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RISK OWNERSHIP FOR NATURAL HAZARDS: SUMMARY OF KEY RESEARCH FINDINGS

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TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

Risk ownership is the one constant in a highly changeable risk landscape; where there is a risk, there needs to be a risk owner. If a risk is not owned, it is very likely it is not being managed.

To date, government expenditure has shown a bias towards funding response activities over mitigation.

"We spend 97% on disaster funding money dealing with the after-effects of things as they occur, and only 3% on mitigating a disaster before it happens." Michael Keenan, Minister for Justice, Australian Commonwealth Government. (*The Guardian*, 2015)

The cost of natural hazard events is increasing and is expected to exceed $23 billion annually by 2050 based on estimates of changing exposure and not taking into account changing hazards (Deloitte Access Economics, 2013) but currently. This is driving the need to rethink expenditure, and to invest more deeply in mitigation and resilience to reduce the costs of these events.

The ability to address these challenges requires developing longer term strategic thinking. It also requires an understanding and acceptance of the long-term consequences of hazard-based risks and who owns the associated risk management activities. As many of the current arrangements in the Emergency Management Sector have a response-based focus, this provides a substantial challenge, because it requires new ways of thinking and acting that extend beyond response. This is particularly relevant to longer term activities, such as building resilience, where risk is 'everyone's responsibility'. Skills and capability at all levels from policy to practice to support both strategic planning and the allocation of risk ownership activities are needed if this is to be achieved.

Shared ownership was found to be difficult, because it is systemic, involving multiple agendas and risk actors. Determining shared ownership requires understanding not only who owns the risk, but how it is allocated, how it is owned and if ownership obligations can be fulfilled. Our research highlighted the need to link with other areas of policy, such as regional development and climate change adaptation, to understand more fully the ownership landscape. Boundary organisations play a key role, by linking institutions to support longer-term activities, particularly those that relate to resilience and recovery.

Social values were found to be the largest group of values identified as important during the scenario workshops, and the community was considered to be the largest owner of these. However, the community was found to have little formal allocation of risk actions associated with these values. The longer term risks appeared to be poorly understood, particularly in the case of natural hazards such as heat waves and flood. We also found considerable gaps in ownership of both environmental and social values and in allocated ownership of risk actions extending beyond 2 years.

Of particular concern was the imbalance in allocations between the ownership of values and the ownership of the different aspects of risk associated with these (Figure 7, p. 21). In the two areas of impact, consequence and risk, and risk actions, the majority of ownership was found to lie with state and local government, which is potentially unsustainable. There was also a lack of clarity in areas of shared ownership, particularly in areas of intangible (non-monetary) values, which are often complex and

systemic. This is highly likely to result in ownership being unacknowledged, creating greater vulnerability to impacts as a result.

Many of the activities needed to build resilience to natural hazards and to support longer term recovery, were found to be based on social contracts or goodwill rather than formal arrangements. The Emergency Management Sector increasingly recognizes the need to engage the community more fully during the risk assessment process to ensure better risk ownership. As a result, we developed a process framework that can be used as part of the current risk planning activities. This process starts by identifying values as a way of prioritizing the most important risks. Key activities identified during the research are described to provide guidance on how to identify, map and apply strategic risk ownership. Collaborative decision making is central to the process and so negotiation to build consensus is needed to ensure that ownership is understood and accepted.

The most common ways of allocating ownership were found to be through the ownership of the asset, funding or finance, or the process of managing the risk itself. As a way of identifying these specific areas during this process, we developed the RAP criteria. The criteria asked the questions: 'Who is responsible?', 'Who is accountable?' and 'Who pays? It proved to be useful for clarifying areas of ownership, but was also found to be contentious. Application of this criteria was found to need a well-facilitated process in group settings and appropriate time to achieve effective outcomes.

During both the workshops and subsequent interviews, participants acknowledged that developing a more strategic approach was a considerable challenge, requiring time, resources and cultural change. Also, that innovation and investment are needed to support the building of capability in these areas if they are to be realised. Areas identified for further research include clarifying what balance of ownership allocation is likely to be most sustainable over time and identifying and understanding social contracts associated with risk ownership within and between public and private domains.

This report provides a summary of the risk ownership research from the Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC) project "Mapping and understanding bushfire and natural hazard vulnerability at the institutional scale" and draws upon the following reports and papers:

- Risk ownership framework for emergency management policy and practice (2017).
- Owning the future: risk ownership and strategic decision-making for natural hazards (2016).
- Institutional maps of risk ownership for strategic decision making (2016).
- Understanding values at risk and risk ownership: Workshop synthesis report (2016).
- Understanding our values at risk and risk ownership workshop: Context paper (2015).
- Whose risk is it anyway? Desktop review of institutional ownership of risk associated with natural hazards and disasters (2015).

2 KEY RESEARCH FINDINGS FOR RISK OWNERSHIP

- The four key aspects of risk ownership which were found to be important are: Who owns the risk, how it is allocated, how it is owned and whether ownership obligations can be fulfilled.
- There is a need for innovation and investment to support collaborative decision making across communities, governments and private business and industry to enable risk ownership.
- Risk ownership was found to show an imbalance between the public and private sectors, which is potentially unsustainable. Ownership allocated to the public sector was 53% for values at risk, 73% for risk and consequences, and 69% for risk actions, mostly to state and local government.
- Risk ownership relevant to strategic decision making is ill-defined in the Emergency Management Sector, particularly for longer term activities focusing on recovery and resilience building. No long-term (2+ years) policy, plans or strategies for environmental or social recovery to natural hazards were found.
- Knowledge gaps were found across long-term strategic horizons (2+ years) in relation to ownership of risks and consequences, and resilience and recovery activities, particularly for flood and heatwave hazards. Knowledge gaps were also found in relation to valuing and identification of social and environmental values.
- Although there is a working understanding of what risk ownership is in the Emergency Management Sector, common understandings and skills need to be established across the broader stakeholder group in practice areas relating to risk ownership, systemic risk and strategic planning.
- Risk ownership in areas contributing to resilience and risk reduction were found across multiple agencies and agendas. This was particularly the case in agencies who work with regional and community development and climate change adaptation. Co-ordination between contributing agencies and agendas is needed to clarify ownership and support more effective allocation and use of resources.
- Social contracts play a critical role in risk ownership. Because of this, risk ownership is often a negotiated process, as people need to understand and accept the risk before they will own it.
- Risk ownership using values based decision making needs to be integrated into current risk assessment frameworks to be effective.
- Boundary organisations such as not-for-profit organisations and peak bodies play a key role in building resilience and longer term recovery.

3 PROJECT BACKGROUND

Current federal government spending on natural disaster response is more than 20 times spending on preparedness (Jones et al 2017). When natural disasters are large and combine in unpredictable ways, they cross domains, moving from the private to the public realm, and shifting from a local, to a state or national concern. Many climate-related natural hazards and the number of people living in hazard prone areas are increasing, raising the potential of future, unmanaged loss.

The spending mismatch between response and preparedness is well understood, but we also face potential deficits in important social and environmental values. Liveability, sustainability and resilience are vital aspects of communities and the environment, but their contributing values are not well understood. These values are often public, shared and non-market, so if they are at risk, may not have clear owners. If risk owners – those responsible for managing these values – can be clearly identified, then we can begin to assess the balance between preparedness, potential damage and post-event recovery. Unowned risks may lead to values being damaged or lost.

