S&T POLICY 2025

Enabling Transitions through Science, Technology and Innovation

Scientific advice in crises: Lessons learned from COVID-19

Virtual Workshop organised by the OECD Global Science Forum (GSF)

3-4 March 2022, 12.00-16.00 CET (Paris time)

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Summary report of a GSF virtual workshop held on 3-4 March, 2022

Executive Summary

The COVID-19 pandemic has highlighted the complexity of science advice ecosystems and the critical importance of establishing trust between the various actors in these ecosystems to ensure their effective operation. These actors include scientists, policymakers, risk analysts and crisis managers all of whom have interactions with the public at large.

The pandemic has challenged existing science advisory systems and revealed their limitations. In the early stages there was great uncertainty (and limited foresight) regarding the evolution of the pandemic and the scale and scope of its socio-economic impact. The scientific advisory structures that already existed, or were initially established, centered on medical care and public health and were not sufficient to deal with the complexity of the crisis as it unfolded. A wide range expertise, including humanities and social sciences, has proven to be necessary to inform policies across governments, and the mechanisms to mobilize and synthesise this have generally been lacking.

Data systems have proven to be inadequate and deficits in data and science literacy have been an obstacle for communicating science advice. The use of information and data from many different sources is critical for informing effective crisis response measures, implementing interventions, and understanding and evaluating their results. Systems and processes for timely data collection, access and analysis, and modelling techniques to integrate different data types, have proven to be inadequate. Social determinants of health have rarely been given the necessary attention in data collection and related scientific advice although a critical factor in susceptibility to crises. On top of this,

the crisis has revealed a widespread deficit in data literacy and in the capacity of citizens and policy makers to understand the value and limitations of scientific information.

Scientific advice has attracted unprecedented public attention and has been strongly politicised in some countries. Uncertainties around scientific knowledge have made is susceptible to misinterpretation and misuse and the ready access to social media have enabled the rapid spread of misinformation. Scientists, who have participated in advisory process, have often been targeted and abused visa social media and in some cases physically threatened.

The overall message from the workshop is that that there is a need for a transformation in the way scientific advice is generated and communicated to prepare for and respond to crises. Critical aspects of what is required to assure this transformation include:

1. Efforts are required to more clearly delineate the roles and responsibilities of scientific advisors and policy officials, protecting the autonomy of science and recognising that the translation of science into policy decisions is a normative process, which necessarily takes account of factors other than scientific evidence.
2. There is a need to respond to societal crises with an interdisciplinary approach that fully incorporates social sciences and humanities and both qualitative and quantitative data. Inter- and trans-disciplinary processes require new skills and methodologies, including new modelling approaches, to synthesize a broad set of inputs into contextually relevant knowledge in a timely manner.
3. Public trust in science and acceptance of science-based policies is rooted in country-specific cultural norms shaped, in part, by historical legacies. Crisis communication strategies should be adapted to specific contexts and should not obscure underlying uncertainties but instead emphasise actions being taken to address what is not currently known.
4. Public engagement is crucial to the development of robust and legitimate scientific advice. This requires multiple approaches, including community-based surveys, citizen science initiatives and citizen dialogues, and requires more systematic attention and allocation of resources.
5. Inclusive international collaboration is a critical aspect of scientific advice to address global crises. With regards to public health, this needs to include consideration of health disparities within and across borders and the disproportionately severe impact that a crisis will have on certain populations. Equity should be embedded in crisis response and associated scientific advice.
6. To date, the implementation of public health and social policy interventions in crises has largely occurred in the absence of the science-based evaluation mechanisms that are necessary to understand and improve efficacy. Policy learning today is an important aspect of preparedness for tomorrow.

These issues emerged from the overall discussions in the workshop and cut across the different thematic sessions. They are expanded on, with more specific insights, in the rest of this report.

Introduction

This workshop was organised by the Global Science Forum (GSF) to reflect on how science advice operated during the COVID-19 pandemic in the face of unprecedented pressure from policy makers and intense public scrutiny. The event was designed to build on

previous OECD-GSF work on scientific advice for policymaking in peacetime[1], during crises[2], and during the initial stages of the COVID-19 pandemic[3]. Sessions were structured with panellists providing initial, short interventions to present relevant learnings and challenges arising in different national contexts, followed by moderated discussions. Additional detail on panellists and the questions framing each session can be found in the workshop agenda, which is attached as an Annex to this report.

The overall aim of the event was to explore key challenges in the development and integration of rigorous scientific advice into policymaking during the COVID-19 crisis; to identify lessons learned, common principles and good practices to be adopted in future crises; and consider implications for science policy. While the primary focus of the workshop was the interface between science advisors and government, communication and engagement of the public was also considered and this will be expanded upon in a future workshop specifically targeted to this issue.

