The bridge: *Reflections on bringing science into policy*

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Our starting place

As steward for the environment, MfE has a dual role in providing advice on ways to demonstrably improve the health of the environment, whilst also ensuring a flourishing environment for future generations. **Science** is a critical component within this advice, in terms immediate policy design, implementation and evaluation, as well longer-term strategic direction.

Particularly relevant to MfE's context is **mātauranga Māori** as a knowledge system. The inclusion of mātauranga within policy advice is an essential component of place-based, holistic, and future-focused environmental stewardship, and needed to fulfil statutory obligations to Māori (Kukutai et al., 2021).

For science and knowledge (including mātauranga Māori) to support and inform the development of policy advice, MfE, like other government departments, relies on a theoretical meeting place: the **'science-policy interface'**. The term 'science-policy interface' implies a hard-line where the offerings of science are handed to policy teams in a swift and clean transaction. However, simply providing more science does not mean better policy (Sutherland et al., 2013). It requires policy teams know where to access science, receive the science in a ready-to-use form, and know how to appropriately incorporate it within their work.

Describing the real nature of the interface

Human impediments such as values, motivation, language, and experience can present as a barrier at the interface. Similarly, the context of time and place is increasingly important to account for when bringing science into policy. In these respects, the science-policy interface is more an ambiguous and opaque three-dimensional space that must allow for context as well as the 'social processes' between scientists and other actors in the policy process' van den Hove (2007).

Several reviews have aimed to build understanding on each side of the interface. Saner (2007) highlights the differences across the interface from concepts and foundations to methods and perspectives, and even derogative terms used to describe the different set of actors (e. *lab coats v policy wonks*). Sutherland et al., (2013), and Milman (2013) suggest '20 concepts that should be taught to government ministers and public servants' about science and scientists including statements such as '*differences and chance cause variation, no measurement is exact, correlation does not imply causation'* as well as a line about *'scientists are human'*.

Less than a month later, a follow-up top 20 was published drafted by Tyler (2013) to educate scientists about the policy world. This review concluded amongst its findings that '*there is more to policy than scientific evidence, making policy is really difficult'*, and a retort that '*policy-makers can be expert, are not homogenous, and are people too!'*

The role of chief science advisor in government was imagined to better connect these diverse worlds and strengthen the effectiveness of the science-policy interface. Sometimes it is hard to comprehend the real differences and disconnects that exist, and so I recently drafted a fabled meeting between Pooh Bear and Christopher Robin as an illustration of the challenge (see *A science-policy fable, Appendix 1*). There are many other devices that could be used to provide locally relevant insight into the contest, such as *The Kuia and The Spider* (Grace, 1982).

In addition to the fable which identifies the **gap**, this paper summarises some of the tools and tricks to cut through the ambiguity and **bridge** it, thereby bringing science intentionally, respectfully, and effectively into policy.

Building the bridge – focusing on the why and what

Connecting across the science-interface and moving from chaos to clarity is a challenge, and requires asking several focused questions:

A. Why bring science into the project?

Just as indicated in *A science-policy fable*, the first step is to build a common understanding of the **starting point, issue** and **intended contribution of science**. For policy-makers this is the need and contribution of science at various stages within the policy cycle: ideally, it is brought in at the beginning to help verify the problem and articulate desired outcomes, but science also has a role in conceptualising the framework and approach, defining limits and targets for change, guiding implementation, and/or tracking progress towards outcomes. Science may also be used to inform the level of risk and uncertainty associated with policy options, insightful for ministers as they consider future projections and options.

It is important to discuss upfront why and where science is intended for use to avoid the science-policy interface risks being a place of contrary and potentially irreconcilable motivations and intent.

B. What level of advice is required?

Another preliminary challenge is defining the level of advice. To address the challenge mentioned at the beginning of the paper there is a need for **technical, and tactical advice** that can be actioned and implemented by teams, often at project level. Additionally, **strategic science advice** to inform long-term stewardship direction (e.g., future scenarios and trends; governance models, institutional form, and critical capability), is required, especially to support the executive level. Within MfE, we wrestle with this tension all the time, and need to think carefully about what we are asking of our advisory structures, and how we can reuse and embed advice at both levels by creating related but audience-specific products (see more in next section on the *who and how*).

C. What type of science is needed?

Good evidence synthesis draws on a wide range of science, and a diversity of perspectives. From the outset it is important to recognise the value of **diverse knowledge sets**, including biophysical, social, and behavioural sciences. Across the science-policy there remains a *'persistent hierarchy of the sciences that privileges the "hard" disciplines – such as virology over social sciences'* as Ball (2021) notes when talking about the UK's COVID response. We know from our own COVID response, there is so much more to consider than the genome sequencing of the virus. This includes the social inequities of benefit and burden, and the individual behaviours that determine the effectiveness of public health measures. This more fulsome approach to demands supplementing science with experiential, observational, and qualitative information, including on *'public attitudes, the experience of practitioners and even anecdotes'* (Giles, 2017).