The project mapped a broad range of economic, social and environmental values, and related these to natural hazards within Victoria. The concepts of risk ownership and values at risk were explored through a desk top review, a series of research workshops with end users and the co-development of a framework with end users to support risk ownership activities. The project was explored though who 'owns' the values, how they own them and what happens to them across different temporal and geographical scales. A processed-based framework to support better application of risk ownership was developed.

This project aimed to benefit decision makers in institutional areas such as local, state and federal government, the community and relevant private sectors, by helping them to better identify the different economic, social and environmental values at risk from natural hazards. It also aims to help clarify areas of risk ownership and show how governance can support the long-term management of natural hazard risk with respect to preparedness, resilience and effective recovery.

The project goal was to enable more effective decision making through the allocation of risk ownership at the institutional scale and to provide greater understanding of how economics could support decision making. This will in turn inform the development of measures, including investment strategies, resilience and risk mitigation. Key outputs have included:

- An economic geography of values at risk at geographic and institutional scales. Its appearance and output has been developed in consultation with key stakeholders.
- Development and testing of the RAP criteria for assessing areas of risk ownership (Who is responsible? Who is accountable? Who pays?).
- A framework for understanding and assessing risk ownership which can be integrated into current risk assessment processes.

4 INTRODUCTION

This research examined the allocation of risk ownership for the strategic management of natural hazard risks in Australia through a series of research activities which included, a desk top review of publically available documents, a series of scenario based workshop, interviews and feedback workshops.

Risk ownership was restricted to strategic pre- and post-event for natural hazard disaster management. Other aspects of ownership, such as the undertaking of emergency response, were not addressed due to the difference in the decision making approach in this area. The areas of hazards examined were bushfire, flood and heatwave.

Ownership was examined within a matrix of broad institutions (federal, state/territory and local government, business and industry and civil society) and values (built, social, economic and environmental).

It was explored through three questions which formed a simple assessment method called the RAP criteria, which used the following questions to determine how ownership was delegated. These questions were:

- Who is responsible (manages) for the risk?
- Who is accountable for the risk?
- Who pays for the risk?

These questions examined allocation of risk ownership of both values that were affected by natural hazards and the associated risk management activities.

The key findings were described according to the strategic activity areas of the risk management process for natural hazard:

- Building and maintaining resilience
- Mitigation
- Plan and prepare
- Early response and recovery
- Medium response and recovery
- Long-term response and recovery

The aim of this research was to understand current strategic decision making in relation to the identification of values, risks (including impacts and consequences), ownership of values and risks and needs arising from these areas. A mixture of basic statistical methods and analysis were applied to synthesise the data and information obtained. This research was then used as a basis for developing institutional maps of risk ownership and also the ‘Risk ownership framework for emergency management policy and practice’.

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5 SUMMARY KEY THEME RESEARCH AREAS

5.1 DEFINING RISK OWNERSHIP

Risk ownership is a term used to define who owns a risk and how they own it. It is important because if a natural hazard risk is not owned, or ownership is not acknowledged or unclear, it is highly likely that is not being managed. This can lead to greater initial impacts during an event, and also an increase of both risks and impacts over time, which can increase vulnerability to potential future impacts.

Risk ownership was determined in the research through either ownership of a value (asset) that is at risk or actions associated with management of a risk. This was drawn from the following definitions:

1. The ISO 31000 standard defines risk as being "… a person or entity that has been given authority to manage a particular risk and is accountable for doing so." (ISO, 2009).
2. The Productivity Commission aligns risk ownership with assets stating "… asset owners are generally best placed to manage risks to their property." (Productivity Commission, 2014, p. 314).

These were then divided into three decision-making areas where ownership of natural hazard risk was identified (Figure 1):

- Ownership of the assets at risk from natural hazards.
- Ownership of the risks associated with short to long-term impacts and consequences of natural hazard events (both direct and indirect effects).
- Ownership of actions in relation to those assets (values) at risk to either mitigate, build resilience to, or recover from natural hazard events.

FIGURE 1: AREAS OF DECISION MAKING FOR RISK OWNERSHIP

Connecting ownership across these three areas of decision-making ensures that risk ownership can be identified across the full activity spectrum of a natural hazard event (see Figure 2) and includes:

- Prevention (mitigation) – where the severity of the hazard is reduced, saving damage and recovery costs.
- Preparation – where damage is reduced by pre-prepared actions before or during the event (not including direct response measures to reduce the hazard).
- Resilience – non-specific measures to improve resilience not covered by the other three categories.
- Recovery - measures for improved recovery following the event.

Mapping across these areas makes it possible to assess more clearly the balance of ownership between institutions and organisations to ascertain how sustainable these arrangements are into the future.

Ownership can also be allocated to response activities but as this research focused on the strategic area of decision making, this area was omitted as it uses a different form of decision making, which is tactical.

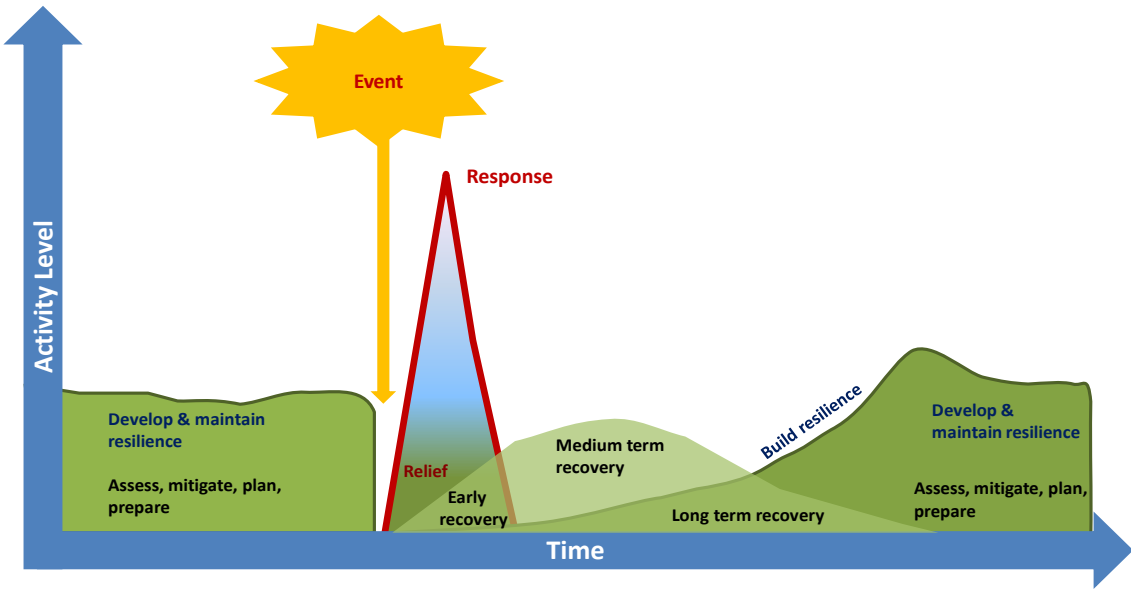

FIGURE 2: PROJECTED RESOURCE REQUIREMENTS FOR EFFECTIVE INTEGRATED NATURAL HAZARD RISK MANAGEMENT TASKS ACROSS TIME SCALES (YOUNG ET AL., 2015B; ADAPTED FROM AEMI, 2011).