Session 1. Setting the scene

Co-chairs: Randolph Kent, GSF Expert Group (EG) member, UK; **Tateo Arimoto**, EG member, Japan

The co-chairs made a brief introduction to the workshop, outlining the aim to draw from a diverse range of experiences regarding the provision and/or use of scientific advice during COVID-19 to identify actions to improve scientific advisory processes. The Chair of GSF, **Amanda Collis**, then briefly introduced the GSF project on Mobilizing Science in Crises: Lessons Learned from COVID-19. She emphasized the importance of using the COVID-19 pandemic as an opportunity for the international community to jointly reflect and learn about the systemic and structural STI system challenges and successes.

1.1 Science, policy and politics - Keynote

Shelia Jasanoff (United States) gave a pre-recorded keynote presentation that emphasised the extent to which science, policy, politics, and public trust are intertwined. The nature of this relationship is context-dependent, necessitating a variety of approaches to policy development and public engagement across nations. The keynote emphasized the following key points:

- The delegation of authority to experts is embedded in country-specific cultural norms related to how and when to trust experts. Different actors, including citizens, can have very different perceptions of the role and authority of science and experts.
- Whilst traditional views perceive the role of science as defining and explaining 'reason' to the public (deficit communication styles), more contemporary approaches view 'reason' as being achieved by 'opening up' knowledge development to better address areas of uncertainty. This requires participatory processes and the active engagement of citizens.

[1] OECD (2015), "Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists", OECD Science, Technology and Industry Policy Papers, No. 21, OECD Publishing, Paris, https://doi.org/10.1787/23074957

[2] OECD (2018), *Scientific Advice During Crises: Facilitating Transnational Co-operation and Exchange of Information*, OECD Publishing, Paris, https://doi.org/10.1787/9789264304413-en.

[3] https://www.oecd.org/coronavirus/policy-responses/providing-science-advice-to-policy-makers-during-covid-19-4eec08c5/#section-d1e267

- Transparency and data alone are not enough. Science is translated into the political realm by policymakers in the development of policy. This translation process must be explained and understood by all system actors, including civil society. This requires a willingness to engage with the underlying politics of who is involved, what is considered, and how decisions are made
- One size does not fit all and building science advisory processes and science-society partnerships must take into account the local context, history, and culture.

1.2 The operational challenges of making evidence-based policy

The keynote presentation was followed by a series of short interventions focused on the practical realities and challenges of working at the interface between science and policy in public health crises.

Commentators: **Ian Diamond,** United Kingdom; **Jet Bussemaker,** the Netherlands; **Bob Kolasky,** United States; OECD High-level Risk Forum

The following key issues, were highlighted in these interventions:

- Multivariate, multi-disciplinary data is needed and should be provided at pace to address policy questions as they arise and in a way that is transparent to the public.
- Qualitative data are as important as quantitative measures; data on how people experience things, secondary health impacts (mental health) and non-health impacts (e.g., domestic violence) are critical for policy-making. The scientific expertise being used by governments needs to include representatives beyond the natural sciences, including from social sciences and humanities (SSH).
- There is a role for civil society in providing input to science advice through participatory processes, as citizens can provide very useful tacit knowledge. Establishing long-term trust requires considering people's daily life experiences.
- The division of roles and responsibilities between scientists and policy-makers should be clearly delineated. Ethical and normative dilemmas can be informed by science but decisions on policy interventions are ultimately political.
- There has been a lack of focus on consistent evaluation of interventions, partly due to the difficulty of foreseeing and collecting the appropriate baseline data, leading in some instances to policymaking and evaluation by anecdote rather than science-based processes.
- Risk assessments should be conducted on a continuous basis, with the evolution of risk and uncertainty communicated clearly as a crisis situation evolves. Such assessments need to take into account competing interests (i.e. public health vs economic impact) and the processes for doing this should be transparent.

Session 2: Evolving advisory processes, roles and responsibilities of scientific advisors

This session explored how different national advisory systems – centralized and decentralized – responded in the face of the COVID-19 pandemic and how adaptation was necessary as the crisis evolved. Panellists were individuals involved in science advisory processes and working at the interface of science advice and policy development.

