

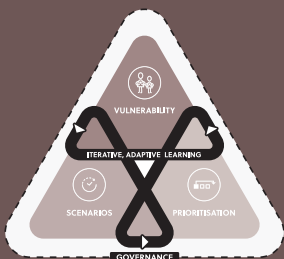
02



Climate and disaster risks:

What they are, why they matter and how to consider them in decision making

Guidance on Governance



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We specifically acknowledge and thank Professor Tom Kompas who worked with the National Resilience Taskforce on describing current limitations of risk matrices.

Disclaimer

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The information contained may not be representative of all audiences and appropriate to all situations. The concepts and knowledge contained in the guidance will improve as the ability to engage more comprehensively with audiences such as the Aboriginal and Torres Strait Islander populations matures and as knowledge about the underlying drivers of climate and disaster risk broadens across society. No liability is accepted for any loss or damage arising from connection with the use of information in all guidance documents.

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Foreword

The risk landscape is changing quickly, and the stability of natural, social and economic systems can no longer be taken for granted. The scale and seriousness of the momentum of change, requires genuine national collaboration, a broad range of knowledge and strategic guidance on navigating growing uncertainty.

Choices made at multiple levels by a wide range of decision makers in both government and industry interact to affect our vulnerability and resilience. Better decision making, guided by new forms of systemic risk governance, assessment and management are key to preventing and reducing climate and disaster risk.

Led by the National Resilience Taskforce and released in April 2019, the co-developed *National Disaster Risk Reduction Framework* (Framework) sets a common agenda for collective action. This new Framework is in part informed by the report *Profiling Australia's Vulnerability* that reflects a fuller understanding of systemic disaster risk and values, choices and trade-offs.

Profiling Australia's Vulnerability brings into sharp focus the reality that hazards lead to disaster where there is exposure of a vulnerable society and where the consequences exceed people's capacity to cope. The report also finds that what we value, and the choices that we make between these values, are different during periods of stability compared with disruption. Understanding this can help reframe how we approach climate and disaster risk reduction efforts into a whole-of-society approach.

The Framework sets a foundation for action for decision makers across all sectors of the Australian economy. It seeks to raise awareness of the causes and effects of climate and disaster risks and to enable decision makers to proactively take steps within their spheres of influence and control to reduce these.

To support its implementation and encourage new conversations about climate and disaster risk, a set of interconnected guidance documents has been developed.

This Guidance is foundational and is a first iteration. It is designed to help decision makers in the non-trivial task of contextualising the systemic physical impacts of a changing climate. In particular, it provides direction on how to call upon knowledge, capabilities and processes to apply climate and disaster risk to governance, strategic planning and investment decisions.

As you *Turn the Page*, you will be contributing to the journey from where we are now, to where we need to be.

Mark Crosweller AFSM

*Head of National Resilience Taskforce
Department of Home Affairs*

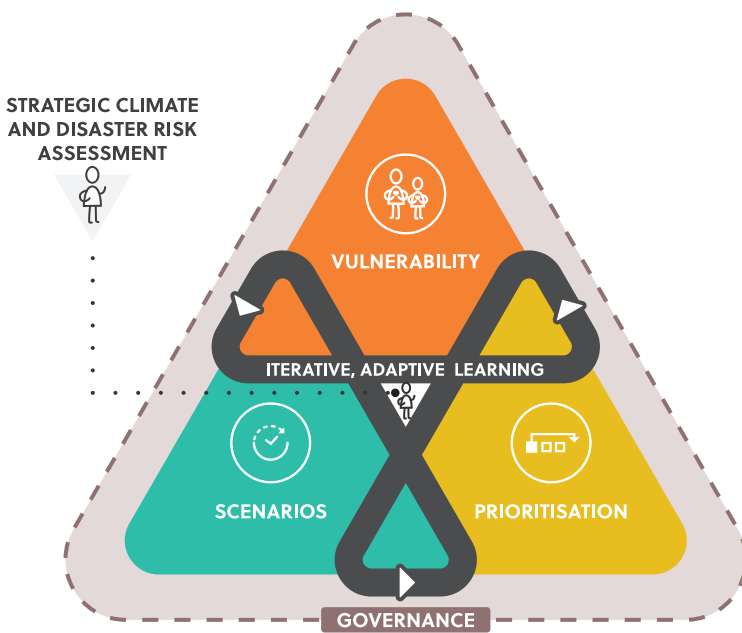


We are Aspiring Towards

A systems and values-based mindset reduces climate and disaster risks.

-  Risk-informed sustainable development
-  Substantial reduction in loss and harm
-  Successfully living with natural hazards and a changing climate
-  Reduced intergenerational vulnerability
-  Wellbeing, trust and confidence

This document is one of a set of interconnected Guidance documents on *governance, vulnerability, scenarios and prioritisation* for enabling strategic climate and disaster risk reduction.