5.2 WHO OWNS THE RISK

Resilience is fundamentally changing how we need to think about natural hazard risk because it is systemic and is everyone's responsibility, so all the parts of our society are potential owners who need to understand and accept the risk.

There were found to be three main types of owners; institutions, groups and individuals (Table 1) and as a result risk ownership has the potential to be assessed across these three levels. However, for this research we chose to focus on institutional ownership.

Ownership of values and the associated natural hazard risks are often shared which can lead to a lack of clarity as to how the risk is owned or at times risks being unowned. This is particularly the case with over-arching values (such as resilience) and intangible values (such as community wellbeing) that depend upon multiple stakeholders.

Many current institutional and organisational structures are not set up to enable or support collaborative arrangements that can accommodate shared ownership. Maintaining accountability in shared ownership arrangements is also challenging – particularly over the longer term, as roles and expectations may change due to the changing contexts and nature of events and so arrangements surrounding ownership need to be flexible and adaptive.

Level	Definitions	Example owner
Institutional	Formal or informal structures and arrangements that provide 'the rules of the game' (North, 1990) that govern and shape behaviour of a common set of groups and individuals.	Community, state, local and federal government, boundary organisations, business and industry.
Group	Groups of individuals who share a common interest or purpose.	A particular community, organisation, agency or network (this can also be a virtual community).
Individual	Individual person or legal entity.	Risk manager, house owner, property manager.

TABLE 1: LEVELS OF RISK OWNERSHIP.

The institutional level was used in this research for identifying the primary stakeholder groups of risk owners and their level of ownership (see Figure 4). This was important because risk ownership needs to be distributed and managed in the long term across all levels of society, if society is to be resilient and sustainable. The key institutional categories we have defined were:

- Local Government
- State Government
- Federal Government
- Business and Industry
- Community
- Boundary organisations.

The two other levels of ownership, the agencies and organisations that make up these institutions and the individuals who make up those agencies, can be used to provide specific detail which support activities. Assessment of these levels can help identify areas of over allocation and operational risk that may result from this. Ownership is also often shared across all these levels, and as a result it is important to clarify not only who owns the risk but how it owned to ensure accountability and responsibility are clearly determined and understood.

5.3 HOW RISK OWNERSHIP WAS FOUND TO BE ALLOCATED

The main instruments used to allocate risk ownership are shown in Figure 3 (overleaf). Policy and strategy relate to over-arching principles and plans that guide and direct the economic, social and environmental terms for influencing the management and mitigation of natural hazard risks. Plans and assessments address the development of specific actions and their implementation – contracts and agreements are part of this process. Legislation provides the framework for the legal aspect of policy making, and regulations and standards support the enforcement of these by providing regulatory processes and rules.

Risk ownership can also be allocated in relation to hazard where specific authorities and agencies are charged with managing a specific area of risk; for example, bushfire or flood mitigation. This can be problematic for emerging hazards such as heat waves where understanding and management strategies are still being developed.

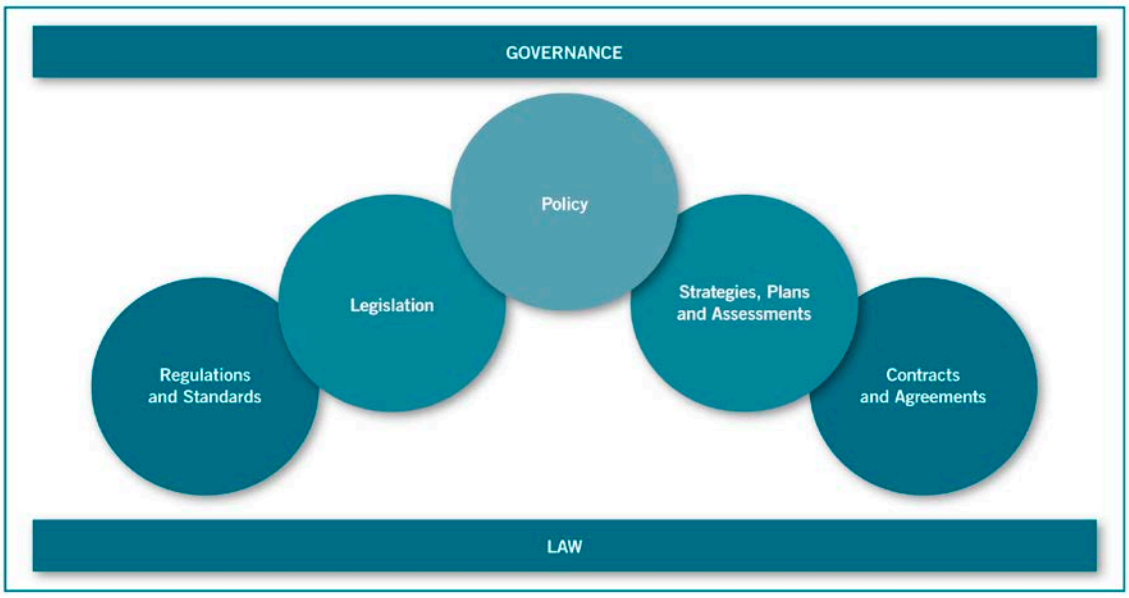

FIGURE 3: INSTRUMENTS FOR ALLOCATING RISK OWNERSHIP

Governance and law are components associated with all these instruments. Governance provides the frameworks for establishing accountability. The legal system provides the framework through which aspects of this can be tested and enforced. These instruments are applied across institutions in different ways (Table 2).

Instruments	Application in ascertaining risk ownership
Policy	All levels of government, industry and business, and aspects of civil society. Includes overarching policy and principles at federal, state and local government levels, and organisational policies in the private sector and community agencies.
Legislation	All institutions, but less so for civil society, compared to government. Includes international, federal and state legislation.
Regulations and standards	All levels of government and industry and business, but less so for civil society. Includes building and planning, consumer protection, official standards and professional codes of practice.
Strategies, plans and assessments	Applicable to most areas of society in the form of risk assessments and response plans at federal, state, regional, municipal, sectoral, community and organisational level. Communities have little accountability in this area but can be allocated roles via specific policies. Also strategies associated with international treaties Australia is a signatory to.
Contracts and agreements	All areas of society covering government, industry and business, and communities. Contracts are a key driver for industry and business. These include vendor agreements, contractual arrangements, commercial law , common law and community arrangements. Includes all international legally binding treaties and agreements.
Social contracts	Social contracts apply across all levels of society. These are arrangements that are agreed upon but have no specific formal structure, and are implied rather than explicit. The arrangements are often based on understandings or unspoken rules that exist between individuals, communities/organisations or institutions.

TABLE 2: APPLICATION OF INSTRUMENTS FOR RISK OWNERSHIP.

Policy and strategy relate to over-arching principles and plans that guide and direct the economic, social and environmental terms for influencing the management and mitigation of natural hazard risks.
Plans and assessments address the development of specific actions and their implementation. Contracts and agreements are elements of this process.
Legislation provides the framework for the legal aspect of policy making, and regulations and standards support the enforcement of these by providing regulatory processes and rules.
Governance provides the frameworks for establishing accountability. The legal system provides the framework through which aspects of this can be tested and enforced.
Social contracts are often informal agreements and are implicit arrangements that are not enforced or enforceable. They are often the basis for ongoing activity that is needed to support resilience and recovery activities.
Law provides a mechanism for, establishing rights and responsibilities in relation to assets and risk and enforcing these through instruments such as contracts and common law.

