UCL Department of Science, Technology, Engineering and Public Policy (STEaPP)

INTERNATIONAL EXPERTISE IN NATIONAL SCIENCE ADVISORY SYSTEMS

This project is implemented in partnership with the International Public Policy Observatory (IPPO) and International Network for Governmental Science Advice (INGSA)

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Abstract

Amidst global interconnectedness and information sharing, the role of international expertise in informing national policy-making processes is increasingly crucial. This report investigates how international expertise and national science advisory systems interact, unveiling the pathways through which knowledge flows. The core of exploration centres around three essential components of pathways of international expertise: international knowledge sources, channels, and government touchpoints. Together, these elements form a dynamic framework that characterises the exchange of international expertise within national science advisory systems.

Examining Argentina, India, and the United Kingdom (UK) through literature and interviews, the report draws the most recurring pathways for international expertise and the factors influencing its formation. This way, it highlights factors such as the national context, political and geopolitical environment, national science advisory system institutionalisation, government staff agency, and the nature of the most recurrent policy areas.

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Introduction

In an era defined by unprecedented interconnectedness and the seamless exchange of information across borders, the intersection of international expertise and national science advisory systems has taken on a heightened significance. With the convergence of global challenges, ranging from climate change and public health crises to technological advancements, an imperative to incorporate international expertise into national science advisory systems has never been more apparent. However, the genesis of this report stemmed from the recognition that despite the growing importance of international expertise in shaping national science advisory systems, a noticeable gap exists in the literature surrounding the dynamics of this interplay. While the interconnectedness of the world has increased, comprehensive analyses of the pathways through which international expertise informs national decision-making have been scarce.

Additionally, this report is particularly significant due to its collaboration with INGSA (International Network for Government Science Advice) – an organisation with a vested interest in this topic, driven by their experiences during the COVID-19 pandemic. Throughout the pandemic, INGSA was approached by numerous governments and policymakers seeking guidance on accessing international expertise to address the multifaceted challenges posed by the pandemic. The global response to COVID-19 highlighted the critical need for coordinated actions at science–policy, science–communication, and science–diplomacy interfaces (López-Vergès et al., 2021), despite initial lack of coordination (Colglazier, 2020). The COVID-19 pandemic response also underscored intriguing insights into international science expertise. For instance, a UK Parliament Report in 2022 observed that despite access to international evidence, it was not effectively utilised in policymaking (Sixth Report of the Health and Social Care Committee and Third Report of the Science and Technology Committee of Session 2021–22, Titled Coronavirus, 2021). This observation underscores the complexity of translating international expertise into actionable policy measures.

This report endeavours to unravel the intricate interplay between international expertise and national science advisory systems, shedding light on the pathways through which knowledge flows and insights are shared, contributing to the discourse by filling this void in existing research.

The report is structured around three fundamental components that constitute the foundation of international expertise pathways. One – international knowledge sources that explore the breadth of entities that generate global scientific insights. Two – diverse channels that facilitate the flow of knowledge across borders and the mechanisms that foster interactions and information exchange. Three – the crucial interfaces were uncovered within national governance—the government touchpoints—that bridge the divide between international expertise and domestic decision-making.

When the interplay between these components is examined, a complex web of interactions emerges, forming a constellation of pathways that transcend national boundaries. Through real-world examples, case studies, and expert perspectives, this report unveils the nuances of international expertise pathways and its components.

Methodology

Purpose

The purpose of this research is to contribute to INGSA's mission of enhancing science–policy interfaces by identifying and understanding the functioning of the pathways for international expertise that countries establish to inform their national policymaking.

Epistemological framework: pragmatism

The report follows pragmatism as an epistemological framework given its suitability to research organisational processes (Kelly & Cordeiro, 2020). For the study of pathways, this approach involves exploring the organisations that play a fundamental role in countries' access to global knowledge resources, taking into account the unique context within which these organisations operate.

Two principles of pragmatism have been deemed particularly relevant for the report's design that helped refining the research objective, the framing of the research problem, and the development of the methodology. First, the principle of actionable knowledge steered the research agenda by conducting iterative processes aimed at "unpacking the research problem and identifying the elements of the problem considered the most useful to the client" (Kelly & Cordeiro, 2020). Second, the "recognition of the interconnectedness of experience, knowing and acting" helped in the development of the methodology, which was designed to provide "a better understanding of the organisational process by documenting actions and experiences of staff to surface complex themes and issues hidden in formal documentation" (Kelly & Cordeiro, 2020).

Research questions

Based on the above research purpose, this report proposes two research questions that guide the study design and implementation of this research. These are the following:

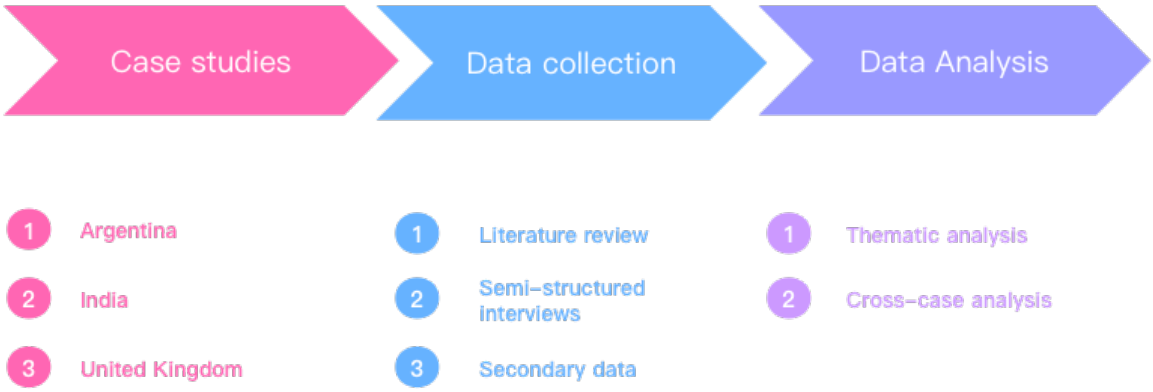
1. What are the existing pathways that countries use to obtain international expertise?
2. How do these pathways operate to inform national policymaking?

Study design: Qualitative multiple case study

The global landscape encompasses a wide variety of national science advisory systems and thereby, wide variety of pathways for obtaining international expertise. Thus, to research the phenomenon of pathways, it was deemed essential to study different national systems and their intricate compositions. Henceforth, a multiple case study design was adopted. In the first place, case studies stand as "an empirical method that investigates a contemporary phenomenon in depth and within its real-world context, especially when the boundaries between the phenomenon and the context may not be clearly evident" (Yin, 2017). Then, multiple case studies would amplify the scope of the research enabling a greater breadth and robustness of the results and the recommendations (Heale & Twycross, 2018).

It is worth mentioning that the multiple case study design of this research (See **Figure 1**) focuses on providing diverse descriptive evidence for understanding the phenomenon studied. It does not aim to provide a comparative analysis among the different national advisory systems studied here.

Figure 1 Qualitative Multiple Case Study



Data selection: case studies

This research is based on the study of three countries: Argentina, India and The United Kingdom. The selection of these resulted from the balance of criteria related to representativeness, accessibility and feasibility.

The representativeness criterion aims to ensure a geographical diversity to the sample by selecting countries from different continents. This diversity was critical for the research as its objective has a global scope for understanding what pathways countries use to obtain international expertise, not focusing on phenomena of any specific region. This way, the three countries selected provided worldwide different context, including different institutional settings, socio-cultural norms, politic and diplomatic relations.

Additionally, the selection of countries aimed to provide representativeness also in terms of different levels of economic development. Therefore, the current classification by income levels developed for the World Bank by Hamadeh et al. was considered as an additional criterion (2022). Then, these three countries represent also different stages

in their economic development, providing particular contexts of political and economic challenges.

The accessibility criterion guaranteed the access to interviewees, so the selection was based on INGSA's and STEaPP's networks in the countries, which helped the study to be more targeted and goal-oriented in completing the expected interviews within the time frame. Finally, the feasibility criteria regarding the time constrains helped choosing the quantity of case studies.

Table 1 Selection Criteria of Case Studies Countries

Countries	Geography	Economic Development	Accessibility
Argentina	South America	Upper-middle income	INGSA and STEaPP
India	Asia	Lower-middle income	STEaPP
UK	Europe	High income	INGSA and STEaPP

Data collection methods

Qualitative research was implemented, centred on gathering and analysing non-numerical information originating from documents and semi-structured interviews. The principal sources of data were experts of science advice, government documents from the case study countries and academic and grey literature on the topic. The qualitative tools used and the criteria for their implementation are detailed below.

Literature review

To understand and define the phenomenon of avenues of international expertise and to summarise previous literature on the subject, a comprehensive literature review was conducted, not limited to the three countries selected for the case studies. This review not only aimed at providing a theoretical foundation but also to identify gaps that could

be further explored through the interviews with experts. The literature review considered a period of 10 years (2014-present) to ensure that it portrays the latest understanding around the functioning of pathways of international expertise.

To initiate this process, based on initial recommendations from the project supervisors and the client, a list of concepts and terms prevalent in the field of study were identified. This compilation served to generate a comprehensive search string (See **Table 2**) that were then used on two academic databases – Scopus and Web of Science.

Table 2 Search string for academic databases

Sources	Keywords
Scopus and Web of Science	**International expertise:** (international) AND (science) AND (expertise OR advice OR knowledge OR diplomacy OR diffusion OR "policy idea*") **Pathways:** (pathways OR touchpoints OR interface* OR mechanism* OR process*) **Transfer:** (transfer OR adopt* OR integrat* OR learn* OR lesson OR influenc* OR inform* OR mimicr* OR sharing OR share) **National policymaking:** (national) AND (policymaking OR policy OR decision-making)

For the grey literature, searches were conducted in the webpages of relevant organisations active in the field of international and national science expertise. In this case, a manual screening was conducted among their publications using the keywords included in **Table 2**. The following organisations were considered:

- Organisation for Economic Co-operation and Development (OECD)
- American Association for the Advancement of Science (AAAS)
- The Royal Society

- Inter-Academy Partnership (IAP)
- International Institute for Applied Systems Analysis (IIASA)
- United Nations Educational, Scientific and Cultural Organisation (UNESCO)
- International Network for Government Science Advice (INGSA)
- International Science Council (ISC)

It is important to highlight that the compilation of literature remained a continuous endeavour throughout the research, wherein numerous recommendations were provided by the experts interviewed.

Interviews

Semi-structured interviews were conducted to collect data for the case studies. The interview consisted of 7 broad questions, inspired by the results of the literature review and recommendations from INGSA (See Appendix **Interview questions**).