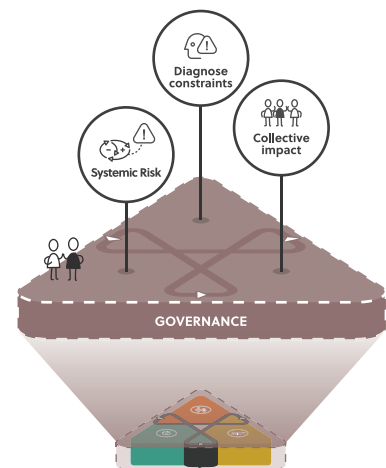
The set of Guidance documents has been developed to help you:

- more holistically understand the systemic nature of climate and disaster risk, particularly the causes and effects of societal vulnerability, using a systems- and values-based approach to assessment and collaboration;
- explicitly revisit the vision, goals, objectives and decision criteria of relevant stakeholders in the context of changing climate and disaster risk;
- recognise which aspects of uncertainty matter when making strategic long-term decisions and how to apply techniques to make robust decisions in lieu of complete knowledge; and
- understand what types of knowledge and information are important for different stages of strategic plans or risk assessments.

The Guidance on Governance can be read and applied in parts, independently or as an integrated set with the Guidance on Vulnerability, the Guidance on Scenarios and the Guidance on Prioritisation. It should be read in conjunction with the Introduction and the supporting Terminology and Concepts.

This Guidance on Governance:

- introduces the concept of systemic risk governance in the context of climate and disaster risk;
- explains the limitations of current governance mechanisms for dealing with systemic risks;
- provides approaches to help decision makers diagnose and strategically overcome governance barriers preventing them from recognising and managing the systemic causes and effects of climate and disaster risks; and
- identifies roles and responsibilities that the public and non-public sectors can play in effective risk governance.



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Approach to developing the Guidance on Governance

The Guidance on Governance has been developed on the principles and practices of inclusive and participatory stakeholder engagement with the private sector, federal, state and local governments, community groups and research/academic agencies. This consultation involved a national survey and many meetings, workshops and focus groups, along with extensive review of published reports, other guidance, journal articles and leading best practice.

It has been constructed on the principles of building on and drawing from existing capabilities, resources, decision processes and initiatives in order to complement existing practices and enable the implementation of the National Disaster Risk Reduction Framework.

1. Introduction

This Guidance introduces the concepts of ‘systemic risk’ and ‘systemic risk governance’. Systemic risks are risks that could trigger severe instability or collapse of an organisation, industry, economy or system. Organisations often refer to systemic risks as ‘strategic risks’ to highlight their relevance or importance to the strategic direction of the organisation.

‘Systemic risk governance’ refers to the rules, norms, routines and practices that enable and constrain individuals and organisations from recognising, assessing and managing the causes and effects of systemic risks.

Governance arrangements can be highly formal, structured, and difficult to change. Jurisdictional boundaries and responsibilities, along with sectoral interests, determine the structure and function of governance arrangements, creating siloes that are not always aligned or complementary.

It is becoming increasingly necessary to revisit and redefine governance arrangements to be more enabling of adaptive, collaborative and cross-scale action as natural, social and economic systems become increasingly interconnected, dynamic and unstable. Doing so during stable times – before emergency or disaster situations arise – can help ensure future decision makers have the necessary systems, capacity and mandates to respond effectively to novel threats or when disaster strikes.

The era of framing, assessing and treating risks as simple ‘likelihood x consequence’ is over¹. New forms of systemic risk assessment, management and governance are emerging to overcome obstacles and to guide better decision-making.

These explicitly consider the complex, uncertain and ambiguous nature of natural hazards and vulnerability under rapid changes to climate, nature environments, economies and populations².

The purpose of this guidance is to introduce people to these emerging approaches to diagnosing and overcoming the governance barriers to acting on climate and disaster risk.

The Guidance on Governance can help you adopt a new mindset. It provides pragmatic actions to overcome the constraints you will face when trying to make decisions about strategically assessing and managing climate and disaster risks.

1 Chapter 2 in UNDRR (2019), Global Assessment Report on Disaster Risk Reduction, Geneva, Switzerland, United Nations Office for Disaster Risk Reduction (UNDRR). https://gar.unisdr.org/sites/default/files/reports/2019-05/full_gar_report.pdf

2 Young, C and Jones, R. 2016. Owing the future: risk ownership and strategic decision-making for natural hazard. Australian Journal of Emergency Management. 31:4 <https://ajem.infoservices.com.au/items/AJEM-31-04-11>; Jones, R. Young, C. and Symons, J. 2017. Mapping values and risks from natural hazards at geographic and institutional scales: framework development. Bushfire and Natural Hazards CRC. <https://www.bnhcrc.com.au/publications/biblio/bnh-3860>; Renn, O. Klinke A. and van Asselt M. 2011. Coping with Complexity, Uncertainty and Ambiguity in Risk Governance: A Synthesis: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3357789/>; UNDP. 2017. 10 Things to Know: Disaster & Climate Risk Governance in UNDP: <https://www.undp.org/content/undp/en/home/librarypage/climate-and-disaster-resilience-/10-things-to-know-about-disaster-risk-governance.html>; IRGC. 2018. Guidelines for the Governance of Systemic Risks. Lausanne: International Risk Governance Council (IRGC): <https://irgc.org/risk-governance/systemic-risks/guidelines-governance-systemic-risks-context-transitions/>

2. Challenges Created by Existing Governance Arrangements

“Risk governance highlights the importance of uncertain, complex and/or ambiguous risks. However, it is a consistent finding that in most of these cases, the risks are treated, assessed and managed as if they were simple”³.