5.4 THE DYNAMIC NATURE OF RISK OWNERSHIP

'**People always seem to talk about disasters as continuity but in my experience it is often disjointed and disconnected.'**

South Australian Workshop Participant (Young et al., 2016a)

Exposed to natural hazards, risk ownership can change abruptly. Two of the key ways this can happen are as a result of:

- risk contagion, and
- the exceedance of capacity thresholds.

'Risk contagion' is a term most commonly used in relation to financial risk and describes how financial shocks travel through an economic system and can 'infect' other areas of the economy. Impacts are seen to spread across geographical and institutional borders 'like a contagious disease' (Bordo and Murshid, 2001), creating a cumulative effect far larger than the initial event. This type of systemic understanding of risk is well understood in the natural hazard literature through catastrophe risk (Hewitt and Burton, 1971, Burton et al., 1993) in areas of social and environmental systems. However, the idea of risk contagion has recently started to emerge in business models as a way of understanding how different areas of risk can be affected by seemingly unrelated risks. This is particularly relevant to the natural hazard sector where risk ownership may be allocated for direct impacts, omitting indirect knock on effects (e.g., Hallegatte, 2015).

Another aspect associated with changing risk ownership is the breaching of capacity thresholds (environmental, social or economic; Jones et al. 2013) where the original risk owner will transfer the responsibility of the risk to another owner (either by a prior arrangement or by default), because they lack the capacity to address or manage the risk.

In terms of risk ownership, identifying whether the nature of the risk is changing through contagion or capacity exceedance is important, as this determines how the ownership may be transferred or where risks may become unowned. It can also help identify potential areas of vulnerability and support better long-term management of these risks.

5.5 SYSTEMIC RISK

'Unfortunately, in many companies, the CFO is handling financial risk, the CEO is handling strategic risk, and the COO is handling operational risk, but no-one is looking at all those risks as one.'

Jim Loucks, Chief Commercial Officer, Aon Risk Solutions

Natural hazards and the risks they trigger are a systemic issue, impacting on environmental, social and economic systems simultaneously over multiple timeframes. These systems are interconnected and reactions in one part of the system can impact another. It is important to understand how the different risk types associated within this system and their interactions, can affect an institution, organization or a community (Figure 4). The basis of determining risk ownership is established through understanding what forms of governance and approaches are most suited to the nature of the particular risk and the context in which that risk exists.

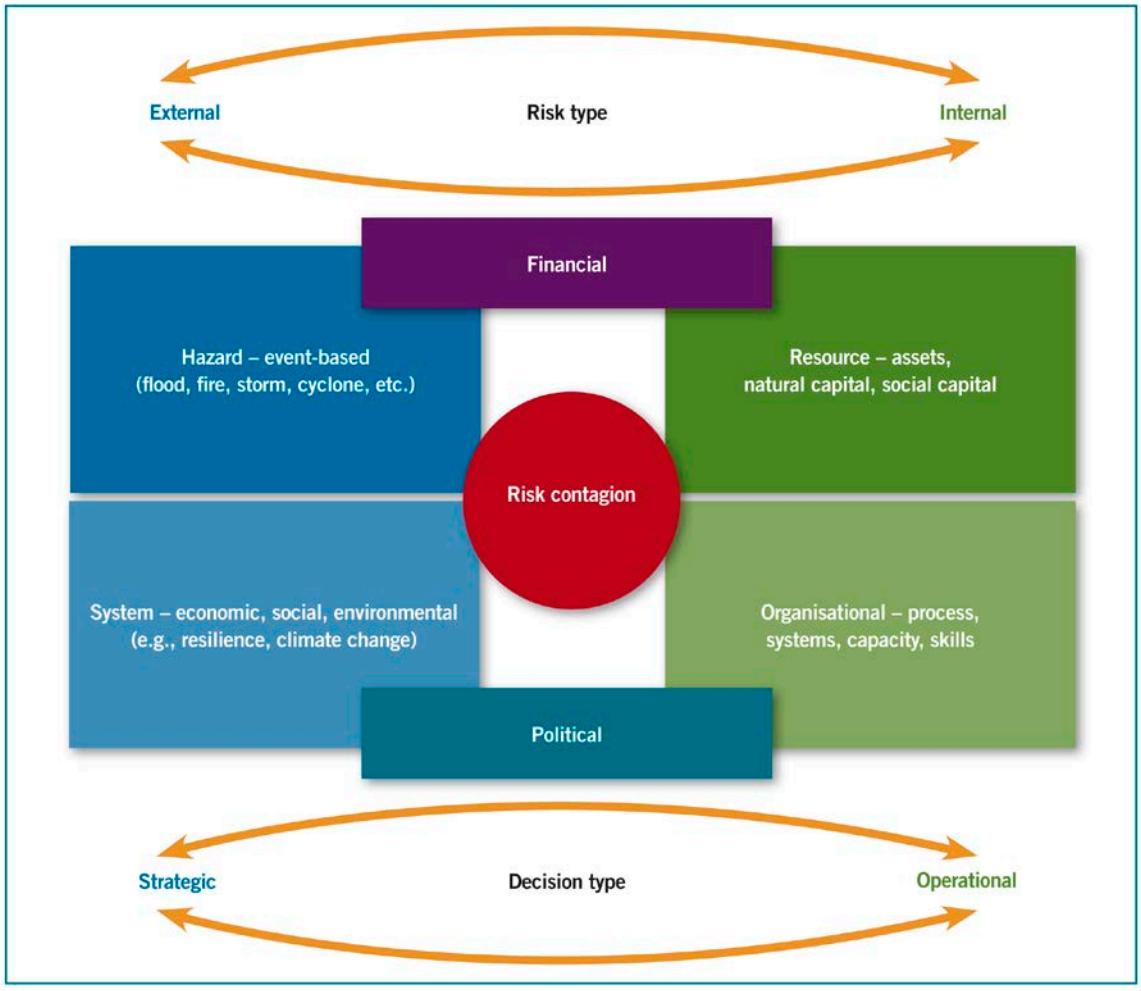

FIGURE 4: RISK SYSTEM WITH INTERNAL AND EXTERNAL COMPONENTS (YOUNG ET AL., 2016B; ADAPTED FROM PCW, 2013 AND KAMBIL ET AL., 2005).

Ascertaining whether a risk is external or internal to an organisation can help risk owners to better understand where they have the most agency to act. It can also help to determine how a risk can be managed and if it can be managed.

It is particularly important to ascertain if a risk owner or their representatives are capable of fulfilling the ownership role allocated, by considering the following areas:

- The capacity and skills of allocated owner/s.
- Resources available to address the risk.
- Key connections the primary owner depends on to deliver outcomes.
- Identified interdependencies between the different values and areas of risk and the possibility of contagion from one risk area to another.
- The nature of the systems (social, environmental and economic) that surround the risk.

Internally-based risks are more likely to have limited impacts within a defined system and are more amenable to controls by risk owners. The effectiveness of these controls often determines the ability of institutions, organizations and communities to manage impacts of externally-driven risks. Effective management of these internally-driven risks is a key part of building organizational resilience and the ability to pro-actively respond rather than react to an event with simple damage control.