With respect to the interviewees' selection, an initial list of potential interviewees was provided by INGSA, which was then complemented with UCL STEaPP's network of experts. Additionally, LinkedIn was used to look for experts and snowballing method was used to enlarge the list by respondents' referrals.

This resulted in the completion of 11 semi-structured interviews, with 4 interviewees from Argentina, 3 interviewees from India and 4 interviewees from the UK. Interviewees were anonymised through a coding process, according to the chronology of interviews and their country of origin.

This coding will be used in the following sections to indicate the content that has been quoted from the interviews, which will be included in brackets as appropriate. This list can be observed in **Table 3**.

Table 3 List of interviewees

Interviewees' code	Country	Profile background
1I	India	Government official in foreign office
2A	Argentina	Academic in science advisory systems
3U	UK	Academic in science advisory systems
4U	UK	Academic and government official in executive science advisory system
5U	UK	Academic and government official in legislative science advisory system
6A	Argentina	Government official in local government
7U	UK	Government official in foreign office
8A	Argentina	Government official in national government
9A	Argentina	Academic and government official in legislative science advisory system
10I	India	Government official in executive science advisory system
11I	India	Academic

In terms of interview design, for feasibility, one-hour semi-structured interviews were conducted online, mainly in English. However, some interviews from Argentina included some responses in Spanish. The aim was to capture the information with preciseness from the respondents.

Secondary data

The secondary data was obtained from official government documents and respondents' testimonials and articles. For case studies, relevant policy documents from

the three countries were screened and contextualised for this research. Documents recommended by the interviewees, including academic literature, were also included as a part of secondary data.

Data analysis methods

Thematic analysis

The transcripts of interviews were analysed by the thematic analysis method. The objective here was to capture the ideas and shared meanings (Braun & Clarke, 2023) between the interviewees of the same country, with the intention of conducting a data reduction process underpinned by the same terminology.

Consequently, a preliminary analysis was carried out leveraging pre-determined themes emanating from the research questions and the problem framing, involving colour-coded categorisation. Flexibility was also given to each researcher to identify emerging themes. After discussing initial themes findings, this was used as input for establishing the research's definition of pathways for international expertise. Then, a secondary analysis was conducted to describe the phenomenon studied in each country following the structure of the definition proposed. It is important to note that the definition and structural composition of the concept of pathways was based on the initial understanding of the literature review and interviews' data.

Cross-case analysis

Cross-case analysis is a research methodology that facilitates the comparison of commonalities and differences between events, activities, and processes that serve as the unit of analysis for a case study (Khan & VanWynsberghe, 2008). This research focused on analysing the data related to the three cases not to compare their differences or similarities, but to complement findings to provide a comprehensive picture about the different types of pathways that exist for obtaining international expertise, while at the same time allowing for the identification of patterns that can be drawn transversally among them.

At the same time, use of this methodology provides a way to conduct causal analysis. It allows for the examination of pathways that have arisen from interviews conducted, enabling an exploration of the causes behind their development and the factors that have impacted, across three countries. One of the criteria used to assess whether countries followed the more prevalent international science advisory pathways was whether they mentioned different pathways in the three cases or not. Repeated mentions were considered to be an important influence on the country's choice of the international science advice pathway. In conclusion, this methodology allowed for a preliminary observation of some of the factors influencing the formation of pathways, their components and their links to international sources of expertise.

Limitations

There are certain limitations in the research methodology that are acknowledged as follows:

- **Limited Samples and Generalisability:** The research based on a sampling of 3-4 interviewees per country may restrict the generalisability and representativeness of findings. This small sample size might not fully capture the intricate diversity and complexity of each country. While the chosen countries offer valuable insights into their unique systems, the findings may not be broadly applied to other global or neighbouring contexts due to the intricate interplay of numerous factors influencing the dynamics of each nation.
- **Interpretation Subjectivity:** The thematic analysis process employed in this research involves interpretation and coding of qualitative data by researchers. While efforts were made to establish pre-determined themes and promote consistency through coding, the subjectivity of interpretation may introduce potential biases and variations in the analysis of interview transcripts.
- **Temporal Scope:** The literature collected for this research is limited to the last decade, and while this can help better understand the existing international

expertise pathways, it may at the same time result in an inability to capture changes in pathway development prior to this period from the literature review.

- **Time Constraints:** Due to time limitations, it was not feasible to obtain a well-balanced representation of interviewees from different interest groups. This could result in a partial vision of the situation, such as in Argentina, where the majority of interviewees were from the government, leading to a potential lack of representation of academic perspectives.

Definition of pathways of international expertise

During the data analysis processes, the conceptualisation of pathways of international expertise emerged as a prominent topic of discussion, first and foremost because of the lack of standardisation of the concept in the literature. For instance, in one paper, pathways are recognised as potential links that connect research to decision-making, which includes factors influencing the use of research as well as knowledge transfer and communication strategies (Gold, 2009). In another paper, pathways are understood as sequences of alternative procedures to achieve goals, and as broad directions of change with different strategic goals or outcomes (Werners et al., 2021).

Henceforth, after the first analysis of the data obtained from the literature review and the interview transcripts, a definition of pathways for international expertise was convened, to set a theoretical ground for the phenomena under study and guide the subsequent analysis and interpretation of the data

"Pathways of international expertise" are hereafter defined as the "dynamic interactions between international knowledge sources and government touchpoints through channels that allow international expertise to inform national decision-making".

The definition conceptualises pathways through three main components: (1) international knowledge sources, (2) channels and (3) government touchpoints. The following section provides an explanation of each of these components and dissects the different entities and elements that can be encountered in each one.

Table 4 Components of pathways of international expertise

International knowledge sources	Channels	Government Touchpoints
International Multilateral Organisations	Documents	Advisory Committees
Intergovernmental Forums	Events	Ministries of Foreign Affairs & Embassies

International knowledge sources	Channels	Government Touchpoints
Foreign Government Departments and Offices	Meetings	Government Departments & Offices
Expert Networks	Personal/Professional Networks	Scientific Adviser Offices/ Chief Scientific Advisers
Institutional Networks	International Cooperation Programmes and Projects	Individual/Team Staff
Academic Community	National Networks of Professionals Living Abroad	
International Media		
Industry and its Association		
Think Tanks		

International knowledge sources refer to entities or individuals that generate international science expertise and advice. Some national-level organisations and institutions are also included given that their international affiliations and expertise allow them to generate international knowledge. They include:

- International multilateral organisations: intergovernmental entities established through treaties or agreements among member states. For example, WHO and other United Nations (UN) agencies.
- Intergovernmental forums: platforms where representatives from different governments gather to discuss and collaborate on shared issues, policies, and agreements in order to achieve common goals and address global challenges. For example, the G7.
- Foreign government departments and offices: organisational units within the government structure of other countries.

- Expert networks: group of professionals from diverse fields who offer unbiased/non-political, research-based insights and recommendations on scientific issues.
- Institutional networks: interconnected groups of organisations sharing similar work, responsibilities and goals, engaging in collaborative efforts to exchange knowledge.
- Academic community: a system of scholars, researchers, think tanks, research institutes and universities.
- International media: media outlets, encompassing news agencies and broadcasting networks, that operate on a global scale or are based in foreign countries.
- Industry and its associations: productive sectors and the organisations formed by businesses to promote collaboration, advocacy, and the exchange of knowledge among its members. In this report, this category also includes consultancy firms.
- Think tanks: Research institutions that aim to play a key role in shaping and influencing global, regional and national policies. For the purposes of this report, think tanks include both national and international level that have the capacity to provide international knowledge to governments.

Channels are means or mechanisms that governments use to obtain international expertise from international knowledge sources. They include:

- Documents: written, electronic, or recorded information that conveys knowledge. For example, reports, journals and briefings.
- Events: online or in-person gatherings, such as conferences, summits, forums that foster interaction, knowledge exchange, and discussions.
- Meetings: online or in-person scheduled private gatherings where individuals discuss and exchange knowledge. This includes communication via phone calls and emails.

- Personal/Professional network: an individual's connections.
- International cooperation programmes and projects: collaborative efforts between countries based on bilateral or multilateral agreements to address common challenges, exchange knowledge, and work towards shared goals. For example, the Triangular South-South Cooperation between two Global South nations mediated by the UN.
- National networks of professionals living abroad: comprise individuals from a specific country residing in different parts of the world, fostering connections, knowledge exchange, and leveraging expertise for the benefit of both the host and home countries.

Government touchpoints are the interfaces or points of engagements that a government have to obtain international expertise. This includes:

- Advisory committees: Advisory committees are groups of experts, either established on a permanent or temporary basis, convened to provide specialised advice, recommendations, and insights on specific topics or issues, assisting decision-makers in making informed choices.
- Ministries of Foreign Affairs & Embassies: Ministries of Foreign Affairs manage a country's international relations and policies, while embassies are diplomatic missions representing a country in other nations, responsible for promoting diplomatic ties, addressing citizen concerns, and facilitating cooperation.
- Government Departments & Offices: organisational units within the government structure of a sovereign state.
- Scientific adviser offices / Chief scientific advisers: positions within a government structure responsible for offering expert guidance and evidence-based advice to policymakers.
- Individual/Team staff: Individuals or teams working within governmental institutions.

The three components together form a complex, non-linear process. Multiple government touchpoints may reach out to multiple international knowledge sources through multiple channels, forming intricate multiple pathways. These pathways may vary for different policy issues.

This conceptualisation is used for structuring the analysis within the findings and discussion sections of the report.

Findings

This section is organised in two subsections, the literature review, and the three-country case studies. Each subsection comprises of an introductory overview of the findings and countries. The findings are then presented following the structure of pathways and its components. In that respect, it must be noted that information on each pathway component is provided as long as it has been identified during data collection. This means that not all sub-sections contain all categories, but only those identified in each case.

Literature review

Overview

Literature published in the last decade was selected and analysed to gain a contemporary perspective on the science advice system and its channels for the uptake of international expertise. The selected timeframe enables capture of the latest developments, adjustments and trends in the field, assessing how the science advice system is responding to emerging global challenges such as climate change and pandemics, and how it is embracing cross-border collaboration.

Thematically, there is a large amount of literature focusing on climate and environment, health, and crisis management. Notably, the literature focusing on science advice, especially after the COVID-19 pandemic, has been dominated by crisis management.

Furthermore, the existing relevant research remains significantly limited in both quantity and scope. There is a substantial research gap in the understanding of how international science advice is used to inform national policymaking. Another critical observation involves the diverse manifestations and varying impacts of pathways for acquiring international expertise, influenced by the distinct economic, political, and social contexts of individual countries.