Moreover, and the subject of *'Te Putahitanga: A Tiriti-led Science-Policy Approach for Aotearoa New Zealand'*, the mainstream view of the science-policy interface too often 'values objectivity and universality, drawing sharp boundaries between knowledge and action, and situates experts outside of communities' (Kukutai et al., 2021). 'What is legitimised as knowledge, and therefore, what can be considered during policy development' (Kukutai et al., 2021) has been restricted and has tended to exclude Māori and Pacific expertise from science advice and key decision-making roles. This means we are excluding very necessary inputs that support and honour Te Tiriti, connect to our communities, and enable effective environmental stewardship.

D. What principles are most important to work at the interface?

One of the biggest risks at the science-policy interface is for policy to be perceived as cherry-picking data or experts to support inherent views or predetermined outcomes. Ball (2021) notes that where there is lack of scientific consensus, science is at risk of becoming a tool not for informing but for justifying policies (Ball, 2021), criticism we have recently weathered in the development of freshwater and clean air policy.

For this reason, the science-policy interface needs careful management, and **good practice guidelines** to bring the two together in a safe and trustworthy way. Helpfully, The Royal Society & The Academy of Medical Sciences (2018), published a set of principles to guide evidence synthesis (later published in Nature, *see* Donnelly et al., 2018). In developing these principles, the authors (many of them science advisors in government), focus on the fundamental features that should apply to any evidence synthesis regardless of the timeframe, topic, or method and including:

- *Inclusive* - involves policymakers and is relevant and useful to them; considers many types and sources of evidence and knowledge; uses a range of people, perspectives, and skills.
- *Rigorous* - uses the most comprehensive feasible body of evidence; recognises and minimises bias; independently reviewed as part of a quality assurance process.
- *Transparent* - clearly describes the research question, methods, sources of evidence and quality assurance process; communicates complexities and areas of contention; acknowledges assumptions, limitations, and uncertainties, including any evidence gaps; declares personal, political, and organisational interests and manages any conflicts.
- *Accessible* - written in plain language; available in a suitable timeframe; freely available online.

Collectively, these provide useful guidance and a rubric for how to operate safely and effectively at (or maybe in) the interface. Each principle ensures that science is bought into policy in a fair, honest, and complete way. Science advice, whether it is data, a model or synthesis of evidence, often carries with it a range of contingencies and assumptions. Policymakers must faithfully caveat science use and provide clarity on any contingencies and guiding assumptions.

At times, there will be a predominant principle that is critical for delivering to intent. The predominance of the principles may vary at points along the project development process. As an example, the inclusive principle more important at the scoping stage; rigour, and transparency, during completion (e.g., independent peer review); and accessibility at the final stage to ensure good outreach and uptake.

Building the bridge – a focus on who and how

Staying with a definition of the science-policy interface as a deeply human endeavour, there are foundational questions to guide productive practice around who should be involved, as well as how:

E. How to bring science into policy?

Various reviews of science to policy effectiveness describe the results on the interface if activity is dominated by either **science-push**, or **policy-pull**. Boaden (2020) discusses the increasing trend (perhaps given the growing reward for research impact) for academics to 'push' research results into practice '*through the development of (supposedly) innovative dissemination methods such as toolkits, video, etc*'.

This model is, however, generally ineffective at informing policy-making especially for complex socio-ecological problems such as climate change (Dunn et al., 2018), because the knowledge generated can be difficult to understand and may lack obvious applicability through a policy lens. Instead, the science-push model can tend to emphasize the **pursuit** of knowledge rather than **applicability**. Boaden (2020) suggests this 'science-push' also serves policy poorly, by viewing non-academics (including policy-makers) as 'evidence users' or 'end-users'.

The policy-pull model is also acknowledged as less than ideal given *'accessing and interpreting the right evidence at the right time is hard'* (Boaden, 2020). It assumes and requires good availability of both data and capacity of researchers and can be perceived as cherry-picking to suit an agenda.

Where at all possible, and from both the science-policy literature and my own experience, the best practice is '**co-production**'. A co-production process, that connects the production of knowledge with the organization of policy-making is likely to bring evidence into policy within required timeframes and more effectively inform subsequent decisions. This 'bridge' approach (remembering this about

motivation and values) it more palatable too, as it recognises the important skillsets and contribution of both science and policy roles.