Externally-based risks are often beyond the control of any single institution. They are usually systemic and highly dynamic and can have multiple owners. The boundaries of these risks are often unclear, spanning multiple areas and timeframes. They can be prepared for, but not predicted, and because of the high level of uncertainty regarding the future, often have unanticipated outcomes.

The strategic management of natural hazard risk also needs to account for political and financial risk. The internal aspects of these risks will influence perceptions and decision making at an individual scale, as well as an institutional scale. External risks arise from external policy and financial markets that can influence the level of risk different parties are exposed to.

5.6 VALUES, RISK AND DECISION MAKING

What we are protecting and why we are protecting it are the basis for determining what activities need to be undertaken and who needs to undertake them. Values provide the starting point for this by identifying what is important and why it is important in particular contexts.

There are three key aspects that determine how people make decisions in relation to natural hazards, these are: internal values, external values and natural hazard risk (Figure 5). Our focus is primarily on the interaction between the external values and natural hazard risk, However, how these risks are perceived and evaluated by individuals and organisations is determined by their internal values.

Internal and external values interact, so that changes or loss of a value in one area will often have repercussions in the other. Perceptions of worth of the many different values spanning the monetary economy, human society and the natural environment, vary widely and can change over time. This can make it difficult for decision makers to fully assess trade-offs when using conventional economic tools. This is particularly the case for intangible benefits over long-term timeframes.

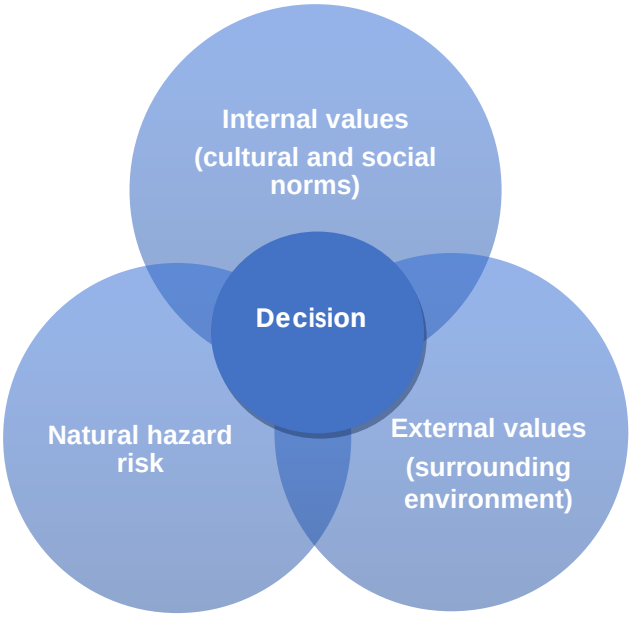

FIGURE 5: DIFFERENT VALUE AND RISK COMPONENTS IN RELATION TO DECISION MAKING.

This interaction between values will determine how risk is perceived and also how ownership is allocated and accepted. Values can also provide a way of prioritising areas of risk and are a powerful tool for bringing together “multiple perspectives” in a way that supports decision making (Hall & Davis, 2007). This is particularly useful for strategic planning and decision making where multiple possibilities, perspectives and agendas need to be considered and agreed upon by diverse stakeholders. This is important as the need to build resilience requires a broader engagement in the decision making process to support uptake of ownership. For a risk to owned it has to be understood and the owners have to have the capability and capacity to fulfill ownership obligations. It is also important to consider that risk knowledge is not consistent across society and how this will need to be accommodated during any decision making process.

5.7 VALUES BASED DECISION MAKING

Values are the foundation of decision making and can provide a motivational basis for longer term actions.

In recent years, values-based approaches are increasingly being used in areas of organisational management, particularly in areas of change management with new paradigms such as Appreciative Inquiry. Schwartz's theory of basic human values and exploration into how these values interact and shape human behavior is the basis of much of this work (Schwartz, 1992).

The need to incorporate values has been driven by the understanding that actions which are based upon what a group of people value are, more robust and lead to better and more sustained outcomes. This is because decisions that are aligned with values and attitudes are more likely to support motivation for action as they are the beliefs that determine what is most important, (Schwartz, 2012. p4). This is particularly useful in relation to strategic planning, where activities need to be maintained over the longer term and the benefit from this may be seen as remote.

A key part of values-based approaches are the processes that define important values through meaningful deliberation and rely on a level of consensus between stakeholders. This is particularly useful as it can provide a pathway for negotiating tradeoffs and obtaining shared understandings across different groups and agendas. An example of a values based approach is *The Common Cause Handbook* (Public Interest Research Institute 2011) which outlines how values can be used for framing to ensure more effective engagement with different stakeholders based on the groups of values identified by Schwartz.

As risk ownership was found to be a 'negotiated process' (Young et al. 2016a) and values can be highly subjective, this process is not without challenges. It requires collaboration and well-structured processes and facilitation to achieve fruitful outcomes. As it is a long-term proposition, maintaining trust is pivotal.

5.8 STRATEGIC DECISION MAKING

'Planning is the pathway, but strategy provides the destination.'

Liam Fogarty, DELWP, Victorian Government (Young et al., 2016 a)

Long-term strategic planning of natural hazards is an emerging area of decision making in the Emergency Management Sector, and the required skills, structures and processes are evolving. The aim of the work we undertook was to develop materials to support practitioners and policy makers in this area of practice.

To do this it was important to understand the different requirements of strategic decision making, as it helps to define the different areas of decision making that are currently used. We have defined key types of decisions by adapting a model developed for adaptation by Jones et al. (2014). Decisions are categorised as simple, complicated and complex (Table 3). Categorising decisions in this manner can help delineate how and where these decisions are used in practice and the type of approaches that are most appropriate.

Decision	Simple	Complicated	Complex
Characteristics	Linear, actionable, can be solved with one solution. Often static risks with known treatments and outcomes.	Systemic, can be bounded but may require more than one solution to address. Will use a mixture of known and unknown treatments. Dynamic, but usually able to be stabilised over time.	Systemic, unbounded, multiple interrelated actions and solutions required to address the issue. The treatment will often evolve and change over time. Highly dynamic and unpredictable, high levels of uncertainty. Often high-impact low probability.
Example	A faulty piece of machinery.	Containment of a natural hazard event.	Climate change, resilience.
Actors	Individual to organisational – person(s) with allocated responsibility or the asset owner.	Collaborative – parties associated with, and effected by, the event. Shared ownership with delegated areas of responsibility.	Extensive collaboration – a 'whole of society approach'. Complex collaborative ownership that is shared across all areas of society.
Thinking frameworks	Logical, analytical, prescriptive and practical.	Short- to medium-term thinking, analytical, responsive. Predominantly prescriptive, but has intuitive elements that respond to changing circumstances.	Long-term, strategic, conceptual, lateral, analytical, creative, reflexive, continuous, flexible.
Leadership actions	Direct and review.	Consult, assess, respond and direct.	Consult, facilitate, empower and direct.

TABLE 3: SIMPLE, COMPLICATED AND COMPLEX DECISION-MAKING RELATED TO PRACTICAL APPLICATION (YOUNG ET AL. 2016a; ADAPTED FROM JONES ET AL. 2014).

5.9 ROBUST RISK CULTURES

"Dedicated leadership is needed to grow and nurture a culture of positive risk management."

(Australian Public Service Commission, 2016)

The changing nature of events and future uncertainty as to how these events will eventuate require a common understanding and acceptance of what natural hazard risk is, and how it works across broader society. To support this, robust risk cultures that are able to communicate, understand, plan and respond effectively to natural hazard events, are needed.