Pathway components findings

International knowledge sources

- **International Multilateral Organisations**

Busch et al. (2021) shed light on the role played by international multilateral organisations in providing country-specific advice to governments. For example, “the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD) publish regular country surveillance reports in which they provide concrete policy advice and follow up on the implementation records of past recommendations” (Busch et al., 2021). Furthermore, international organisations can also engage in national debates. For instance, during the COVID-19 pandemic, the World Bank offered specialised policy advice to governments (Van Hecke et al., 2021).

Countries recognise the value of the expertise emanating from international multilateral organisations. For example, as Waisbich & Haug (2022) explain, China recognises the value of the expertise of the United Nations (UN), which plays a “cross-cutting and management-related advisory role” in terms of China's international development cooperation. Additionally, these international organisations are also important sources of science funding, requiring recipient countries to be open to scientific exchange and cooperation with donor countries (Legrand & Stone, 2018; Koch & Weingart, 2016).

- **Foreign Governments**

Foreign governments are used as international knowledge sources in a variety of ways. Waisbich & Haug (2022) talk about the Trilateral South-South Cooperation (SSC) involving UN entities as mediators to establish projects for knowledge sharing and technical cooperation activities, such as "seminars, trainings, study tours and hands-on technical assistance projects" for public institutions and their civil servants. Another example are partnerships, such as the “preferred” bilateral and multilateral partners for

science advice exchange (OECD, 2020). For example, in the case of the COVID-19 pandemic, these partnerships led to the formation international research networks to collect and exchange data and models on the COVID-19 outbreak's effect on society (OECD, 2020).

- **Expert Networks**

Chandran et al. (2018) argue that networks of experts comprising scientists and technologists across countries can "influence the decision process through non-political knowledge diffusion" and play a key role in evidence brokerage and synthesis. Some examples of such networks are INGSA (Gluckman & Wilsdon, 2016), the Foreign Ministry Science and Technology Adviser Network (FMSTAN) (Arimoto et al., 2017) and the Global Network of Chief Science Advisers and Equivalents; Aitsi-Selmi et al., 2016). These networks also help experts share their knowledge with international colleagues and help strengthen the science–policy interface.

- **Institutional Networks**

Institutional networks are also important for providing science expertise to governments. For example, the Regional Leaders Summit (RLS-Science) is an institutional network focusing on interregional scientific research and exchanging scientific expertise through multilateral political forums linking government departments in seven regions of different countries around the world[1] (Da Silva et al., 2021). An OECD paper (2015) states that transnational networks, built in several areas to exchange data by national

[1] Seven regions include: Bavaria, Germany; Georgia, USA; Québec, Canada; São Paulo, Brazil; Shandong, China; Upper Austria, Austria; and Western Cape, South Africa

advisory bodies, can “play a dual role in both providing credible and trustworthy advice from different countries to national authorities as well as authoritative information to media and the general public” (OECD, 2015).

- **Academia**

Academic communities are of high value to governments as international knowledge sources. In order to canalise international expertise to the country, governments support international higher education activities, such as academic exchanges for students and scholars, scholarships and recruitment of international students and establish joint programmes (Knight, 2022).

- **Think Tanks**

Think tanks are playing an increasingly relevant role in the international arena and are becoming transnational in nature, influencing international and domestic governance through the dissemination of knowledge (Stone, 2021). These institutions actively seek international expertise by employing international staff, consulting international experts, and working with foreign think tanks. They also actively engage in a great deal of informal exchanges with national entities (McGann, 2019).

Channels

- **Documents**

Written documents are used as channels by a wide range of international knowledge sources, such as international organisations and academic communities. These documents are subsequently disseminated to government agencies and their respective personnel (Busch et al., 2021). Another example provided by Akerlof et al. (2019) is that information and analysis on science and technology assessments generated by libraries

and research services are usually disseminated to the legislative science advisory systems through written reports.

- **Events**

Garard et al. (2018) and Uygun (2015) both point out that participants from diverse backgrounds are able to exchange views through deliberative platforms such as forums, workshops, roundtables, and other ad hoc collaborative environments, which are important bridges between scientific expertise, policy, and society. For example, Aitsi-Selmi et al. (2016) discuss the 2015 World Conference on Disaster Risk Reduction, in which UN member states exchanged science advice on disaster risk reduction. Another illustrative instance provided by Da Silva et al. (2021) is the 2019 ad hoc summit organised by the Ministry of Foreign Affairs of Costa Rica which brought together leading experts in the field of science and technology to discuss diplomacy and science. Moreover, the authors mention the Regional Leaders Summit (RLS-Science) as a platform that connects political, scientific and administrative coordinators in seven partner regions of the world.

- **Personal-Professional Networks**

Allen & Gluckman (2014) highlight the relevance of personal networks of scientific advisers. Gluckman (2016) explores the importance of personal-professional networks in science advice mechanisms. He claims that since advice is “needed virtually on demand" during the initial stage of the process of brainstorming policy questions, this stage is where science advice is primarily accessed through personal-professional networks channels.

- **International Cooperation Programmes & Projects**

Doyle et al. (2015) discuss how scientific advisers often access international knowledge by participating in international collaborative programmes. Doyle et al. also cite the

example of the biennial Exercise Pacific Wave organised by international organisations such as the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) to coordinate a global volcanic disaster response. Waisbich & Haug (2022) explain how different national administrations have adapted their structure to foster international cooperation, such as creating offices to manage the South-South Cooperation projects.

Government touchpoints

- **Advisory Committees**

Advisory committees can "either be fully embedded with the government or have an independent status with a governmental mandate" (OECD, 2015). For example, Kenny et al. (2017) underscore the substantial presence of scientific advisers across diverse arenas in the UK, including policy teams, interdepartmental advisory groups, and independent committees. Allen & Gluckman (2014) identify two types of advisory committees: (1) "standing committees attached to ministries with a regulatory function" and (2) "ad hoc committees set up for a sole purpose on a limited time basis". In emergency situations, most countries have a standing advisory structure related to identified institutions that enable other ad hoc advisory committees to add relevant international evidence through their transnational network for decision-making and provide direct access to relevant emergency response agencies (OECD, 2015).

- **Ministries of Foreign Affairs**

Arimoto et al. (2017) discuss the significant role played by the Ministries of Foreign Affairs (MFAs) in the collection of international evidence and expertise to inform national policy, the improvement of the interface between science and public policy, and the facilitation of the development of innovation networks. Arimoto et al. also argue that scientific and technical advisers to the Minister of MFAs, who have

interdisciplinary skills to understand the science and know how to find appropriate international experts on different topics, play a crucial role as evidence brokers.

- **Government Department & Offices**

Departments and offices within a bureaucracy serve as touchpoints, facilitating the transformation of science advice into actionable policies. A pertinent example comes from Waisbich & Haug (2022) who elaborate on the intricate mechanism through which the Brazilian Government acquires science advice from the UN. The initial choice for the intermediary of knowledge transfer lies with Brazilian experts embedded within national government entities, encompassing Line Ministries, Specialised Agencies, and Public Research Centres (Waisbich & Haug, 2022).

- **Scientific Adviser Office and Chief Scientific Advisers**

National science advisory offices often serve as important domestic governmental touchpoints that receive international expertise. For example, the "Chief Scientific Advisers and Equivalents" group, established by the Asia-Pacific Economic Cooperation (APEC) was built to become a rapid pathway for exchange of scientific expertise between the Chief Scientific Advisers of member countries in case of emergency.

- **Individuals / Staff Teams**

Individuals in the government system are equally important touchpoints for receiving and providing science advice, acting as knowledge brokers. Gluckman & Mendisu (2021) cite the example of the Jamaican government, which acquiring international scientific knowledge and inform policy by formatting ad hoc teams for the particular thematic calls. This ad hoc team comprises institutional and individual experts from the academia, the business sector and civil society, and is co-chaired by a technology bureaucrat and an independent expert, both of whom played an important role as evidence brokers during the Covid-19 period (Gluckman & Mendisu, 2021).

Case studies

In the following section a detailed description of the case studies is provided based on the analysis of interview transcripts and secondary data. It includes a country overview detailing the country's context regarding the domestic science advisory system. Then, a description of the identified pathways is provided organised by its components.

Argentina

Overview

The Argentine Republic follows a federal republican representative organisation. This arrangement entails that the provincial governments have their own constitutions and possess the autonomy to establish their own self-governing institutions (National Constitution of Argentina, 1994). This autonomy of provincial governments also includes the capacity to sign international agreements (as long as these do not conflict with national foreign policy). This implies the potential existence of more points of contact within the government to exchange knowledge with international sources, compared to the case where such agreements could only be signed by the national government. This feature holds significant relevance for the purpose of this research as this organisational model results in a more decentralised panorama of actors involved in the policymaking process.

In terms of governmental science advice systems, Argentina shows an early stage of development. As such, the concept is a new paradigm that has prominently emerged in the public debate during the last decade, and recently showing progress towards its

institutionalisation in the legislative sphere (9A). As a result, in 2020, the Scientific Office of Legislative Advice (OCAL) was established in the Deputies Chamber of the Argentinian Parliament. The recent institutionalisation of the science advice system in Argentina also means that this process is still extensively discussed. These discussions cover a range of topics, from the methodologies required to provide science advice into legislative processes, to how to safeguard its independence from political influences, and to how it should be implemented at the executive level in the future (2A and 9A).

In this respect, it is important to differentiate it from the science, technology, and innovation (STI) system that exists in Argentina. The STI system encompasses bodies from the public sector, universities and the private sector for the promotion of scientific and technological research and development, and it is led by the Ministry of Science, Technology and Productive Innovation (MINCyT) (Science, technology and innovation Law, 2001). Regarding the public bodies in this system, the National Scientific and Technical Research Council (CONICET) is the institution at the core of the system, which dates back to 1958 (CONICET, n.d.). This long-established institution has achieved to be extensively connected with the international science community, involving academic and scientific organisations and networks around the globe (2A, 8A and 9A).

Thereby, while Argentina's governmental science advice system is fairly recent and in development, the STI ecosystem is providing a platform for the flow of international expertise into national policy and decision-making. This way, this case study provides relevant insights into the impact of the institutionalisation of science advisory systems, which goes beyond the existence of international expertise exchange. Its impact on aspects such as the ability to generate clarity for actors to navigate the system, and the accountability mechanisms for measuring how it informs public policy will then be addressed in the discussion section in conjunction with other findings identified in this research.

A more detailed description of the findings of the pathways identified in the case of Argentina is presented below.

