in several ways. In some difficult to solve problems, Bhutan has a clear guidance from the principles of gross national happiness that helps make the policy makers decide on factors that favours the will and happiness of the people, that protects the environment and that will bring about sustainable development.

In India, NASI identifies that scientific evidence is one of the tools for its decision making process, thus the system falls short when dealing with issues that lack clear definition and scientific basis. Finally, Philippines

Malaysia states that its policies are complex because they are cross-cutting in terms of subject matter. The key to the success of these recommendations is to have a very inclusive stakeholder engagement and inclusive experts representing many disciplines and sectors to ensure it has a holistic view in the exercise.

Nepal promotes rational thinking, robust methodology, digging out empirical data, teamwork and collaborations among scientists and thus avoids this phenomenon.

NASTPH highlights in a previous response that it uses interdisciplinary, multidisciplinary, and transdisciplinary approaches when it comes to producing advice, thus, allowing the advice to have greater flexibility to support its scientific evidence.

South Korea, Türkiye and Thailand identify that there are no such processes within its decision-making systems; while in **Bangladesh**, the decision-making process involves all stakeholders by incorporating everyone's view, and as such no problems arise.

3.2.7 STRATEGIES USED TO COMMUNICATE POLICY MAKERS ABOUT UNCERTAINTY ABOUT THE FACTS OR PRECAUTIONARY PRINCIPLES MENTIONED IN THE ADVICE GIVEN

Australia highlights that science can be complex and uses its own language to deal with that complexity. Communication of science advice, and its complexity and uncertainty, remains a challenge. Science advisers seek to communicate this clearly, but the capacity to do so, as well as the audience, differs from case to case.

Bhutan states that while neutral scientific advice needs to provide precautionary principles, there are high chances of it being misunderstood and decisions being hampered by it. Uncertainty and doubt has a negative impact on the advice being adopted.

Since **NASI** depends on scientific evidence to process and develop science advice, the system takes existing available literature, meta analysis of data, probability tests etc. into serious consideration.

In **Malaysia**, the science advisor office will ensure that all the uncertainties will be evaluated and deep-dived before being brought up to the government. The science advisor and the Academy as a statutory body, has all access to the stakeholders *i.e state and federal government.* Hence, the source is directly available for clarification.

The country of **Nepal** refers to the Implementation of National Science Technology and Innovation Policy 2019: Assessment of Challenges in Government Organizations of Nepal (Poudel, 2021) as a document that tackles the subject at hand.

Advice given by the **NASTPH** comes from the collective expertise of the members. Uncertainties and precautionary principles are always discussed and communicated together with recommendations.

Nepal cites the Implementation of National Science Technology and Innovation Policy 2019: Assessment of Challenges in Government Organizations of Nepal. https://doi.org/10.3126/njst.v20i2.45779

Sri Lanka, Thailand, and Türkiye have not volunteered any information.

3.3 STRENGTHENING AND INSTITUTIONALISING SCIENCE FOR POLICY IN COUNTRIES

Diverse suggestions were reported to strengthen and institutionalize sciency for policy within countries.

Australia suggests strategies such as strengthening the evolution of the Australian science advice ecosystem by enshrining the role of the Chief Scientist in legislation, including placing the office within the Department of Prime Minister and Cabinet. Calling for the reform of the National Science and Technology Council to provide greater participation from a greater number of ministers, and a link to independent, non-government scientists such as through the learned academies. They also advocate establishment of a national centre for the practice of science advice and policy to link policymakers, scientists, and science advisers (similar to the UK's Cambridge Centre for Science and Policy. And finally, establishing a legislative science advice mechanism to provide evidence and advice to parliament, modelled on the UK Parliamentary Office of Science and Technology.

Science decision-making and priority-setting should be integral to overall development planning and the formulation of sustainable development strategies.

In Bangladesh, science for policy receives less priority in policy formulation, and it is time society and policymakers seriously consider this issue. A slight modification of the existing institutional structure may render the system more effective. To strengthen the institutionalization process of advising the national science and technology policy-making machinery of the country, including planning, programming, and budgeting of scientific and technological development, we proposed to establish different sectarian Task Forces within the overall NCST structure that would have the power of formulating S & T policy of each sector. The Task Force should comprise relevant sector stakeholders from universities, research institutes, industry, Government, and community sectors, to consider and advise the nation on scientific issues. To formulate science advice, the Task Force can form specialized working groups chosen for the relevance of their expertise to the nature of the advice being developed. The scientific knowledge and expertise of these working groups will assist in developing and implementing public policy across a broad range of issues. The mission of the Task Force will be to provide independent, authoritative, and influential scientific advice, to build public awareness and understanding of science, technology, and emerging research, and to assist evidence-based policy development and decision-making. It would be chaired by the Minister, Ministry of Science and Technology, and its membership would be exclusively composed of the Secretaries (as Member Secretary) in charge of government Ministries as represented in the NCST. The NCST will ensure coordination and implementation of Task Force policy issues by issuing executive orders binding for all government departments and their related agencies or institutions. In that context, the NCST would formulate guidelines and procedures to regulate continuous evaluation and coordination at operation levels.

Bhutan[1] feels that incorporating evidence-based decision-making in policy is very important. The academia and the researchers could conduct research which is a priority area for the country to generate evidence that the government can utilize in decision-making. On an ad-hoc basis during the COVID-19 pandemic, the Ministry of Health could use academia to conduct a literature review to generate evidence for recent development in the field. The Academia could also help the Ministry in coming up with training modules and curricula for the other health worker. The Academia could also help in health technology assessment that would allow the Ministry to institute and procure the best medical equipment. The policymakers on the other hand could support academia in terms of providing research grants and capacity building the researchers. As long as [centres of basic research] are vigorous and healthy and their scientists are free to pursue the truth wherever it may lead, there will be a flow of new scientific knowledge to those who can apply it to practical problems in Government, in industry or elsewhere. In most western countries, the idea of autonomous science resulted in universities as the `home of the scientists' and in research councils and academies as their parliaments.

In India, science for policy is already institutionalised. The Government of India established the Office of the Principal Scientific Adviser (PSA) in November 1999.

Nepal highlights the sentiments put forward in the; Implementation of National Science Technology and Innovation Policy 2019: Assessment of Challenges in Government Organizations of Nepal (Poudel, 2021)[3].

South Korea strongly feels that the South South Korean Presidential Office and S&T-related ministries should actively utilize the South Korean Academy of Science and Technology (KAST), as the South South Korean Academy is composed of top-level scientists and researchers. However, the South South Korean Academy also should strengthen its capabilities of carrying out policy research and making relevant policy advises based on its policy research capabilities.

In Sri Lanka, the vision was to introduce a sustainable mechanism for providing advice to the government on multiple ranges of health, socio-economic, environmental and development issues, with the help of a diverse range of scientists and stakeholders. This was not achieved because of the expectation of quick results by the politicians due to their poor long term sustainable plan for developing the country. Scientists who had conflict of interests and plan for political gains and personalised goals were influenced by politicians. Geopolitics which restricted certain areas of development. The intention was to introduce a systematic science advisory mechanism in particular referring to the "OECD (2015-04-20), "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[4].

Türkiye suggests that countries should; build capacity for science advice, develop structures and mechanisms for science advice, foster collaboration between scientists and policymakers, encourage open science, encourage science communication and ensure science advice is transparent and accessible. Further elaborating this, they suggest that governments can invest in building the capacity of scientists and policymakers to interact with each other, understand each other's needs, and use scientific evidence in decision-making. This can be done through training programs, workshops, and collaborative projects. Governments can establish clear and transparent structures and mechanisms for science advice, such as independent advisory bodies, that provide expert and independent advice to policymakers. Collaboration between scientists and policymakers can be encouraged by providing opportunities for joint projects, funding research that is relevant to policy, and establishing regular forums for dialogue. Governments can encourage the openness and transparency of scientific research and data by promoting open access to publications and data, encouraging citizen science, and supporting open science initiatives and they can encourage the communication of science to the public, policymakers, and other stakeholders by supporting science communication training for scientists, promoting science journalism, and creating opportunities for public engagement with science. It can be ensured that science advice is transparent and accessible by making advice publicly available, providing clear explanations of the evidence used, and encouraging public scrutiny and debate. The response also further proposes to establish different sectarian Task Forces within the overall NCST structure that would have the power of formulating S & T policy of each sector and formulate guidelines and procedures to regulate continuous evaluation and coordination at operation levels.

Thailand has not commented.

[1] https://www.sciencedirect.com/science/article/abs/pii/S0048733398000493
[2] Weblink: https://www.psa.gov.in/
[3] NJST 20(2): 85-102. DOI: https://doi.org/10.3126/njst.v20i2.45779
[4] http://dx.doi.org/10.1787/5js33l1jcpwb-en"

3.4 THE ROLE OF NATIONAL ACADEMIES IN SCIENCE ADVICE

The Australian Academy of Science (AAS) identifies the convening of scientific expertise or synthesising evidence for the government on a range of science issues as the go-to independent organisation for science advice, the development of a process for generating science advice through expert roundtables and involvement in Rapid Research Information Forum reports that summarise the scientific evidence to answer questions from Government Ministers, usually on emerging science policy issues. There are a range of organisations and mechanisms that provide science advice to governments in Australia. The AAS is an important and respected part of the science advice ecosystem in Australia, engaging with the government on a range of science issues, convening scientific expertise or synthesising evidence. The Academy has built and is continuing to enhance visibility as the go-to independent organisation for science advice. The Academy has been at the forefront of influential science advice for policymakers on issues such as the mass fish kills in the Darling River, wild horse management and RNA science and technology. AAS have been developing a process for generating science advice through expert roundtables, on topics such as RNA science, greenhouse gas removal, and climate impacts on the Great Barrier Reef.

The process for these involves:
- working with experts and stakeholders to frame the discussion.
- a nomination and selection process to identify and invite leading experts to participate in the roundtable.
- a survey and prioritisation process to identify key themes and priorities for discussion in the roundtable, modified from the processes developed by Sutherland et al. (2011);
- results from the survey and prioritisation process are presented to the participants in the roundtable as a starting point for discussion. The roundtable seeks to arrive at a consensus of important issues or priorities to communicate from the discussion or highlight points of contention.
- A statement or report is produced following the roundtable, and engagement with key stakeholders to communicate the advice/outcomes.

Another process AAS is involved in is the Rapid Research Information Forum reports. These reports are rapid turnaround (2-4 weeks) and summarise the scientific evidence to answer questions from Government Ministers, usually on emerging science policy issues (e.g., COVID-19, generative AI). This process involves appointing expert lead authors who are supported by policy analysts to synthesise the current scientific knowledge. Leading national and international experts are identified and approached to provide input, which is then synthesised by the lead authors, reviewed for feedback from experts and government/policy stakeholders (e.g., the Chief Scientist), and peer reviewed.

In Bangladesh, the BAS provides recommendations and advice to most on Science and Technology related matters from time to time (but cannot ensure the incorporation of that in policy documents or implementation of that recommendation).

In Bhutan, the Medical University plays a significant role in the case of Science Advise especially training health workforce according to the National Health Policy. The University supports the Government in decision making in terms of using best available evidence in setting up Institutions and health care on ad hoc basis as and when the Government requires them. There is no advisory board or an academy to advise the Government on regular basis.

South South Korea calls for the active utilisation of the South South Korean Academy by the South South Korean Presidential Office and S&T-related ministries, whilst also strengthening capabilities of the South South Korean Academy carrying out policy research and making relevant policy advice.

In Türkiye, TUBA establishes the provision of independent, evidence-based advice to the Turkish government on a range of scientific issues, advice and support on scientific matters related to policy decisions and the promotion of scientific research and education in Türkiye, on a range of scientific issues.

In India, the academies do not play a direct role in science advice in India. However chief scientific advisors and the entire science advisory ecosystem largely consist of senior scientists who are either fellows or members of these academies.

Within the country of **Nepal, NAST** acts as an advisory body of the Nepal government to be established by the legal system.

The Academy of Sciences in Malaysia acts as an advisory body on national STIE policy and related matters as a point of reference in all STIE matters for the country.

In the Philippines, the National Academy of Science and Technology plays an important role as an advisor to the government and the science community. It is the body that the government turns to for disinterested advice on science and technology. It addresses issues and concerns on Science and Technology at the national and local levels.

In Sri Lanka, the National Academy of Sciences (NASSL) established in year 1976, incorporated by an Act of Parliament (Act no. 66 in 1988) is mandated to function as a consultative body to the government, providing independent advice on policy matters related to science and technology on subjects of national importance. However, this process remains ad hoc without a formally recognized or established role for the academy. The participatory role of the academy in the process of science advice depends on the government and its ministers who are in power and institutional heads who are in control of administration. Despite this situation, the NASSL continues to make an impact through unsolicited submissions and in response to ad hoc requests made by policy makers at different levels in the hierarchy.

Thailand does not describe a role of the National Academies in Science Advice.

NEXT STEPS

The next step includes sharing our experiences in developing modes of science advice that are appropriate for each country. This could be based on the SWOT analysis done by individual countries. Once the framework is developed and agreed upon by stakeholders, roadmaps could be developed for each country with the assistance of experts in science advice for policy. The development of roadmaps will be an iterative process in which the academies could take a prominent role in providing leadership.

Finally, we would like to replicate the process we have used in other regions and globally thus, contributing to an advancement in policy processes across nations.

CHAPTER 3

Report on Workshop: "Institutionalizing Science Advice to Governments" Colombo, Sri Lanka; 6-8 July 2023

A three-day workshop on 'Institutionalizing Science Advice to Governments' was held from 6-8 July 2023 (see program; Annex 3). It was aimed at addressing the void as to the lack of a proper institutional mechanisms and process for either obtaining or delivering science advice in the Asian region.

The participants included representatives from Science Academies or institutions in the regional countries (add a link to the map giving the countries represented with the name of the representative from each country) and representatives from AASSA and the Asian Chapter of the International Network for Governmental Science Advice (INGSA). There were 35 participants from 10 countries: Australia, Bangladesh, Bhutan, South Korea, Nepal, Philippines, Turkey and Sri Lanka (see participant list: Annex 4).

Inauguration

The session was inaugurated on 6th July 2023 evening with the welcome address by Professor Nadira Karunaweera, President, NASSL. Several dignitaries graced the inaugural session.

The opening remarks were delivered by Dr Peter Mc Grath, Coordinator, IAP. which was followed by a series of addresses by the Chief Guest (Professor Remi Quirion, President, INGSA), Guests of Honour (Professor Dr A. Nuri Yurdusev, President, AASSA and Professor Zakri Hamid, Patron, Asian chapter, INGSA). The keynote address was delivered by Mr Rohan Pethiyagoda, Fellow of NASSL.

Remarks for National Academy of Sciences Sri Lanka
Coordinator, IAP Secretariat, Trieste, Italy
Peter McGrath

The InterAcademy Partnership (IAP) congratulates the National Academy of Sciences Sri Lanka (NASSL) for convening this workshop on 'Institutionalizing Science Advice to Governments' and thanks the Association of Academies and Societies of Sciences in Asia (AASSA) for additional support.

Academies have long recognized the role of science advice in shaping policies that can drive progress and foster development. By enabling evidence-informed decision-making, science advice empowers governments to chart their course guided by the wealth of information provided by trusted research. In essence, science advice contributes to enhancing the quality, effectiveness, and legitimacy of government policies, which in turn leads to better outcomes for societies and the environment at large.

Over the years, the IAP has fostered the sharing of best practices, facilitated capacity building for academies, and encouraged more academies to fulfil their role in providing science advice. By developing close relations with policymakers, conducting global assessments, and advocating for the intrinsic value of science advice, IAP endeavours to enhance the interface between science and policy, thereby promoting evidence-based policymaking.

This workshop serves as a crucial platform for enhancing our collective understanding of different modalities of science advice and how science advice is institutionalized as an integral part of governance structures.

By hosting this workshop, we see the commitment of NASSL to advance science advice. These efforts will undoubtedly yield fruitful results that will shape the future of policymaking in Sri Lanka and the other participating countries. By defining the science-policy interfaces and promoting evidence-informed policymaking, it is hoped that this workshop will also serve as a catalyst, propelling us towards national, regional and international policies that have the potential to transform our societies for the better.

At IAP, we are also looking at this workshop with the idea of how it might look in other world regions and to consider a global comparison of science advice mechanisms.

Address by President, INGSA
Professor Remi Quirion

President Karunaweera, the Council of the NASSL and partner academy representatives, I am pleased to join this event virtually and thank you Prof. Karunaweera for the invitation. International Network for Government Science Advice (INGSA) was established by Sir Peter Gluckman, Chief Science Advisor for New Zealand, about 10 years ago.

The COVID19 pandemic highlighted the need for established specialised science advise. During a crisis you don't have time to test a structure, decide whether the solutions are fully effective before implementation. Rapid decisions need to be taken. Pandemic has had a positive impact on INGSA as governments of many countries saw the importance of having established structures during normal times to strongly respond during a threatened time.

INGSA consists of about 6000 members in over 130 countries. I invite you, the President of NASSL and its Council to join us, if you are not a member already and the membership is totally free. INGSA is based in Auckland, New Zealand. Main goal of INGSA is capacity building in science advice globally. It operates mainly through its regional chapters. We have three chapters currently in Asia, Latin America and Caribbean and Africa. We tried to promote science advice by organizing workshops through local academies of the host countries. In addition to these three chapters, we plan to create 2 more, one in North America and the other in Europe that will support resolving their unique problems related to science advice.

As networking is critical, the main meeting of INGSA will happen Kigali, Uganda in May 2024. We invite you to be there to discuss your project. This project is a great initiative and an example for the other parts of the world to compare the challenges in the delivery of science advice to the governments in different parts of the world. In the future more and more governments may tend to base their decisions fully or partly on scientific data and effective science advice. INGSA is a model consisting of chief scientists. But the optimal model will have participants from different parts of the world. Depending on the model used and how it operates will have an impact in the long run. The report you make will be very valuable in gathering relevant evidence from the countries in the region. The key to effective science advice is to be open, transparent and humble about the science advice you give. The policy maker will have many considerations, in addition to the scientific data presented by the scientists, when policies are made.

Looking forward to hearing from you more about your deliberation and hope to see you in Kigali, Have a great discussion over the next couple of days.

Thank you.

Address by the Acting President, AASSA
Professor Dr A. Nuri Yurdusev

I would like to thank National Academy of Sciences of Sri Lanka for hosting this workshop on "institutionalizing science advice to governments".

The Association of Academies and Societies of Sciences in Asia is a non-profit international organization with science, technology, and innovation interests. It consists of science academies and societies in Asia and Oceania. It was launched in 2012 through the merger of two organizations, i.e., AASA (Association of Academies of Sciences in Asia, founded in 2000) and FASAS (Federation of Asian Societies and Academies of Sciences, founded in 1984). Its current members are 32 national academies and societies of sciences from 30 countries and one regional academy of engineering and technology.