Moderator: Marie Delnord, EG member, Belgium

Panellists: **So Young Kim,** Korea; **Marion Koopmans,** the Netherlands; **Petr Smejkal,** Czech Republic; **Dominique Costagliola,** France; **Patrick Fafard,** Canada

The following issues, were highlighted in the panel discussion:

- Some countries had long-standing, established advisory structures and processes already in place to deal with health crises, but these often lacked the necessary multi-disciplinary dimensions. The complexity of the COVID-19 crisis underlined the need for advice from beyond the biomedical/public health domain, something that few countries' advisory or pandemic response systems had been well prepared for.
- In many instances, additional advisory groups were developed over time to respond to broader health consequences and socio-economic issues that arose during the pandemic. Socio-economic advisory structures were often established late and tended to be less visible than those focused on medical advice. Moreover, integrated advisory systems had not been pre-tested which led to some lack of clarity and transparency on how advice came together and was translated into policy.
- The use of multiple bodies to provide scientific advice, creates significant challenges for policymakers in engaging the right actors, coordinating, and synthesizing the relevant scientific inputs, and developing timely policy options. Interdisciplinary advisory approaches require a distinct skillset with focus on improved consensus-building and the need for experts to be open-minded and able to consider alternative views.
- The pandemic highlighted the need for more inclusive processes. There are important questions as to whether top-down, government-driven committees or single agencies can effectively mobilize and leverage all the relevant knowledge in complex crises. Can individual government advisors or chief medical officers transfer different scientific perspectives into effective decision-making? and, how can multiple responsibilities be effectively distributed and roles coordinated?
- Looking to the future, it will be critical to assess the lessons learned in terms of what structures and processes worked best. This evaluation needs to consider existing and new structures and local contexts, while simultaneously enabling learning across countries. At the same time, it should be recognised that many aspects of the COVID-19 pandemic needed a unique response. What is required to respond to future crises may not be equivalent. It is important that any newly developed advisory bodies or mechanisms are not overly narrow in their focus.
- The limited international focus of most national scientific advice proved detrimental in that the advice that was provided lacked consideration of the whole picture. This increased the risk that policy decisions in one jurisdiction could be undermined by the interventions of other countries. International communication channels that effectively connect national advisory bodies have an important role to play both regionally and globally.
- Deficiencies in public communication, understanding and engagement must be addressed by: 1) creating realistic perceptions of science and the differences that exist within and across disciplines, 2) improving the ability of scientists and policymakers to explain processes, conclusions, and potential impacts in plain language, and 3) delineating between scientific evidence and its translation into policy by government.
- Historical legacies and culture have longstanding impacts on science advisory capacities and mechanisms and the relationships between politicians, policymakers, scientists, and the public.

Session 3: Ensuring a holistic/multidisciplinary evidence base

This session explored the processes used to formulate science advice: the actors involved, integration of evidence from different scientific domains and disciplines, and the effectiveness of this in meeting the demands of policymakers. Panellists included individuals involved in science advisory processes with different disciplinary and operational perspectives. A number of cross-cutting topics emerged during the initial interventions from panellists and the subsequent discussion.

Moderator: Frans Brom, EG member, the Netherlands

Panellists: **Muto Kaori,** Japan; **Marijn de Bruin,** the Netherlands; **Geoff Mulgan,** United Kingdom; **Remi Quirion,** Canada; **Bob Kolasky,** United States; OECD High level Risk Forum

Maintaining neutrality and objectivity

- Transparency is critical in the translation of science into policy and can help prevent science being blamed for contested political decisions. This requires broad access to underlying data as well as open discussion of the scientific method. Delaying public release of scientific advice and evidence can undermine trust in the advice and associated policies.
- There is a risk that as science becomes more prominent in political processes, it will also become more politicised. Ensuring that scientific advisory processes are transparent and accountable is critical to maintaining neutrality and objectivity. Improved visibility of challenges or bottlenecks can also create opportunities to improve effectiveness.
- Clear criteria and transparency in processes for the selection of science advisors can help to ensure their legitimacy. Protocols to rotate or replace the experts engaged in scientific advisory processes may improve the integration of emerging or unrepresented disciplines, integrate fresh thinking, and help to build trust in the independence of science advice. At the same time, there is a need to protect science advisors and experts from undue public or political backlash.

Synthesizing transdisciplinary knowledge

- There is a need to develop the mind-set, skills, and science-based methodologies required to mediate and synthesize knowledge from different sources under emergency response timelines. Close engagement between disciplines using different and, at times, conflicting theories, terminologies, etc. can generate tension. This needs to be mitigated by emphasizing and improving mediation and consensus-building abilities for both scientific experts and policymakers. It may also be helpful to have a chief scientist or experienced champion who can guide this process and bridge science and policy.
- A full picture of the domains, disciplines, and types of knowledge relevant for crisis response is necessary to understand how best to organize, mobilize and synthesize different sources of knowledge and how to weigh importance in relation to context. There can be a tendency to give greater authority to certain scientific disciplines, although this is often based on assumptions or biases rather than a systematic assessment of requirements.
- Social sciences disciplines must be more visible and better integrated into crisis response mechanisms to translate data and knowledge from their fields of expertise into effective policy decisions. It is possible that better engagement of these disciplines at the outset of the pandemic may have mitigated the fatigue, apathy, and distrust of certain population groups in certain countries.