Pathways

International sources of knowledge

Argentina's long history of collaboration in the international relations arena enables their capacity to have strong institutional bridges for obtaining international expertise (6A). In that sense, **international multilateral organisations**, such as United Nations agencies, the Inter-American Development Bank and the Intergovernmental Panel on Climate Change, are some of the more recurrent and relevant sources for leveraging knowledge for informing policymaking processes (2A, 6A and 8A). Depending on their policy topics, government departments and offices, and their staff, are in constant contact with these organisations to obtain and exchange knowledge through the mechanisms available for that purpose, for example by accessing to relevant publications, technical meeting or attending events , This is also the case of **intergovernmental forums**, such as G-20, in which Argentina participates to capitalise on opportunities for cooperation with international actors, and exchange scientific knowledge through its S-20 group (8A).

The use of diplomacy mechanisms is also in place to engage with counterparts in **foreign governments departments** at the national and local level (2A and 6A). For example, during COVID-19 pandemic, the Autonomous City of Buenos Aires engaged in an ad-hoc setting with local governments from six different cities in the South-American region to exchange experiences and good practices (6A). Additionally, bilateral and multilateral agreements are promoted for knowledge transfer, exchange and collaboration settings with other countries.

On the other hand, **international experts' networks** are a key source for policy analysts staff working within the government, who usually get in contact with international colleagues specialised in similar topics and issues for gathering information. In this

regard, the high level of academic and professional mobility programmes existing in the country are enablers for policymakers to maintain strong linkages in international scientific and academic networks (2A and 8A).

Similarly**, international institutional networks** specialised in specific topics or policies are relevant spaces for knowledge exchange, where two types can be identified : (a) specialised governmental institutional networks, where national specialised agencies reach their counterparts in other countries to exchange knowledge (2A, 6A and 8A), such as the National Institute of Agricultural Technology that is in constant exchange with the national institutes of the same topic in other countries through the network; and (b) institutional memberships networks gathering institutions around similar policies or topics, like the participation of the City of Buenos Aires as a member of C40 Cities, a global network of mayors who exchange expertise to fight climate change (6A), or the recent inclusion of OCAL as a member of the International Network of Scientific and Technological Offices of European Parliaments (EPTA) (OCAL, 2022).

The **academic community**, comprising universities and research institutes, and **think tanks** are sources in continuous production of knowledge pieces. It is considered that their research frequently synthesises the state of international knowledge about specific topics, which makes it relevant for policymakers (2A and 8A).

On another note, **international media** is also recognised as a platform that leverages and spreads knowledge globally, playing a key role at communicating the state of science, technology and public policy progress. This was evident during the COVID-19 pandemic, when it actively produced visual and written reports that raised awareness of the issue among Argentine society, reaching government and policy makers (9A).

In some cases, **international consultancy firms** (as part of industry and its associations) are considered to have the potential to bring international knowledge when informing government departments in certain scenarios and policies (6A).

Channels

Personal-professional networks are one of the most important channels for accessing international knowledge sources. The strong personal connections that civil servants maintain with the international professional and/or academic networks they belong to are a key aspect of their ability to obtain international knowledge (2A, 6A, 8A and 9A). The use of this channel not only allows them to get in contact with international experts and institutions around the globe, but also to be aware of, and have access to, the most up-to-date research available about their topics of interest through the exchange of **publications and periodic reports (documents)**. In the same line, **public documents with specialised content** are a second recurrent channel, with government staff constantly visiting publications from multilateral organisations, the academic community and think tanks to inform their policy analysis.

Attending international **events** that are regularly organised by multilateral organisations, like forums and conferences, are considered highly prominent as well, as those permit the exchange of knowledge about common topics of interest and getting in contact with different countries' representatives and experts (2A, 6A, 8A and 9A). Moreover, these events can also trigger **meetings** as an additional channel, as events are often followed by casual meetings between attendees, allowing for the development of international networking that can potentially lead to future collaboration agreements (8A and 9A). In addition to that, technical meetings are held by government departments with specialised teams in international organisations, institutional networks or foreign government offices.

International cooperation programmes and projects, such as bilateral and multilateral agreements, are also a channel used by all levels of government to engage with

international knowledge sources. For instance, international agreements signed by the MINCYT with foreign countries that possess relevant experience in strategic areas for Argentina's development (8A), and the promotion of South-South and Triangular Cooperation that is actively used as a tool for the exchange of international expertise with countries in the Latin-American and Caribbean region as well as Africa and Asia (6A).

Finally, the initiative led by MINCyT, called the **Network of Argentinian Researchers and Scientists Abroad (known as RAICES)** is a channel that leverages Argentinean researchers living abroad and integrates their international knowledge in the national science, technology and innovation policies (8A).

Government touchpoints

The most dynamic actors are **government departments and offices** at the national and provincial level. These entities often engage through institutional mechanisms, such as international agreements, to collaborate and implement programmes and projects. They are also invited by global and regional organisations and networks to participate in a wide range of initiatives.

In the same way, **individuals and staff teams working** in government departments and agencies are also considered touchpoints in their own right, as they heavily rely on their personal networks to get in contact with international sources. Furthermore, policy analysts are constantly conducting research and synthesis of international expertise as part of their routine work (2A, 6A and 8A). In addition, some professionals in government staff positions are nationals from foreign countries in the region, which also contributes to bringing in international perspectives when synthesising evidence (6A).

Among the international institutional settings, the **Ministry of Foreign Affairs** is also considered an important touchpoint within the government to promote international cooperation agreements and collaborations not only at the national level, but also

playing an important role at the interface of provincial states with international entities. For instance, a designated fund exists for this purpose, called the Argentine Fund for South-South and Triangular Cooperation (FOAR), by which these types of agreements are promoted and funded (6A).

Advisory committees in the executive branch have not been mentioned as a standard means of obtaining international knowledge. However, during the COVID-19 pandemic, an ad-hoc expert committee was established to leverage global knowledge and provide advice to the President and its Ministers, which was an exception to the rule. (2A).

On the parliamentary level, the recent creation of a **scientific advice office** stands out, with the Scientific Office of Legislative Advice (OCAL) being considered now a relevant touchpoint for leveraging scientific knowledge produced from domestic and international expert bodies. Also, the Parliamentary Diplomacy and International Cooperation Department represents a key touchpoint, as it maintains bridges with international entities for consulting and exchanging knowledge in topics of special interest of the Argentinian Congress. It deserves special mention that OCAL originated through this contact point, because of the cooperation between this department and the Parliamentary Office of Science and Technology (POST) in the UK (9A).

India

Overview

The political structure of India is based on a federal parliamentary democratic system. The economic liberalisation in the 1990s prompted a shift towards globalisation, increasing the international collaboration efforts of the country. Ever since, the National Science, Technology, and Innovation Policy (STIP) of India has strongly emphasised international cooperation as a way to foster the nation's STI ecosystem.

With this underlying approach, in order to receive advice on science and technology matters, the Government of India constituted, over the years, various apex science advisory committees, as well as various subject-oriented high-powered bodies (Sikka, 1995). The Government of India established the Office of the Principal Scientific Adviser (PSA) in 1999. The PSA's office aims to provide pragmatic and objective advice to the Prime Minister and the cabinet in matters of Science and Technology. The Office of PSA was placed under the Cabinet Secretariat in 2018 (Office of the Principal Scientific Adviser to the Government of India, 2023). While the overall national advisory system of India involves multiple stakeholders within and outside the government, the Office of the PSA and the Department of Science and Technology (DST) form an integral part of the national science advisory system.

International science advice is of great significance for India's policymaking, particularly for addressing complex multidisciplinary challenges (1I and 10I).

Pathways

International sources of knowledge

International multilateral organisations play a significant role in providing international expertise to India, whether through direct country advice or global guidelines. According to two of the interview participants, one of the policy areas for which international expertise is most frequently sought after is healthcare, with the World Health Organisation (WHO) serving as a primary source of insights and directives (1I, 10I). Additionally, the Intergovernmental Panel on Climate Change (IPCC) is another prominently referenced source of international expertise (10I and 11I).

Intergovernmental forums are also considered a valuable source of international expertise for India (10I). For example, India currently holds the Presidency for the G20 (the Group of 20 is an intergovernmental forum bringing together 20 of the world's largest economies to address issues pertaining to the global economy). These collaborative initiatives provide India with opportunities to tap into a diverse pool of insights, experiences, and technological advancements from around the world.

Inviting foreign members of **expert networks** to roundtable discussions organised by government departments or advisory groups is also a frequent practice (1I). Additionally, individuals working in **foreign universities** are also called upon to provide international knowledge (1I).

India puts a lot of effort in implementing a multi-stakeholder approach to its national policymaking process, trying to frequently include international sources from the **global academic community, industry sectors and their associations, international expert communities, lobby groups, think tanks as well as civil society organisations** (10I).

Channels

International cooperation programmes with other countries hold significant importance for India in the context of seeking and providing science advice. These

agreements create avenues for collaboration, knowledge exchange, and scientific cooperation. For example, South-South Cooperation enables India to tap into the expertise and knowledge of scientists, researchers, and experts from other countries. Additionally, joint research initiatives and projects were also identified as powerful channels for obtaining international knowledge (10I).

Another channel for obtaining expertise through international sources is government officials using their **personal-professional networks**. This approach underscores the significance of informal channels like emails and phone calls for swiftly exchanging and accessing international information, evidence, and ideas (10I).

Events also offer essential avenues to access international knowledge, both for individual government officials and institutions. These include forums, summits, industry events, and roundtables (1I, 10I). For example, within the G20 framework, the Science 20 Summit (S20) serves as a global assembly that brings together national academies from G20 member nations, as well as invited countries and international organisations. India also invests significant resources in actively promoting the participation of Indian representatives in events of international organisations and their expert groups, such as UN conferences and forums, as they are perceived as a valuable channel for the exchange of knowledge and research findings.

Written documents were also frequently mentioned as channels used for gathering international knowledge, both for focused topics like gene therapy, and for staying abreast of ongoing advancements from entities like the WHO and related United Nations technical agencies (1I, 10I and 11I).

Secretariat **meetings** conducted by IGOs and Foreign Governments are mostly attended by different ministry departments. It provides a strong channel that not only facilitates the acquisition of international science advice but also cultivates a network that can be leveraged for future scientific guidance (10I).

Finally, India gives **awards** to esteemed members of the scientific community, both national and international. This, in turn, creates an incentive for scientific communities to share their expertise with India (10I).