The principal objective of AASSA is to act as an organization in Asia, which plays a major role in the development of the region through science and technology. AASSA serves as a forum to discuss and provide advice on issues related to science and technology, research and development, and the application of sciences and technology for socio-economic development. AASSA promotes initiatives and networking in Asian academies and societies of science to address global challenges through science and technology. To this end, it is an essential mission of AASSA to provide evidence-based science policy advice.

Institutionalization of human activities assures their sustainability in human society and science is no exception. By examining the various aspects of the institutionalization of science and science advice, this workshop will, I am sure, shed light on the various issues and problems in this respect and contribute to the greater institutionalization.

In concluding my remarks, I would like to congratulate the NASSL for organizing such a comprehensive workshop and pledge the continuous support of AASSA.

Address by Professor Zakri Hamid
Patron, Asian chapter, INGSA

I am delighted and honoured to be here in this forum to discuss about science advice to the governments.

The answers to the global challenges such as climate change, biodiversity loss and plastic pollution are embedded in science. That is why what we are doing here is crucial.

It is not as if we do not have enough scientific knowledge or scientific facts to resolve these issues. The main reason is that we scientists are not ready to speak the language of the policy makers and the diplomats. Science policy nexus is therefore very important. It will connect the scientific community with the politicians and policy makers. Too often we scientists come up with reports, which are not impactful due to the different language used in its presentation. Two examples of bodies that connects the scientists, policy makers and politicians are the Intergovernmental panel on climate change IPCC and Intergovernmental platform for biodiversity and ecosystem services (IPBES).

Science diplomacy is the dialog between two or more countries trying to resolve science problems. Here science advice plays a big role. After this workshop I hope you can reflect on science advice that we could vouch on. An important elements of science policy nexus is to build capacity - which is very important.

I am here because I feel for the developing countries, because knowledge base is still in the global north. And it is a very noble effort that you are bringing this to the global south. I congratulate Professor Nadira Karunaweera and her hardworking team on their efforts.

Thank you.

Address by Mr Rohan Pethiyagoda
Fellow, National Academy of Sciences of Sri Lanka
Keynote Speaker

Mr Pethiyagoda's address described and analyed the data on gender inequalities in educational performance and achievements in science and other professions. He observed that there is a wide disparity between the two genders with females outnumbering males in a number of fields in Sri Lanka.

He suggested the need to explore the reasons and factors shaping these disparities in Sri Lanka, that could have implications for advancement of science and development.

He asked whether one of the factors is that the the education system is not engaging favourably with males.

Plenaries

The plenary presentations on 7th July 2023 also added much value to the deliberations and were delivered by subject experts.

Professor Roger Pielke Jr., Centre for Science and Technology Policy Research, University of Colorado Boulder, USA,

Professor Saroj Jayasinghe, NASSL Council member and Professor Emeritus, University of Colombo.

Professor Jayasinghe summarized the findings of the situation analysis that was done. He outlined definition of Science Advice to Government, the project to institutionalize the process of science advice to government and the situation analyses done of the process in 11 countries. The results obtained from the countries using the questionnaire and informal discussions were synthesized and described using the Colombo Framework.

This consisted of the following 10 elements or processes :

1 Institutional structure
2 Process of appointing advisors (proxy of independence)
3 Legislation and administrative processes that underpin science advice
4 How are policies that need science advice identified?
5 What is the process of framing the questions?
6 How is evidence gathered to answer the questions?
7 How is evidence synthesized?
8 What is the process followed to communicate advice?
9 How is impact of science advice assessed?
10 How is the process used as an exercise in learning?

The SWOT analyses done by each country was then described and he proposed a simple way forward for the project. In his presentation he described the need to develop roadmaps for individual countries as well the academies.

Discussion sessions were conducted with participation of Professor Veranja Karunaratne (Fellow, NASSL and Chairman, NASTEC) and Professor Ranjith Senaratne (Fellow, NASSL and Chairman , NSF) on the situation analyses of science advice presented by academy representatives highlighting the strengths, weaknesses, opportunities and threats (SWOT analysis) within their systems (see Annex 8).

Case Studies (see Annex 6)

A discussion ensued on the use of case studies to strengthen situation analysis report that is under preparation, with a structure for case studies presented by Dr Ranjith Mahindapala, former President, NASSL.

The Concluding Session

This began with a plenary presentation by Professor Priyan Dias, immediate past president, NASSL who proposed a roadmap for science advice followed by discussions centering on the 'situation analysis' of science advice processes and bodies involved in each country.

This culminated in the design of early drafts of 'contextualized roadmaps' for science advice for each partner country. The 'Country-specific Roadmaps' will continue to be expanded and developed over the coming months.

On a proposal made by Professor Dr A. Nuri Yurdusev the workshop participants helped to draft and agree on issuing the 'Colombo Declaration'. The Declaration calls on governments to partner with scientists and demonstrate stronger commitment in strengthening institutions, streamlining processes, enabling scientific evidence to influence policies, and academies and partners to reinforce their commitment through urgent concerted action to institutionalize science advice to governments (see full text below: Chapter 4).

The workshop was concluded on 8th July 2023 by Prof Nadira Karunaweera who outlined the importance of continuing to work closely and submitting the individual country-specific roadmaps (annex 7). The next stage of the project would be to review the road maps of the countries and see how they could be operationalized with assistance from IAP and INGSA.

Evaluation of the workshop

The workshop was evaluated using an anonymous questionnaire (Annex 5)

Case studies, roadmaps and SWOT analyses from countries are included at the end of this report as Annexes 6-8 respectively.

CHAPTER 4

The Colombo Declaration

Institutionalising Science Advice to Governments (6-8 July 2023)

WE, the representatives of Science Academies meeting in Colombo, Sri Lanka from 6-8 July 2023:

RECOGNISING the encouragement and support of the Interacademy Partnership (IAP), the Association of Academies and Societies of Sciences in Asia (AASSA) and the International Network for Government Science Advice (INGSA) towards Institutionalising Science Advice to Governments,

AFFIRMING that sound, comprehensive and independent scientific advice is an integral part of effective policymaking, and

ACKNOWLEDGING the pivotal role played by organizations such as the IAP, AASSA, INGSA, national academies and other science organizations in strengthening science advice to governments.

NOTING that the progress on institutionalizing science advice to governments has been uneven across nations, as demonstrated by the varying responses of countries during the COVID-19 pandemic, and

DEEPLY CONCERNED that nations and their people do not optimally benefit from scientific knowledge.

CALL UPON on governments to partner with science academies and SCIENCE organizations and demonstrate stronger commitment to institutionalizing and strengthening the process of science advice to government and enabling scientific evidence to shape policies,

STRONGLY RECOMMEND all academies and partners to reinforce their commitment through urgent concerted action to institutionalize science advice to governments, taking into consideration the relevance of social sciences and humanities, and

FURTHER RECOMMEND enhancing regional and global science advice networks to address common challenges in institutionalising science advice.

SIGNATORIES

National Academy of Sciences of Sri Lanka
Academy of Sciences Malaysia
Australian Academy of Science
Bangladesh Academy of Sciences
Korean Academy of Science and Technology
National Academy of Science and Technology Philippines
Nepal Academy of Science and Technology
Turkish Academy of Sciences

Date: 8 July 2023

ANNEXES

ANNEX 1

List of Contributors from the NASSL, Partner Academies and Institutions and Observers of Study:

Core team of NASSL Council members who coordinated the project:

Saroj Jayasinghe
Priyan Dias
Ranjith Mahindapala
Nadira Karunaweera (President, NASSL)

Others:

Nilwala Kottegoda, NASSL Fellow

Representatives of Partner Academies and Institutions who contributed to the project (in alphabetical order of the partner country):

Australian Academy of Sciences: Chris Anderson
Bangladeshi Academy of Sciences: Yearul Kabir
Khesar Gyalypo University of Medical Sciences of Bhutan: Kuenzang Chhezom
Board member, INGSA Asia and representative from India: Kavita Shah
Korean Academy of Science and Technology: Sunyang Chung
Academy of Sciences, Malaysia: Hazami Habib
Nepal Academy of Science and Technology: Anjana Singh
National Academy of Science and Technology Philippines: Aura C. Matias
Turkish Academy of Sciences: Musab Talha Akpinar
Science Society of Thailand: Supawan Tantayanon

Observers:

SLAYS representatives: Thilini Perera, Nimshi Fernando
Local scholars of the YPL program: Lakmali Amarasiri, Dakshitha Wickrmasinghe

ANNEX 2

QUESTIONNAIRE

This questionnaire is meant to collect data from partner academies of a project led by the National Academy of Sciences Sri Lanka and supported by the Association of Academies and Societies of Sciences in Asia with the ultimate aim of creating a roadmap for 'institutionalising science advice to governments. Data collected will be stored securely and analysed for the said purpose only and will not be shared with any third parties. The stored data will be destroyed at the end of the project.

SITUATION ANALYSIS OF GOVERNMENT SCIENCE ADVICE IN SELECTED COUNTRIES (ie. Science for Government Policy)

Thank you for taking on the responsibility of completing the questionnaire for the AASA Project on 'Institutionalizing Science Advice to Governments'. The questionnaire is based on documents that are given in the reference section. Some of the definitions are direct quotes from these references.

Preamble

We define 'Science for Policy' or 'Science Advice' as "the scientific knowledge and expertise that can assist in the development and implementation of public policy across a broad range of issues" (Defined by the Australian Academy of Science (1). This contrasts with Policy for Science which is to 'influence the rules, regulations, programs and international commitments that affect how scientists work'.

The questionnaire is on Science for Government Policy.

For the purposes of this questionnaire, it is important to state our scope:

Science advice is NOT prescriptive policy making by scientists.
Science advice consists of

a. **Evidence synthesis** that aims to establish the state of available knowledge on a given issue through a range of methods including literature reviews, scientific assessments, and expert inputs.
b. **Brokerage** The process of dialogue between science and policy. Brokerage is essentially about bringing scientific evidence to bear by helping decision-makers to interpret scientific information, its meanings, implications, and limitations for the purpose of supporting their deliberations and decision-making.

There could be a range of policy instruments: policy statements by the government and instruments that reflect policies: legislations, circulars or gazettes.
The published literature was used to develop this draft version (1,2, 3)

QUESTIONS WITH EXPLANATIONS

1. **Details of Investigator completing the questionnaire**
   - **1.1.** Name of the person completing the questionnaire
   - **1.2.** Designation of the person
   - **1.3.** Completing the questionnaire on behalf of …… (please state name of Academy)
   - **1.4.** Country
   - **1.5.** Dates of filling the information (please give an approximate range)
   - **1.6.** Your contact number (with country code); preferably with WhatsApp
   - **1.7.** Your contact email:
   - **1.8.** If emails to you need to be copied to your Academy, please indicate the email address we need to copy to:
   - **1.9.** Main sources accessed to obtain information:

2. **Question to identify the models of science advice in your country**

These questions are to identify the types of science advice that exist in your country. There may be more than one answer. The literature quotes the following models (2)

- Chief Science Advisor or Advisors: Typically, the CSA is either a position seconded from academia or applied research institutes but retaining a small academic appointment or a senior appointment, following a career as a practising academic.
- Science Advisory Office or Agency: As part of the administrative apparatus rather than attached to the government. However, the director position may be a government appointee, sometimes by multi-party consensus or vetting.
- Science Advisory Board: A mix of recognized experts in a variety of fields external to the organisation (eg. outside a ministry or department) and providing advice on its activities and direction.
- Science Advisory Council: Like a Board, however in addition to experts a Council will often include external stakeholders and partners (e.g., citizens, beneficiaries, and civil society groups), as well as executive members of the organisation receiving advice.
- Ad-hoc arrangements during emergencies or crises, such as Task Forces

	Models of science advice existing in your country					
	Chief Science Advisor	Science Advisory Office or Agency	Science Advisory Board	Science Advisory Council	Ad-hoc appointments (e.g. Task Forces)	Any other (Please mention the name of the specific structure)
a. Appointed: Y / N (please tick)						
b. Are appointees responsible for a specific area or discipline?						
c. Who is the appointing authority?						
d. Are any elected: Y/ N						
e. Number elected						
f. Who elects?						
g. Any nominated? Y/N						
h. Number nominated						
i. Who nominates?						
j. Are any advisors appointed ad-hoc? Y /N						
k. How many are appointed?						
l. Who appoints?						
Other comments						

Please attach any documents that describe the process of Science Advice in your country

3. **Questions on the operation of science advisory structures** (2).

These address key issues in the standard advisory process:

3.1. Are there laws, regulations or government circulars that have legitimised Science for Policy in your country? Yes / No

If yes, please elaborate*****

******Please provide the weblink(s) for any evidence for such key policy documents.*

3.2. Does your country have an organisation established by statute (i.e. not think tanks that are established by private individuals or private sector or the not-for-profit sector) that is identified to provide science advice for policy? Yes / No

If yes, please elaborate (Please give links to its/their website/s if any)

3.3. How do policy makers decide which questions they should ask their expert advisors, and when in the policy cycle should they be asked?

3.4. How do you avoid conflicts of interest? (Is there a clear conflict of interest statement to be signed by the advisors for each issue?)

3.5. Who identifies the issues that require science advice? Is it done by the end-users of the advice or the scientific experts? Or is the process of advice continuously happening as a routine (for example, would key policy issues be automatically referred for science advice?

3.6. Who frames the questions? Is it the scientists or the policymakers or together? In order for science advice to influence policy, the eventual end-users of the advice should ideally be involved together with scientific experts in framing the question(s) at the outset.

For questions 3.5 and 3.6: Also, please elaborate if there are any set mechanisms for that.

3.7. What is the process of producing the advice?

3.7.1. Is there a specified process or SOP to develop science advice? Yes / No
Please attach any documents.

3.7.2. How do the advisors develop science advice? Please give an outline.

3.7.3. Some advisors use networks of experts, formal and informal. What are the networks used in your government Science Advice system?

How is the evidence gathered?

3.7.4. Is evidence gathered through systematic review or meta-analysis of published literature? Yes / No
Please give an outline or an example

3.7.5. Do the Science Advisors do original research or analysis of data? Yes / No
Please give an outline or an example. Please mention any organisations / structures / mechanisms facilitating science advisors to analyse data (e.g., Department of Census and Statistics)

3.7.6. Is advice made by referring to original research papers in the literature (ie. not synthesised information like meta-analysis or systematic reviews) ? Yes / No
Please give an outline or an example.

3.7.7. Is advice obtained by asking experts? Yes / No
Please give an outline or an example.

3.7.8. Is the advisors' own knowledge or expertise used?
Please give an outline or an example.

3.8. Does the advice specifically state the limitations and uncertainties of the advice Yes / No

3.8.1. If yes, please give an example.

3.9. How are conflicting scientific evidence handled? Is there a specific SOP? What mechanisms can ensure that this takes place? (please explain)

3.9.1. Give an example where science advice was followed by the government:

3.9.2. Give an example where science advice was NOT followed by the government:

3.10. How are the scientific advisory processes made transparent?

3.10.1. Is there an in-built public consultative process that is followed by those developing government science advice? Yes / No
Please provide an example.

3.10.2. Is it made publicly available in a timely manner?
How is it made available?

3.10.3. Is it through publication of reports? Yes / NO
Please give an example

3.10.4. Is it through workshops or seminars or media conferences or engaging with the media? Yes /No
Please give an outline or an example

3.10.5. Is it disseminated in a Webpage? Yes /No
Please give a weblink:

3.11. Describe the process of communicating the advice:

3.11.1. Who is responsible for communicating what and to whom?

3.11.2. Are there communication protocols you use?

3.11.3 Are there any specific strategies used to convince policy makers in science Advice?

(Please elaborate and / or give web links to such examples / cases if any)

3.12. Was scientific evidence used to support political decisions that have already been made?

(The question is to capture the use of science advice at the 'post-policy' stage.

Yes / No.

If yes, please give an example

3.13. In your opinion are there any budgetary constraints on the advisory process?

3.14. Are the science advisors allowed to work independently without any interference from political or other quarters? Yes / No

Please feel free to explain

3.15. What has been the influence of scrutinising institutions, such as those of legislative bodies (e.g., Parliament) on the process of science advice?

3.16. How is the impact of advice assessed?

3.16.1. Is there formal assessment of the impact of science advice?

3.16.2. What is the process used to assess impact? (Please elaborate with web links to examples if any)

4. <u>Question based on principles identified in science advice (1, 3).</u>

4.1. Independence: Are most of the scientists appointed or identified by the policymakers? We wish to obtain an approximate assessment on the independence of the *process*

4.2. Legitimacy: What is the mechanism to ensure that science is legitimate and trustworthy?

4.3. Access: How is science advice assured of access to the policy makers

4.4. Diversity: How does the process of science advice ensure diversity of evidence? Does this process ensure broader perspectives e.g., social, cultural and economic considerations?

4.5. Reducing uncertainty: Do you provide advice that clarifies what is known, not known, knowable and unknowable about an issue without seeking to provide a definitive answer or explanation

4.6. How is scientific evidence incorporated into decision-making about so-called "wicked" problems, which lack clear definition and cannot be solved definitively?

4.7. Are there any strategies used to communicate policy makers about uncertainty about the facts or **precautionary principles** mentioned in the advice given (Any examples, please elaborate and / or give web links to such examples / cases if any) *(* I think this is a crucial factor in science advice)*

5. **In your opinion or the opinion of the Academy you represent, how do you think Science for Policy could be strengthened or institutionalized in your own country?** Please attach any documents or research papers relating to this along with any web links (if any).

6. **What is the role of the Academy in your country on Science Advice?** In several countries, national academies figure significantly in the science advisory ecosystem, with some serving as the primary source of science advice for governments.

The researchers from the National Academy of Science of Sri Lanka may contact you at a time convenient to you to gain any clarifications. The collated information will be used during the face-to-face meeting we wish to have in May 2023 or June 2023.

We are extremely grateful to you for completing the questionnaire!

REFERENCES

1. Science policy and analysis. Principles of science policy advice
   The Australian Academy of Science
   https://www.science.org.au/supporting-science/science-policy-and-analysis
2. P. Gluckman, R. Quirion, M Denis, K Allen, *Principles and Structures of science advice: An Outline* International Science Council (ISC) and International Network for Government Science Advice (INGSA) Occasional Paper International Science Council March 2022)
3. Sutherland WJ, Bellingan L, Bellingham JR, Blackstock JJ, Bloomfield RM, et al. (2012) A Collaboratively-Derived Science-Policy Research Agenda. PLoS ONE 7(3): e31824.

This questionnaire was prepared by the National Academy of Science of Sri Lanka based on a draft prepared by Prof Saroj Jayasinghe, Council Member of the NASSL.