Long-term investment in foresight and preparedness

- A minimum level of sustained, long-term investment is needed to prepare for future health crises. Additional activities are also required to prepare for general emergency response and build long-term public trust and visibility. Well-designed cost-benefit analyses can play a role in improving understanding of alternative scientific advisory structures and processes, such as long-term versus ad hoc committees or mechanisms to integrate context-specific expertise.
- Lack of involvement of the science community in emergency preparedness may have prevented the development and strengthening of the communication and information dissemination channels necessary to expedite knowledge development and distribution to the right actors in real-time.
- Good scientific evidence based on real-time data collection are vital to crisis response. Availability of robust and disaggregated data gives scientists and policymakers better insight into both the course of the crisis and the effectiveness of policy measures. When combined with appropriate models, such data is critical for assessing future scenarios and potential outcomes.

Session 4: Communication of scientific advice, building trust

The session explored how science advisory structures have engaged with the public(s) and the role played by mainstream and social media. Panellists included individuals involved in communicating scientific advice to the public and/or studying communication processes. A number of cross-cutting topics emerged during the initial interventions from panellists and the subsequent discussion.

Moderator: Carthage Smith, OECD-GSF

Panellists: **Mikihito Tanaka,** Japan; **Michael Bang Peterson,** Denmark; **Camilla Stoltenberg,** Norway; **Henrique Barros,** Portugal

Building trust through open and accountable public communication

- Effective public communication and engagement should aim to give actionable advice and raise awareness that scientific understanding is conditional and constantly evolving. This means conveying what is known together with the uncertainties and associated risks, as well as what is being done to improve the scientific evidence and the associated policy implications.
- In the many instances, where the media has played a positive role in communicating science, this is because prior efforts have been made to establish mutual trust and workable relationships. Creating and maintaining clarity on the needs and expectations of officials, experts, media, and the public is critical. Some jurisdictions have adopted the use of closed discussion meetings with media representatives to enable a more unified dissemination of information to the public. This can also help in identifying and dealing with misinformation.
- Communication strategies are dependent on contextual factors, such as science literacy and political polarization. Public perceptions of science and/or government institutions are often shaped by historical legacies, which should be reflected in the communication and engagement strategies that are adopted.
- The communication of scientific ‘successes’, such as the development of new vaccines in record time, strengthened overall public support for science in many countries. Quality

control of scientific publications and transparency with regard to errors and retractions were also critical to maintaining public trust and limiting the spread of misinformation.

Managing conflicting scientific viewpoints

- It is important to be transparent about the degree of consensus and uncertainty underlying science advice to maintain trust and minimize political contention. Conflicts, within and across scientific disciplines, should not be concealed but need to be managed carefully to protect scientific credibility. Forums have been used in some instances to foster common understanding among experts, so that public messaging is less fractured.
- Successful communication campaigns should be grounded in an understanding that public(s) are capable of handling complexity and uncertainty. The scientific process should be openly portrayed and understood as one that embraces disagreement in order to progress and generate reproducible findings. Social media discussions have often exacerbated representations of science as a one-dimensional 'provider of truth', but digital tools might also be useful in remedying this perception.

Public engagement and the use of digital tools

- Public engagement is a crucial aspect of science advice and there is a need to consider how public knowledge and opinion can be systematically captured and integrated into advisory processes. The capacity requirements to engage representative groups can pose significant challenges. In some contexts, a strong culture of trust and collectivism may serve as a barrier to public engagement if activities are viewed by the public as attempts by experts to defer their responsibilities.
- In some instances, expert groups have broadened engagement to include direct interaction with the public. Individual communications and the use of social media tools have been important in some jurisdictions, while other countries have maintained a clear distinction between formal and informal communication by forgoing the use of social media.

Contextualizing scientific advice using social science and qualitative data

- Knowledge is contextual and requires that the methodology and weightings used in the integration of underlying data and information is determined by the situation.
- Acceptance of the pandemic as a social crisis necessitated the consideration of a broad set of inputs; however, established skillsets, infrastructure and mind-sets in many jurisdictions delayed or prevented the integration of social science inputs and qualitative measures.
- Pre-pandemic work could have been done to establish the necessary monitoring infrastructure and methodologies to inform effective policy interventions. For example, public health interventions have been repeatedly introduced in the absence of rigorous evidence of their effectiveness from randomized control trials. There is an urgent need to improve the evidence base on how, why, when, and to what extent, certain interventions are effective.