F. *Who should be at the science-policy interface?*

Within MfE we have a variety of disciplines and roles to 'walk the bridge' with policy teams, from our science capability (principal scientists, science analysts) through to advisory panels comprising external science and mātauranga Māori advisors. Our ongoing experience suggests having this **variety in roles** can help traverse the different levels and types of science advice required for environmental stewardship: from the strategic and systems perspectives, through to the more technical, tactical, and project based. This variety also helps maximise diversity and inclusion (one of the key principles listed above). Some specific roles, such as panel chairs and secretariats, as well as chief advisor, play a critical connecting role to facilitate the bridge-building, brokering across the levels, managing the science-policy interface, and ensuring repeatable use of advice and fitness for use of products.

As an agency we should also prioritise bringing in 'science hybrid' talent: hybridisation is becoming an increasingly popular career path at university with students combining majors, for example, environmental science with law, economics, or social studies. Fundamentally, however, the role of leaders, directors, and managers is essential to building the **culture**, **confidence, and science literacy** to support work at the science-policy interface. It is for the reason we published *Our Science Strategy Rautaki Pūtaiao*[1] as an underpinning performance framework, recognising it takes time to build a trusting culture and therefore good receiving environment for science input. However, as Ball (2021) reflects, *'mature leaders, irrespective of their training, who respect science for what it is – a social system for arriving at reliable but contingent knowledge, based on data, embracing error and uncertainty and diversity of opinion – will not struggle to put it to good use',* neither will their teams.

G. *How can we create activity and discussion at the science-policy interface?*

There are many activities that can help bridge the interface and stimulate a co-production process. Choi et al., (2016) developed a useful a comparison of activities across China and Canada. Our primary effort to date, has been **real-time advice** to connect existing science with policy need. This is of course important and necessary given policy advice timeframes. Activities include personal contact (phone a friend), science-policy forums and workshops, through to the procurement of specific research and advice.

But given the challenge of intergenerational outcomes and environmental stewardship there is a need to think beyond real-time activities to those that contribute to **long-term and enduring bridge building** between science and policy. Developing capable 'bridge-builders' requires talents that intuitively traverse the interface and hybridise science with policy skills. MfE may need to consider working more closely with schools and universities on the capability pipeline and curriculum, as well as creating opportunities to share life at the interface by guest lecturing, and provision of intern, shadow, and mentor experiences.

In the mid-term, more joint supervision, collaborative study design and co-creation of research is a pragmatic compromise. However, we are yet to fully invest in either these long or mid-term efforts, and yet these are more likely to build communities of practice and authentic and enduring partnerships between scientists and policymakers. This is particularly true when engaging with Māori iwi and is needed as a 'counter to quickfire research that consultants are often commissioned to do for policy development' that often excludes 'Māori lived experience' (Kukutai et al., 2021) and fails to build trust.

H. *How can product form support effective bridging the gap?*

A previous section highlighted the opportunity to take science advice into policy for both strategic and tactical impact. To do this depends on agreeing the purpose of, and audience for, the advice before matching it to the product format. Within MfE, this is still a work in progress but highlights the need to think beyond 'a one size fits all' approach.

[1] https://environment.govt.nz/assets/Publications/Files/our-science-strategy.pdf

Building an enduring, multi-lane bridge

As this review has outlined, the science-policy interface is an ambiguous and complex place, driven by human experience, values and needs. Given this context there is no right way, or single approach to bridging the interface. Instead, it is about selecting what works for the policy area, the project, but most of all the people involved.

As someone living at the interface my parting advice is to:

- **Start with the outcome in mind**; science must be brought into work in a deliberate, purposeful, and planned way, ideally at the beginning of a policy process.
- **Create a culture** in teams that allows and encourages scientists to engage with policy and for policy teams to engage with science in a constructive, co-produced way.
- **Build confidence and respect in teams.** Not everyone needs to be a science expert, but they should understand the need for, and have processes they can trust, to bring science into policy work in an appropriate and safe way.
- **Consider longer-term opportunities** to build capability, authentic relationships, and enduring structures at the meeting place, not only the quick and transactional fixes.
- **Keep both sides safe and trustworthy** by using a set of good practice principles (for example as per Donnelly et al., 2018), and build organisational understanding of those principles.
- And finally, **embrace the ambiguity,** and recognise the **various contributions** at the science-policy interface. There is opportunity, innovation, and impact within the interface to satisfy the needs of both sides.

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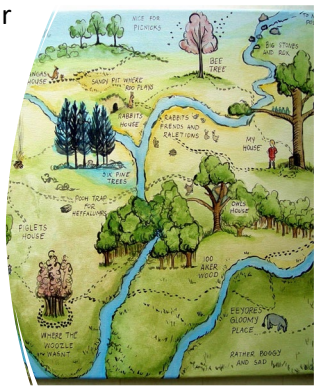
Appendix 1: A science-policy fable[2]

The meeting



It is a beautifully sunny day, with just a gentle breeze. Two friends, Pooh Bear and Christopher Robin agree to meet for a game of Pooh sticks 100 paces down river from Pooh corner. Unfortunately, when they meet, they are on different sides of the river. You see they didn't agree which side, just the 100 paces downstream. Not to be stopped by a trivial issue like that, they try to make the best of it.