ANNEX 3

Programme of the workshop on Institutionalising Science Advice to Governments

[JAIC Hilton Colombo Residences, Colombo 2]

Thursday, 6 July 2023

Inaugural Session: Chair: Professor Nadira Karunaweera, President, NASSL	
18 45	Inauguration by lighting the traditional Oil Lamp
19 00 – 19 15	Welcome, and an Outline of the Project Professor Nadira Karunaweera, President, NASSL
19 15 – 19 30	Opening Remarks Dr Peter McGrath, Coordinator, InterAcademy Partnership (IAP)
19 30 – 20 10	Address by the Chief Guest Professor Remi Quirion (President, INGSA)
	Address by the Guest of Honour Professor A Nuri Yurdusev, President, AASSA
	Address by the Guest of Honour Professor Zakri Hamid (Chair, INGSA South-east Asia network)
20 10 – 20 40	Keynote address Rohan Pethiyagoda, Fellow, National Academy of Sciences of Sri Lanka
20 40 – 20 45	Vote of Thanks Professor Sagarika Ekanayake, General Secretary, NASSL
20 45	Dinner

Friday, 7 July 2023

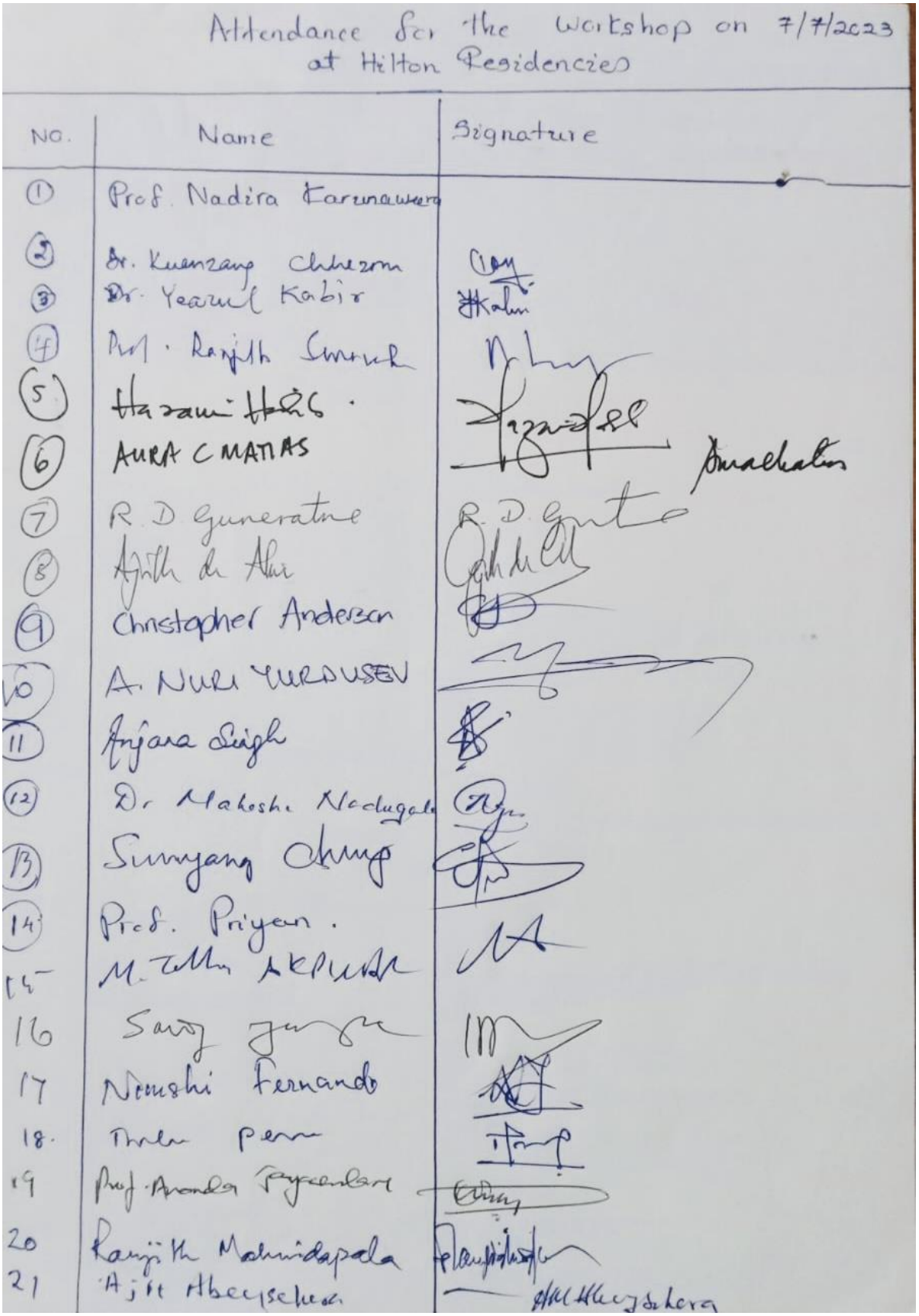
Session I: Chair: Professor Nadira Karunaweera, President, NASSL	
08 30 – 09 00	Plenary Presentation 1– The Situational Analysis Professor Saroj Jayasinghe, Fellow, NASSL
09 00 – 10 00	Plenary Presentation 2– To be announced Professor Roger Pielke Jr., Centre for Science and Technology Policy Research, University of Colorado Boulder, USA
10 00 – 10 30	Refreshments
Session II: Chair: Professor Nadira Karunaweera, President, NASSL	
10 30 – 13 00	Country presentations by representatives based on responses to the questionnaire and the SWOT analysis Responses from the Discussants • Professor Veranja Karunaratne (Fellow, NASSL, and Chairman, National Science and Technology Commission of Sri Lanka) • Professor Ranjith Senaratne (Fellow, NASSL, and Chairman, National Science Foundation of Sri Lanka) • General discussion
13 00 – 14 00	Lunch
Session III: Chair: Professor Priyan Dias, Immediate Past President, NASSL	
14 00 – 15 00	Plenary Presentation 3 - Establishing Science Advice Processes: Malaysian experience Professor Hazami Habib, CEO, Academy of Sciences Malaysia
15 00 – 15 30	Plenary Presentation 4 - Developing roadmaps (a framework) Professor Priyan Dias, Immediate Past President, NASSL
15 30 – 16 00	Refreshments
Session IV: Chair: Professor Saroj Jayasinghe, Fellow, NASSL	
16 00 – 17 30	Group work on Developing Roadmaps for each country

Saturday, 8 July 2023

Session V: Chair: Professor Saroj Jayasinghe, Fellow, NASSL	
08 30 – 10 30	Presentations on individual roadmaps and the role of Science Academies
10 30 – 11 00	Refreshments
11 00 – 12 00	A template for case studies with examples from Sri Lanka Dr Ranjith Mahindapala, Fellow, NASSL
12 00 – 12 30	Concluding remarks and Future Actions Professor Saroj Jayasinghe, Fellow, NASSL
12 30 – 13 30	Lunch
14 00 – 17 00	Excursion to the Lotus Tower, Colombo [optional] < https://colombolotustower.lk/>

ANNEX 4

Participant list



Attendance for the Workshop on 7/7/2023 at Hilton Residencies

NO.	Name	Signature
1	Prof. Nadira Karunaweera	
2	Dr. Kuenzang Chhezom	
3	Dr. Yeasmin Kabir	
4	Prof. Ranjith Senarath	
5	Hazami Haq.	
6	AURA C MATIAS	
7	R D Gunaratne	
8	Ajith de Alwis	
9	Christopher Anderson	
10	A. NURI YURDUSEV	
11	Anjana Singh	
12	Dr. Mahesh Nadugala	
13	Sunyang Chung	
14	Prof. Priyan.	
15	M. Zillur Rahman	
16	Sang Jun	
17	Nimshi Fernando	
18.	Thilan Perera	
19	Prof. Ananda Jayawardana	
20	Ranjith Mahindapala	
21	Ajit Abeyseker	

Attendance for the workshop on 8/7/2023 at Hilton Residencies.

No.	Name	Signature
1	Musab Talha AKPINAR	[signature]
2	R.D. Guneratne	R.D. [signature]
3	Prof. Nadira Karunaweera	
4	Prof. Dakshitha	
5	Piyan Das	[signature]
6	Christopher Anderson	[signature]
7	AURA MATIAS	[signature]
8	Hazami Habib	[signature]
9	Dr. Kuenzang Choezom	[signature]
10	Prof. Dr. Anjana Silva	[signature]
11	Dr. Locana Gunaratne	[signature]
12	Ranjith Mahindapala	[signature]
13	Yearul Kabir	[signature]
14	Sungjoong Chung	[signature]
15	Prof. Saroj Jayasinghe	[signature]
16	R A ATTALAGE	[signature]
17	A. NURI YURDUSEV	[signature]
18	Thilina A. Perera	[signature]
19	Nimshi Fernando	[signature]
20	Ajith de Alwis	[signature]
21	Saman Fernando	[signature]
22		
23		

No.	Name	Signature
22	Karunaratne	[signature]
23	Prof Zakri	
24	MUHAMMAD AZMIL	[signature]
25	Dr Locana Gunaratne.	[signature]

ANNEX 5

Evaluation of Workshop
Anonymous questionnaire

Scale from 0 (least satisfied) to 10 (most satisfied).

Country Code >>>>>		1	2	3	4	5	6	7	8	9	MEAN SCORE
DAY 1	**INAUGURATION**										
	Overall impression of the session:	8	9	9	9	9	7	10	9	9	7.9
	The objectives I had in mind were achieved	9	8	5	9	8	7	10	9	9	7.4
DAY 2	**Situation Analysis**										
	Overall impression of the topic:	9	8	9	8	9	8	10	9	8	7.8
	The objectives I had in mind were achieved:	9	7	7	9	9	7	10	9	9	7.6
	The Colombo Framework										
	Overall impression of the Colombo Framework:	6	9	8	7	8	8	9	8	8	7.1
	The Framework helped me to understand its elements	5	9	8	8	8	7	10	9	8	7.2
	in science advice for policy:										
	The Framework helped me to understand the process of institutionalizing science advice	7	8	5	8	8	8	10	8	9	7.1
	Country Experiences										
	Overall impression of the session	9	7	8	7	9	9	10	8	9	7.6
	The objectives I had in mind were achieved:	9	7	7	8	9	8	10	8	9	7.5
	I was happy with my presentation	9	8	7	9	9	8	7	8	9	7.4
	SWOT Analysis										
	Overall impression of session on SWOT	8	7	8	8	9	8	10	9	9	7.6
	Helped me to better understand the situation in my country	9	8	8	9	9	9	9	9	9	7.9
	Helped me to understand the situation in other countries	9	9	8	9	9	9	10	9	9	8.1
	Roadmap (day 2 and 3)										
	Overall impression of session on Roadmap	8	9	7	7	10	8	9	8	9	7.5
	The presentations (Day 2) helped me to understand a way forward for my country	9	9	7	8	10	9	10	8	9	7.9
	Group work (Day 2) helped me to understand a way forward for my country	7	8	7	9	10	9	6	9	9	7.4
	Group presentations and discussion (Day 3) helped me to understand a way forward for my country	8	8	7	9	10	9	10	9	9	7.9
DAY 3	**Case studies**										
	Overall impression of session on Case Studies:	8	9	8	8	5	7	9	8	9	7.1
	The session helped me to understand a way forward for my country	9	8	7	9	5	8	10	9	9	7.4
	OVERALL COMMENTS ON WORKSHOP										
	OVERALL satisfaction with the workshop	9	9	8	9	9	9	10	9	9	8.1

We wish to evaluate the Workshop you attended. Please fill in the evaluations for **each** of the sessions of the workshop. For ease of recall we have classified the workshop according to the main topics.

Please encircle the appropriate cell using the scale 0 to 10.

(0=lowest possible satisfaction / agreement to 10 = highest possible satisfaction/agreement)

DAY 1: Inauguration

1. Overall impression of the session**:** 0 1 2 3 4 5 6 7 8 9 10
2. The objectives I had in mind were achieved: 0 1 2 3 4 5 6 7 8 9 10
3. Suggestions to improve the session: ……

……

DAY 2

Situation Analysis 0 1 2 3 4 5 6 7 8 9 10

4. Overall impression of the topic**:** 0 1 2 3 4 5 6 7 8 9 10
5. The objectives I had in mind were achieved:
6. Suggestions to improve the session: ……

……

The Colombo Framework

7. Overall impression of the Colombo Framework: 0 1 2 3 4 5 6 7 8 9 10
8. The Framework helped me to understand the elements in science advice for policy: 0 1 2 3 4 5 6 7 8 9 10
9. The Framework helped me to understand the process of institutionalizing science advice: 0 1 2 3 4 5 6 7 8 9 10
10. Suggestions to improve the Colombo Framework: ……

……

……

Country Experiences

11. Overall impression of the session**:** 0 1 2 3 4 5 6 7 8 9 10
12. The objectives I had in mind were achieved: 0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

13. I was happy with my presentation:

14. Suggestions to improve the session: ……

……

SWOT Analysis

15. Overall impression of session on SWOT:

0	1	2	3	4	5	6	7	8	9	10

16. Helped me to <u>better understand</u> the situation in <u>my country</u>:

0	1	2	3	4	5	6	7	8	9	10

17. Helped me to understand the situation in other <u>countries:</u>

0	1	2	3	4	5	6	7	8	9	10

18. Suggestions to improve the Session: ……

……

……

Roadmap (day 2 and 3)

19. Overall impression of session on Roadmap:

0	1	2	3	4	5	6	7	8	9	10

20. The presentations (Day 2) helped me to understand a way forward for <u>my country</u>:

0	1	2	3	4	5	6	7	8	9	10

21. Group work (Day 2) helped me to understand a way forward for <u>my country</u>:

0	1	2	3	4	5	6	7	8	9	10

22. Group presentations and discussion (Day 3) helped me to understand a way forward for <u>my country</u>:

0	1	2	3	4	5	6	7	8	9	10

23. Suggestions to improve the Session: ……

……

……

DAY 3 : Case studies

24. Overall impression of session on Case Studies:

0	1	2	3	4	5	6	7	8	9	10

25. The session helped me to understand a way forward for my country:

26. Suggestions to improve the Session:

0	1	2	3	4	5	6	7	8	9	10

……

……

OVERALL COMMENTS ON WORKSHOP

27. OVERALL satisfaction with the workshop:

0	1	2	3	4	5	6	7	8	9	10

28. What are your suggestions to improve the Workshop (please feel free to include organizational aspects, academic content, accommodation, social activities etc etc)

……

……

FUTURE PLANS:

29. What is your suggestion on how we ought to move forwards with the project AFTER completion of the workshop?

……

……

……

……

……

30. Thank you so very much for participating. Hope you have a pleasant journey back home!

ANNEX 6: CASE STUDIES

Bangladesh; Case Study # 1

1. Title: Elimination of Lymphatic Filariasis in Bangladesh.

2. Background:

Lymphatic filariasis (LF) is a vector-borne parasitic disease that affects 70 million people worldwide and causes life-long disabilities. LF is a long-term disease that causes pain and severe disability for sufferers, as well as stigma for those directly affected and their families.

In Bangladesh, an estimated 44,000 people suffer from clinical conditions such as lymphoedema and hydrocoele, with the most significant burden in the northern Rangpur division. The parasite responsible for LF in Bangladesh is *Wuchereria bancrofti*, transmitted by *Culex* mosquitoes and thrives in poor domestic environments, especially urban [1,2]. In 2001, an estimated 70 million people were at risk across 34 endemic districts (19 high endemic–MDA required; 15 low endemic–no MDA required) with baseline infection rates between 1% and 15% [3].

3. The policy decision taken by the Government/agency:

Fortunately, the Directorate General of Health Services in Bangladesh recognized the immense burden of LF and responded positively to WHO's Global Programme to Eliminate Lymphatic Filariasis (GPELF) initiative [4]. In 2001, the Ministry of Health and Family Welfare launched the National LF Elimination Programme, intending to eliminate the disease as a public health problem by 2020, with Mass Drug Administration (MDA) and morbidity management as its core components [5,6]. Bangladesh Government aimed to declare and be recognized as an LF disease-free country by 2021.The program included the largest transmission assessment survey for lymphatic filariasis worldwide. At its high point, the survey included testing 136,080 primary school-aged children in 2,464 schools using rapid diagnostic tests. The program also included two other key components: repeated mass drug administration through door-to-door distribution to more than 35 million people and treatment for the more than 40,000 people who had already been infected in 2,000 community clinics. In all, more than 150 million prophylaxis treatments were distributed by health workers and community volunteers. Some districts received more than six rounds of medication. In the South-East Asian Region, Bangladesh was one of the first countries to start the GPELF strategy [6].

4. The process undertaken in arriving at the policy decision:

Baseline prevalence mapping and historical data indicated that the disease was endemic in 19 of the 64 districts and was considered eligible for MDA due to microfilaria (Mf) and antigenemia (Ag) prevalence rates of between 1% and 17% and evidence of clinical cases [7–9]. Some endemic districts, however, showed a <1.0% Mf rate but had some localized areas with chronic disease patients. Hence, it was decided to implement MDA as a very conservative approach. Overall, three broad regions of the country required MDA, which included districts from the north (Rangpur Division), central west (Rajshahi/Khulna Divisions), and the south (Barisal Division). The burden is highest in Rangpur Division, where 23% Mf prevalence and up to 10% chronic disease have been reported [6,10]. An additional 15 districts across the central and southern regions were considered to have low endemicity and not require MDA.

Over the past 15 years, the LF Programme in Bangladesh has concentrated on interrupting transmission through annual MDA with the two drugs albendazole and diethylcarbamazine (DEC). These programmatic efforts have been very successful, as measured by the Transmission Assessment Surveys, following the WHO guidelines [11].

5. Positive/negative effects of the policy decision:

LF was endemic in Bangladesh, but good progress has been achieved since the inception of the Bangladesh LF Elimination Programme in 2000 and has recently achieved LF elimination as a public health problem [12,13]. Bangladesh was one of the first countries in the South-east Asia Region to start the elimination process with mass drug administration (MDA) to interrupt transmission in endemic areas [5,6] and one of the first countries to begin the elimination verification process using the new WHO guidelines of the Transmission Assessment Survey (TAS) on a large scale [14,15]. Most districts verified transmission interruption through the standard WHO Transmission Assessment Surveys. A cluster survey indicates an overall low prevalence of disease in a historically endemic area of the country. Further, very few individuals were found to have advanced-stage disease, and these people tended to be in the older age groups.

On 13 May 2023, **WHO officially declared that lymphatic filariasis was eliminated from Bangladesh** and is now the **fourth country in WHO South-East Asia Region** to eliminate lymphatic filariasis as a public health problem after Maldives, Sri Lanka and Thailand.

6. Replicable elements /possibility for scaling up/ elements to avoid:

In 2001, the Bangladesh LF Elimination Programme began MDA in a single district using the drugs albendazole and diethylcarbamazine and has since steadily scaled up to reach full geographical coverage, i.e., all 19 endemic districts, targeting approximately 35 million people with door-to-door distribution [6,16]. The key factors for the achievement are the Ministry of Health and Social Welfare support, rapid scaling up, timely and coordinated implementation of program components, especially MDA, dedicated program team, and successful partnership. It illustrates how program inputs affect health system outputs (i.e., quality of health system functions), which, in turn, affect the health system's ability to generate outcomes (i.e., provide health services) [17]. Ultimately, the health system outcomes have an impact on poverty and health.