Delineating roles and responsibilities of scientific advisors and policy officials

- It is important to delineate between scientific conclusions and normative considerations, including values and risk preferences that may relate to personal biases or agendas. To facilitate this distinction, the data underlying expert assessments should be transparent and accessible, and the roles and responsibilities of policymakers and scientists – in academia and government - should be clearly defined and communicated.

- At times, the boundaries between scientific and political decision-making can be unclear. It is the role of scientists to provide an understanding of the costs and benefits of potential policy options. The use of normative considerations to weigh conflicting priorities is part of the political process.

Session 5: Scientific advice at different scales: coordination and contextualization

This session explored science advice in different scales and contexts and how to balance the inter-dependence inherent to different advisory processes with a need for autonomy. The panel was comprised of scientists and policy advisors working in a variety of contexts and scales to inform decision-making during the pandemic. A number of cross-cutting topics emerged during the initial interventions from panellists and the subsequent discussion.

Moderator: David Castle, EG member, University of Victoria, Canada

Panellists: **Melanie Davern,** Australia; **Christian Leonard,** Belgium; **David Nabarro,** former WHO and UN; **Nicole Grobert,** European Commission; **Ian Diamond,** United Kingdom

International collaboration and science advice

- There is a growing need to reframe historical motivations for STI activities related to national prestige and explicitely include global public good considerations. Multi-lateral collaborations that leverage national expertise are critical for mitigating power imbalances and maximizing the public good.
- The impacts of the pandemic and resulting policy interventions have been largely universal across jurisdictions, although there has been a lack of appetite among national governments to share learnings. In the face of growing societal fatigue and political pressure, there is risk that governments terminate policy interventions prematurely with negative impacts on certain population groups within and beyond their borders.
- Rushed re-prioritization - turning over the page - may limit the ability of scientific advisors and policymakers to learn from what did and did not work in responding to the COVID-19 pandemic up to now. This may negatively affect not only the ongoing management of this pandemic but also have negative implications for the response to future crises.

Coordinating national and sub-regional science advisory mechanisms

- Many jurisdictions have experienced challenges in integrating local and national responses and in bridging knowledge gaps across geographic scales and population groups. Additional confusion and delay has arisen where the division of responsibilities across different levels governance has been unclear or where analysis has been done without sufficient awareness of local contexts.
- Challenges in linking existing data sources and early prioritization of natural over social sciences has limited the ability of policymakers to understand the interplay between various dimensions of the crisis, such as the impact of social health determinants on disease transmission and virulence.
- Some countries deployed community-based surveys to gain insights into local, demographic contexts, which enabled targeted interventions and communication. Conversely, universal policy approaches were adopted in other jurisdictions, which may

have contributed to increased rates of transmission and more severe health outcomes in certain groups.

Public communication and open access to information

- The public is instrumental to the effectiveness of policy interventions and the public is made up of a diversity of different groups with varying needs, knowledge, and experiences. As a result, successful public communication and engagement strategies require the development of targeted narratives that reflect the lived experiences of relevant population groups.
- Long-term commitments are needed to invest in data/science literacy to ensure that every citizen has access to, understanding of, and representation in, data. National commitments to research integrity and open science are also critical to enable science and innovation system stakeholders, including civilians, to engage with and critique the data that is being used in science advice processes.

Interrogating normative framings of science, policy, politics, and publics

- Knowledge domains have distinct normative values and objectives, which may not align with other disciplines and dominant political or cultural views. Increasing the familiarity of policymakers with underlying theoretical frameworks and possible alternatives has the potential to improve their ability to navigate differing normative priorities and develop consensus. For example, utilitarian values are often used as a frame to translate science advice into political decisions. In relation to COVID-19, this equates to lives saved or maximizing quality-adjusted life-years across the population[4]. Alternative values, e.g. with more focus on justice or equity, could equally well have been deployed or given greater weighting.
- Additional investments may be required to build the skills and capacity needed to support horizontal and vertical collaboration across disciplinary, geographical, and other boundaries. Knowledge sharing among diverse actors that includes the communication of what is known, unknown, or uncertain, can help identify underlying assumptions or biases. This is critical for synthesising robust, transdisciplinary knowledge.
- Clear expectations and processes are required and these need to openly acknowledge that scientific inputs are part of a variety of multi-dimensional information that will be considered, weighted and synthesized in political decisions made under tight time constraints.

Building on and improving established capacities

- Nations have seen high return on long-term investment in foundational infrastructures and capacities, in areas such as data collection and management, epidemiological modelling and genomic sequencing. In some circumstances, existing capacities could also be adapted and pivoted towards urgent needs. Established capacity has enabled policymakers to prioritize the strategic allocation of resources to maintain situational awareness. Flexibility, such as with the rapid development and regulatory approval of new statistical surveys, has enabled new tools to be rapidly introduced.