Key attributes of robust risk cultures are:

- A willingness to work with what is unknown, and to accept that there is no one perfect solution or answer. To ask 'What if?' rather than state 'What is'.
- An understanding of current perceptions of how success, failure and risk can impede or enable progress.
- Curious, engaged and proactive people.
- Strength-based approaches to managing vulnerability and weakness.

It will require considerable cultural change in some areas. This is type of change needs to be considered in the context of long-term continuous change, rather than a change with a beginning and an end. This means "thinking about long-term goals (where we want to be in the future), as well as the short and medium-term (the transitions needed

to get there)" (Young 2014, p. 57). There are multiple different models of change management that can be used and how they are used will depend on the context and resources available (Nauheimer, 1997).

Key activities needed to support the development of a robust risk culture include:

- A well-articulated culture statement, policies and procedures.
- Embedding strategic risk thinking into decision-making structures and arrangements.
- Continuously reinforcing and instilling the culture through communications and training.
- Clear definition of roles, responsibilities and expectations.
- Reinforcement of accountability through performance reviews and compensation.
- Constant assessment and monitoring of progress and adjustment.
- Openness and transparency – changing from dialogues around success and failure to what works and what doesn't.
- The creation of safe spaces that support uncomfortable conversations.

It also requires understanding the different types of thinking frameworks and leadership needed to support different organisational activities, so that decision making processes support rather than impede progress (see Table 3, p. 17).

Because building a robust risk culture is a long-term activity, ongoing communication and engagement with organisations and communities is crucial to these activities. One way progress can be monitored is by using a maturity matrix (Table 4 overleaf) and integrating this into current performance processes. For organisations that already have quality assurance, this can be integrated into the overall auditing and assessment program.

MATURITY LEVEL	1	2	3	4	5
Culture	Unaware	Initial awareness in isolated pockets with areas of resistance	Awareness across the majority of the group, minimal resistance	Consistent levels of awareness across organisation, acceptance	A proactive organisation that continues to learn and adjust
Strategic vision	No strategic vision or goals, individual project with no connections	Joined-up thinking but still siloed approaches with individual goals	Has strategic vision and goals, but does not include them as part of day-to-day operations	Uses strategic vision and goals as part of organisational decision making to guide activities	Optimises activities and resource use using strategic planning
Governance	No strategic plan or mission statement	Has strategic plan and mission statement	Has policies and plans to support strategy	Uses plans and policies and has dedicated funding to support activities	Flexible, governance that supports reflection and adjustment as changes occur
Process and systems	Linear processes and systems that do not relate to each other	Identifies systems process opportunities and gaps Siloed processes and systems	Develops integrated and flexible process and systems that allow for ongoing feedback and improvement	Uses integrated and flexible process and systems that allow for ongoing feedback and improvement	Comprehensive ongoing evaluation, reflexion and adjustment of processes and systems
Knowledge	Knowledge is poor and does not support strategic decisions	Understanding of knowledge gaps	Development of new knowledge to support decision making needs	Integration of new knowledge into day to day decision making	Ongoing development and integration of new knowledge
Communication and engagement	Fractured communication – poor engagement and distrust	Mapping and connecting communication across organisation – increasing engagement, understanding	Building connections understanding and trust	Connected communication that is understood and accepted, trust established	Ongoing communication that empowers and engages
Collaboration	No collaboration	Collaboration between parties within a department	Collaboration between parties across an organisation	Collaboration between diverse stakeholders within and beyond an organisation	Long-term collaborative arrangements between diverse stakeholders

TABLE 4: ORGANSATIONAL RISK MATURITY MATRIX

5.10 INNOVATION FOR THE FUTURE

'We can't do this without our communities and know we can't just keep telling them what to do because that just doesn't work. We have to work it out with them and that takes time and lots of listening, a lot of patience and an acceptance that sometimes it is two steps forward and one back.

Tasmanian Workshop Participant (Young et al., 2016a)

New decision-making arrangements are needed if communities and private sectors are to be actively involved in the resilience agenda. These needs are already driving policy and social innovation. More inclusive approaches that actively engage communities as part of the decision making process are being developed. Current activities identified in these areas are the 'Safer Together Community First', policy (Victorian State Government) and the Bushfire Ready Program (Tasmanian Fire Services). 'Safer Together Community First' provides a policy framework for more inclusive decision making between communities and government. 'The Bushfire Ready Neighborhoods' Program works from a strong evidence base and focuses on engagement with the communities to build understanding and acceptance of the risk, so that communities feel empowered to act and be responsible for their own risks.

Changes in organisational cultures, longer term strategic development and resource allocation have been key to these innovations. There is a need to rethink current expectations in these areas across the broader Emergency Service Sector to support further innovation and the cultural changes needed to support these activities.

6 WHOSE RISK IS IT ANYWAY – DESK TOP REVIEW SUMMARY

A desk top review (Young et al. 2015b) was undertaken to provide a 'map' of policy and regulatory instruments that allocated risk ownership either directly or indirectly in the strategic area of natural hazard management.

Clarity of ownership was found in the following areas:

- Built infrastructure and assets have the most complete coverage of risk ownership, which is supported by a wide range of policies and regulation.
- State government has the highest legislated level of allocation in relation to natural hazard risk ownership.
- There are well-developed early and medium-term recovery plans for impacts on built assets and infrastructure and to a lesser extent on social assets and infrastructure. The majority of recovery funds are currently spent on roads and other transport infrastructure due to high levels of damage and lack of insurance in this area in most states.
- Growing allocation of ownership in risk planning and preparation at the state and local level, and for civil society and business and industry in designated high-risk areas for specific hazards such as flood and fire.
- Broad ownership by civil society of overall hazard risk in terms of insurance coverage, although growing exposure increases the risk of under-insurance.

Ownership gaps were observed in the following areas:

- Mitigation of risk to environmental assets and infrastructure has limited ownership and there are important gaps in coverage for both built and social assets and infrastructure.
- Despite a degree of existing resilience, resilience in all areas of the risk management process and its application is not well defined. Accountabilities also extend beyond emergency management into broader social, economic and environmental areas.
- Lack of clarity between investment in and relative effectiveness of active (e.g., emergency management plans, targeted mitigation) and passive resilience measures (e.g., building to regulation).
- Recovery plans for social and environmental assets and infrastructure. There was no defined funding mechanism for environmental recovery or for social recovery over the long term.

It was also found that there are multiple agencies who have ownership related to longer term activities such as building resilience; for example, agencies involved in climate change adaptation and regional planning. However, there is currently a lack of co-ordination between some of these different agendas and agencies and the Emergency Management Sector, which is contributing to a lack of clarity in areas of risk ownership.

7 WORKSHOP SYHTHESIS REPORT SUMMARY

Four workshops were undertaken in Victoria, New South Wales, Tasmania and South Australia in August 2015 to understand decision-making preferences through exploring:

(1) What types of decision-making structures are being used to apply values at risk in the strategic planning of natural hazard risk management?
(2) What are the current strengths and gaps in risk ownership at an institutional level?
(3) Difficulties observed during the workshop process to decision-making areas that may need development.

The workshops used a scenario-based approach concentrating on fire, flood and heatwave, through a series of decision-making based exercises:

The key components of the workshop process are shown below.