The most significant activity and potential challenge for the LF program is to develop and maintain a sustainable long-term surveillance system integrated into existing health infrastructure and other ongoing programmatic activities [18].

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Bangladesh; Case Study # 2

1. Title: Eradication of Thalassemia from Bangladesh.

2. Background:

Thalassemia is one of the most common life-threatening yet preventable congenital hemoglobin disorders, especially in South Asian regions like Bangladesh. No precise validated data is available about the prevalence of thalassemia and related hemoglobin disorders in Bangladesh. It has become a rising public health concern for Bangladesh; about 10–19 million people (6–12% of the population) are carriers of the thalassemia gene, and many are unaware of it [1]. According to World Health Organization (WHO) estimates, approximately 3% of the population (3.6 million) carries β-thalassemia and 4% (4.8 million) carries hemoglobin E (HbE) in Bangladesh [2-4]. Based on prevalence data, it has been shown that roughly 33/10,000 newborns are born each year with thalassemia in the country [5]. Among the inherited monogenic blood disorders in Bangladesh, the incidence of thalassemia is the highest, and it causes not only substantial morbidity and deaths but inflicts profound emotional and financial loads on the family and society at large [5]. However, most public and private hospitals lack thalassemia patient care and support facilities. Most importantly, health awareness of thalassemia remains highly insufficient among the general population. Addressing thalassemia control in Bangladesh requires considerable work, financial support, and political obligation.

3. The policy decision taken by the Government/agency:

The WHO has advocated and promoted programs for thalassemia prevention since the early 01970s. Several countries have already set up comprehensive national thalassemia prevention programs. The Government of Bangladesh acknowledges the magnitude of the thalassemia problem and has recently initiated a National Thalassemia Prevention Program. As a part of that strategy, a study [6] was conducted with funds from the Non-Communicable Disease Control (NCDC) Program, the Director General of Health Services, MOHFW, the Government of Bangladesh, and the Rotary Club of Dhaka North. The study confirmed that even in resource-limited conditions, detecting and confirming the carrier status is cost-effective and achievable.

Although the Ministry of Health, Bangladesh intends to start a National Thalassemia Prevention Program as a policy, it has not issued a circulation or proclaimed a national screening program for thalassemia by Gazette Notification. The Ministry published a booklet on "National Guidelines on Thalassaemia Management for Physician" -- Safe Blood Transfusion & Thalassaemia Management in 2019 [7]. However, a lot of scientific datapoints to the need to formulate and implement a policy.

4. The process undertaken in arriving at the policy decision:

The process of agreeing to start a national thalassemia program is unclear. It has to be based on available substantial scientific evidence and media coverage that implicate thalassemia as a burning health issue of socio-economic significance. The Ministry of Health has announced that under the National Thalassemia Prevention Program, eight centers will be established nationwide for thalassemia patient sat the initial stage. Two DNA labs will be run for genetic analysis of these patients, one in Dhaka and another in Chottogram. Thalassemia patients will get blood, a transfusion set, leukodeplated filter, and iron chelating agents free of cost.

Although the Ministry of Health announced the policy of undertaking the National Thalassemia Prevention Program based on comprehensive scientific studies, there is no evidence that the Ministry will implement the policy and start the prevention program soon.

5. Positive/negative effects of the policy decision:

In Bangladesh, the yearly medical cost required for thalassemia patients ranges from $1632 to $3960. A national insurance facility or a subsidized or free treatment system from the government is not available [5], suggesting a severe health, economic, and emotional burden to the nation. Thus, adopting a national thalassemia prevention strategy is a demand of time.

Bangladesh has attained remarkable success in many areas, viz., reduction of child mortality, birth rate control, child marriage prevention, vaccinations, etc. However, it has paid very little attention to thalassemia. A few NGOs, like Bangladesh Thalassemia Samiti, Bangladesh Thalassemia Foundation, and Bangladesh Thalassemia Protirodh Andolon, are working on it with limited resources. The government should *formulate a* comprehensive national integrated prevention program on *thalassemia,* public awareness and education, carrier screening, genetic counselling, premarital screening, and prenatal diagnosis before it becomes too late.

6. Replicable elements /possibility for scaling up/ elements to avoid:

The country has no government survey on the number of people affected with thalassemia, how many are carriers, or how many couples are at risk of giving birth to thalassemic children. Some research has been conducted at the private level, which shows that the number of affected people and the potential carriers of this disease in our country are quite alarming. This figure is no less than the countries already placing the "national thalassemia prevention program" recognizing this disease as their national problem or potential threat to national health.

The increasing number of children diagnosed with thalassemia in Bangladesh indicates that thalassemia will be an emerging health problem for the country. Thalassaemia prevention program has become a public concern as it affects marriage practices and reproduction. We should first establish a national thalassemia register and referral center under Bangladesh's national thalassemia prevention program. To fight the potential economic barrier, we need initiatives and support from major health organizations and funding agencies on top of the funding from the government.

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1. Title : Lessons from Sungai Kim Kim, Pasir Gudang

2. Background

In March 2019, Pasir Gudang became national headline and captured the country's attention after thousands of people, most of them schoolchildren, were reported to have experienced severe breathing difficulties, fainting, vomiting, dizziness and muscular cramps in the hands and legs after smelling an acrid and burning odour, presumably from toxic gases/vapours. Many of the victims were sent to hospitals for emergency medical treatment, and a few of them were admitted into the hospital for further observation and treatment. Soon after the tragedy, an illegal chemical waste dumping was discovered at a nearby river, Sungai Kim Kim, which was immediately assumed by the authorities to be the source of the toxic gases/ vapours affecting 5,039 people, mostly schoolchildren. A major clean-up of the river was ordered by the Department of Environment (DOE) on 4 April 2019, in order to stop any further emission of toxic gases from the chemical wastes.

However, just a few months later in June 2019, more cases of nausea, dizziness and shortness of breath were reported, with 1,178 people schoolchildren were reported to experience similar symptoms in a larger number of schools in the area. This time no chemical dumping was detected at Sungai Kim Kim because it had been cleaned after the first incident. The second incident cast some doubts on whether the source of the toxic gases was the Sungai Kim Kim's chemical waste or whether there was another source that had evaded detection.

Although the number of cases was not as high as the Sungai Kim Kim incident, it was enough to cause alarm among the Malaysian public when it became national headline news. It precipitated calls by many quarters on the government to end the tragedy in Pasir Gudang by finding and prosecuting the culprits and to take steps to prevent it from happening again. The Academy of Sciences Malaysia (ASM) Task Force on Sungai Kim Kim and Pasir Gudang Incidents was formed with the support of the Minister of Energy, Science, Technology, Environment and Climate Change (MESTECC) to investigate the source of the toxic gases and to recommend steps to prevent recurrence in the future.

3. The policy decision taken by the Government/ agency

Based on the analysis & findings, there are several recommendations for ministries and agencies to implement in order to avoid a recurrence of similar incidents in the future.

A. Immediate Actions

i. DOE & DOSH to take immediate actions and to deploy rapid joint multi-agency investigations for future chemical emergencies;
ii. To adopt more sophisticated and accurate equipment to measure air pollutants;
iii. To improve back trajectory modelling to account for denser than air gases;
iv. To improve time series modelling to account for spikes in concentration measurement;
v. To further study the possible occurrence of mass psychogenic illness among the affected schoolchildren during both incidents.

B. Short-term Actions

i. To implement better methods of assessing toxic gasses to mitigate adverse effects of these hazardous chemicals.

C. Medium-Term Actions

i. To amend the definition of "Pollution" in the Environmental Quality Act (EQA) 1974 to broaden the scope of "pollution" – based on the definition found in EQA 1974 prior to its amendment in 2012;
ii. To determine acceptable conditions for Environmental Hazardous Substances (EHS) in EQA 1974, in order to strengthen prosecution of air pollution cases;
iii. To amend the definition of EHS in EQA 1974 to be based both on the intrinsic hazardous chemical characteristics and the Multi-lateral Environment Agreement (MEA) listing;
iv. To amend the CLASS Regulations 2013 under OSHA 1994;
v. To amend the buffer zone distance for chemical factories in the Guidelines for Siting & Zoning of Industry & Residential Areas 2012.

D. Long-Term Actions

i. To implement an integrated approach for chemical governance;
ii. To strengthen water governance through the adoption of Integrated Water Resources Management (IWRM) & Integrated River Basin Management (IRBM).

4. Process undertaken in arriving at the policy decision

To determine the course of action, ASM established a Task Force comprised of stakeholders and experts in the relevant fields to data and share their initial findings up to that point of time. Data were requested from relevant agencies such as the Ministry of Health (MOH), DOE, Pasir Gudang City Council (MPPG), Department of Occupational Safety & Health (DOSH), Department of Irrigation & Drainage (DID), Universiti Teknologi Malaysia (UTM). Other than that, data was also collected from local state departments and a scientific study of the incident by Prof. Abdull Rahim Mohd Yusoff, Chairman of the Scientific Committee for Illegal Chemical Dumping in Pasir Gudang, UTM, which concluded that the source of the toxic gases in the first incident was from the illegal chemical waste dumping in Sungai Kim Kim. The ASM Task Force also made field trips to the area between 26 and 28 August 2023 to meet the first responders, authorities and victims directly involved. In order to reach the policy decision, thorough data analysis were made by the Task Force to come to the findings and identification of sources of the toxic gases.

5. Positive/ negative effects of the policy decision

The toxic gases were positively identified as acrolein, acrylonitrile, methyl mercaptan and benzene. The symptoms experienced by the schoolchildren of vomiting, nausea, dizziness, shortness of breath, coughing, sore throat and muscular cramps, were consistent with the adverse effects of inhaling these gases.

The initial conclusion that the source of the toxic gases was from illegal dumping of chemical wastes in Sungai Kim Kim has been ruled out because dense gas from the ground did not have enough buoyancy and momentum to hit the upper floors and Sungai Kim Kim was clean when the second incident occurred.

Based on the findings, the Task Force has outlined several recommendations for ministries and agencies to implement in order to avoid a recurrence of the incidents.

6. Replicable elements/ possibility for scaling up/ elements to avoid

The EQA 1974 is currently being reviewed by the ministry, led by the Academy of Sciences Malaysia, in the hopes of redefining the national environmental governance. Part of the recommendations in the revision of the act is introducing the concept of "Pay First", where the regulations require an owner or occupier of premises which involve activities that generate pollution to take out and maintain policies of insurance or performance bonds, where if one pollutes or break the regulations, they will lose their insurance/bond.

The study has also proved that collaboration is the key to finding prompt and accurate solutions, especially for emergency cases that require speedy actions from all relevant stakeholders. This is evident through the collaborations undertaken between state governments & municipalities, MOH, DOE, MPPG, DOSH, DID, UTM & many more – in sharing updated & real-time data & information in order to come up with the key findings.

Furthermore, in an attempt to provide accurate information and build awareness amongst the public, ASM has also produced an online media briefing on this case, led by the ASM Task Force Chairman of this report, Professor Dato' Dr Ir Wan Ramli Wan Daud FASc. This method is a good practice especially for subject matters or issues that are highly technical as it provides an avenue to record and disclose official statements and findings in order to ensure that the narrative and information disseminated is clear and transparent.

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Malaysia: Case Study #2

1. Title: Science Outlook

2. Background

Science Outlook is one of Academy of Sciences Malaysia's (ASM) flagship studies that aim to present insights based on relevant data on Malaysia's Science, Technology, and Innovation (STI) landscape. The findings of the report shed lights on how to increase STI proficiency and to transform the coordination of STI policies as part of the efforts to mainstream STI at all levels in the country. These efforts are needed to catalyse the nation's productivity, enhance competitiveness, and promote inclusive growth in order to realise Malaysia's aspiration of becoming one of the top innovation-led nations in the world.

This flagship study is a biennial national report by ASM and was initiated in 2013 with its first report the Science Outlook 2015 – Action towards Vision (SO2015) launched in 2015. This evidence-based independent review on key STI trends in Malaysia was specifically introduced as a yardstick for Malaysia's performance. Response to SO2015 indicated the necessity to keep a finger on the pulse of national STI trends at national and global level to evaluate possible future implications; hence a biennial review was proposed. The second report, Science Outlook 2017 - Converging towards Progressive Malaysia 2050 (SO2017) was launched in April 2018. The progressive outcomes of SO2015 and SO2017 are outlined in Prelude Section of this chapter. Below is the philosophy guiding the Science Outlook reports:

The most recent Science Outlook 2020 (SO2020) explored the progress, development, and impact of STI on the economic, societal, and environmental outcomes for Malaysia since the declaration of Vision 2020. The report probed selected STI-related indicators and the impact of national-level programmes, frameworks ,and initiatives from the year 1991 to 2020. This data is used to identify the strengths and shortfalls of the present STI ecosystem and how the ecosystem can be stimulated to drive Malaysia's sustainable growth towards evaluating the steps & possible development trajectory to ensure that Malaysia is able to reach its goals & definitions as defined in the Shared Prosperity Vision 2030 (SPV2030).

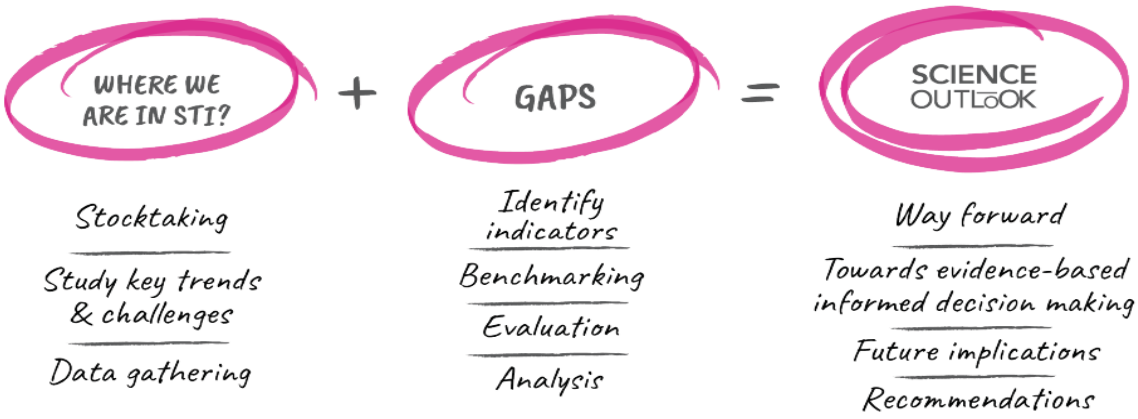
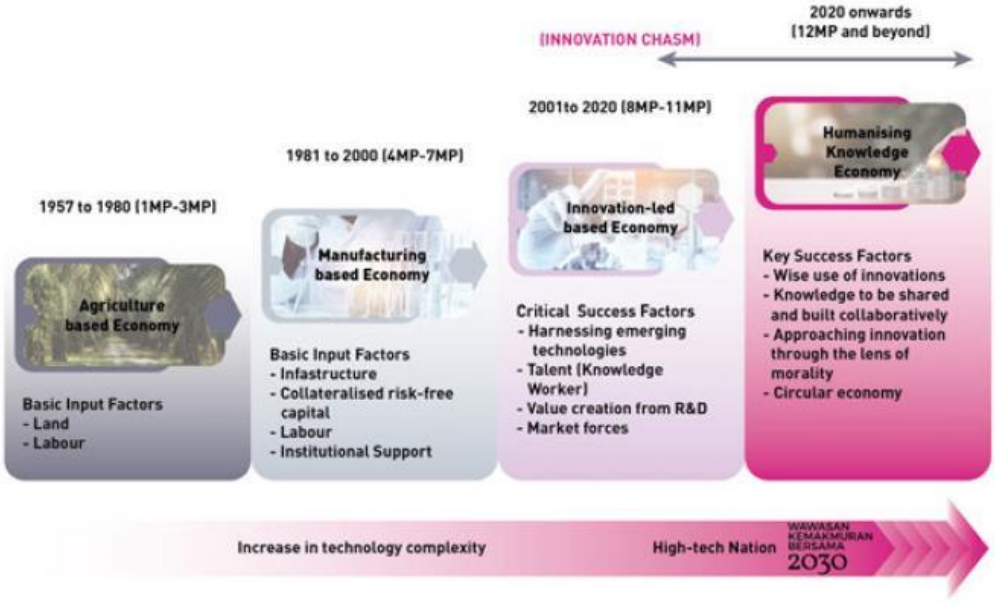


Figure 1: Philosophy of the Science Outlook

3. The policy decision taken by the government/ agency

The increasing convergence in STI elements has led to convergence in economic, social and environment and other global systems which poses challenges to many countries. Analyses of major development policies that emphasised on tangible economic gains demonstrated that such measures are not only unsustainable, but also adversely affecting societal and environmental well-being which underscores the need for national policies to be people- centric rather than GDP-oriented alone. Therefore, it is necessary for Malaysia to humanise the knowledge economy in an attempt to reduce support for unfeasible economic activities through STI to balance socio-economic development and socio-environment sustainability. As such, national developmental policies were designed with adaptations for the evolving international economy and increasing technological complexity that spurs globalisation (Figure 1.25).

The Science Outlook studies by ASM serves as a monitoring and evaluation exercise which has paved the path for several key platforms of engagement and drawn opportunities for collaboration with government ministries and agencies, industry players, researchers and civil society. These reports have highlighted the need for Malaysia to adopt a more focused approach in setting its STI priorities and direction across multiple agencies & economic sectors. As a biennial national report, ASM will present the findings of the report to the National Science Council every two years and propose to the Cabinet the recommendations through multiple policies and strategies.



Reference: Adapted from ASM, (2017)

Figure 1.25: The Changing Global Economy and Malaysia

4. Process undertaken in arriving at the policy decision

In finding out what does the Malaysian STI ecosystem looks like and how to describe its framework, Science Outlook employed a mixed methods research approach, which entails using both qualitative and quantitative research approaches to draw a comprehensive understanding of the industry, public and the key stakeholders' perspectives. The following methods were undertaken to achieve the objectives and complete the study:

i. Desktop analysis to review reports, plans, and policies related to Malaysia's STI Development
ii. Qualitative analysis comprising qualitative interviews with industry experts to obtain a more comprehensive insight into the state of the Malaysian STI ecosystem, at both industry and public level. Subsequently, the qualitative stage responses were used to develop the path model for the quantitative analysis.
iii. Quantitative analysis comprising both micro and macro level analysis. The micro level analysis entails two separate online questionnaire survey-one for the firm-level participants and another for the public. The questionnaires were designed to capture the impact of the STI ecosystem on dynamic capabilities, economic, social and environment outcomes. The macro level analysis used global dataset to construct the STI ecosystem index to benchmark Malaysia's economic, social and environmental performance vis-à-vis other countries.