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[4] **Ferranna, M., Sevilla, JP, Bloom, D. E.** *Addessing the COVID-19 Pandemic: Comparing alternative value frameworks.* Cambridge : National Bureau of Economic Research, 2021. Working Paper. 28601.

- Systematic evaluation of the scientific and policy response to the pandemic is necessary to understand: 1) how the scientific advice and policy response has changed over time; 2) how policy interventions and different components advisory systems have worked at different phases of crisis response; and 3) what can be done to better predict and mitigate negative consequences of policies, such as the exacerbation of existing inequities. National evaluations need to be complemented by similar exercises at the global, regional and sub-national level and these need to be open and transparent.

Session 6: Implications for science advice in future crises

6.1. Reflections on the workshop from the operational perspective

Prior to the final panel discussion on policy implications, several individuals, who had contributed over the 2 days, were invited to give their views on the key lessons from the workshop and their potential implications from an operational perspective.

Contributors: **Ian Diamond,** United Kingdom; **Tateo Arimoto,** EG member; **Randolph Kent,** EG member

Key Lessons

- Three key areas of consideration for science advisory processes in the future are: international collaboration; public engagement in decision-making on how data is used; and, the provision of timely, transparent, and accurate data flows to scientists and policymakers.
- Policy interventions have, in many cases, paid limited attention to societal dynamics and culture. In the future, there is a need to more proactively consider how to be more inclusive and how to engage and build trust with neglected population groups.
- More attention to the boundaries and interplays between science, policy and society is required in the development of scientific advice. Novel approaches to science and data generation that actively engage citizens, may require reflection on the role(s) of scientists and experts.
- There may be a need to establish more refined guidance on roles, responsibilities and expectations for science and policy communities, with consideration of whether (and/or when) researchers should act as neutral providers of science-based input or as advocates or influencers.
- Systemic operational challenges must be addressed to improve preparedness and response capacities. In some instances, this may require the transformation of science and policy development structures. For example, established funding mechanisms and mind-sets may contribute to siloed operations and the prioritization of competition over collaboration.

6.2. What are the implications for science policy (and for scientists)?

The final session focused on what needs to be done to improve science advice for future crises and for addressing complex societal challenges. Representatives included actors from science ministries, scientific institutions, and science funding agencies.

Moderator: Randolph Kent, EG member, United Kingdom

Panellists: **John-Arne Røttingen,** Norway; **Kiyoshi Kurokawa,** Japan; **José Esperança,** Portugal; **Daan Du Toit,** South Africa; **Rebecca Bunnell,** United States

Addressing systemic and structural challenges

- Sustained investments are required to break established cycles of neglect and reactivity in the public health sector. There is a need to improve global capacity to respond to health emergencies and crises more generally; crises invariably have implications for health and wellbeing. Historic neglect of the factors contributing to health disparities has resulted in worse pandemic outcomes within and across borders. This reality must be acknowledged and integrated into modern public health research culture. Existing structural barriers between sectors, regions and countries need to be addressed so that tackling the underlying drivers of health inequalities is recognised as a critical global priority.
- There is currently a window of opportunity to advance changes in the health sector, but this will require strong, clear messaging regarding the impact that chronic public health concerns and health disparities have had on the severity of pandemic outcomes. This overlaps with the need to address global vaccine inequity. Research on social determinants and technological solutions need to proceed hand in hand – both are required to support an effective policy response to crises.

Strategic long-term investment

- Nations have seen returns where systematic efforts and investments were made to establish and advance STI systems in accord with future-oriented societal challenges. For example, past investments in social science infrastructure and networks were instrumental to South Africa's ability to rapidly deploy community surveys to understand public perceptions of policy interventions.
- It will be important to apply learnings from the pandemic response in a way that fosters sustainability and resilience, while mitigating over-specialization. Continued investment is required to strengthen broad prevention and preparedness capacities and can be guided using established tools such as the Sendai Framework. Foresight capabilities will also be valuable in identifying potential future crises, translating emerging societal challenges into immediate actions, and providing a rationale for long-term investment.
- The pandemic has made existing STI system deficiencies and challenges more visible. Going forward, it will be important to address these shortcomings and assess whether current resource allocation processes should be adapted to address constraints posed by outdated technologies, capacity scarcities, or other limitations.
- Over the course of the pandemic, there have been numerous examples of game-changing innovations developed from long-term investments in basic research activities. For example, mRNA-based COVID-19 vaccines build on a landmark discovery from 1987[5] and scientific activities dating back to the 1960s[6]. As STI funding becomes more challenge-driven in response to the integration of resilience, sustainability, and inclusiveness as policy goals, it will be important to also maintain support for flexible, curiosity-driven research. Science needs to continue to provide the technological tools that are essential for effective policy interventions during crises.