Currently, the responsibilities for disaster risk management and climate adaptation are decentralised from national to local levels. Appropriately, this promotes local solutions to manage the local manifestation of the physical impacts of natural hazards and climate change.

The decentralised governance approach has resulted in an emphasis on preparing, responding and recovering from disruptions and disasters. The roles and responsibilities for reducing the systemic causes and effects of climate and disaster risks are not well understood⁴.

A decentralised approach also means that no levels of government has the mandate, authority, legitimacy or resources to fully address the deeper socio-economic, cultural, regulatory or political forces that put people at risk in the first place on its own.

Numerous challenges and limitations emerge from this situation:


- Past and present decisions made by government, civil society, or corporate entities across all sectors, jurisdictions, and levels of decision-making continue to create climate and disaster risks. Both the causes and effects of these are outside the mandate of the emergency management sector or local governments to control.
- Investments in climate and disaster risk reduction are fragmented. They consist of uncoordinated small-scale initiatives, focussing on individual hazard events and artificially separated from the surrounding, more systemic dimensions creating vulnerability⁵.
- There is a lack of coordination between policy and institutional frameworks for disaster risk reduction, climate adaptation, environmental management, and the broader sustainable development agenda.
- There is no indicative quantification of the investment required for climate and disaster risk reduction. There are also weak mandates or institutional arrangements to incentivise and enable public and private sector finance vehicles to support investment structures for climate and disaster risk reduction projects⁶.
- There is a growing inability of emergency services and locally-led initiatives to manage natural hazards and mitigate consequences through response and recovery. This shift is occurring as climate and disaster risks intensify and increase in frequency and duration, and socio-economic systems become increasingly interconnected, exposed and vulnerable.
- Prevailing decision processes and decision support tools and methods (such as traditional cost-benefit analysis and risk assessments) are not equipped to effectively diagnose or inform the prioritisation of climate and disaster risk reduction options. (see Supplementary Materials and Guidance on Prioritisation)
- Conventional methods perpetuate a narrow framing of risk and only account for a subset of measures of value and success. The consequence is that only a subset of possible options to reduce risk are considered and these tend to be limited to those focused on proximate causes of the problem.

3 Renn, O., Klinke A., and van Asselt M. 2011. Coping with Complexity, Uncertainty and Ambiguity in Risk Governance: A Synthesis. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3357789/> and Renn, O., Klinke A. 2006. Systemic Risks as Challenge for Policy Making in Risk Governance: <http://www.qualitative-research.net/index.php/fqs/article/view/64/131>

4 Lawrence, J. 2016. Implications of Climate Change for New Zealand's Natural Hazards Risk Management. Policy Quarterly. 12:3 <https://apo.org.au/sites/default/files/resource-files/2016/08/apo-nid67895-1187146.pdf>.

5 Twigg, J. 2015. Disaster Risk Reduction. Good Practice Review 9. Humanitarian Practice Network. <https://goodpracticereview.org>

6 Investor Group on Climate Change. 2019. Policies for a Resilient Net Zero Emissions Economy. https://igcc.org.au/wp-content/uploads/2016/04/Policies-for-a-resilient-economy_FINALa.pdf



“Traditional understanding of risk can be likened to a view of the Himalayan peaks from above, with a cloud cover that obscures the topography below. From above, humans have described and named these peaks of risk as if they are separate and independent, when in fact below the clouds the connections are clear. Significant and influential peaks of risk occur that do not rise to the level of the clouds and currently remain obscured from view but are nonetheless highly relevant.”

Source: 2019 Global Assessment Report on Disaster Risk Reduction

3. Navigating Governance Constraints

At the core of risk governance is the need to be aware of, understand, and manage the causes and effects of risks. It is important to be able to diagnose how prevailing governance either does or does not incentivise decision makers to acknowledge, understand and manage the causes and effects of risks. Diagnosis of barriers is insufficient. Decision makers across multiple sectors and jurisdictions also need to be able to identify and co-develop shared agendas and actions to overcome these governance barriers.

Two tools are described to help navigate existing governance constraints.

The values-rules-knowledge (*vrk*) approach provides a novel lens and a structured process for decision makers to diagnose the systemic barriers preventing them from understanding and acting on climate and disaster risks.