5. Positive/ negative effects of the policy decision

A comprehensive study and analysis of the national STI outlook has enabled the ministry and relevant agencies to undertake and implement related policies and action plans. Following are some of the key takeaways taken up by the government:

i. The government has established key STI governing bodies and organisations such as the National Science Council (NSC), Research Management Unit (RMU), Malaysia Science Endowment (MSE) and Malaysian Research Accelerator for Technology & Innovation (MRANTI) – to strengthen the national STI ecosystem by mainstreaming STI in national socioeconomic. A Parliamentary Select Committee (PSC) was also created to ensure strong political will in promoting STI.
ii. Malaysia Open Science Platform (MOSP) was officially launched in May 2023 wit the goals of facilitating data sharing & providing open access for sharing of facilities, expertise, publications & data-driven interventions amongst relevant stakeholders in the ecosystem
iii. National STI policies and frameworks has also been created to provide national direction towards creating big impact initiatives in elevating societal well-being & quality of life for the people such as the National Policy on Science, Technology and Innovation (NPSTI) 2021-2030 & 10-10 MySTIE Framework.
iv. The national STI ecosystem is also pushing for collaborative networks to enable industry-led, demand-driven R&D and market-driven delivery through initiatives such as i-Connect. Furthermore, the development of adaptive STI talent has been a major focus, in which the national planning of STI talent required for knowledge economy is to be centralised by the government in order to ensure the demand and supply of STI talent is fulfilled.

6. Replicable elements/ possibility for scaling up/ elements to avoid

As an overall, around 80% of the recommendations put up in all three editions of the Science Outlook (i.e., SO2015, SO2017, SO2020) have been fully implemented or partially taken-up till date by the government, relevant ministries and agencies. Following SO2020, the fourth edition of this report is planned to be undertaken by ASM in 2024.

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Nepal

1. Title: Illegal orchid trade threatens Nepal

2. Background

Orchids are among the most diverse and charismatic plant groups in the world, and they are threatened by illegal and unsustainable trade, largely for Ayurvedic and Chinese medicine The **Policy decision taken** by the Government/agency. According to folklore, the pale purple flowers, which bloom hanging from trees in the garden known as the Salahesh Fulbari, represent a garland that local folk hero Salahesh received from his beloved. Botanists have identified the flower as an orchid species (*Dendrobium aphyllum*) found from Nepal to Southern China and peninsular Malaysia.

Scientific estimates suggest that there are roughly 30,000 species of orchids around the world, approximately 500 of which have been reported in the forests and fields of Nepal. Most orchid plants require tree limbs for support and don't need soil to grow — hence the garland-like appearance. One of the orchid species found in Nepal, *Paphiopedilum venustum,* has been listed as "endangered" by IUCN. But as Nepal has yet to prepare its national species management plans, trade in orchids is illegal, despite the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) provisions. The collectors are known to use "destructive methods" such as digging up the entire plant to remove its tubers. Although each orchid pod or capsule contains thousands of seeds, they can't germinate on their own as they don't contain food required during the germination period. For example, officials seized around 75 kg (165 lb) of dried *Dactylorhiza hatagirea* from Gorkha in western Nepal with an estimated market value of $166,280 (NPR 22.07 mln).

3. Process undertaken in arriving at the policy decision

Despite all these ploys used in illegal trade, officials sometimes seize orchid parts prepared for illegal trade.

4. Positive/negative effects of the policy decision

NA

5. Replicable elements /possibility for scaling up/ elements to avoid

NA

Nepal Academy of Science & Technology

31 Aug 2023

Turkiye

1. Title: Improving Earthquake Preparedness and Mitigation Measures in Turkey

2. Background

Turkey is one of the most seismically active countries in the world due to its location at the convergence of several tectonic plates. The North Anatolian Fault (NAF), running just south of the populous city of Istanbul, is one of the most active and well-studied fault lines in Turkey. Throughout its history, Turkey has experienced devastating earthquakes that have resulted in the loss of life, destruction of infrastructure, and economic disruptions. According to the Kandilli Observatory and Earthquake Research Institute, Turkey experiences around 10,000 earthquakes every year, with many exceeding magnitude 4.0 on the Richter scale [1]. One of the most devastating earthquakes in Turkey's history occurred on August 17, 1999, in the city of İzmit, near Istanbul. The earthquake, known as the Marmara earthquake, had a magnitude of 7.4 and resulted in the death of over 17,000 people, injuring more than 50,000, and displacing hundreds of thousands [2]. The 2011 Van earthquake, with a magnitude of 7.1, was another major seismic event that shook eastern Turkey, killing more than 600 people and displacing tens of thousands [3]. On February 6th, a seismic event of magnitude 7.8 transpired in the southern part of Turkey, proximate to the northern boundary of Syria. This earthquake was succeeded approximately nine hours later by another seismic occurrence with a magnitude of 7.5, situated approximately 59 miles (95 kilometers) southwest of the initial epicenter. The initial earthquake was the most catastrophic to strike seismically vulnerable Turkey in over two decades and was of comparable magnitude to the most potent earthquake documented in the region, which occurred in 1939. The response to this natural disaster was primarily orchestrated by the Turkish government, under the coordination of the Disaster and Emergency Management Authority (AFAD), and in collaboration with the Turkish Red Crescent. However, international non-governmental organizations (INGOs) and local NGOs also significantly contributed to the response efforts in Turkey. State authorities declared a level- 4 emergency, prompting an appeal for international assistance. Turkish President Recep Tayyip Erdogan declared a three-month state of emergency in 10 of the country's provinces. In the wake of this disaster, international governments promptly responded to appeals for aid, deploying rescue teams and proffering assistance. While various countries have pledged support to Turkey and financed immediate relief efforts, and the country has disaster management structures in place to facilitate the response, the provision of aid to affected Syrians has encountered challenges. The country of Turkey is recognized as Türkiye in English by the United Nations (UN). In the wake of these devastating events, the Turkish government has taken steps to improve earthquake preparedness and mitigation measures. These include the development of earthquake-resistant buildings and infrastructure, the establishment of early warning systems, and the creation of public awareness campaigns regarding earthquake safety measures.

3. The policy decision taken by the Government/agency

The Turkish government, in collaboration with international organizations, implemented a comprehensive earthquake preparedness and mitigation program. This program includes the development of earthquake-resistant buildings and infrastructure, the establishment of early warning systems, and the creation of public awareness campaigns regarding earthquake safety measures.

Furthermore; following the devastating earthquake, the Turkish government implemented a series of policies to address the immediate needs of affected populations and to facilitate long-term recovery and rebuilding efforts. These policies included:

- Emergency Assistance: The government, under the coordination of the Disaster and Emergency Management Authority (AFAD), quickly launched rescue and relief operations, including search and rescue teams, medical aid, and provision of emergency shelters, food, and water. The government also coordinated efforts with the Turkish Red Crescent, international non-governmental organizations (INGOs), and local NGOs.
- Declaration of State of Emergency: President Recep Tayyip Erdogan declared a three-month state of emergency in 10 provinces affected by the earthquake. This declaration allowed for the expedited allocation of resources, coordination of emergency response efforts, and the establishment of temporary accommodations for displaced individuals.
- Reconstruction and Rehabilitation: The government implemented a comprehensive reconstruction and rehabilitation plan, focusing on rebuilding homes, schools, hospitals, and other critical infrastructure. The plan also included provisions for restoring livelihoods, offering financial support, and providing psychological assistance to affected individuals.

- Disaster Risk Reduction Measures: The government introduced policies to enhance disaster preparedness and risk reduction measures, including strengthening building codes, enhancing early warning systems, and implementing public awareness campaigns on earthquake safety.
- TÜBA provided valuable scientific reports and insights into earthquake risk assessment, seismic hazard analysis, and disaster preparedness. The academy's researchers offered recommendations on construction practices that would minimize damage from future earthquakes, as well as the establishment of early warning systems to alert communities of impending quakes. TÜBA conducted studies on the socio- economic and environmental impacts of the earthquake, evaluating the effectiveness of response efforts and the implementation of rehabilitation programs. The academy provided policy recommendations to the government, advocating for a comprehensive approach to disaster risk reduction, including strengthened building codes, land-use planning, and community-based resilience initiatives.

4. **Process undertaken in arriving at the policy decision**
    - Who provided the evidence for this decision? The evidence for this decision was provided by a team of experts from various disciplines, including seismologists, civil engineers, urban planners, and emergency response professionals. The team was selected based on their expertise and experience in earthquake-related fields.
    - How was the evidence gathered? The team conducted comprehensive studies, analyzing earthquake risk assessments, building assessments, and past earthquake events.
    - How credible is the evidence? The evidence is highly credible as it was gathered through systematic and scientific methods, and the synthesis was carried out by experienced professionals.
    - Describe the process used to communicate to policymakers: TÜBA's involvement in the post-earthquake response exemplifies the important role that scientific academies can play in disaster management and recovery efforts. By providing scientific expertise, conducting research, and advocating for evidence- based policies and international collaboration, TÜBA significantly contributed to the success of Turkey's response and recovery efforts.
    - How was the process made transparent? The entire process was documented, and all meetings and discussions were recorded. The report and its supporting evidence were made publicly available to ensure transparency.

5. **Positive/negative effects of the policy decision**

    Positive Effects: The policy decision has led to the construction of earthquake-resistant buildings and infrastructure, reducing the potential impact of earthquakes on lives and property. The early warning system has improved emergency response times, and public awareness campaigns have increased citizen preparedness. These measures have collectively contributed to a decrease in the number of casualties and economic losses in subsequent earthquakes.

    Negative Effects: The policy's implementation has required significant financial investment, and there have been challenges in enforcing building codes and standards across all regions. However, the long-term benefits outweigh the initial costs and challenges.

6. Replicable elements /possibility for scaling up/ elements to avoid

- Replicable Elements: The establishment of a multidisciplinary expert team, the systematic approach to gathering evidence, and the transparent communication process are all replicable elements that contributed to the success of the policy.
- Possibility for Scaling Up: The policy can be scaled up to cover other natural disasters and hazards, such as floods or wildfires, by adapting the methodology and approach.
- Elements to Avoid: It is essential to avoid partial implementation of the recommendations and ensure that building codes and standards are enforced uniformly across all regions.

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Turkish Academy of Sciences 21 August 2023

Sri Lanka

Sri Lanka; Case study #1

1. Title: Congenital hypothyroidism and management of thyrotoxicosis in Sri Lanka

2. Background

Congenital Hypothyroidism (CH) is a common cause of preventable mental retardation. In some developed countries, newborns are screened for the disease, but lack of such screening in Sri Lanka resulted in children developing the disease. The disease can cause serious problems such as mental disability, growth delays, or loss of hearing. The incidence of CH in some parts of Sri Lanka has been noted as significant, which could have been avoided if there was a proper screening programme.

The University of Ruhuna, with a grant from the National Research Council of Sri Lanka started a research project to screen newborns for CH on a regional basis in the Southern Province in 2009 using heel-prick blood spots. The screening enabled identification of newborns with CH leading to corrective treatment thereby avoiding long-term effects of CH.

3. The policy decision taken by the Government/agency

Based on the findings of the research study, the Ministry of Health accepted this as a policy and issued a circular (02-90/2010) to screen newborns and undertake follow-up action as necessary. Subsequently, the Ministry, by circular 01-39/2013 extended the screening process to Kalutara and Ratnapura districts and subsequently nationwide.

The Ministry also issued comprehensive guidelines for management of CH which included six steps – education of health professionals and parents, screening, early follow-up, clinical and biochemical evaluation, management, and outcome monitoring.

4. Process undertaken in arriving at the policy decision

The policy decision is a result of research carried out by the Nuclear Medicine Unit of the University of Ruhuna with a grant from the National Research Council (Prof. C Liyanage) in collaboration with the Ministry of Health. The peer reviewed results were made available to the Ministry of Health by the researchers.

In 2019, 159,559 newborns were screened (92 per cent of coverage) and 126 babies were confirmed as having the disease. The annual incidence of hypothyroidism was 1 in 1266 live births among the screened population. The positive predictive value of the program was 66% with a false-positive rate of <0.04% among those screened.

The benefit-to-cost ratio was 3.60 with total cost of the program LKR 98,924,300 with total benefit of LKR 356,553,781 in 2019.

5. Positive/negative effects of the policy decision

With early detection and treatment, children develop normally without medical handicaps and become productive members of the society. The families are relieved of the stress of having a sick child. Aside from that, the health care costs of the country are very much reduced as seen from the cost-benefit analysis undertaken by the researchers.

The CH screening program proved its effectiveness in both timely detecting at-risk babies as well as being appropriately effective in economic impact to society. The improved health outcomes are of utmost importance considering screening expansions and policy decisions.

6. Replicable elements /possibility for scaling up

As a result of the pilot study in the Southern Province, the screening programme was extended to Kalutara, Ratnapura district and subsequently nationwide.

8 April, 2023

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Sri Lanka; Case study #2

1. Title: Ban on import of palm oil and cultivation of oil palm in Sri Lanka

2. Background

Oil Palm (Elaeis guineensis) cultivation in Sri Lanka started in about 1968 at Nakiadeniya Estate near Galle in the Southern Province. The production of oil palm fruits was dramatically increased following the introduction of the pollinating weevil, Elaeidobius kamerunicus to the estate in early 1987. Following this, the area under oil palm increased with Government support. Currently, there are about 11,000 ha of oil palm mostly in the Southern Wet Zone with an annual rainfall of about 3,000 mm/year. With the increasing interest in expanding oil palm cultivation by replacing unproductive or uneconomic rubber, the Government in 2009 approved tax concessions for import of oil palm seeds; in 2016 the Government permitted expansion of oil palm cultivation up to 20,000 ha, with the Coconut Research Institute (CRI) providing technical support.

The national vegetable oil requirement in Sri Lanka is about 250,000 MT/year. This requirement is met from (a) the local annual production of about 25,000 MT of coconut oil and about 15,000 MT of palm oil, and (b) by importing about 180,000 to 220,000 MT per year of palm oil. Most of the imported palm oil is in ready-to-use form. The consumer price of palm oil is about 30 – 40% less than coconut oil prices.

Even with the Government's current coconut cultivation expansion programme, the vegetable oil requirement of Sri Lanka cannot be met from coconut in the foreseeable future.

The social impact of the oil palm industry is a complex area. The daily wages for oil palm workers can be from LKR 30,000 to LKR 50,000/month compared to LKR 18,000/month for rubber tappers and LKR 25,000/month for tea estate workers. In terms of profitability, oil palm generates the highest income/ha, and is the most stable source of revenue for maintaining profitability in low country estates. The financial returns from oil palm in Sri Lanka is about 10 times higher when compared to crops like rubber. The contribution of oil palm to the GDP is more than that from the other three plantation crops, tea, rubber and coconut. Given the country's needs, oil palm offers a solution to bridge the gap in supply of edible oils.

Based on many public complaints related to oil palm cultivation received by the Central Environmental Authority (CEA), it commissioned a study in 2018 to identify and assess environmental and social impacts due to oil palm cultivation in Sri Lanka. The study relied mainly on observations of communities living in oil palm areas, some research carried out elsewhere in the world, and observations from several related agencies. The complaints from the communities were: poor undergrowth in oil palm plantations, high nutrition use and water usage, toxicity of fruits to dogs, high soil erosion, processing industry generating high load of pollutants, clearing of forest lands, and increased serpents. Based on this study, CEA recommended that establishment of new plantations, expansion of existing plantations and re- plantation of oil palm should be discontinued in Sri Lanka.

3. The Policy decision taken by the Government/agency

In April 2021, the Government proclaimed, by Gazette Notification of 5 April, 2021, a total prohibition of oil palm cultivation in Sri Lanka due to the 'public dissatisfaction at the continued cultivation of Oil Palm by large scale Companies regardless of disastrous consequences that may affect to the caused on environment (sic). The proclamation also ordered systematic removal of existing oil palm plantations at an annual rate of 10% and to use the land for 'rubber planting or any other cultivation conducive to conservation of water resources'.

At the same time, the Government banned importation of palm oil due to its purported adverse effects on public health, which was subsequently partially lifted allowing the importation of processed palm oil. The decision to remove existing oil palm trees has not been implemented, possibly due to the fact that they contribute about 42 per cent of local vegetable oil production.

4. Process undertaken in arriving at the policy decision

The process used in arriving at the decision is unclear, except the report of the Central Environmental Authority and the media allegations which varied from biodiversity loss, depletion of ground water, and negative health aspects to negative socio-economic aspects.

The only documented evidence is the report of the CEA which lacks sound scientific basis.

5. Positive/negative Effects of the Policy decision

The ban on expansion of oil palm cultivation has directly affected the foreign exchange reserves of the country as the gap in vegetable oil supply will have to be met with imports. Furthermore, it has an effect on employment (and livelihoods) of people who could be engaged in oil palm cultivation and has prevented the introduction of a new small holder concept in the oil palm industry.

In 2021, a scientific study was commissioned by Solidaridad as independent academic research. The study examined the Sri Lanka's vegetable oil demand and supply, agronomic, ecophysiological and environmental aspects of oil palm cultivation, the impact of oil palm cultivation on biodiversity, effect of oil palm cultivation on soil and water quality, nutritional and health effects of palm oil, palm oil factory waste management, and socio-economic impacts of oil palm industry. This comprehensive study did not find evidence towards the allegations made in the CEA Report; it noted that fertilizer inputs to oil palm is not high compared to other crops, there is no evidence of depletion of water resources, there was no evidence of lowered level of biodiversity nor on water resources degradation, and that there was no evidence that palm oil is toxic. Indeed, it noted that palm oil is healthier than coconut in its lower contribution to cardio-vascular diseases, and additional health promoting components such as carotenoids and antioxidants and absence of mycotoxins. The study also noted that oil palm cultivation can contribute to rural development while saving foreign exchange.

The study noted that there was no reason to assume that palm oil processing leads to more environmental problems than processing of other crops but noted the need to comply with the requirements of the Central Environmental Authority standards on processing and discharging effluents. The study report has been presented to the President, but the decree on banning cultivation has not been rescinded.

6. Replicable elements /Possibility for scaling up/Elements to avoid

The imposition of the policy generated a comprehensive scientific study, which can be seen as positive. However, there is no evidence of reversal of the policy.

2 May, 2023

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ANNEX 7: ROADMAPS

Roadmap Exercise

1. Select 3 or 4 elements from your SWOT analysis which you feel can be opportunistically used to promote and develop the Science advice mechanisms in your country.