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[5] Malone, R. W. (1989). Cationic liposome-mediated RNA transfection. *Proceedings of the National Academy of Sciences, 86*(16).

[6]Dolgin, E. (2021). The tangled history of mRNA vaccines. *Nature, 597*.

International collaboration and inclusivity

- Science advice has been organised at the national level to inform decisions within specific jurisdictions; however, arbitrary divisions have created blind spots regarding the impacts of policy on actors outside these jurisdictions. How national policy interplays with international developments may limit effectiveness or result in counterproductive outcomes.
- The development of cross-national and global science advice structures should be prioritised; however, collaboration at these scales is challenged by institutional and individual incentives.
- Long-term, dedicated investment is required to ensure inclusivity and continue to develop STI capacities and national science advisory mechanisms in the Global South. Cross-jurisdictional knowledge sharing must be done sensitively, with the understanding that insights are context-specific and may be based on different risk profiles and values.

Modernise and protect scientific knowledge production processes

- Approaches to scientific knowledge production need to be modernised in accordance with social, cultural, and technological changes. Existing systems are not sufficient to deal with the current speed and volume of data creation and may entrench and exacerbate antiquated and siloed operational procedures and mind-sets. For example, process innovations can transform established workflows for data sharing and regulatory approval into mechanisms that facilitate nimble, transparent, proactive and equitable action in peacetime and in crisis response.
- There is a need to protect scientific processes and advice against inappropriate political interference in the wake of increasing polarization. The visibility and public engagement of independent and impartial scientific institutions has increased public trust in science and these institutions need to be protected and valued. Further momentum will depend, to a large extent, on ensuring the continued relevance of science to social needs.

Public communication and engagement

- Scientists and civilians speak with different languages, literally and figuratively, but this can be managed using intermediaries, including the use of digital tools to engage online communities. In some instances, it may also require more traditional approaches, such as the translation of formal documents into different languages.
- Open science and the active engagement of the public are crucial to catalyse bottom-up data collection and promote the advancement towards a more open and inclusive society. Public communication and citizen engagement need to be incentivised by appropriate science policies.

Further Reading

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Annex: Workshop Agenda

1.1. Session 1. Introduction and Opening Keynote

Contributors

- **Randolph Kent**, EG member, Visiting Professor, African Leadership Centre, King's College and Honorary Professor, University College, London's Institute for Risk and Disaster Reduction
- **Tateo Arimoto**, EG member, Visiting Professor, National Graduate Institute for Policy Studies and Chief Research Fellow, International Institute for Advanced Studies
- **Amanda Collis**, GSF Chair; Executive Director, Research, Strategy and Programs, UKRI – Biotechnology and Biological Sciences Research Council

1.2. 1.1 Science, policy and politics – Keynote

The opening keynote laid out how science, policy, politics and public trust have been intimately intertwined in the different actions taken by countries in response to the COVID-19 pandemic.

Keynote Presentation

- **Sheila Jasanoff**, S&T Studies, Harvard Kennedy School, United States

1.3. 1.2 The operational challenges of making evidence-based policy

Oral interventions focused on practical realities and challenges of working at the interface between science and policy in public health crises.

Commentators

- **Ian Diamond,** National Statistician, United Kingdom
- **Jet Bussemaker,** Council of Public Health and Society, Leiden University, the Netherlands
- **Bob Kolasky,** Director, National Risk Management Centre, Cyber and Infrastructure Security Agency, United States Department of Homeland Security and Chair, OECD High-level Risk Forum

Session 2: Evolving advisory processes, roles and responsibilities of scientific advisors

Key questions

1. What advisory structures were in place prior to the crisis and what role did these play during the crisis? What new structures or mechanisms were put in place and how did these perform?
2. Aside from the scientific advice coming via formal government mandated advisory structures, what other scientific advice informed policy-making and how did this interact with formal mechanisms? What level of plurality/disagreement in terms of science advice is optimal/desirable?
3. How was scientific autonomy maintained and how were conflicts of interest managed in advisory processes? What measures are in place to 'protect' scientists, who provide advice from abuse or legal prosecution?