Despite the common location, each is experiencing a very different perspective. Pooh is on a riverbank with plentiful willows and alders. There are so many sticks to choose from. Pooh gets to work testing them, making very useful observations about length, size, density and even colour.

Meanwhile Christopher Robin surveys the grass around him, but there is no sign of sticks. Pooh being the kindly bear he is, tries to throw Christopher Robin sticks across the river, he has so many, but none reach Christopher Robin. Instead, the sticks get caught in the trees, float downstream or get stuck on the rocks and are inaccessible for Christopher Robin.

Pooh is sad his friend can't play. But never mind, he has brought his pot of honey for a picnic, there is a lovely shady patch with soft grass for him to sit and consider the best stick to win the race. So much so, he might even write a book describing the attributes of the very best Pooh stick; what a lovely day to spend by the river!

Christopher Robin on the other hand is feeling very uncomfortable. There is no shade, and the sun is burning his neck. There are flies buzzing around and the long dry grass is scratching his legs. And he is feeling hungry. He looks at his watch - he needs to be home for lunch, time is ticking. If only he could get one stick – it doesn't need to be perfect, just to have a chance to be in the game.

Two sides of the riverbank

Pooh has many strengths. He is deeply analytical and understands what makes science trustworthy. He is highly respected amongst his community of peers and trusted by the media. Pooh is also highly networked; he knows who to go to on different science topics.

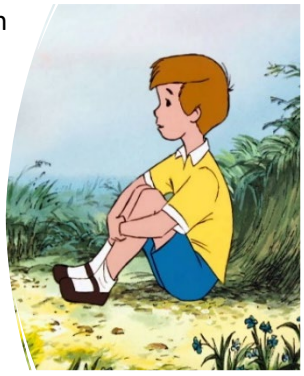
Pooh is motivated by the pursuit of knowledge and generating new understanding. He loves asking why and gets excited when trends emerge from his analysis. He likes to aim for as much certainty as is possible, fill in unknowns, and feel confident in what he is saying. Pooh likes time to think about the problem and builds a picture from the bottom up based on what the evidence tells him.

Pooh loves his lexicon of hypothesis, confusion matrix, Monte Carlo Simulation, machine learning, neural networks, hierarchical clustering etc. Pooh is great at writing papers and gives inspiring lectures on his topic – these are the products that are critical to building his reputation. His performance is often judged against these products as well as the research funding he gains.

Pooh gets frustrated because he can see there is so much opportunity to bring his science into policy, but it's like Christopher Robin doesn't the have the time to engage or listen, only interested at short notice when he needs something. Pooh is also frustrated by policy short-termism, it goes against his moral belief on the importance of intergenerational stewardship.

[2] Gratefully acknowledging the contributions of character and place from A.A Milne

Christopher Robin has many strengths too. He is a generalist, is agile and can turn his hand to most things. He has worked as a private secretary in the minister's office and understands what is needed and in what form to ensure the minister has access to free and frank advice. He is great at briefing notes, Cabinet papers and can talk confidently with ministers. His performance is judged by the timeliness and usefulness of his advice. He understands the machinery of government, the policy process, as well as the risks.



But Christopher Robin is often mistrusted by the public and the media – he is considered a 'bureaucrat'. If only people understood his primary motivation is the 'mission': identifying the problem and working towards a solution. He typically starts with the problem and builds a picture of what is needed, from the top down with the outcome in mind. His language is one of problem statements, regulatory design, legislative reform, participatory governance, and non-regulatory incentives.

Christopher Robin is motivated by the outcomes and the potential to change things for the better, for his children and their children. He recognises knowledge is critical in helping offer up options, but that it is always going to be imperfect and so not knowing enough shouldn't prevent action.

The bridge, and the race

For their next meeting, Pooh and Christopher Robin vow not to repeat their last frustrating day on the river. This time they identify and agree their starting point, firmly shake hands, agreeing also to the purpose of the meeting – a Pooh stick race.

The following day, they meet and walk to the centre of the bridge together. Pooh brings sticks, and summarises their fitness for use, based on what he has observed. He points out the uncertainties, and mentions his friend Owl, who also knows about buoyancy (who knew that was a thing). Christopher Robin writes a set of bullet points, to share with others, prioritising the four most important success factors necessary to account for when preparing for Pooh stick races.

By the time they look downstream, they have a perfectly crafted briefing note, robust and clear on what is known and what is not. It is delivered in the timeframes required to meet need. And pleasingly, two sticks float side by side down the river.

It has been a been a better experience for both, a shared morning tea and a feeling that each has achieved something important to them individually – science being used responsibly and wisely, and policy advice that is grounded in appropriate science and evidence. They also have a story to share with their children, and their children's children.