2. Which of the science advice structures below should your country have in place, which one should you start with and/or strengthen? (Depending on which are the most appropriate for your country? E.g.: An existing structure to be strengthened or a new structure to be introduced)

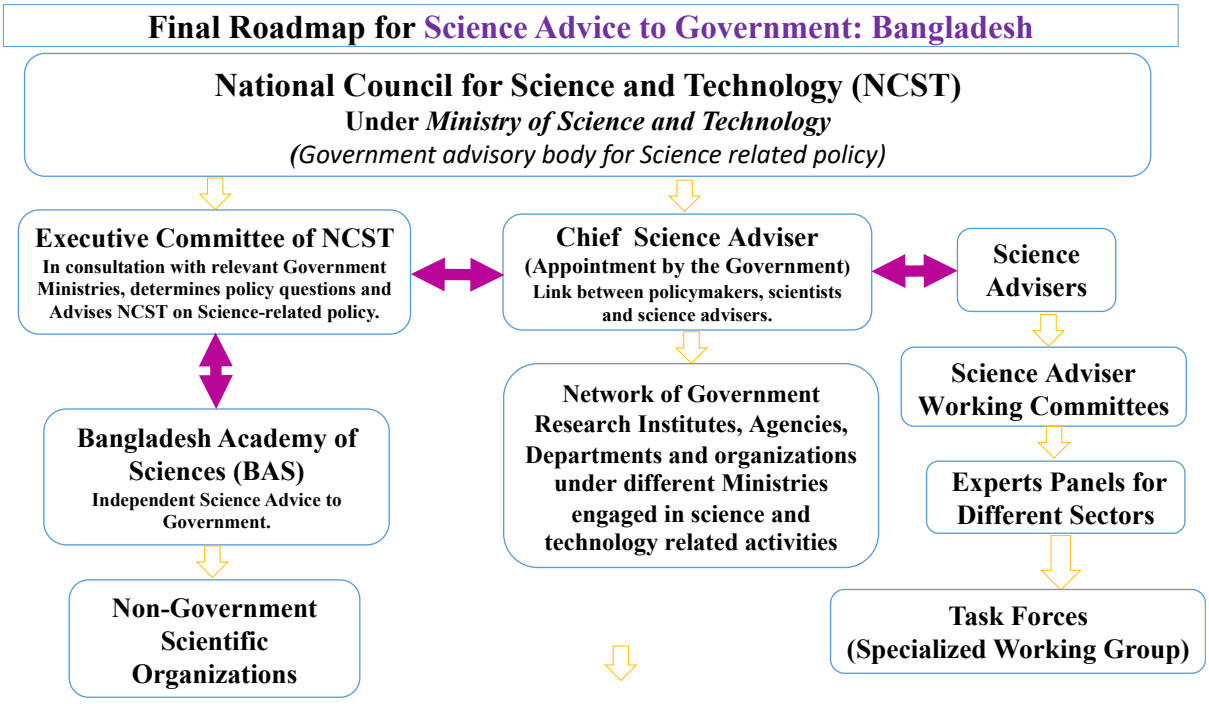
- Chief Science Advisor or Advisors (CSA): Typically, the CSA is either a position seconded from academia or applied research institutes but retaining a small academic appointment or a senior appointment, following a career as a practicing academic.
- Science Advisory Office or Agency: As part of the administrative apparatus rather than attached to the government. However, the director position may be a government appointee, sometimes by multi-party consensus or vetting.
- Science Advisory Board: A mix of recognized experts in a variety of fields external to the organization (e.g., outside a ministry or department) and providing advice on its activities and direction.
- Science Advisory Council: Like a Board, however in addition to experts a Council will often include external stakeholders and partners (e.g., citizens, beneficiaries, and civil society groups), as well as executive members of the organization receiving advice.
- Ad-hoc arrangements during emergencies or crises, such as Task Forces
- Any others

3. Flesh out some details about the SWOT analysis elements and/or science advice structures. How do you think you will achieve your goals and what is the process (i.e. the roadmap)?

4. What is the role of your academy (and any other academies in your country) in the above process?

Examples

Roadmap: Bangladesh



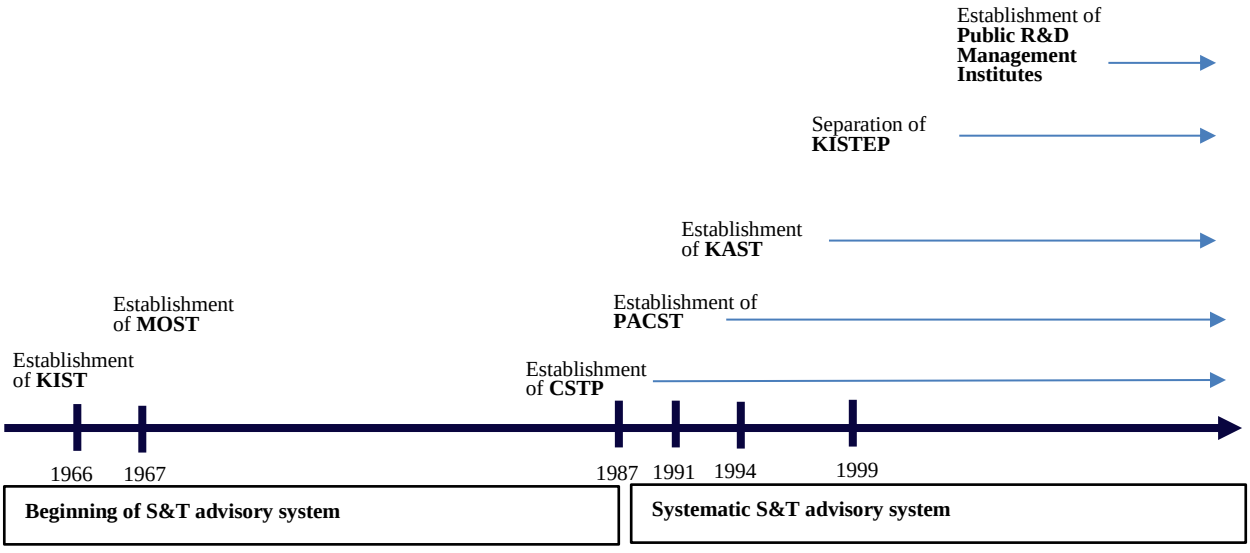
Retrospective Roadmap: South Korea

October 15, 2023
Sunyang Chung
(Korean Academy of Science and Technology)

The roadmap is a well-recognized method for future planning of S&T management and policy. Specht et al (2002) classifies two kinds of technology roadmap, i.e., retrospective roadmap and prospective roadmap. The former aims at identifying pros and cons in the experiences of identifying and planning the promising technologies and providing a better roadmap. The latter is rather concentrated in identifying future technologies from long-term perspectives. Both are very helpful for S&T planning and S&T policy making. This classification could be well applicable to the formulating the roadmap for science advice. In particular, the retrospective roadmap will be well applicable to Korea, as Korea has experienced a rather systematic formulation of roadmap in science advice, compared to developing and developed countries. The evolution of Korean S&T advisory system can be illustrated in Figure 1.

The Korean industrialization was especially based on S&T and innovation capabilities and started with the establishment of the first government-sponsored research institute (GRI), Korea Institute of Science and Technology (KIST) in 1966. It started to employ Korean scientists and engineers who had studied in advanced countries such as USA, UK, and Germany. They were good advisors for the development and Korean S&T and innovation capabilities. One year later in 1967, the Korean government established the Ministry of Science and Technology (MOST), which was the first S&T promoting ministry in developing countries. The ministry listened very carefully lots of advice from Korean scientists and engineers, especially who studied in advanced countries. In 1971, the Korean government established the first S&T-oriented university in Korea, Korea Advanced Institute of Science (KAIS), which were built particularly based on advice from Professor Fredrick Terman, Stanford University, USA. From the 1970s and the end of the 1980s, the Korean government established GRIs in important S&T areas according to the KIST model. Korean scientists and engineers in GRIs have not only conducting R&D activities but also providing advice to the government in their S&T areas.

Figure 1 Evolution of Korean S&T Advisory System



In 1987, the Center for Science and Technology Policy (CSTP) was established under the umbrella of the Korea Institute of Science and Technology (KIST) to carry out S&T policy research for the government, and in 1993 it was expanded and separated into an independent institute, Science and Technology Policy Institute (STEPI). STEPI has been carrying out research in almost every area of science and technology and provide relevant advice for many diverse S&T-related ministries. In 1999, the Korea Institute of S&T Evaluation and Planning (KISTEP) was separated from STEPI and become an independent advisory and supporting institute to the Ministry of Science and Technology (MOST). Since 2000, other S&T-related ministries established their own advisory and supporting institutes has increased and almost every ministry has operated an advisory and supporting institute. For example, the Ministry of Trade, Industry and Energy (MOTIE) has established and implemented the Korea Planning and Evaluation of Industrial Technology (KEIT). They are called public R&D management institutes as they support the implementation of national R&D programs of each ministry. In addition to the management support, they also provide S&T advice to relevant ministries.

In March 1991, the Korean government enacted the Act of Presidential Advisory Council on Science and Technology (PACST) so that the President of Korea could hear the advice from science community systematically. To strengthen its function the President of Korea has become a chairman of PACST since March 2004. It is the highest S&T advisory organization in Korea. In addition, depending on governmental administration, Korea has implemented a position of Special S&T Advisor and/or S&T Secretary to the President of Korea. However, both have no legal foundation.

The Korean Academy of Science & Technology (KAST) was established in 1994 to provide science advice to the Korean government and related institutions such as general assembly. By having the most competent Korean senior scientists and engineers, KAST has been expected to provide comprehensive S&T advice to the government and society. it covers all S&T areas by having five divisions: Policy, Natural Sciences, Engineering, Medicine, and Agriculture & Fisheries. In 2008, KAST established its Policy Research Institute to provide more effective S&T advice. In the long term, KAST aims at becoming the Korean version of the National Academies of Sciences, Engineering and Medicine in USA. However, it has long way to accomplish this ambitious goal. In this sense, KAST must strengthen its policy research function by increasing policy researchers and policy research budget to a large scale.

To summarize, the Korean S&T advisory system is complicated and has at least two layers. At the level for the President of Korea, PACST is the most important advisory body and has a sound legal base. In addition, there have been Special Science Advisor and/or S&T Secretary to the President. At the ministry level, almost every S&T-related ministry has at least one advisory and supporting institutes. Facing the fierce global S&T competition and global challenges such as climate change, aged society, discrepancy of development among countries, many experts emphasize more comprehensive S&T and innovation policies (Chung, 2016, 2022; Chung & Chung, 2023). As a result, a series of new S&T and innovation policy such as transformative innovation policies (Diercks et al, 2019), next generation innovation policies (Kuhlman & Rip, 2018), and (new) mission-oriented innovation policies (Mazzucato, 2028) have been diffusing, particularly among developed countries. It means that many diverse disciplines should be merged in S&T and R&D activities and S&T policy and policy makers will be more in need of more comprehensive and deeper advice in promoting S&T and innovation. In this sense, the role of KAST as the most competent and comprehensive advisory institute in Korea will be strengthened and KAST should also prepare for it.

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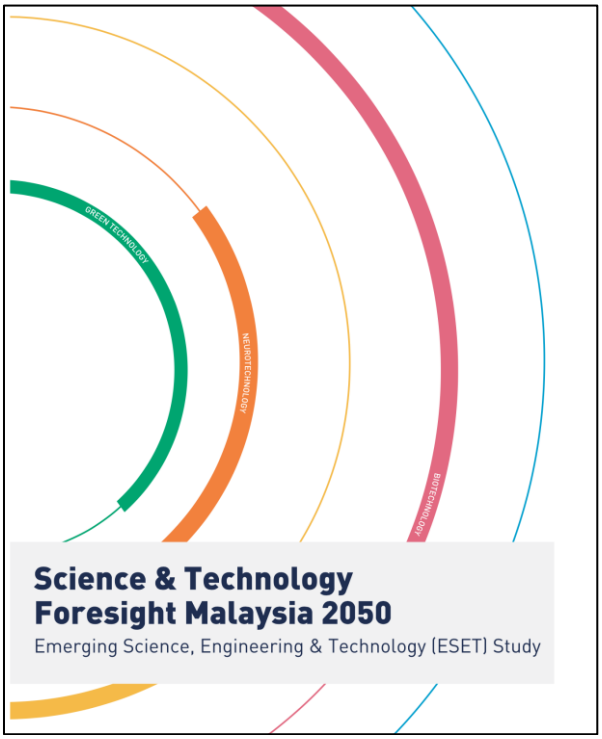
Roadmap: Malaysia

Link: MALAYSIA - Roadmaps



Roadmap: Nepal

Roadmap in Institutionalising Science Advice to Nepal Government

1. To promote and develop the Science advice mechanisms in Nepal need of Increase from 0.1 R&D investment to 0.3 GDP in S&T in 2030. Nurturing and sustaining more experts: scientists and engineers.

2. **STI strategy and legal framework: Enact the Basic Law for Developing S&T and Innovation. Foundation"**
STI policy frameworks, institutional arrangements, and international support

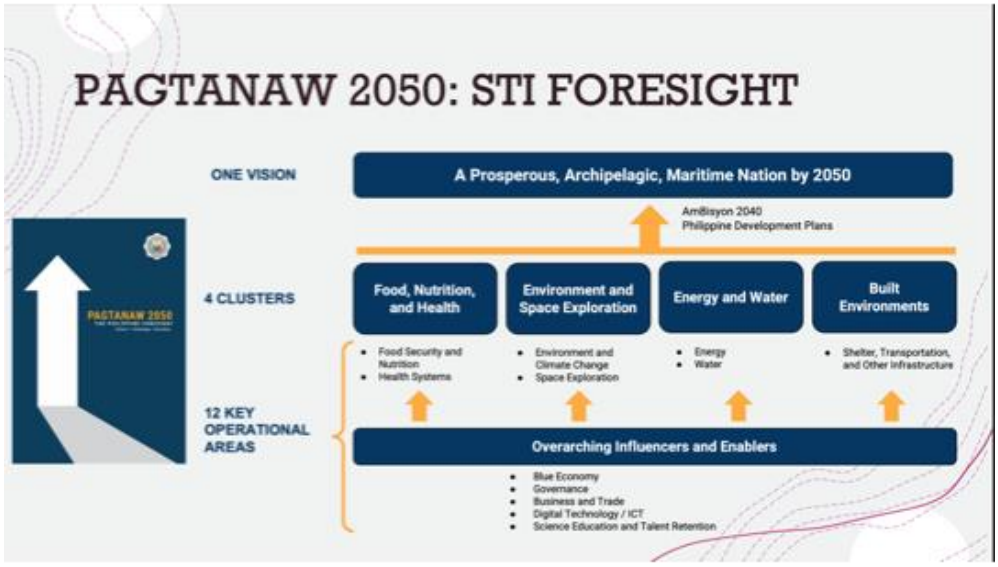
- Ministry of Education, S&T with inter-ministerial coordination bodies: Initiation a Multi-ministerial Program for S&T and Innovation
- Council for STI at cabinet office

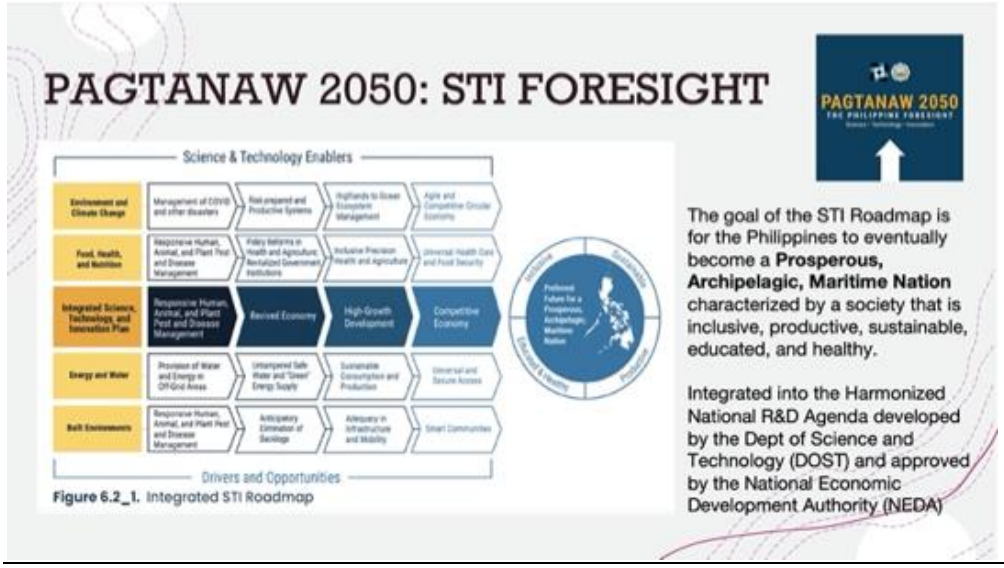
3. State of national plan for the SDGs and STI's roles in it.

- Supporting organisation is need for the coordination among the S&T-related ministries. The restoration the hierarchy of VC as before as to the level of Prof-Chancellor early as possible to make accessible to function appropriately.
- Developing and coordinating S&T based on basic law.
- Comprehensive master plan for the development of S&T innovation based on basic law.
- Each ministry should cooperate in initiating and implementing the five year plan, as it is a multi-ministerial program.