Government touchpoints

India has **a Principal Scientific Adviser (PSA)** who plays a pivotal role in coordinating and overseeing science-related activities across the entire government, encompassing various ministries. The PSA serves as the central figure responsible for providing international scientific advice, fostering global collaboration, and promoting the integration of scientific knowledge into policy-making processes (1I, 10I)

Other significant touchpoints are ministries (India has eight ministries related to science) and **government departments** (1I). They usually establish **advisory committees and technical advisory groups**. These advisory committees are usually formed on an **ad-hoc** basis to gather scientific knowledge – both national and international and provide recommendations to the government. These are dissolved once their purpose is achieved. However, there are some **long-term advisory bodies** by the government as well. For example, the Prime Minister's Science, Technology, Innovation Advisory Council (PM-STIAC), an advisory council aimed at tapping into specialised expertise, also serves as one of the key government touchpoints for international knowledge. Among its eight members, there are notable inclusions of international academic and professional experts (10I).

United Kingdom

Overview

The United Kingdom is a unitary state, in which the central political institutions hold substantial authority over sub-national bodies' finances and functions (Wincott et al., 2022). Therefore, most of the science advisory activities are centralised around the decision-making bodies at the national level.

The present science advisory system has its origins dating back 70 years, with its roots traceable to the appointment of England's inaugural Chief Medical Officer in 1855.The system has a high level of institutionalisation, with some permanent institutions regulated by law and some ad hoc bodies such as, “science advisory committees and councils that are activated in specific circumstances, such as in emergencies” (Morales, 2021).

At the centre of operations is the Government Office for Science, “a body responsible for leading national scientific strategy and overseeing scientific capability within government” led by the Government Chief Scientific Adviser and supported by the network of Chief Scientific Advisers (Hopkins et al., 2021). The Chief Scientific Adviser’s main role is to advise the prime minister and the Cabinet on scientific issues.

At a later stage, in 1989, the Parliamentary Office of Science and Technology (POST) was established to provide in-house independent analysis to the UK Parliament. In fact, the UK has served as a model to various foreign nations’ executive and legislative science advisory systems (5U).

This long tradition coupled with a dynamic knowledge production industry has resulted in a wide-spread sense of "British exceptionalism" (3U and 4U). It is thought that the substantial investments in research and development (R&D), the long-established and prestigious academic system, and the vast influx of immigration allows the science advisory system to work in a self-reliant way (3U and 5U). In other words, international tapestry and connectedness of the domestic structures, spanning academia, business and government, is adequately meeting the needs of the country. Moreover, the formal decoupling from the EU structures for science and technical advice in post-Brexit UK has accentuated the deinstitutionalisation of the pathways for obtaining international expertise (3U).

It is important to mention that even though the science advisory system has a high level of institutionalisation domestically, there is a lack of formalised pathways for international expertise (3U and 4U).

Pathways

International knowledge sources

The **academic community** emerged as one of the most relevant sources of knowledge for the UK's advisory system, particularly domestic universities and the four national academies. Domestic universities stand as foundational pillars of the system due to their vast knowledge production capacity, internationally networked faculty and their enduring international liaisons - spanning academic institutions, governments, and businesses (3U and 5U). Therefore, when the government needs international expertise, it turns to university departments to tap into domestically produced international expertise and facilitate knowledge exchange with the international academic community (5U).

National academies, including the Royal Society, the Royal Academy of Engineering, the Academy of Medical Sciences and the British Academy play a key role in obtaining and, in some cases, producing international knowledge. This is a result of their internationally

diverse workforce and well-established institutionalised mechanisms for obtaining international expertise. Among these, the Royal Society, is actively engaged in providing science advice to the government. It maintains a stable and long-lasting international network and nurtures bottom-up connections with foreign entities (3U). Notably, the Royal Society has individuals that continuously work in developing the diplomatic relations of the institution.

Expert networks, particularly those hailing from academia, are tapped into by the majority of the government entities (5U and 7U). These networks not only help domestic experts to stay up to date with what their international counterparts are doing, but also act as catalysts for international collaboration opportunities and as sources of contacts that provide international expertise for specific needs. As examples, INGSA and the Global Network of Chief Scientific Advisers were frequently mentioned.

Equally, **institutional networks** serve the UK's entities for the same purposes: to keep track of other country's knowledge production efforts, exchange information and as sources of contacts. Some examples are Horizon Europe and the European Research Council that are used to develop international collaborations for academic research (5U). Another example is the institutional networks (which has members like Royal Society), such as the InterAcademy Partnership and the International Science Council. These networks facilitate sharing of knowledge, production of joint documents and connections to international experts (3U). Finally, the European Parliamentary Technology Assessment (EPTA) network is used by POST to foster connections with foreign legislative science advisory offices to share best practices and information (5U).

International multilateral organisations, especially for emergency management situations, such as the WHO for the COVID-19 pandemic and the IPCC for the climate crisis (3U, 4U, and 7U) are sought after as essential sources of international knowledge.

Participation in **intergovernmental forums** enables the collection of international expertise, from the insights of individual foreign countries and the collective knowledge generated through collaborative sessions (4U and 7U). Of particular significance for the UK is the international expertise gathered through the participation in the G7 and the G20, facilitated by instruments such as the Joint Academy Statements (3U). These statements are developed in a joint effort by the national academies of the participant Member States to support the forums' discussions.

Foreign **industry** is sought after to gather international technical expertise in situations when there is a lack of domestic scientific and technological development. For example, since the UK has a comparatively less developed AI-related infrastructure and expertise compared to the USA, the UK has incorporated Silicon Valley's expertise to design its AI regulatory and governance framework (7U).

Finally, **civil society** organisations are also a relevant source for the UK's policymaking, particularly the independent science advice associations that provide governmental recommendations for the climate crisis and COVID-19 pandemic (3U). Amidst the COVID-19 crisis, Independent SAGE emerged as a group of scientists unaffiliated to the government. Their remit encompassed counselling and publishing advice regarding the pandemic's response strategies, underscoring the relevance of integrating international expertise. The group's leading scientist, Sir David King who was a former Government Chief Scientific Adviser, has also launched the Climate Crisis Advisory Group. Comprising 14 experts from 10 nations, the group provides independent advice on global warming.

Channels

Regarding channels, the most used across the government is individual's personal-**professional networks**. This entails that when staff require international expertise, they leverage the relationships they have built throughout their careers to obtain the required knowledge. It is believed that the key to the well-functioning UK system is to have internationally connected individuals in key roles (3U, 5U and 4U). Consequently,

one of the principal responsibilities of the UK's scientific advisers is to maintain and expand their international professional networks (5U). For example, for crisis management scenarios, the obtaining of international expertise from international multilateral organisations usually occurs through scientific advisers. They contact their network within these multilateral organisations, usually comprising UK nationals who were former colleagues, to informally access insights and knowledge faster, instead of waiting for the institutional communication (3U and 5U).

For the evidence synthesis processes of the majority of government entities, **documents** are the most consulted channels (3U, 4U, 5U and 7U). Most government departments (3U and 7U), expert advisory groups (3U) and the legislative office for science advice (4U) have individuals whose task is to gather documents containing international knowledge.

The Foreign, Commonwealth and Development Office (FCDO)'s **national network of professionals stationed abroad** called the Science and Innovation Network (SIN) also plays a pivotal role. Operating through an extensive network of professionals stationed abroad, its central aim revolves around fostering international collaborations and partnerships, while gathering relevant information. Members are not only diplomats, but also individuals already ingrained within foreign science, technology and innovation ecosystems (4U). SIN is a used channel across the entire government, helping entities such as POST (5U), the Government Chief Scientific Adviser and the scientific adviser networks (3U) and expert committees (4U).

Brush-by **meetings** are a key resource for the system, which encourages individuals to use their networks to arrange personal meetings and share information informally (5U, 7U). Alongside this, formal institutionalised meetings are also a relevant channel for obtaining specialised insights into specific subjects. Examples include the act of inviting foreign delegations for focused discussions on particular topics (5U).

Finally, **international cooperation programmes and projects** are used by the UK to secure preferential access to policy, science and innovation ecosystems of other nations. For example, POST helping the Argentinian government set up a science advisory office translated into the gathering of large amounts of knowledge on the Argentinian political and economic system and the establishment of personal relationships between officials (9A). Bilateral or trilateral collaborations between national academies, either periodic or ad hoc were mentioned as reliable channels for obtaining international knowledge; particularly important for the UK is the cooperation with the national academies from the US, China and Brazil (3U).

Government touchpoints

Advisory committees are a recurrent government touchpoint, as they routinely assemble international expertise through document review and interviews to formulate their recommendations. Additionally, they occasionally include international experts as members (3U, 4U and 7U). These committees can be permanent, such as the science advisory councils mainly composed by academics (4U); or temporary, to address a specific issue or manage a crisis (3U).

Among the latter, the Scientific Advisory Group for Emergencies (SAGE) is especially relevant given that it is responsible for coordinating science advice during emergencies. On various occasions, such as in the 2010 Icelandic volcano crisis, this committee spearheaded international collaborations, engaging in discussions and harmonising responses with experts from other affected countries to orchestrate effective responses (3U).

Another relevant example is the temporary advisory committee for the Cabinet Office's International Comparators Joint Unit (ICJU), which closely coordinated with SIN to gather information on the measures implemented by foreign governments during the Covid-19 pandemic.

Individual staff across the civil service are also a touchpoint, given the profound reliance on personal-professional networks as channels (3U, 4U and 7U). Same happens with the **Government Chief Scientific Adviser** and the rest of scientific advisers, for whom one of their primary responsibilities is to maintain open channels of communications with their international networks and serve a visual point of contact for the international community (4U and 7U).

Government departments manage the relationship with the network of people and institutions related to their particular mandate. For example, the International, Science and Resilience Team of the Department of Energy Security and Net Zero manages the relationship with the IPCC, other foreign governments departments involved with the climate crisis, and the academic community in order to guarantee a constant flow of information among them.

Finally, **FCDO** is a governmental touchpoint for all the information gathered by SIN (7U). This department coordinates communications between government entities and the network for specific purposes. Furthermore, it disseminates information gathered by the network to relevant governmental stakeholders

Discussion

The research presents a thorough analysis of the "pathway of international expertise" that is composed of three components: international knowledge sources, channels, and government touchpoints. These components work in conjunction to facilitate the flow of international expertise, which can subsequently inform national policymaking. Thus, to identify these pathways, the research conducted a literature review and three case studies, which resulted in a comprehensive overview of how these pathways operate.

This section presents the main conclusions derived from the analysis of the findings in the literature review and the case study descriptions. This section is divided in two parts: first, it includes discussion around the identified pathways of international expertise, and second, discussion around the factors that influence the formation of the pathways and how they inform national policymaking.