The Collective Impact Initiative method is also described. It provides a structured approach for stakeholders to co-develop shared visions, agendas and mutually reinforcing actions to overcome the governance barriers identified from the *vrk* diagnosis.

“Interdependent systems of infrastructure, goods and services and ways of living are inherently reliant on interdependent risks being collectively managed”⁷.

3.1 Diagnosing governance constraints: values-rules-knowledge approach

Where systemic constraints or barriers to making meaningful progress exist, the *vrk* approach can help diagnose the problem and inform potential actionable interventions. Having conversations using the *vrk* approach may better equip us to navigate towards long-term, uncertain futures.

Climate and disaster risk reduction is not a simple matter of identifying how to defend or protect the current system and reality. Transformations brought about by climate change and population growth mean we will have to plan differently to minimise the risk to lives, livelihoods and wellbeing. There are *vrk* barriers that prevent us from being able to do this.

There is a process of continual interaction between the *values* that guide what we want our futures to look like, the *rules* that shape what we can and cannot do to get there, and the *knowledge* we have which informs how best to proceed.

Greater attention is generally required in one of the three *vrk* areas in order to move forward (Figure 1).

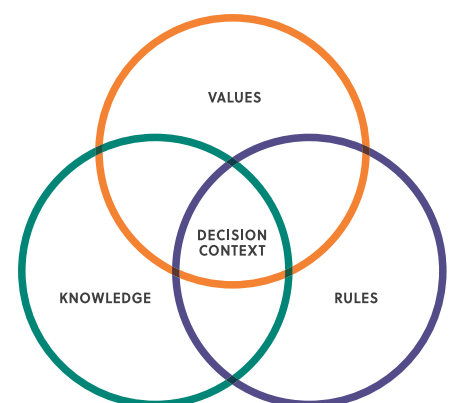


Figure 1: Decision context: values, rules, knowledge (*vrk*)

⁷ Jones, R. Young, C. and Symons, J. 2017. Mapping values and risks from natural hazards at geographic and institutional scales: framework development. Bushfire and Natural hazards CRC. <https://www.bnhcrc.com.au/publications/biblio/bnh-3860>

There are sometimes significant disconnects between what we know, what we value and what we can or cannot do. The *vrk* approach identifies ways to address these disconnects or conflicts by adjusting the rules, seeking new or different kinds of knowledge (not necessarily scientific knowledge), and expressing and understanding values.

The process allows new spaces for action and change to open up when values, rules and knowledge come into closer alignment. When any one of them 'fails' (for example - 'we can't change that rule') we can turn to the others to identify alternative pathways to create change.

The *vrk* approach can be used to diagnose a governance failing by helping to:

- reveal and describe pertinent aspects of the decision context;
- analyse how the decision context influences decisions;
- examine how and why a decision context has developed, persisted or changed; and
- identify strategies for influencing a decision context.

To act effectively to reduce disaster risk, decision makers need to:

- know the implications of their choices (a focus on knowledge);
- want the expected outcome (a focus on values); and
- be allowed that choice (a focus on rules).

The *vrk* lens, also discussed in the Guidance on Vulnerability, helps to diagnose governance constraints that may be preventing leaders and policy, project and risk managers from being able to understand and reduce climate and disaster risk.

Steps to applying the *vrk* approach

The steps below provide a basis for understanding and revealing systemic risk governance barriers. This deeper awareness can inform the creation of agreed and coordinated ways of moving beyond them⁸.

1. Identify the major issue or barrier that is limiting capacity to implement effective disaster risk reduction measures as either value, rules or knowledge. Are there underlying values or beliefs that are inconsistent with your objectives? Are rules or regulations limiting you? Is there a lack of data or understanding?
2. Ensure that you analyse the decision process as it occurs (not as it is idealised) as you identify the issue and seek the views of stakeholders to ensure the incorporation of different perspectives.
3. Identify the knowledge, value or rule that is missing or in conflict and the potential changes required in order to overcome this barrier.
4. Determine if the decision context can adapt without intervention? If not - what is the barrier? (That is, examine how the decision context is maintained or recreated over time, and identify any *vrk* interactions in this process that prevent the decision context from being changed to incorporate the newly relevant value, rule and/or knowledge elements identified in step 3).
5. Identify actions that could influence the dynamic processes that recreate the decision context as described.
6. Reflect on what might limit the implementation of these actions, or of building the capacity of future initiatives to do so.
7. Adopt the Collective Impact Initiative method (see Section 3.2) to enable stakeholders to collaborate in the co-development of mutually reinforcing actions to either influence the decision context, or to build legitimate and effective adaptation initiatives for future change.

3.2 Overcoming governance constraints: Collective Impact Initiatives

Identifying and overcoming governance barriers that are constraining effective climate and disaster risk management, requires collaboration and coordination of diverse stakeholders across multiple sectors and jurisdictions.

All partnerships – whether formal, informal, professional or personal – work best when there is a commitment to achieving a shared vision or outcome.