Moderator: Marie Delnord, Public Health Researcher and Epidemiologist, Sciensano, Belgian Public Health Institute, Belgium

Panellists

- **So Young Kim,** Director, Korea Policy Centre for the Fourth Industrial Revolution, Korea Advanced Institute of Science and Technology, Korea
- **Marion Koopmans,** Director, Viroscience, Erasmus University, the Netherlands
- **Petr Smejkal,** Chief Epidemiologist, IKEM, Prague, Czech Republic
- **Dominique Costagliola,** Sorbonne Universite, INSERM, Institut Pierre Louis d'Epidemiologie et de Sante Publique, France
- **Patrick Fafard,** Global Strategy Lab, University of Ottawa, Canada

Session 3: Ensuring a holistic/multidisciplinary evidence base

Key questions

1. How were policy concerns and priorities incorporated into advisory processes and translated into scientific questions? Was there a co-design process and, if so, who was involved and how did this operate? Has this changed during the course of the pandemic?
2. How were different disciplinary perspectives including biomedical, social and behavioural sciences taken into account? What weight was given to different sources of evidence and did this evolve over time?
3. How were trusted data sources selected and what quality control measures were implemented? How was Big Data, e.g. from social media that was not specifically collected for research, used in scientific advice/policy making?

Moderator: Frans Brom, EG member, Netherlands Scientific Council for Government Policy (WRR) and Ethics Institute of Utrecht University, the Netherlands

Panellists

- **Muto Kaori,** Department of Public Policy, Institute of Medical Science, University of Tokyo, Japan
- **Marijn de Bruin,** Head of Research, Behavioural Medicine, National Institute of Public Health and Environment, the Netherlands
- **Geoff Mulgan,** Science Policy, University College London, United Kingdom
- **Remi Quirion,** Chief Science Advisor of Quebec and President of the International Network for Government Science Advice
- **Bob Kolasky,** Director, National Risk Management Center, Cyber and Infrastructure Security Agency, United States Department of Homeland Security and Chair, OECD High level Risk Forum

1.4. Session 4: Communication of scientific advice, building trust

Key questions

1. How can openness and accountability be ensured and what can be done to effectively communicate scientific advice and its associated uncertainties in a way that promotes public trust?
2. How can conflicting scientific viewpoints and advice be best managed within formal advisory processes? And in the public debate more broadly?
3. How can science advice be best communicated to the public using traditional and/or social media? What is the role of the scientists who are involved in formal science advisory processes in communicating this advice to the public and how does this relate to the role of the authorities responsible for crisis response and politicians?

Moderator: Carthage Smith, OECD-GSF

Panellists

- **Mikihito Tanaka,** Political Science and Economics, Waseda University, Japan
- **Michael Bang Peterson,** Political Science, Aarhus University, Denmark
- **Camilla Stoltenberg,** Director, Norwegian Institute of Public Health
- **Henrique Barros,** Public Health, University of Porto, Portugal

1.5. Session 5: Scientific advice at different scales: coordination and contextualization

Key questions

1. How can national and international science advisory mechanisms complement each-other and work together most effectively?
2. How can national and sub-regional, including municipal and local, science advisory mechanisms be best coordinated?
3. How can science advice be used to support community decision makers and key actors in regions or situations, where traditional governmental authority is absent?

Moderator: David Castle, EG member, University of Victoria, Canada

Panellists

- **Melanie Davern,** Associate Professor, RMIT University and Director, Australian Urban Observatory
- **Christian Leonard,** Strategic Director, Sciensano, Belgian Public Health Institute
- **David Nabarro,** 4SD, former WHO Director and former UN Special Envoy on Pandemics
- **Nicole Grobert,** Chair, EC Scientific Advisory Mechanism
- **Ian Diamond,** Chief Statistician, United Kingdom

Session 6: Implications for science advice in future crises

6.1. Reflections on the workshop from the operational perspective

Key questions

1. What are the 3 key messages coming out of the workshop and what are their future implications from an operational perspective?

Contributors

- **Ian Diamond,** Chief Statistician, United Kingdom
- **Tateo Arimoto,** EG member and National Graduate Institute for Policy Studies, Japan
- **Randolph Kent,** EG member and United Kingdom

6.2. What are the implications for science policy (and for scientists)?

Key questions

1. What science policy actions can be taken to improve the preparedness of science systems to effectively inform policymaking in future emergencies?
2. What science policy actions are necessary to ensure that the necessary scientific evidence and advice is effectively provided to policy makers (and citizens) to inform solutions to future pandemics? To what extent can this be extrapolated to other complex crises and chronic societal challenges?

Moderator: Randolph Kent, Co-chair and EG member

Panellists

- **John-Arne Røttingen,** Ambassador for Global Health, Ministry of Foreign Affairs, Norway
- **Kiyoshi Kurokawa,** emeritus Professor, University of Tokyo, Japan
- **José Esperança,** vice-President, Board of Directors, FCT, Portugal
- **Daan Du Toit,** Deputy DG, Department of Science and Technology, South Africa
- **Rebecca Bunnell,** Chief Science Officer/Director, CDC Office of Science, Centre for Disease Control and Prevention, United States