4. The role of academy in the above process is to give suggestions and make available of the experts if needed.

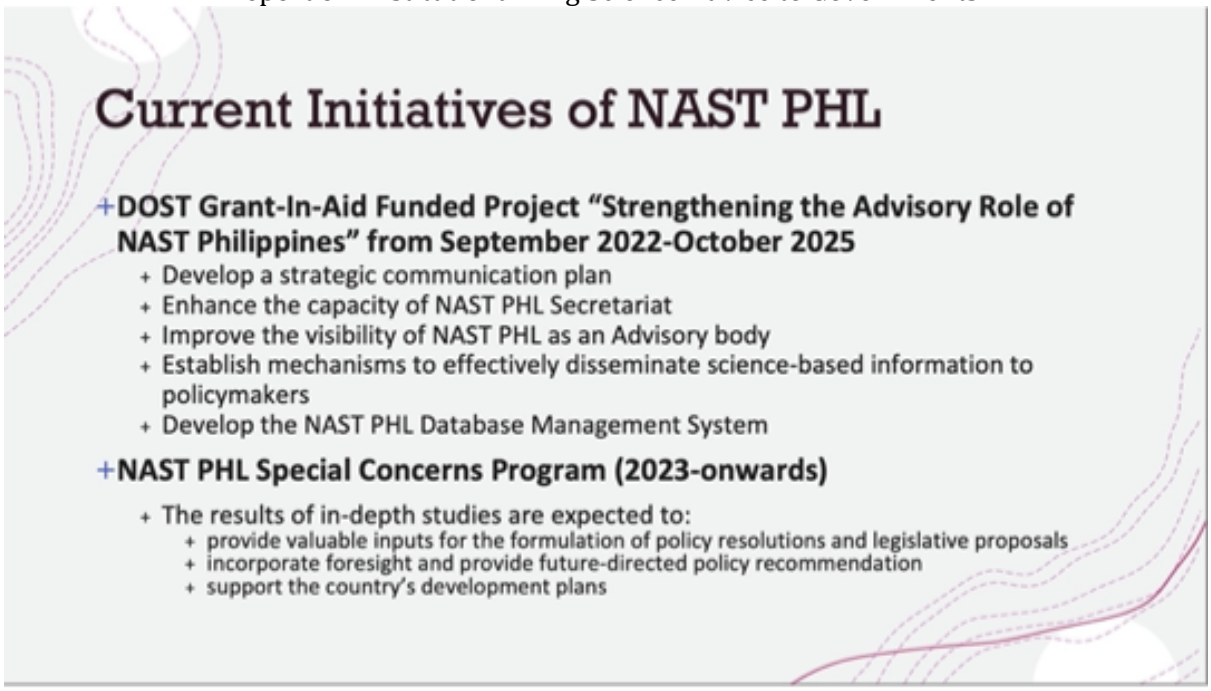
Roadmap: Philippines





SCIENCE ADVICE ROADMAP

Success Factors	NAST PHL	NAST PHL Structure	National Govt	Legislators
Leadership	Elevate the role of the NASTPh Executive Council as the **National Science Advisory Council (NASC)** to the President	Expand the role of the NAST Executive Director as a Science Administrator, not merely as an office administrator	DOST and NEDA Secretaries to regularly communicate and coordinate implementation of the STI Foresight with the Academy	Create an S&T desk that will craft S&T legislative agenda based on science advice from the NSAC
Mandate	Strengthen the advisory function of the Academy by designating the President of NAST PHL as the Chief Science Advisor	Increase visibility of NAST PHL to the Office of the President and the Cabinet with quarterly reports on S&T metrics, landscape	Mainstream science for policy and policy for science in the strategic plans in line agencies (NGU, LGU) Benchmark best practices from other developed nations (S.Korea, Malaysia, Australia, etc)	Upgrade the PD/EO creating the NAST PHL into an Act to give full mandate for the Academy to become the NASC to the nation
Manpower	Elect younger members into the Academy by tapping the OYS under the NAST PHL umbrella Brand the NAST PHL as the apex advisory scientific body representing the scientific community network	Upgrade the competency of Science Research Specialists to Science Analysts and Science Policy Researchers	Engage with Science Policy researchers in NAST PHL in seeking expert advice from the Academicians	Senate/Congressional Committee on S&T to forge strategic partnership with NAST PHL in seeking expert advice from the Academicians In aid of legislation
Money	Lobby for increased number of slots for Academicians (corresponding funding for benefits) Uncap the ceiling for no. of fellows and increase % progressively	Review financial benefits of fellows to enable the increase in no. of Academicians Identify creative incentives schemes for Academicians	Engage the expertise of the Academy in lieu of consultants on STI matters	Increase the operating budget of NAST PHL Progressively increase the R&D expenditure & investment for STI (UNESCO target of 2.5% of GDP)


Current Initiatives of NAST PHL
DOST Grant-In-Aid Funded Project "Strengthening the Advisory Role of NAST Philippines" from September 2022-October 2025
Develop a strategic communication plan
Enhance the capacity of NAST PHL Secretariat
Improve the visibility of NAST PHL as an Advisory body
Establish mechanisms to effectively disseminate science-based information to policymakers
Develop the NAST PHL Database Management System
NAST PHL Special Concerns Program (2023-onwards)
The results of in-depth studies are expected to:
provide valuable inputs for the formulation of policy resolutions and legislative proposals
incorporate foresight and provide future-directed policy recommendation
support the country's development plans


NAST Special Concerns Program
Agriculture and Natural Resources Management
The Competitiveness and Sustainability of Philippine Agriculture: Developing New Products
Natural Resource Management Issues and the Economy
Targeting the Appropriate Technological Maturity of Rural Industries
Use of Space Technology for agriculture and natural resources management
Industry and Trade Facilitation
Assessment of Basic Industrial Base of the Philippine Economy
Assessment of the Regulatory Laboratories in the Philippines and their Role in Trade Facilitation
Plastics (Bioplastics)
Batteries, Conversion of Public Transportation and Agricultural Machineries
STEM Education and the Scientific and Innovation Ecosystem
An Assessment of the Effectiveness of the National R&D Investment
Enhancing the science, technology and mathematics components of the K-12 curriculum including research in the teaching and learning of science, technology and mathematics
Review of the Schemes to Retain Highly-Trained Scientists and Engineers in the country
Studies on the Alignment of the Philippine R&D System from a Domestic to a Global Network
Health
Applications of Advanced Technologies in the Delivery of Health Care Services
Air Quality in Transport, Workplace, Schools, and Homes

Way forward for Sri Lanka in 'institutionalizing science advice to government': a draft

The Science and Technology Development Act No 11 of 1994 provides the National Science and Technology Commission (NASTEC) authority towards '*application of Science & Technology to stimulate economic growth'.* Given this position, the most appropriate agency to provide science advice to the Executive appears to be the NASTEC. However, NASTEC does not have adequate technical and financial resources to discharge this function fully. In order to provide credible and unbiassed scientific advice to the Executive, NASTEC should have clear statutory powers. Additionally, the capacity of NASTEC, both in terms of technical expertise and financial resources, must be enhanced. In the main, NASTEC's mandate must be enhanced by:

(a) Amending the relevant legislature to identify NASTEC as the main agency to provide scientific advice to the Executive; and

(b) Enabling NASTEC to create the necessary structures within itself to discharge the duties related to providing scientific advice.

In regard to (b) above, several actions are needed, *inter alia,* ensuring that the Chairperson of NASTEC is independent by members electing the Chairperson[i], establishment of a permanent committee under NASTEC to develop scientific advice, and providing the necessary finances for the functioning of the Committee. The Committee, by statute, should comprise representatives of the key national-level scientific bodies[ii] and independent experts to be appointed by NASTEC, and should be chaired by the Chairperson of NASTEC. There should be flexibility to appoint interim members depending on the technical subjects discussed.

Science advice to the Executive should be based on the decisions of the Committee and should be conveyed by the Chairperson of NASTEC.

[1] There is a precedence – The Sri Lanka Council for Agricultural Research Policy Act says that the Chairperson should elected from amongst the members at its first meeting.

2 Key scientific/professional bodies should include but may not limited to: NASSL, NSF, NRC, NIFS, and IPS

Roadmap: Turkiye

Roles within TÜBA for Science Policy Advisory:

- Chief Science Advisor: Entrusted to the TÜBA President, this pivotal role focuses on liaising directly with the national government and offering high-level strategic science advice. The President serves as the primary science diplomat, fostering international scientific relationships and driving national science agendas.
- Science Advisory Office or Agency: The TÜBA General Assembly acts as the primary agency, reviewing major science policies, recommending research directions, and ensuring that academic freedom and research integrity are upheld.
- Science Advisory Board: The TÜBA Presidency assumes responsibility for setting agendas, prioritizing research areas, and making decisions on major projects and collaborations.
- Science Advisory Council: Functioning under the TÜBA Council, this body ensures the incorporation of diverse scientific disciplines in policy recommendations, promoting interdisciplinary and holistic approaches.

Inability to Attract Qualified Individuals to Academia:

- Issue: Despite the support, academia and research institutions face hurdles in retaining top-tier talent, thereby affecting the calibre of science advice.
- TÜBA-Led Solution: Spearhead a campaign emphasizing the prestige and impact of academic roles in Turkey. Collaborate with higher education institutions to enhance the incentive structure, from competitive salaries to international faculty exchange programs. Such efforts can elevate Turkey's appeal on the global academic stage.

Organizational Management Concerns:

- Issue: Governance discrepancies, insufficient inter-agency collaboration, and communication gaps weaken the cohesive structure of science advisory bodies.
- TÜBA-Led Solution: Inaugurate routine inter-organizational meetings, with TÜBA acting as the harmonizing body. Propose the creation of an integrated digital communication platform and advocate for shared research initiatives, bolstering efficiency and synergy.

Budget Constraints:

- Issue: Limited funding obstructs the breadth and depth of scientific advice, from research undertakings to infrastructure investments.
- TÜBA-Led Solution: Actively lobby for amplified governmental budget allocations for science advisory facets, showcasing the direct correlation between investment and national progress. Establish a TÜBA-centric team to delve into international grant opportunities, enriching financial avenues.

Challenges with International Collaborations:

- Issue: Hesitation or non-cooperation from targeted nations for collaborative research initiatives.
- TÜBA-Led Solution: Engage in science diplomacy, leveraging the TÜBA President's role to cultivate relationships at both governmental and institutional levels. Proactively build frameworks for collaboration, preempting and addressing concerns.

Improve Attraction and Retention of Qualified Individuals to Academia: Initiatives should be undertaken to make academia and research institutions more appealing to highly qualified individuals. This could include offering competitive salaries, creating clear career advancement paths, and providing opportunities for academic and professional development. Collaborations with international universities could also be explored for potential faculty exchange programs or joint research projects. Offering competitive salaries and clear career advancement paths are strategies that would require the cooperation of higher education institutions, research facilities, and governmental entities responsible for education and scientific research.

This can be achieved by carrying out a comprehensive review of the existing incentive structures and working out necessary amendments. Additionally, TÜBA can take the lead in building partnerships with international universities for faculty exchange programs and joint research projects. Such partnerships can increase the global exposure of Turkish academics and improve the quality of research output.

1. **Strengthen Organizational Management of Science Advisory Organizations:** Efforts should be directed towards enhancing coordination among different scientific advisory organizations, improving communication, and promoting collaboration on shared objectives. This could involve regular inter-organizational meetings, joint projects, and the use of shared digital platforms for communication and collaboration.
   Strengthen Organizational Management of Science Advisory Organizations: TÜBA can play a key role in promoting inter-organizational collaboration by initiating regular meetings with other science advisory organizations, creating a shared digital platform for communication, and establishing joint research projects. These measures can improve coordination, prevent overlap of efforts, and foster a more cooperative atmosphere among different organizations. TÜBA could also work on developing an organizational management training program to enhance the management skills of the leadership teams in these organizations.

2. **Increase Budget Allocation for Scientific Advice:** Advocacy for increased governmental and private sector funding for science advisory entities is crucial. More funds will facilitate comprehensive research, enable the provision of training and support to scientists, and allow investment in necessary infrastructure. Additionally, explore opportunities for international grants and funding.
   Increase Budget Allocation for Scientific Advice: Lobbying for increased governmental funding could be an area where TÜBA and other academies could actively participate, by highlighting the importance of scientific advice in policymaking. They could provide evidence-based arguments showing how increased funding can improve research outputs and contribute to national development. Moreover, TÜBA can establish a dedicated team to seek international grants and funding opportunities, thereby adding to the available resources.

3. **Manage Relationships with Collaborative Countries:** The diplomatic relations with countries earmarked for scientific collaboration should be managed carefully to ensure their cooperation and participation in shared research initiatives and knowledge exchange. This could involve diplomacy at the governmental level and building strong relationships at the institutional level.
   Increase Budget Allocation for Scientific Advice: Lobbying for increased governmental funding could be an area where TÜBA and other academies could actively participate, by highlighting the importance of scientific advice in policymaking.

   They could provide evidence-based arguments showing how increased funding can improve research outputs and contribute to national development. Moreover, TÜBA can establish a dedicated team to seek international grants and funding opportunities, thereby adding to the available resources.

   This roadmap would require the support and involvement of several stakeholders, including governmental bodies, scientific advisory organizations, academia, the private sector, and international partners. The Turkish Academy of Sciences (TÜBA) could play a crucial role in driving these initiatives, given its position as a respected scientific body.

   In summary, TÜBA, along with other academies in Turkey, have the potential to significantly impact the improvement and development of the country's scientific advice mechanisms. By acting as facilitators, catalysts, and advocates, they can bring about much-needed changes and contribute towards a more robust science advisory system in Turkey.

IMPROVE ATTRACTION AND RETENTION OF QUALIFIED INDIVIDUALS TO ACADEMIA:	**Policy**: TÜBA should advocate for policies that promote competitive remuneration, professional growth opportunities, and international collaborations within academia. The aim is to attract and retain top talent in Turkey's academic and research institutions.	**Identify Needs**: The primary need is to improve the desirability of academic and research positions in Turkey. This involves addressing issues such as compensation, career development, and international exposure. TÜBA should gather information on the current state of these issues in Turkey and compare them with international standards.	**Frame**: The framing of this issue should emphasize the importance of high-quality scientific research for the country's development and the key role that top talent plays in generating such research. TÜBA should highlight that ensuring competitive conditions in academia is an investment in the country's future.	**Evidence**: TÜBA should collect and present evidence to support the advocated changes. This could include research on how remuneration, career development opportunities, and international collaborations influence academics' decisions on where to work. Case studies from other countries that have successfully implemented such measures could also be helpful.	**Synthesis**: After collecting and analyzing the evidence, TÜBA should create a comprehensive report detailing the current issues, the proposed solutions, and the potential benefits of implementing these solutions. This report should be presented in a clear and compelling manner, suitable for both scientific and non-scientific audiences.	**Communicate**: TÜBA should communicate its findings and recommendations to the key decision-makers in higher education and governmental entities responsible for education and scientific research. This communication should be clear, concise, and focused on the potential benefits for Turkey. Furthermore, TÜBA can use its networks to disseminate this information widely, including to the public, to build support for the proposed changes.
STRENGTHEN ORGANIZATIONAL MANAGEMENT OF SCIENCE ADVISORY ORGANIZATIONS	**Policy**: TÜBA should advocate for policies promoting robust organizational management across all science advisory organizations. These policies should encourage regular inter-organizational coordination, joint projects, and the use of shared digital communication platforms.	**Identify Needs**: The primary need is for better communication, coordination, and collaboration among different scientific advisory organizations. TÜBA should identify specific areas where collaboration is currently lacking or could be improved, and pinpoint any obstacles preventing effective communication and coordination.	**Frame**: The issue should be framed in terms of improving the efficiency and effectiveness of scientific advice in Turkey. TÜBA should emphasize that strengthening organizational management in science advisory organizations can help avoid duplication of efforts, streamline resources, and ensure a unified approach to addressing scientific issues.	**Evidence**: TÜBA should gather evidence supporting the importance of strong organizational management. This could involve studies showing the benefits of inter-organizational collaboration, case studies of successful joint projects, and examples of how shared digital communication platforms have improved coordination in other contexts.	**Synthesis**: After gathering and analyzing the evidence, TÜBA should prepare a comprehensive report outlining the current issues, proposed solutions, and expected benefits of these solutions. The report should be written in a clear, accessible manner that communicates the importance of this issue to both scientific and non-scientific audiences.	**Communicate**: TÜBA should communicate its findings and recommendations to decision-makers in science advisory organizations, government entities, and any other relevant stakeholders. This communication should clearly articulate the benefits of improving organizational management and provide practical, actionable steps that can be taken. Additionally, TÜBA can use its platforms and networks to disseminate this information widely, raising awareness of the

						issue and building support for the proposed changes.
INCREASE BUDGET ALLOCATION FOR SCIENTIFIC ADVICE	**Policy**: TÜBA should advocate for policies that increase budget allocation for scientific advice, from both government and private sector sources. Additionally, TÜBA should push for the development of policy mechanisms that encourage and support applications for international grants and funding.	**Identify Needs**: The primary need is for increased funding to support scientific research, training, and necessary infrastructure. TÜBA should conduct a comprehensive evaluation of the current funding landscape, identify gaps, and determine where additional resources are most urgently needed.	**Frame**: The issue should be framed in terms of its impact on national development, the quality of scientific research, and the effectiveness of scientific advice in policy-making. TÜBA should highlight how increased funding will lead to improvements in these areas.	**Evidence**: TÜBA should collect evidence to support its arguments for increased funding. This could include studies showing the correlation between research funding and scientific output, case studies of successful projects that were adequately funded, and examples from other countries where increased funding led to advancements in science and technology.	**Synthesis**: After gathering and analysing the evidence, TÜBA should compile a comprehensive report detailing the current funding situation, the areas in need of more resources, and the potential benefits of increased funding. The report should be written in a clear, accessible manner that can be understood by both scientific and non-scientific audiences.	**Communicate**: TÜBA should communicate its findings and recommendations to government entities, private sector organizations, and other relevant stakeholders. The benefits of increased funding for scientific advice should be clearly explained, and TÜBA should propose actionable steps for implementing the recommended changes. TÜBA can also use its platforms and networks to raise public awareness of the issue, building public support for increased funding for scientific research and advice.
MANAGE RELATIONSHIPS WITH COLLABORATIVE COUNTRIES	**Policy**: TÜBA should adopt a policy that promotes active diplomacy and collaboration with countries that have been identified as potential scientific collaborators. This could involve fostering institutional partnerships, participating in	**Identify Needs**: The key need is for effective management of international relationships to ensure successful scientific collaboration and knowledge exchange. TÜBA should identify the countries with which Türkiye could beneficially collaborate, the	**Frame**: The issue should be framed as one of international cooperation and diplomacy, emphasizing the mutual benefits of scientific collaboration and the role such collaborations play in enhancing scientific knowledge and contributing to	**Evidence**: TÜBA should gather evidence demonstrating the value of international scientific collaborations. This might include case studies of successful collaborations, data showing the contribution of such collaborations to scientific advancement, and evidence of how	**Synthesis**: TÜBA should synthesize the evidence into a comprehensive report, highlighting the benefits of international collaboration, the potential obstacles, and proposing strategies for managing these	**Communicate**: TÜBA should clearly communicate its findings and policy recommendations to the relevant governmental bodies and other stakeholders. This could involve presentations to policymakers, publications in relevant journals,

international scientific consortia, and engaging with international bodies that fund scientific research.	scientific fields that would benefit most from such collaborations, and the challenges that might arise during the process.	global scientific progress.	these collaborations have resulted in practical benefits for the countries involved.	relationships. This report could serve as a guide for policymakers and other stakeholders in their efforts to build and maintain effective international scientific collaborations.	and public outreach efforts to build support for international scientific collaborations. TÜBA should also reach out directly to potential partner institutions in other countries to discuss collaboration opportunities.

ANNEX 8: SWOT ANALYSES

Australia

Bangladesh

Strengths

- National Council for Science and Technology (highest advisory board) under the Ministry of Science and Technology, whose mandate is to coordinate and lead the government science advice for policy, is already established under a parliament act.
- The government policy and national planning documents identified major areas that needed to be implemented for economic development through Science and Technology.
- Availability of intellectuals who could lead the advising role on the wide spectrum of areas of social, economic, and scientific concerns of the "journey toward a knowledge-based economy."
- Availability of well-established research institutes for many areas.
- The country has a high-quality research-oriented university sector and a well-developed research infrastructure.
- The Ministry of Science and Technology has strong relationships with the scientific community through the involvement of research scientists at national laboratories and facilities and its support of scientific research in universities.
- As the head of state, the Prime Minister has authority and powers according to the actof parliament to appoint a scientific advisor.
- The Government of Bangladeshis committed to pursuingproblems identified by the scientific community in exchange for delivering new scientific knowledge and technology.