Motivation builds because all parties have a stake in the future. Collective Impact⁹ Initiatives demonstrate the commitment of a group of important actors from different sectors to a common agenda for solving a social problem at scale.

The Collective Impact Initiative approach is comparable to the steps involved in adaptive decision-making and learning to assess and manage climate and disaster risks (Figure 2).

Such initiatives show how individuals can purposefully and strategically create relationships and good interactions amongst key stakeholders, creating net benefits and moving towards the shared vision.

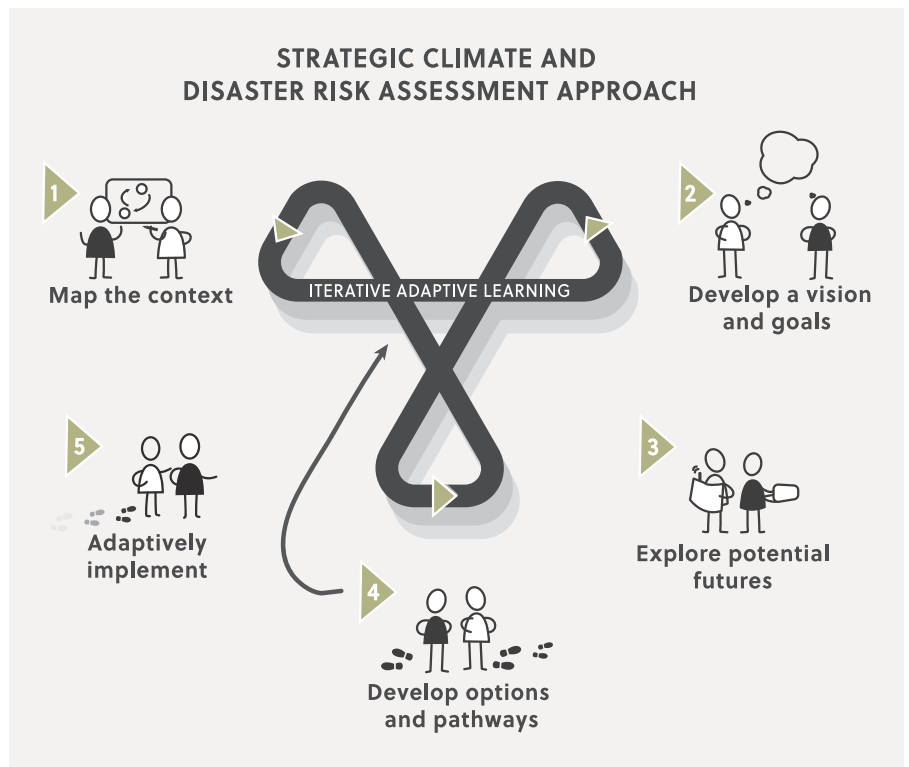


Figure 2: Schematic of the steps involved in adaptive decision-making and learning to assess and manage climate and disaster risks

“If I had to select one sentence to describe the state of the world, I would say we are in a world in which global challenges are more and more integrated, and the responses are more and more fragmented, and if this is not reversed, it’s a recipe for disaster.”

António Guterres, United Nations Secretary-General, January 2019
(source: UNDRR. 2019. Global Assessment Report on Disaster Risk Reduction)

8 Goddard, R. Colloff, M. Wise, R. Ware, R. and Dunlop, M. 2016. Values, rules and knowledge: Adaptation as change in the decision making context. Environmental Science & Policy. <https://www.sciencedirect.com/science/article/pii/S1462901115301210>

9 Various resources on Collective Impact are available from the Stanford Social Innovation Review: Informing and inspiring leaders of social change. https://ssir.org/articles/entry/collective_impact#

Collective Impact Initiatives have five conditions important to success. These align with the steps of the adaptive strategic risk assessment process.

1. Set a common vision and agenda

All participants create or have a shared vision for change that includes a common understanding of the problem and a joint approach to solving it through agreed-upon actions. The Guidance on Scenarios provides advice on how to create a vision and the pathways to achieve this.

2. Use a shared measurement system

All participating organisations agree on what needs to be achieved, and identify a tangible outcome. They determine how that will be measured and reported, with a short list of common (well rounded) indicators identified and used for learning and improvement.

3. Find mutually reinforcing activities

Each entity contributes activities to the common, mutually beneficial goal. The power of collective action comes from the acknowledgement and coordination of the unique strengths of diverse stakeholders.

There is power too, in recognising that outcomes could not be achieved in isolation. The Guidance on Vulnerability provides advice on how to reveal causes of vulnerability and points of intervention to begin to overcome these.

Critical to making progress is the requirement that relevant entities understand and accept the importance of the goal, and their own roles in the process, including where each may have a clear lead

role, or where it can appreciate others' perspectives and leadership actions. The mutually reinforcing relationships required for this will often need to be sustained for extended periods. This is possible through a virtuous cycle of communication, reciprocity, cooperation and trust.