Pathways for obtaining international expertise

To facilitate the analysis of the findings, a matrix was developed to systematically track the appearance of the different pathways in the findings section. The structure of the matrix was built by mapping all the possible combinations of the three components forming one pathway, resulting in a total of 270 possible pathways. Subsequently, the identification process was carried out by systematically tracking where these pathways were referenced in a structured record, namely in the literature review and/or in the case studies of Argentina, India, and the UK. For further detail, please refer to the Appendix **Matrix of identification of pathways**.

As a result, 135 different pathways were identified in the findings section with only six pathways mentioned in the four cases. These pathways are summarised in **Table 5**.

Table 5 Common pathways identified in the literature review and case studies

	International knowledge sources	Channels	Government Touchpoints
1	International Multilateral Organisations	Documents	Govt. Department & Offices
2	International Multilateral Organisations	International Cooperation Programmes & Projects	Govt. Department & Offices
3	Foreign Govt. Department & Offices	International Cooperation Programmes & Projects	Govt. Department & Offices
4	Academic community	Documents	Govt. Department & Offices
5	Academic community	Personal/Professional network	Individual / Team staff
6	Think tanks	Documents	Govt. Department & Offices

When analysing these six common pathways, certain patterns become apparent. Firstly, it is clear that international multilateral organisations and the academic community are important sources of international knowledge. Through documents and international cooperation programmes and projects, these entities facilitate the sharing of international expertise with government departments and offices in various countries.

Second, the predominance of government departments and offices as touchpoints in five of these pathways demonstrates their crucial role at the interface with international knowledge sources. As such, they are mainly engaging with international organisations, also with their counterparts in foreign countries, the academic community and think tanks as knowledge providers.

In addition, the recurrent mention of the use of personal and professional networks to obtain international expertise between the academic community and the staff working

within the government shows the high importance of less visible pathways operating for informing the work of policymakers.

Thereafter, a subsequent level of analysis enables a more in-depth exploration of how the components within the pathway interact with each other. For enabling flow of knowledge among the components, each pathway contains two interactions. These are between international knowledge sources and the channels, and between the channels and the government touchpoints.

For measuring the frequency of these interactions, first a score of 1 to 4 was assigned to each pathway in the matrix. The score was determined based on the frequency of its mentions in the findings section, which can also be found in the Appendix **Matrix of identification of pathways**.

Next, the scores of the pathways in which each interaction appeared were summed to determine their total frequency. For a better understanding, an example of this process is presented below. The following table includes a sample of three pathways identified in the matrix:

Table 6 Sample matrix of three pathways

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Lit. Review	Score
International Multilateral Organisations	Documents	Advisory committees	1	1	1		3
International Multilateral Organisations	Documents	Govt. Departments & Offices	1	1	1	1	4
International Multilateral Organisations	Documents	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3

As observed, these three pathways contain four unique interactions, which are:

- **Interactions between International knowledge sources and Channels**
  - From international multilateral organisations to documents
- **Interactions between Channels and Government Touchpoints**
  - From documents to advisory committees
  - From documents to government departments & offices
  - From documents to Scientific Adviser Offices / Chief Scientific Advisers

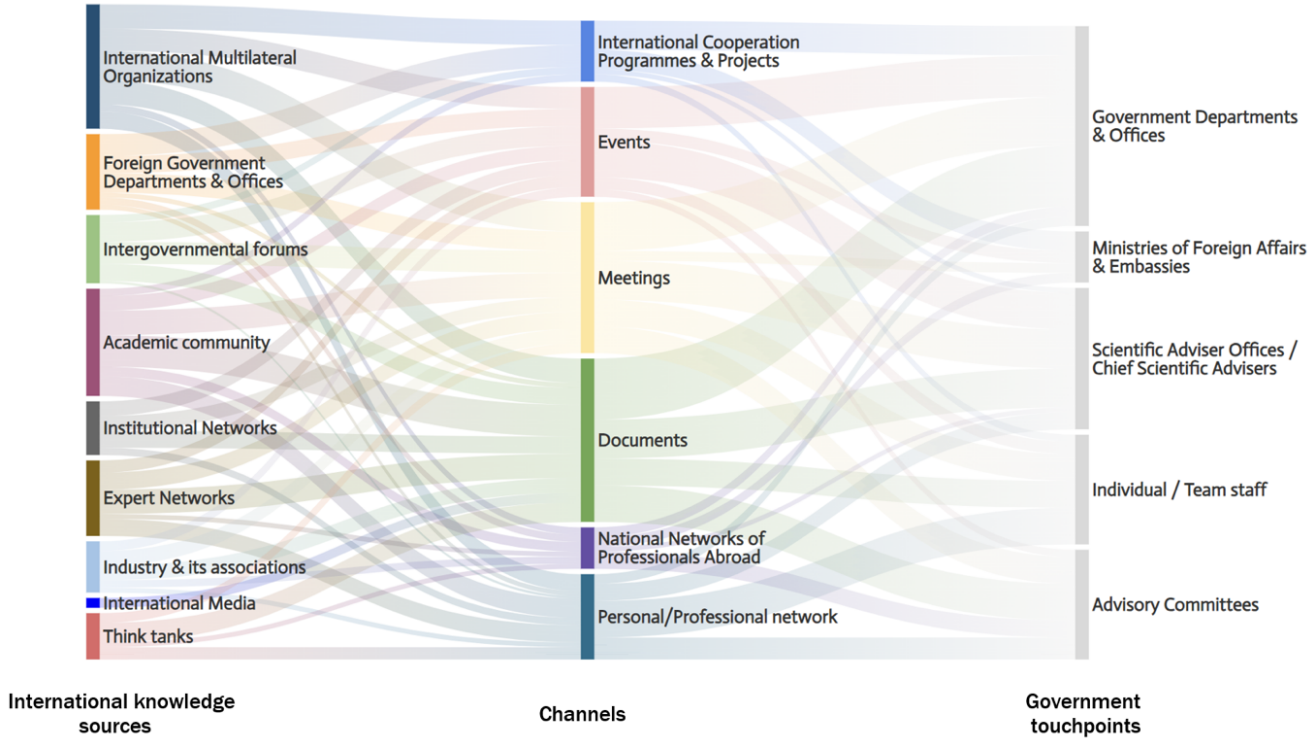
This is because one of these interactions has been repeated in the three pathways. Then, for determining the frequency of each interaction, the scores of the pathways in which they appear are summed. This would result in the following frequencies for each case:

- From international multilateral organisations to documents:**10**
- From documents to advisory committees: **3**
- From documents to government departments & offices: **4**
- From documents to Scientific Adviser Offices / Chief Scientific Advisers: **3**

This rationale was applied throughout all the interactions contained in the matrix to calculate their frequencies. These results allowed to build a Sankey diagram (See **Figure 2**), where the frequencies were applied as weights for modelling the flows of the interactions between the pathway's components. Consequently, the thickness of the flows between components and the width of the categories of each component represents the frequency of their appearance in the findings.

It is important to note that as the elaboration of the diagram is based on the identification of the pathways, it provides information regarding the number of times their existence has been reported. The diagram does not portray the frequency of their use or the importance they have in each case.

Figure 2 Sankey diagram of pathway's components interactions



The Sankey diagram visually delineates the multitude of interactions between the pathways' components that enable the flow of knowledge between international sources and government touchpoints, portraying the complexity of the international knowledge exchange ecosystem.

Firstly, the diagram shows that multilateral organisations and the academic community are the most significant sources at the extremities of the information flow and government departments and offices at the other extremity of the flow. Second, it also highlights that gathering documents, holding meetings and attending events stand as the more recurrent channels to connect the universe of existing actors in both extremes of the spectrum.

International multilateral organisations are identified as the most recurrent international knowledge source. It is worth highlighting that the WHO and the IPCC are some of the examples which are most referenced across the interviews. Similarly, intergovernmental forums represent an important role in providing a collaborative setting for knowledge exchange in common priorities' agenda among countries, where international cooperation opportunities are also promoted.

Expert networks also are also a significant international knowledge source. These networks are constantly fed by the individuals connected to them, which makes them dynamic and responsive. This may explain the common viewpoints among interviewees from the case studies about the significance of mobility programmes that increasingly connect nationals to specialised networks.

Regarding the channels, it should be considered that these are not exclusive, but rather, in most cases, they occur in parallel or the occurrence of one frequently triggers the use of another. Having said that, the high reliance on documents shows their predominance as they offer an accessible, easily transferrable, and enduring way of obtaining international expertise, also highlighting the importance of its production and wide dissemination to inform public policies. Also, the use of meetings is perceived as a preferable channel for real-time exchanges, allowing for direct dialogue and immediate responses to questions to gather information in a timely manner, especially when dealing with complex scenarios. Then, attending events provides a platform that usually allows discussion on specialised topics and exchange with a high international diversity, but most of all, it allows the amplification of contact networks for building bridges towards common agendas in the future.

With respect to government touchpoints, as mentioned before, the most significant are the government departments and offices, given that these organisational units represent most of the state body, with specialised units for all public policy issues where the policy formulation is located. Then, in countries that have a Science Advice Office or

a Chief Scientific Adviser along with Advisory Committees, serve as an important source for garnering international expertise. These units are well-positioned as visible contact points, internationally connected, and are expected to provide unbiased opinions. Lastly, Ministries of Foreign Affairs and their embassies were mentioned as one of the traditional interfaces for connecting with expertise from foreign countries, where collaboration mechanisms are promoted and mediated. Meanwhile, the staff working in each department fulfil a less tangible but interesting role, as it has been pointed out as one of the most active. Their ability to resort to personal connection networks is, in many cases, decisive in obtaining the necessary international expertise in the process. It should be noted that this has been highlighted in the case studies regardless of the level of institutionalisation of the government advisory systems in the country, aspect that will be cover in the following subsection.

Factors influencing the pathways and its components

Pathways of international expertise are highly dependent on a multitude of interconnected factors within the environment in which they operate. Among these factors, three were identified as having a significant influence in the shaping of the pathways and how they inform policy formulation: the national context, the staff's agency and topics.

National context

The national administrative and political, landscape, as well the geopolitical situation directly shape the anatomy of pathways for international expertise and the integration of such knowledge. The structure of the advisory system is dependent on the institutional structure of the State, given that the advisory process needs to adapt to the characteristics and functions of the entities it advises. Henceforth, a unitary or federal structure will usually lead to different science advisory anatomies at different levels of government. For instance, in the case of India and Argentina, the autonomy of the

provincial institutions allows them to generate their own international expertise pathways, while in the UK most of the pathways emanate from the national level.