Weaknesses

- The appointment of the advisors, the role of advisors/committees, and the government advisory mechanism need to be better defined (ad hoc methods arepracticed).
- **Lack of a long-term strategic plan or vision identifying priority areas. Therefore, no mechanism to select which problems to be addressed or which questions to be formulated during the advisory process.**
- Lack of coordination between Ministries and institutes/organizations to implement the Science & Technology policy recommended by the Ministry of Science.
- Poor strategic alignment/coordination between the subject ministry and the Ministry of Science and Technology. All activities are based on individual political agendas.
- Lack of subject knowledge in administrative officers/secretaries in ministries.
- Poor strategies to appoint higher-level officers responsible for the implementation of advice.
- **Poor coordination/coordination mechanisms between all the partners/stakeholders of a particular problem being addressed: industry partners, scientists, government officials, social scientists, end users, and regulatory and policy bodies.**
- **Unavailability of reliable, validated data or no mechanism to maintain data which is the most important in data synthesis during the advisory mechanism.**
- Unavailability of policy/regulatory framework in certain critical areas.
- Unavailability of infrastructure/ modern technology.
- **Administration bureaucracy.**
- Lack of holistic approach encompassing all multi-facet factors like coordination, management, monitoring, and implementation of Science and Technology policy.
- Unavailability of an integrated information dissemination system in Science and Technology.
- Failure to communicate with the public in an understandable way the need for science and technology in national development.

- Lack of real influence on scientific decision-making on needs and expectations of society at large.
- Lack of political commitment, science and technology issues are not strongly represented in the political arena.
- The involvement of national researchers in interdisciplinary science and technology projects is weak.
- Lack of enthusiasm to establish and support unique research infrastructure for the scientific community.
- Lack of interdisciplinary research opportunities and alliances among laboratories and between Govt. and private organizations.
- The low visibility of the Bangladesh Academy of Sciences as an Apex science agency.
- Lack of interest in institutionalizing the Science Advisory system.
- Political influence on the national research institute/universities and the limited merit review of their research activities and funding and management difficulties undermine efforts to build adequate and innovative science and technology research.
- Lack of continuing evaluation of the Science and Technology policy (short and long-term plans) and implementation.
- Once the advice is derived based on synthesized data, there is no formal mechanism for communication and subsequent implementation.

Opportunities

-Availability of a talented pool of human resources/ technical experts/ advisors with updated knowledge.
- Availability of a resourceful pool of experts who could support the advisory process.
- Promote more interchange between the public sector, industry, and academia to educate and inform the public regarding science and technology to establish public trust in science.
- Opportunities for improving priority setting through a more systematic dialogue among key actors of science and technology and making a more frequent monitoring system.
- The growing imbalance between funding in the agricultural sciences and biomedical sciences, and engineering could be addressed to assess the more effective funding priority under Science and Technology policy.
- Strengthening links between the scientific community and international organizations (e.g., INGSA, IAP, ISC).

Threats

- Infrequent meetings of the NCST, which is supposed to meet once every six months.
- Political, social, and economic instability
- Frequent changes in regulations and strategic policies.
- Poor legal framework and a high degree of corruption.
- Interferences to maintain an independent advisory mechanism by various political influences.
- Hidden interests of politicians/businessmen/civil society/professionals and government officials.
- Colonial mentality and reluctance to change and exodus of qualified personnel in recent times.

Bhutan

Strengths:	Weakness:
• Advisories from international organizations such as WHO, UN or mandatory requirements of international protocols such as Kyoto or Montreal Protocols, Madrid Plan for Elderly, etc. Many in agriculture, livestock and forestry field • Science is given high priority by the government of Bhutan • evidence gathered through systematic review or metanalysis of published literature (all methods may be used as and when relevant to the subject) • Instituting Evidence based practice into the educational curriculum • The number of researchers is increasing in the country. • Platform to publish research also established in the university • There is increasing external linkages as well • International or regional consultation may be carried out by the individuals involved in the decision-making process. • Advice When available, it is mostly as reports and publications that are put up publicly on the agency websites or as hard copy publications • There is increasing involvement of the parliaments in such decision making and consultations • The national assembly of Bhutan has a group of officers who are supposed to be involved in research and data production to help decision making • The parliament also have several committees to help decision making during which they make consultations with the expert groups specific to the task in hand • In Bhutan, the Medical University plays a significant role in the case of Science Advise especially training health workforce according to the National Health Policy.	• There is no science academy to advise to the Government • there is no regulation or laws that specifies the government policy to legitimizes science for policy. • Mostly individual experts and/or committees formed ad hoc on need basis • There is no SOP for this but when required most of the time, the committees or groups have Terms of References to do the job in hand for the designated time of their job. • No budget to take experts • Many taken up based on anecdotal evidences when matters are urgent • Most of the cases, thing is dependent on the advisor's knowledge and expertise especially when there is no advisory group to advise and work on • Conflicting evidences are debated but not always possible • There may be some bias towards searching and considering more literature that favours the intended purpose in such cases since there are no expertise • No such formal process and protocols for the • not all the decisions supported by evidence. • advice obtained by asking experts • Since we have no capacity to perform our own independent groundbreaking research, we may be mostly using regional and international data • There are budget constraints at all levels of research programs and no research endowment funds, have to rely on the development partners • The advisors are allowed to work that is specific to their job and task at hand as part of day to day job and independent research projects with huge fundings are not possible • All researchers perform the job secondary to their primary responsibilities

• University supports the Government in decision making in terms of using best available evidence in setting up Institutions and health care on ad hoc basis as and when the Government requires them. There is no advisory board or an academy to advise the Government on regular basis.	• Research funds, especially when huge, should always be routed through the government channel • even when there are evidences, there are no proper means of delivering the message or recommendations to the policy makers • Not paid for the work which is ad addition to their primary job • There is no routine formal assessments of impacts
Opportunities • Regulation or laws that specifies the government policy to legitimizes science for policy. • The number of researchers is increasing in the country but there is a need to improve health research capacity. • Research endowment fund • Instituting Bhutan Medical Association which can support instituting National Academy of Science • As an academic Institution, can work with other relevant agencies on instituting the science advice academy • Linking with other academies of science and international organizations to institute the science advice academy • The academia can provide evidence-based decision making to the Government	**Threats** • Resistance from the so called expert groups. • Lack of support including finance from the relevant authorities • Lack of commitment from individuals • Bureaucratic hurdles

South Korea

Strengths

- Systematic institutionalization of science advices: PACST Act in 1991
- Long history of providing science advices to the President and S&T-related ministries
- The Chairman of PACST has been the President of Korea since 2004
- Relatively good science advisory system for the President: Science Advisor, Scientific Staff; Policy institutes for S&T related ministries (e.g., STEPI, KISTEP, KIAT)
- Strong governmental needs on S&T policies, which demands an active science advices
- Relative long history of governmental S&T policies since the end of 1960s: Korea has been developing based on its accumulation of S&T capabilities
- Competent national innovation system since the beginning of the 2000s
- Good legal and institutional framework for S&T development (e.g., Basic Act for Science and Technology since 2001 and other S&T-related acts)
- Good implementation of S&T policies and science advices among S&T-related ministries
- Strong public research institutes, which are called government-sponsored research institutes (GRIs), for example Korea Institute of Science and Technology (KIST)
- Rapid increase of well-qualified S&T manpower: as of 2021 Korea ranked in the #5 in the number of researchers in the world

Weaknesses

- National S&T policies are focused only 5-Year Plan, which is the period of government, so that the science advices should be short-term oriented
- As for S&T advices, there are strong tendency of competition among S&T-related ministries and advisory institutes in advising, formulating and implementing S&T programs and strategies. It leads to the duplication of S&T programs and waste of scarce national R&D resources.
- Some scientists and engineers, who have had no policy-related knowledge, have been appointed as advisor, which has provided only short-term and sector specific advices
- Insufficient linkage among S&T-related ministries in formulating and implementing inter-ministerial S&T programs
- Still heavily oriented to implementing S&T policies for developing economic and industrial development, and no sufficient S&T policies for solving and responding long-term oriented and comprehensive social, environmental challenges
- No sufficient utilization of Korean Academies in science advices for the President and S&T-related ministries
- Korean Academies have no sufficient research and advising capabilities for advising and consulting the President and S&T ministries

Opportunities

- Successful history of socio-economic development by accumulating S&T capabilities, which recognized the importance of science advices
- Korean S&T policies have been transforming from economy-oriented policies to comprehensive sustainable policies since the beginning of the 2020s
- Korean society have been appreciating the importance of S&T and innovation capabilities in socio-economic development
- Strong ICT and digital capabilities, which accelerate and diffuse science advices in Korean society
- Very good S&T manpower and policy study manpower, which enable the effective implementation of science advices and S&T policies
- Strong S&T and industrial policy for socio-economic development, which could require S&T policy advices
- Korean regional governments have been recognizing the importance of S&T and innovation capabilities in the socio-economic development of their regions
- Recent strong competitions in many S&T areas (AI, semiconductors, electric cars, decarbonations, healthcare) among advanced countries, which require high-level science advices from diverse level of government

Threats

- Heavy concentration of economic and S&T potential in Seoul, Capital City, and its outskirts
- Weak S&T policies of regional governments, most of which are heavily dependent upon the central government in its S&T policies and budgets
- Relatively weak economic and S&T power of Korean SMEs, compared with those of big enterprises, e.g., Samsung, LG, SK
- Relative weaknesses in educating and producing convergent-type manpower
- Relative strong avoiding science and engineering, compared with medicine and social sciences
- Relatively short history of developing science culture, science communication, and public understanding of science among Korean society
- Relatively low recognition of science and engineering in Korean society, compared with law, medicine, business administration and economics
- Too militant interest groups, especially in private sector
- Low birth-rate in Korean society

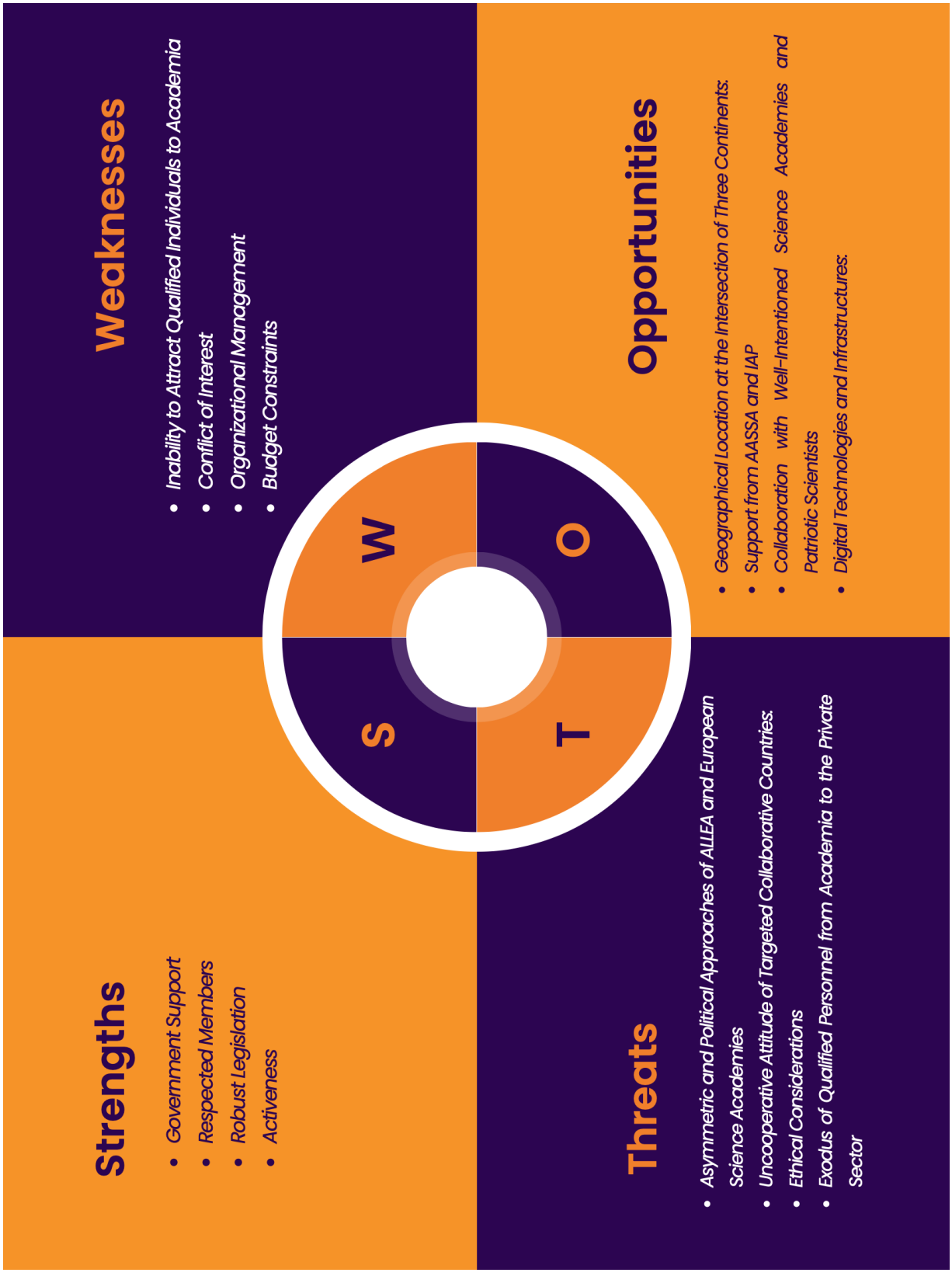
Philippines

Strengths	Weaknesses
- NAST Philippines, was created by Republic Act 2067 as the body of competent scientific and technological experts to promote S&T research and development,foster invention, utilize scientific knowledge for national progress. - NAST Philippines, through Executive Order No. 818, the Academy became the advisory body of the President of the Republic of the Philippines on policies concerning S&T - President, as the head of state has authority and powers to appoint the Officers of the Academy - The Harmonized National Research and Development Agenda (2022-2028) is prepared by the Department of Science and Technology (DOST) and reviewed by the National Economic and Development Authority (NEDA) in consultation with government and private research and development institutions, the academe, industry and other concerned agencies to serve as guide for the prioritization of research programs and projects to be funded for the planning horizon. - Availability of scientists and engineers who can be tapped to lead the preparation of science advisories in diverse fields of specialization ranging from the social, economic, health, engineering and technology, agriculture, biological, mathematics and physical sciences. - Availability of R&D institutions (e.g., NRCP, PCAARD, PCHRD, PCIEERD, DRRM) and the scientific community (i.e., academe, professional associations, industry associations, etc.) to promote science for policy. - NAST PH regularly holds Annual Scientific Meetings on a chosen theme where scientific researches are presented to the public; it also is avenue for public consultation and resolutions on proposed policy or action items are formulated and presented to the DOST and NEDA.	- The appointment of the advisors, role of advisors/committees, and government advisory mechanism is on an ad hoc basis (e.g, providing comments on draft bills, invited to provide expert advice during committee hearings on matter related to S&T) - Once the draft Science Advisory is approved for publication and disseminated to the concerned individuals, organizations and government agencies, its adoption for implementation will depend on the appreciation of the policy makers. - Changes in policies come with the change in national administration's political platform. - Poor strategic alignment/coordination between the national government and the local government offices. - Poor coordination/ coordination mechanisms between all the partners/stake holders of a particular problem being addressed: industry partners, scientists, treasury officials, social scientists, end users, regulatory and policy bodies. - Unavailability of reliable validated data or no mechanism to maintain data. Experts rely on their own body of knowledge and expertise, and if needed, they consult the opinion of other experts in other fields. - Unavailability of infrastructure/modern technology. - Administration bureaucracy - Lack of subject knowledge in administrative officers/secretaries in national and local government agencies. - Poor strategies to appoint higher level officers responsible for implementation of advice.
Opportunities	**Threats**
- Skillful pool of human resources/ technical experts/ advisors with updated knowledge. - Access to foreign experts through academic and scientific linkages who can support in providing advice - Availability of successful advisory models/ mechanisms in countries with similar socio-economic backgrounds. - Access to well-established models and literature on government advisory mechanism. - Access to digital technology.	- Exodus of qualified personnel for more lucrative opportunities abroad - Political, social, and economic instability - Inconsistent and constant changes in regulations and strategic policies. - Reluctance to change and slow adoption of advanced technology. - Government funding support for S&T expenditure is influenced by political interests.

Sri Lanka

Strengths	Weaknesses
- Major areas that needed to be implemented for economic development through industrialization have been identified in the government policy and national planning documents. - NASTEC, whose mandate is to coordinate and lead the government science advice for policy is already established under a parliament act. - Growing interest in the scientific community led by the NASSL to institutionalize science advice for policy. - Strengthening links between the scientific community and international organizations (eg. INGSA, IAP, ISC) that have promoted science advice for policy. - Availability of intellectuals who could lead the advising role on wide spectrum of areas of social, economic, and scientific concerns of the "journey toward a knowledge-based economy." - Availability of well-established research institutes for many areas. - President, as the head of state has authority and powers according to act of parliament to appoint chief scientific advisor. - Each ministry has its well-defined, e.g: S and T ministry subject portfolio and therefore, any advice role could be coordinated through the relevant ministry for implementation. - Initial feasibility studies of major areas that require advice on government implementation plans are already available as a basic platform. - Availability of BOI zones and other trade agreements. - Availability of historical knowledge, natural resources.	- The appointment of the advisors, role of advisors/committees, and government advisory mechanism is not well-defined (ad hoc methods are practiced). - Lack of a long-term strategic plan or visions identifying priority areas. Therefore, no mechanism to select which problems to be addressed or which questions to be formulated during the advisory process. - Frequent changes in policies due to political influences. - Once the advice is derived based on synthesized data, there is no formal mechanism for communication and subsequent implementation. - Poor strategic alignment/coordination between the subject ministry and presidents' coordination office. All activities are based on individual political agendas. - Poor coordination/ coordination mechanisms between all the partners/stake holders of a particular problem being addressed: industry partners, scientists, treasury officials, social scientists, end users, regulatory and policy bodies. - Unavailability of reliable validated data or no mechanism to maintain data which is the most important in data synthesis during the advisory mechanism. - Unavailability of policy/regulatory framework in certain critical areas. - Unavailability of infrastructure/ modern technology. - Administration bureaucracy - Lack of subject knowledge in administrative officers/secretaries in ministries. - Poor strategies to appoint higher level officers responsible for implementation of advice.
Opportunities	**Threats**
- Skillful pool of human resources/ technical experts/ advisors with updated knowledge. - Availability of successful advisory models/ mechanisms in countries with similar socio-economic backgrounds. - Access to well-established models and literature on government advisory mechanism. - Access to digital technology. - Availability of resourceful pool of epacts who could support in advisory process. - Availability of data on strategic failures since independence (lessons learnt are available to avoid failures).	- Political, social, and economic instability - Constant changes in regulations and strategic policies. - Lack of patriotism/ cohesiveness. - Untrustworthy system/ law and order. - Ethnic and religious divisions/conflicts. - Poor legal framework and high degree of corruption. - Interferences to maintain an independent advisory mechanism by various political and mysterious powers. - The business of advisors/ experts to receive various individual benefits. - Geo-political and international interferences (conspiracies) on independent advisory mechanism. - Hidden interests of politicians/businessman/ civil society/ professionals and government officials. - Island/ colonial mentality and reluctance to change. - Exodus of qualified personnel in recent times

Türkiye



[i] There is a precedence – – The Sri Lanka Council for Agricultural Research Policy Act says that the Chairperson should elected from amongst the members at its first meeting.

[ii] **Key scientific/professional bodies** should include: NASSL, NSF, NRC, NIFS, IPS etc.