4. Maintain continuous communication

Communication is core to the necessary relationship building. All stakeholders should engage in frequent and deliberate open communication to build trust, assure mutual objectives, discuss learnings and sustain common motivation.

Effectively navigating the complexities that come with a new way of thinking about climate and disaster risk reduction also needs new forms of communication. Helping people develop the skills and ability to broker knowledge needs to be cultivated, resourced and prioritised.

5. Identify boundary-spanning organisations

Coordinated efforts are necessary, but they are not without cost. Coordination is expensive in terms of time, effort and attention. Coordination at certain scales and times could require a bridging institution, social arrangement, or network that acts as an intermediary between traditional risk owners. Boundary-spanning organisations bridge structural holes between different sources of knowledge and risk ownership and create networks through building trust.

Examples of boundary-spanning organisations include the Bushfire and Natural Hazards Co-operative Research Centre, the Australian Institute Disaster Resilience, the National Climate Change Adaptation Research Facility and the Grattan Institute.

In addition to boundary-spanning organisations, people or 'knowledge brokers' are also needed who have adequate training, an ability to hold a broad view, and can see climate and disaster risk in all its interconnectedness as a many-sided phenomenon. Skills to coordinate and effectively navigate this web of systems may be more important than technical skills for reducing climate and disaster risk, in this context.

Collectively, knowledge brokers can break down 'monopolies on advice' by bringing in new ideas, giving rise to a more competitive model of knowledge provision and enabling decision makers to obtain value and consider knowledge they would not otherwise have.

Governance arrangements and organisational culture can prevent any one or more of these five conditions from being realised. Organisations can usefully adopt the *vrk* approach to understand their internal governance constraints to inform their own governance reform agenda that will allow them to engage effectively with external stakeholders to overcome broader societal governance barriers.

4. Roles and Responsibilities

Clarifying roles and responsibilities is required to diagnose and overcome governance constraints to promote effective investments in climate and disaster risk. Governance encompasses, but also transcends, government. There are many others, including the private sector, industry, community, elders, households and individual citizens – all with allied, but different, governance systems.

4.1 The public sector

Governments at all levels can and do have important roles to play in incentivising and enabling climate and disaster risk reduction. They have a duty to ensure the safety of their citizens. They are likely to have the resources and capacity to undertake large-scale multi-disciplinary initiatives, and a mandate to direct or coordinate the work of others. Governments also create the policy and legislative frameworks within which risk reduction can be accomplished.

Options available to governments to address these challenges and better enable climate and disaster risk reduction include:

- promoting and supporting cooperation and partnerships amongst private, public and not-for-profit agencies for collective action to reduce climate and disaster risks;
- providing financial and technical support for research and development into better understanding the novel and systemic nature of the risks; and for boundary-spanning organisations with science-policy competence to engage experts and decision-makers at local and regional scales in iterative exchanges of information to promote learning;
- creating a licence to talk about climate and disaster risk and about what we value, and to develop a clear narrative that articulates our vulnerabilities to climate and disaster risks and how we can collectively address this to more successfully live with natural hazards and a changing climate;
- building national capabilities in climate and disaster risk assessment, data and information. In particular, supporting the development of authoritative sets of consistent scenarios of climate and disaster risk at the national, state and regional scales, and regular updates to the assessments and quantification of the investments (and potential pathways / roadmaps) required for climate and disaster risk reduction; and
- developing the policy, regulatory and planning frameworks to promote transparency, understanding and incentives for climate and disaster risk reduction, (for example business case assessments, planning processes, and building standards that ensure land-use zones and infrastructure investments are not unduly exposed or vulnerable to disruption from natural hazards).

“Our challenge is that there is only so much we can do as one small part of the complex system and not all parts of the system have the necessary sense of urgency to deal with the risks.”

Quote Source: *Anonymous (Strategic Climate and Disaster Risk Assessment Survey, National Resilience Taskforce, 2019)*

4.2 The non-public sectors

Agencies in both the private and not-for-profit sectors are becoming actively involved in climate and disaster risk reduction. They are aware of the increasing impacts, damage and costs being incurred by people and companies as a result of weather and climate-related events.

They also have growing legal and regulatory requirements to report on their exposure and vulnerability to climate and disaster risk.

There is significant capital to be gained through corporate social responsibility initiatives in risk reduction. There is also significant opportunity in recognising the important role the private sector plays in shaping society, the environment and contributing to sustainable development.

Not-for-profit and private sector agencies can play a vital role in climate and disaster risk reduction. They can:

- provide resources, expertise and essential services on which the community depends;
- understand the risk to their own strategic objectives and physical assets by a changing climate and ensure continued supply of goods and services during and following disaster;
- recognise the investment and savings opportunities provided by mitigation;
- partner with communities and governments in raising awareness and developing mitigation strategies;
- integrate sustainability into their own portfolio management; and
- engage in dialogue and partnership with stakeholders in government and society.