FIGURE 6: KEY COMPONENTS OF THE WORKSHOP PROCESS.

The workshops produced a number of common themes relating to needs, barriers and opportunities. The most common themes raised concerns about limitations of current decision-making structures, approaches, systems and tools and the inability of these to meet the emerging needs of communities, government and NGOs trying to implement resilience and recovery.

In summary, key findings were (Young et al., 2016a):

- Allocations made during these workshops indicate imbalances with current public/private sector arrangements between ownership of values and ownership of risk (Figure 7).

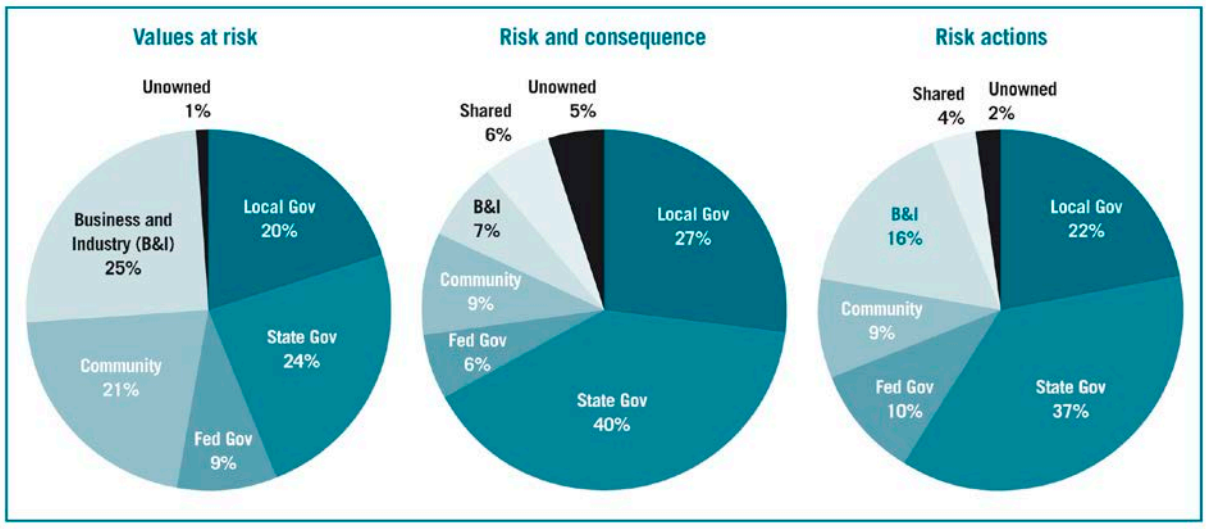

FIGURE 7: ALLOCATION OF INSTITUTIONAL OWNERSHIP ACROSS KEY DECISION-MAKING AREAS.

- Knowledge gaps were found across long-term strategic horizons (2+ years) in relation to mapping and identifying risks and consequences, and allocation of risk ownership in longer term recovery and resilience activities, particularly for the flood and heatwave hazards.
- The Social values category had the most allocations. It also had the highest allocation of unowned risks and values. The community was allocated the largest ownership for this value category (Figure 8).

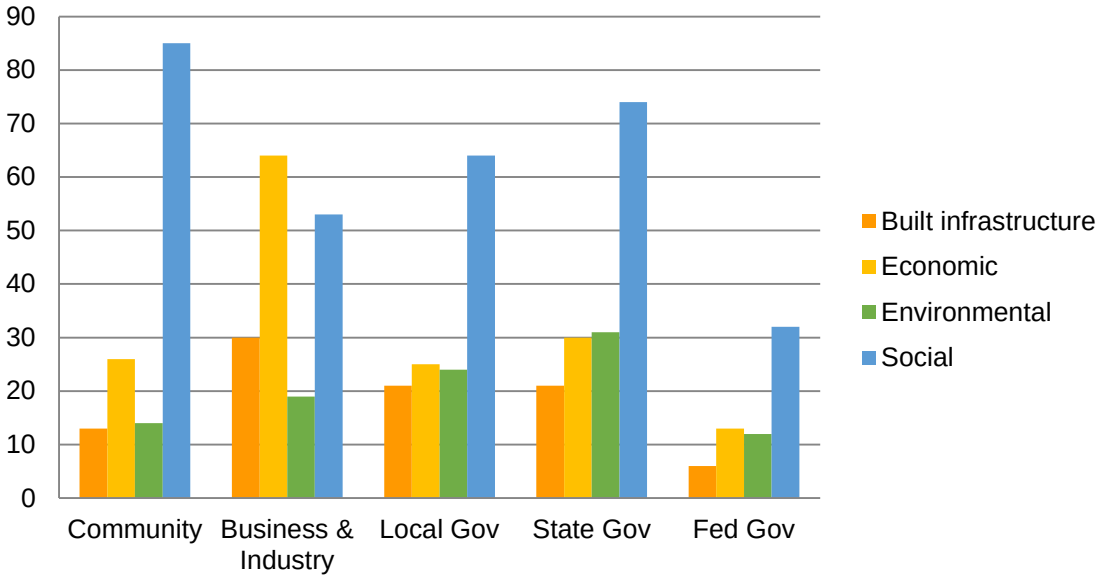

FIGURE 8: ALLOCATED VALUES AT RISK BY INSTITUTION – ALL WORKSHOPS.

- The risk and consequence area had highest allocation of unowned risks, in contrast to the ownership of actions.
- Specific allocation of accountability, responsibility and payment was found to be particularly difficult and, at times, contentious.
- There is a need to clarify and better determine areas of shared ownership, especially the ownership of long-term social and environmental risk, to ensure appropriate management is being undertaken.
- The allocation of risk ownership roles (who is responsible, who is accountable and who pays) was found to be difficult and at times, contentious.
- There is a need to develop specific monitoring and evaluation measures for long-term recovery and resilience activities that can be embedded in current planning activities.
- Boundary organisations have a unique role and should be considered as a separate institution when allocating ownership.

When allocating risk ownership, the following were found to be important:

- The need to understand not only who is allocated ownership, but what it is allocated for, how it is allocated and if the allocated responsibilities can be fulfilled.
- That the process of allocating specific risk ownership needed to be supported by clear process structures, skilled facilitation and allocated sufficient time for effective outcomes to be achieved.

- Ascertaining community values requires stakeholders with diverse expertise and experiences to fully represent the different agendas and values that make up the community.

Key workshops messages:

- Expectations in relation to natural hazards need to be realigned to match current capacities and capabilities across both the public and private sectors.
- People need to understand the risk properly before they will accept the responsibilities they need to fulfil.
- There is a unique opportunity to redefine areas of natural hazard risk management to build strategic pathways with communities to support future resilience.
- There is a need to rethink how to work with uncertainty and how success might need to be measured.

8 INSTITUTIONAL MAPS OF RISK OWNERSHIP FOR STRATEGIC DECISION MAKING SUMMARY

The Institutional Maps of Risk Ownership for Strategic Decision Making (Figure 9) were built on earlier work (Young et al. 2015b, 2016a), using the frameworks and research developed through that work as a basis. Boundary organisations were included as part of the community ownership allocations for the workshop exercises undertaken, so they are not visible as an institutional category in maps drawn from these exercises.

They have been constructed from the following sources:

- State Emergency Plans from Victoria, New South Wales, Tasmania and South Australia.
- Activity-based exercises that allocated perceived risk ownership from the workshops undertaken as part of this research project.
- A document 'map' which identified areas ownership delegation from publically available documents.