The ideology and priorities of the governing body in relation to science, research and development influence the level and shape of international expertise pathways that exist in a specific country. A greater alignment with this agenda provides the political support needed for generating impulse around the creation of bridges with international expertise to strengthen the national system capacity. On the other hand, the distancing of this will be likely to negatively impact the resources available for knowledge exchanging and pathways being reduced and less frequent.

Moreover, regarding the origins and direction of major international flows of knowledge, factors such as the geopolitical position that governs each country and geographical closeness are outlined by interviewees in the three case studies countries (3U, 7U, 8A and I10). In this sense, at the time of determining the sources of international expertise for strengthening pathways, these factors will come into play for tend to encourage engagement with those who have shared alignment of interests and values. This is also aligned with the need of national contextualisation and adaption of policies that countries do for evaluating the applicability and implementing international advice (6A, 8A, I1, I10). Therefore, the combination of these factors is particularly relevant when analysing countries with a stronger orientation towards regional exchange (8A).

Finally, the domestic public perception of the legitimacy of the formal structures of the science advisory system may also influence the proliferation of pathways outside the system for informing national policymaking. Some examples were mentioned in the UK and Argentina during the COVID-19 pandemic when as a response of the scepticism about the mechanisms being used by formal structures, independent advisory organisations were formed which strongly focused on integrating publicly available international expertise in their recommendations (2A and 3U).

Staff's agency

Disregarding the level of development of national science advisory systems, a common phenomenon identified is the lack of institutionalisation of the pathways for international expertise. This translates in a lack of a methodical approach for integrating international expertise in the policymaking process, preventing the ability of conducting quality assurance of the international knowledge gathered. Additionally, it may translate in a lack of incentives among the staff to incorporate this expertise.

Consequently, the role played by the individuals in decision-making positions and those responsible for gathering evidence in the government staff has been recurrently highlighted as a determinant for explaining the access and use of international expertise in policymaking (9A, 3U and 4U).

Therefore, there is an important agency factor in the staff's willingness to incorporate international expertise and their capacity to obtain such knowledge. Especially in scenarios where government support is low, the agency of the staff has shown to be capable of maintaining momentum and pushing inertia toward the continuity of the integration of international expertise.

Influence of topics

The shaping of pathways is influenced by the topical information they are obtaining. Given that each topic has particular actors, networks and sources of knowledge in the international system, this impact in the pathways generated to align with the dynamics associated with those international systems. For example, the health policy often relies more on the academic community and international multilateral organisations, while technology policy relies more on industry.

Although international expertise is sought across multiple policy areas, there are certain areas, wherein it is actively pursued. For instance, health policy, climate policy and energy policy were frequently mentioned in the interviews (I1, 2A, 3U, 4U, 5U, 6A and

8A). Among other topics, technology, artificial intelligence, biology and genetics were mentioned (1I, 3U, 7U, 8A and 10I). In that sense, the existence of an internationally recognised transboundary issue promotes the active seeking and exchange of knowledge in the international arena.

Crisis management is also a preeminent area that triggers large flows of international expertise exchange, mainly including emergencies, accidents and natural disasters. The impact is shown in governments' desire to gather international knowledge sources to evaluate alternatives for addressing crises. This also led to the emergence of ad-hoc pathways to obtain international expertise in a timely manner. Here, examples such as the COVID-19 pandemic or the Icelandic volcano ash crisis were brought up to showcase the importance of resorting to international expertise.

Conclusion and Recommendations

This research serves as an initial exploration of the pathways that countries establish to obtain international expertise for informing national policymaking. The definition of pathways of international expertise, proposed in the third section of this report, provides a framework for conceptualising their taxonomy. This framework aims to establish a foundation based on the outcomes of the literature review and findings on three countries case studies. Therefore, it is important to stress that the aim of the research is not to produce an exhaustive catalogue of pathways in the global context, but rather to develop a proposal that can be enhanced with further research to be applied to a wider context.

Based on the above findings and analysis, this research proposes recommendations for three target groups: INGSA, practitioners and researchers in governmental science advice.

For INGSA

1) **Enhancing INGSA's global impact by expanding membership to include professionals not limited to science advice.** To enhance INGSA's global impact, it is recommended to actively promote the membership of professionals involved in policymaking, not limited to those involved in the science advice field. Currently, INGSA mostly consists of experts from the science advisory sector. However, this focus poses challenges in engaging countries that do not have dedicated positions for science advice in their governments.

   These countries may struggle to access essential international scientific guidance, putting them at a disadvantage in making informed policy decisions. Additionally, it's essential to recognise that international science advice is required to be sought across various areas of government activities. Therefore, including professionals from diverse policymaking backgrounds as members of INGSA would be a

constructive step towards integrating science-based insights into decision-making processes across a broader spectrum of policy areas, thereby boosting the impact of INGSA's network and advancing evidence-based policymaking on a global level.

2) **Leveraging the definition of pathways for future research initiatives.** It is recommended for INGSA to adopt the proposed definition of pathways of international expertise as a guiding factor for its forthcoming research endeavours and collaborations. For example, the studies being conducted by INGSA's regional chapters or those conducted in partnership with the International Public Policy Observatory (IPPO) in this topic. This recommendation aims to promote consistency and clarity in the INGSA's research initiatives, allowing for more focused investigations, contributing to a deeper understanding of the international science-policy interfaces. This uniformity will enable INGSA to maintain its position as a leader in fostering fruitful connections between science and policymaking. In that sense, the following aspects are recommended:

   - When gathering information, encourage the representation of members from the wide diversity of international knowledge sources and government touchpoints. For instance, promote that participants have a background not only from science advice or science diplomacy, but also representatives and staff from different government departments and members of advisory committees. Additionally, promote participation of representatives of international multilateral organisations and the academic community, as well as those from international institutional and expert's networks.

   - When building tools for collecting information, potential questions could be made around the components determined in the definition of pathways to explore how they perform in different settings. Also, for diving deep into the

factors influencing on the pathways for international expertise, the factors aforementioned in the discussion would be useful as a starting point to analyse the phenomenon.

For practitioners in governmental science advice

1) **Leverage the advantages of existing pathways of international expertise.** Consider utilising existing pathways of international expertise not only in popular areas of science advice, but also in other areas of interest for countries. For example, events such as climate change conferences provide a platform to connect with international experts and policymakers working in different fields. Furthermore, existing models can provide inspiration for creating equivalent pathways in other relevant areas for international science advice.

2) **Focus on structuring domestic government agencies' access to international expertise and evaluating individual network effectiveness to enhance robust channels.** While many national government agencies have established institutionalised pathways for obtaining international expertise, this research reveals the prevalent reliance on personal networks cultivated by science advisory personnel. This dependency, though offering flexibility during crises, renders these pathways vulnerable to individual. Therefore, it is recommended that professionals in science advisory system consultancy develop a balanced approach, focusing on not only structured pathways for domestic government institutions to access international expertise, but also ensuring the effectiveness of personal network. This strategy is more likely to empower efficient and adaptable international expertise integration.

For the academic community

To ensure the wider relevance of the report's findings, forthcoming research should be conducted on more countries, encompassing a larger representation of the globe. This broader perspective will allow for a comprehensive analysis of how countries acquire and assimilate international expertise, enabling a deeper understanding of the factors influencing these pathways, thereby addressing limitations present in the current research framework. Some specific areas for future research are listed below:

1) **Explore factors influencing the willingness for obtaining international expertise**. The research highlights different factors on how and why countries decide to integrate international expertise. Some of them may present an inclination for drawing upon local knowledge sources, while others a higher willingness to embrace expertise from across borders. In that sense, this showcased that further research is needed to explore which factors contribute for promoting a higher openness in integrating international expertise into the domestic policymaking.

2) **Measure pathways efficiency and tracking impacts.** This research formulates a pathway definition for accessing international expertise, based on a literature review and case studies' analysis, depicting combinations of different pathway components that enables the flow of international expertise to domestic policymaking. However, it is important to note that a gap have been found about the integration process of international expertise into national policymaking. This denotes that further attention is required for tracking and evaluating whether and how international expertise impacts policy making. Therefore, the report recommends future research to focus on the meticulous tracking and evaluation

of the impact exerted by international expertise through the entire integration process into policy making.

3) **Standardise the terminology.** The research underscores a lack of consistent definitions for pivotal terms like "pathways" "international expertise" and “integration”. This definitional disparity introduces ambiguity and threatens the precision and validity of both academic discourse and practical implementation. Future research and scholarly discourse must strive to establish a coherent and universally accepted lexicon to rectify existing conceptual ambiguities and foster a more rigorous intellectual and practical milieu.

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Appendixes

Interview questions

1) **Is international expertise important in the policymaking of your country?**

2) **What are the (path)ways your country uses to obtain international science advice?**
   - **Additional Prompt:** Can you describe any formal or informal mechanisms your country uses to collect and share international knowledge, expertise, and policy lessons?

3) **What are the factors that determine what sources your country seeks to obtain international expertise?**
   - **Additional Prompt:** How does your country decide which international sources or experts to consult for scientific advice?

4) **How does your country integrate international knowledge, expertise, and policy lessons into national policymaking? Please provide an example.**
   - **Additional Prompt:** Can you provide examples of policy decisions that were influenced by international knowledge and expertise?

5) **With reference to your example, can you describe the specific pathways your country used to integrate international science advice?**
   - **Additional Prompt:** How did your country prioritise which sources of international science advice to rely on?