For example, insurers and other firms publish and distribute information on disaster impact and risk reduction measures. Insurance and reinsurance companies have also sponsored important hazards research, and in some public-private insurance schemes the premiums are reduced if households or communities demonstrate that they have taken certain steps to protect their property.

Responsibilities for climate and disaster risk reduction cannot be equally shared. There are imbalances in capabilities, capacity, agency and mandate to take action to manage these risks.

Identifying and developing appropriate risk-sharing arrangements requires deeper understanding of how the broader systems of rules, societal values and knowledge incentivise or disincentivise the creation and transference of risks (See Guidance on Vulnerability).

Regulatory and legal requirements to understand, manage and report on climate and disaster risks

There is growing pressure from regulators and shareholders for businesses to disclose climate and disaster risk. This is driven by recent international and domestic developments, including recommendations of the G20 Financial Stability Board's Task Force on Climate-Related Financial Disclosure (TCFD).

The Australian Prudential Regulation Authority and Australian Securities and Investment Commission have stated that climate-related physical and economic transition risks are foreseeable and material financial risks that should be addressed by company directors alongside all other financial risks.

Mainstream investors are divesting from stock in exposed industries. Credit rating companies are reassessing credit ratings to factor in climate-related risks. Several banks have commissioned analysis of their mortgage books based on location. The Investor Group on Climate Change, in its 2018 Investing in Resilience report, predicts that the ability to differentiate investment opportunities by climate risks will be a key financial metric within the next 3-5 years.

The 2016 legal opinion from one of Australia's leading commercial barristers, Noel Hutley SC, found that Australian company directors who fail to consider 'climate change risks' now, could be found liable for breaching their duty of care and diligence under the Corporations Act in the future. In Mr Hutley's view, *"it is likely to be only a matter of time before we see litigation against a director who has failed to perceive, disclose or take steps in relation to a foreseeable climate-related risk that can be demonstrated to have caused harm to a company."* These developments provide strong incentives to take action to reduce disaster risk and position Australia for the future.

The 2016 Hutley opinion on directors' duties and climate risk and updates are available from: <https://cpd.org.au/2019/03/directors-duties-2019/>

A guide on climate risk disclosure to assist boards and their committees has also been prepared by MinterEllison: <https://www.minterellison.com/articles/climate-risk-reporting-notes-for-directors>

5. Tools and Resources

Other flexible and adaptable approaches are emerging to help organisations address the difficult problem of assessing or measuring systemic risk, of modelling cascading consequences, of applying different management instruments and of implementing participatory processes.

The International Risk Governance Council (IRGC) systemic risk governance guidelines¹⁰

The IRGC recognises that complex systemic risks are fundamentally different from conventional risks, and traditional risk management practices are not sufficient for dealing with them. The guidelines address the question of how to deal with systemic risks in the context of transitions, i.e. in situations that require adaptation to new context conditions or transformation. Examples include desertification processes, fisheries depletion, transformation of energy systems or new transportation systems and even mobility patterns.

Risk Ownership Framework for Emergency Management Policy and Practice¹¹

The Risk Ownership Framework for Emergency Management Policy and Practice was developed and applied in collaboration with the Victoria Institute of Strategic Economic Studies and the Bushfire and Natural Hazards CRC (BNHCRC). It recognises that if a risk is not recognised, acknowledged or understood, or if an individual or organisation does not have the agency, means or incentives to understand and manage risks (or is not dis-incentivised from creating the risk in the first place), it is very likely new risks will be created and existing risks not managed or transferred to others.

Recognising effective disaster risk governance requires greater understanding and transparency of risk ownership, i.e. 'Who is making the decisions that create risk and for whom?'

The BNHCRC developed the framework for understanding the ownership of risks from natural hazards at the institutional level in order to improve risk governance.

2019 Global Assessment Report (GAR) on Disaster Risk Reduction¹²

GAR is a comprehensive review and analysis of disaster risk and risk management published every two years. GAR 2019 moves beyond disaster risk to consider the pluralistic nature of risk: in multiple dimensions, at multiple scales and with multiple impacts. It provides an update on how we – as governments, as communities and as individuals – understand our relationship with risk and its reduction.

¹⁰ IRGC. 2018. Guidelines for the Governance of Systemic Risks. Lausanne: International Risk Governance Centre (IRGC)

¹¹ Young, C. K., Jones, R. N., Kumnick, M., Christopher, G. and Casey, N. 2017. Risk Ownership Framework for Emergency Management Policy and Practice. Bushfire and Natural Hazards Cooperative Melbourne, Victoria Institute of Strategic Economic Studies (VISES), Victoria University. <https://www.vu.edu.au/sites/default/files/risk-ownership-framework-for-emergency-management-policy-and-practice.pdf>

¹² UNDRR. 2019. Global Assessment Report on Disaster Risk Reduction, Geneva, Switzerland, United Nations Office for Disaster Risk Reduction (UNDRR). https://gar.unisdr.org/sites/default/files/reports/2019-05/full_gar_report.pdf

6. Supplementary Materials

6.1 Risk matrices – time to move beyond, or at least repair them?

Risk matrices are a well-established decision-support tool in government, business sector (large corporations in particular) and non-profit organisations. They create a two-dimensional representation of risks based on the combination of the likelihood of an event (or group of events) *occurrence* and the consequence of the situation arising, though precise terminologies used differ.

These matrices force judgements and assessments into discrete categories rather than create a continuous range of relationships between likelihood and consequence, which are often easier to use than continuous and potentially complex relationships. These categories should be, but are not always, linked to quantitative expressions of likelihood and consequence.

The most common approach is to mimic an expected value calculation in finance, by multiplying assumed or estimated likelihood and a financial loss value as an expression of consequences (so in effect a risk matrix of this type seeks to specify expected loss for a set of discrete scenarios). However, unlike in investment finance, there is no specification of the decision-makers' appetite for risk. There are usually visual depictions using colour coding to draw attention to risk 'hot spots' created by the combination of different likelihoods and consequences.



Risk matrices have the advantage that they are easily produced compared to more complex types of risk assessment, and the visually expressed conclusions are easy to grasp – especially for decision-makers without statistical and mathematical expertise. They direct attention to possible future situations over which we should focus our concern, and therefore, in principle, help us make decisions that should reduce our exposure to risks in the future.

In his research, Cox identifies a number of (potentially severe) technical limitations in how risk matrices are used:

- 1 First, there is the **risk acceptance inconsistency** problem. The use of colour coding to reflect the implicit expected loss estimates based on multiplying likelihood and financial loss tends to lead to confusing and inconsistent risk assessments. This can lead to high priorities for risk mitigation being set for relatively moderate expected loss scenarios.
- 2 Secondly, there is a **range compression** problem. Identical risk ratings are applied to qualitatively different risks. For example, a risk matrix in the oil and gas sector may assign an oil well-control failure risk and a full-blowout similar likelihood and consequence categories. However, in reality a blowout is a far more serious and costly system failure than a well-control failure that is contained and does not lead to a blowout. Very different risks of this type may even be bundled together into the same categories for the sake of avoiding too many cells in the matrix. In either case, the loss of analytical resolution from range compression can distort and limit the effectiveness of decision making.
- 3 Thirdly, there is a **centering bias** problem. This is a psychological tendency for people to avoid extreme values, which can result in amplifying the range compression problem.

Cox's work on the technical errors generated by current risk matrix forms concluded that typical risk matrices have such poor resolution that they are only able to unambiguously compare less than 10 per cent of randomly selected hazards. He found that if likelihood and consequences are negatively correlated (which is not unusual) then decisions based on conventional risk matrices will be 'worse than useless' in the sense of creating worse than random decisions.

There are also problems created by subjective interpretations of the wording used to describe likelihoods or probabilities. Different people can describe different numerical likelihoods using different available labels if precise matchings are not provided. This indicates that sticking to numerical estimates is preferable in order to avoid the resulting confusion (similar semantic problems are encountered in security intelligence analysis).

The scientific work referenced here points to a next generation of risk matrices that are accurate enough to inform decision-making.

They will need to be based on more robust analysis and modelling that considers co-dependencies between risks, and avoids introducing fundamentally distortionary errors of the type identified by Cox. If the easily grasped results of a conventional risk matrix can be combined with robust quantitative analysis and modelling to create the risk assessment, then this approach may be useful for informing decisions relating to systemic disaster vulnerability.

Accuracy specification will be essential to this next generation of risk matrices, ideally by stating and clearly communicating the likelihood that a given estimate falls within a specified margin of error. Risk management in public policy settings could be improved by treating interventions explicitly as hypothesis tests applied over the entire policy cycle (from ex ante appraisal through to ex post evaluation). It could provide a seamless and integrated methodology for evidence-informed 'risk aware' policy.

The use of 'causal networks' is key here, along with 'natural frequency' data that directly expresses the relative incidence of observations that can be used to generate odds-based expressions of risk using competing hypotheses. This approach allows the overall prevalence of diagnostic errors in hypothesis tests (i.e., false positive and false negative results) to be factored into risk assessments.

Tracking the incidence of false positive and false negative test results and learning how to minimise these misleading conclusions over time is critically important to risk management because it avoids 'red herring' and 'unsafe comfort zone' conclusions. Confusion Matrices track the balance of false positive, true positive, false negative and true negative test results. Receiver Operating Characteristic (ROC) curves plot how much better or worse than random a risk assessment regime is able to perform in practice.

The categories used to characterise risks must be the ex post product of quantitative analysis not an ex ante categorisation imposed on the situation before it has been analysed properly. It is this categorisation before proper quantitative analysis that drives the risk matrix accuracy problems identified in the scientific literature.

References for Supplementary Materials

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