6) **Can you provide examples of policy decisions that were influenced by international science advice for the case you mentioned?**

7) **Can you describe any new mechanisms that were established to facilitate the sharing of international science advice during the pandemic?**

Matrix of identification of pathways

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
International Multilateral Organisations	Documents	Advisory committees	1	1	1		3
International Multilateral Organisations	Documents	Govt. Departments & Offices	1	1	1	1	4
International Multilateral Organisations	Documents	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3
International Multilateral Organisations	International Cooperation Programmes & Projects	Individual / Team staff	1	1		1	3
International Multilateral Organisations	Events	Advisory committees		1			1
International Multilateral Organisations	Events	Ministries of Foreign affairs & Embassies	1	1			2
International Multilateral Organisations	Events	Govt. Departments & Offices	1	1	1		3
International Multilateral Organisations	Events	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3
International Multilateral Organisations	Meetings	Advisory committees	1	1	1		3
International Multilateral Organisations	Meetings	Ministries of Foreign affairs & Embassies	1				1

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
International Multilateral Organisations	Meetings	Govt. Departments & Offices	1	1	1		3
International Multilateral Organisations	Meetings	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3
International Multilateral Organisations	Meetings	Individual / Team staff	1		1		2
International Multilateral Organisations	Personal/Professional network	Advisory committees	1	1	1		3
International Multilateral Organisations	Personal/Professional network	Govt. Departments & Offices		1			1
International Multilateral Organisations	Personal/Professional network	Scientific Adviser Offices / Chief Scientific Advisers		1			1
International Multilateral Organisations	Personal/Professional network	Individual / Team staff	1		1		2
International Multilateral Organisations	International Cooperation Programmes & Projects	Ministries of Foreign affairs & Embassies	1	1	1		3
International Multilateral Organisations	International Cooperation Programmes & Projects	Govt. Departments & Offices	1	1	1	1	4
International Multilateral Organisations	National Networks of Professionals living abroad	Advisory committees	1				1

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
International Multilateral Organisations	National Networks of Professionals living abroad	Ministries of Foreign affairs & Embassies			1		1
International Multilateral Organisations	National Networks of Professionals living abroad	Govt. Departments & Offices	1				1
Foreign Govt. Departments & Offices	Documents	Advisory committees			1		1
Foreign Govt. Departments & Offices	Documents	Scientific Adviser Offices / Chief Scientific Advisers	1				1
Foreign Govt. Departments & Offices	Events	Ministries of Foreign affairs & Embassies	1	1			2
Foreign Govt. Departments & Offices	Events	Govt. Departments & Offices	1	1		1	3
Foreign Govt. Departments & Offices	Events	Scientific Adviser Offices / Chief Scientific Advisers	1	1			2
Foreign Govt. Departments & Offices	Meetings	Advisory committees			1		1
Foreign Govt. Departments & Offices	Meetings	Ministries of Foreign affairs & Embassies	1		1		2
Foreign Govt. Departments & Offices	Meetings	Govt. Departments & Offices	1		1		2

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Foreign Govt. Departments & Offices	Meetings	Scientific Adviser Offices / Chief Scientific Advisers	1		1		2
Foreign Govt. Departments & Offices	Meetings	Individual / Team staff			1		1
Foreign Govt. Departments & Offices	Personal/Professional network	Advisory committees			1		1
Foreign Govt. Departments & Offices	Personal/Professional network	Individual / Team staff				1	1
Foreign Govt. Departments & Offices	International Cooperation Programmes & Projects	Ministries of Foreign affairs & Embassies	1	1	1		3
Foreign Govt. Departments & Offices	International Cooperation Programmes & Projects	Govt. Departments & Offices	1	1	1	1	4
Foreign Govt. Departments & Offices	International Cooperation Programmes & Projects	Scientific Adviser Offices / Chief Scientific Advisers	1		1		2
Foreign Govt. Departments & Offices	National Networks of Professionals living abroad	Advisory committees			1		1
Foreign Govt. Departments & Offices	National Networks of Professionals living abroad	Ministries of Foreign affairs & Embassies			1		1
Foreign Govt. Departments & Offices	National Networks of Professionals living abroad	Scientific Adviser Offices / Chief Scientific Advisers			1		1

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Expert Networks	Documents	Advisory committees	1		1		2
Expert Networks	Documents	Govt. Departments & Offices	1		1	1	3
Expert Networks	Documents	Scientific Adviser Offices / Chief Scientific Advisers	1		1		2
Expert Networks	Documents	Individual / Team staff	1		1	1	3
Expert Networks	Events	Advisory committees		1			1
Expert Networks	Events	Govt. Departments & Offices		1			1
Expert Networks	Events	Scientific Adviser Offices / Chief Scientific Advisers	1				1
Expert Networks	Events	Individual / Team staff	1			1	2
Expert Networks	Meetings	Advisory committees	1	1			2
Expert Networks	Meetings	Govt. Departments & Offices		1			1
Expert Networks	Meetings	Scientific Adviser Offices / Chief Scientific Advisers	1				1
Expert Networks	Meetings	Individual / Team staff	1		1	1	3
Expert Networks	Personal/Professional network	Advisory committees	1		1		2
Expert Networks	Personal/Professional network	Scientific Adviser Offices / Chief Scientific Advisers			1	1	2

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Expert Networks	Personal/Professional network	Individual / Team staff	1		1	1	3
Expert Networks	National Networks of Professionals living abroad	Advisory committees	1				1
Expert Networks	National Networks of Professionals living abroad	Govt. Departments & Offices	1				1
Institutional Networks	Documents	Advisory committees			1		1
Institutional Networks	Documents	Govt. Departments & Offices	1		1	1	3
Institutional Networks	Documents	Scientific Adviser Offices / Chief Scientific Advisers	1		1		2
Institutional Networks	Documents	Individual / Team staff	1				1
Institutional Networks	Events	Govt. Departments & Offices	1		1	1	3
Institutional Networks	Events	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3
Institutional Networks	Meetings	Govt. Departments & Offices	1		1	1	3
Institutional Networks	Meetings	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Institutional Networks	Personal/Professional network	Govt. Departments & Offices			1		1
Institutional Networks	Personal/Professional network	Scientific Adviser Offices / Chief Scientific Advisers			1		1
Institutional Networks	Personal/Professional network	Individual / Team staff			1		1
Academic community	Documents	Advisory committees	1	1	1		3
Academic community	Documents	Govt. Departments & Offices	1	1	1	1	4
Academic community	Documents	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3
Academic community	Documents	Individual / Team staff	1	1		1	3
Academic community	Events	Advisory committees		1			1
Academic community	Events	Govt. Departments & Offices		1		1	2
Academic community	Events	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3
Academic community	Meetings	Advisory committees	1	1	1		3
Academic community	Meetings	Govt. Departments & Offices		1	1	1	3
Academic community	Meetings	Scientific Adviser Offices / Chief Scientific Advisers	1	1	1		3
Academic community	Meetings	Individual / Team staff			1		1

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Academic community	Personal/Professional network	Advisory committees			1		1
Academic community	Personal/Professional network	Govt. Departments & Offices			1	1	2
Academic community	Personal/Professional network	Scientific Adviser Offices / Chief Scientific Advisers			1		1
Academic community	Personal/Professional network	Individual / Team staff	1	1	1	1	4
Academic community	International Cooperation Programmes & Projects	Ministries of Foreign affairs & Embassies		1			1
Academic community	International Cooperation Programmes & Projects	Govt. Departments & Offices		1		1	2
Academic community	National Networks of Professionals living abroad	Advisory committees	1		1		2
Academic community	National Networks of Professionals living abroad	Ministries of Foreign affairs & Embassies			1		1
Academic community	National Networks of Professionals living abroad	Govt. Departments & Offices	1				1
International Media	Documents	Advisory committees	1				1

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
International Media	Documents	Govt. Departments & Offices	1				1
International Media	Documents	Scientific Adviser Offices / Chief Scientific Advisers	1				1
International Media	Documents	Individual / Team staff	1				1
Industry & its associations	Documents	Advisory committees			1		1
Industry & its associations	Documents	Govt. Departments & Offices	1	1	1		3
Industry & its associations	Documents	Scientific Adviser Offices / Chief Scientific Advisers			1		1
Industry & its associations	Documents	Individual / Team staff	1				1
Industry & its associations	Events	Govt. Departments & Offices		1	1		2
Industry & its associations	Events	Scientific Adviser Offices / Chief Scientific Advisers			1		1
Industry & its associations	Events	Individual / Team staff		1			1
Industry & its associations	Meetings	Govt. Departments & Offices	1	1	1		3
Industry & its associations	Meetings	Scientific Adviser Offices / Chief Scientific Advisers		1	1		2
Industry & its associations	Meetings	Individual / Team staff			1		1
Industry & its associations	Personal/Professional network	Scientific Adviser Offices / Chief Scientific Advisers		1			1

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Industry & its associations	Personal/Professional network	Individual / Team staff			1		1
Industry & its associations	National Networks of Professionals living abroad	Advisory committees			1		1
Industry & its associations	National Networks of Professionals living abroad	Ministries of Foreign affairs & Embassies			1		1
Industry & its associations	National Networks of Professionals living abroad	Scientific Adviser Offices / Chief Scientific Advisers			1		1
Think tanks	Documents	Advisory committees	1		1		2
Think tanks	Documents	Govt. Departments & Offices	1	1	1	1	4
Think tanks	Documents	Scientific Adviser Offices / Chief Scientific Advisers			1		1
Think tanks	Documents	Individual / Team staff	1				1
Think tanks	Meetings	Advisory committees	1				1
Think tanks	Meetings	Govt. Departments & Offices		1		1	2
Think tanks	Meetings	Individual / Team staff			1		1
Think tanks	Personal/Professional network	Advisory committees	1		1		2

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Think tanks	Personal/Professional network	Scientific Adviser Offices / Chief Scientific Advisers			1		1
Think tanks	Personal/Professional network	Individual / Team staff	1		1		2
Think tanks	National Networks of Professionals living abroad	Advisory committees	1				1
Think tanks	National Networks of Professionals living abroad	Govt. Departments & Offices	1				1
Intergovernmental forums	Documents	Advisory committees			1		1
Intergovernmental forums	Documents	Govt. Departments & Offices	1	1	1		3
Intergovernmental forums	Documents	Scientific Adviser Offices / Chief Scientific Advisers		1	1		2
Intergovernmental forums	Documents	Individual / Team staff	1				1
Intergovernmental forums	Events	Ministries of Foreign affairs & Embassies	1				1
Intergovernmental forums	Events	Govt. Departments & Offices	1	1	1		3
Intergovernmental forums	Events	Scientific Adviser Offices / Chief Scientific Advisers		1	1		2
Intergovernmental forums	Events	Individual / Team staff	1	1			2

International knowledge sources	Channels	Government Touchpoints	Argentina	India	UK	Literature Review	Score
Intergovernmental forums	Meetings	Advisory committees			1		1
Intergovernmental forums	Meetings	Ministries of Foreign affairs & Embassies	1				1
Intergovernmental forums	Meetings	Govt. Departments & Offices	1	1	1		3
Intergovernmental forums	Meetings	Scientific Adviser Offices / Chief Scientific Advisers		1	1		2
Intergovernmental forums	Meetings	Individual / Team staff	1		1		2
Intergovernmental forums	Personal/Professional network	Individual / Team staff			1		1
Intergovernmental forums	International Cooperation Programmes & Projects	Ministries of Foreign affairs & Embassies	1				1
Intergovernmental forums	International Cooperation Programmes & Projects	Govt. Departments & Offices	1	1			2

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