The scope of the maps was for activity-based allocation in value categories and did not include analysis of uptake of ownership to determine the effectiveness of this.

All institutional mapping exercises across the four states showed consistent findings in the following areas:

- There is a lack of specific long-term allocation of ownership, particularly in relation to some of the intangible social and environmental values.
- Risk ownership in the above area is generally poorly defined, particularly in relation to social and environmental aspects related to resilience and long-term recovery.
- The majority of risk ownership is allocated in the shorter term and the focus of the plans reviewed was on the management of the event itself and 12 months following.
- There were no clear indications as to how ongoing activities such as long-term recovery or resilience are measured within the current State Emergency Management Plans.
- Local Government had a significant delegation of responsibility in many of the maps, but it was found to be unclear in many cases as to how this would manifest practically.
- Shared ownership across institutions and across temporal scales is still developing.
- There are potential imbalances in relation to allocation of risk ownership between different hazards and also between the public and private sectors.

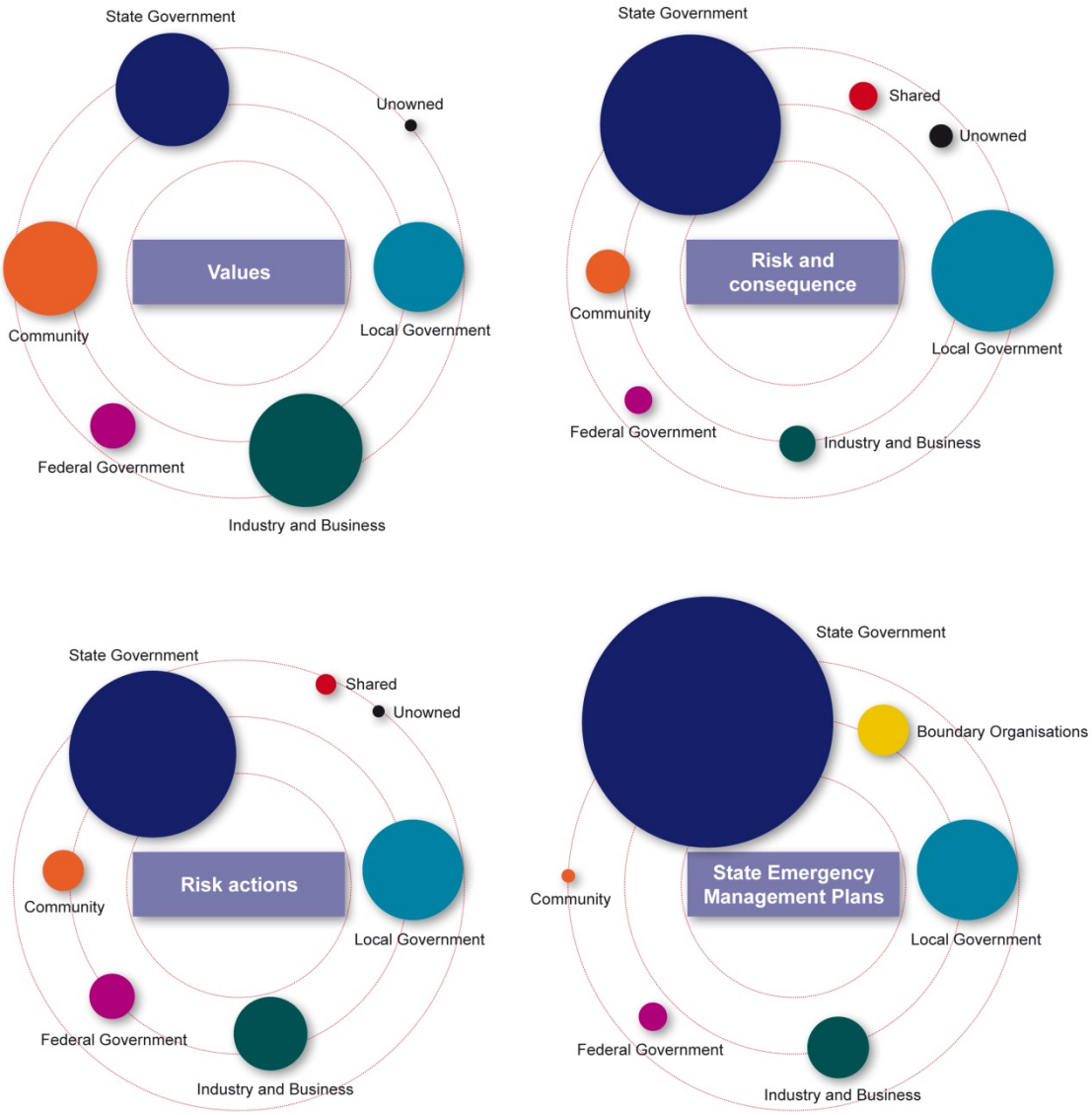

FIGURE 9: INSTITUTIONAL MAPS FOR ALLOCATIONS OF OWNERSHIP OF VALUES AT RISK, RISK AND CONSEQUENCES OF NATURAL HAZARD EVENTS, RISK MANAGEMENT ACTIONS (YOUNG ET AL., 2016B) AND STATE GOVERNMENT EMERGENCY MANAGEMENT PLANS (LOWER RIGHT). NOTE THE ADDITION OF BOUNDARY ORGANISATIONS AND REMOVAL OF SHARED IN THE LOWER RIGHT DIAGRAM.

9 RISK OWNERSHIP FRAMEWORK FOR EMERGENCY MANAGEMENT POLICY AND PRACTICE

The use of values as the basis of the risk ownership process framework places the focus on what is most important as a starting point for assessing risk.

The 'Risk ownership framework for emergency management policy and practice' has two components:

- A **Conceptual framework** which identifies the key areas you need to understand to use the framework.
- A **process framework** that can be integrated into current risk planning processes and supporting material for this process for practitioners and facilitators of the process.

To develop the process framework decision making, preferences and questions elicited during the workshops were mapped into key decision points in the National Emergency Risk Assessment Guidelines (NERAG) to provide a foundation for the values-based decision-making process. As social contracts and the need to engage more fully with communities were identified as a key aspect of risk ownership, this framework was developed with a focus on consensus building to support these. A draft framework was then developed and circulated. A feedback workshop was organised and hosted by Emergency Management Victoria and a number of smaller focus groups meetings with government agencies (including the Victorian Managed Insurance Agency and the Victorian Department of Environment, Land, Water and Planning in Victoria) were undertaken.

Risk ownership implementation and practice needs to ensure that people understand and are willing to accept a risk and have the capability to do so. To do this requires establishing a robust risk culture that monitors and assesses as part of ongoing processes, is able to communicate and collaborate and is agile and flexible. These combined areas are crucial to enabling the process framework.

To ensure that this process does not remain outside of or compete with current arrangements, consideration prior to the process being undertaken will need to be given to:

- Formal mechanisms such as legislation and regulations that allocate risk ownership in the EMS, as these are often not negotiable and as a result this process should be informed by these arrangements.
- To look at how outcomes from this process may relate to current government plans and pre-existing processes and identify where outcomes from this could feed into or add value to these outcomes.

This process covers the assessment and planning process for implementation of activities, but does not include implementation of activities.

9.1 CONCEPTUAL FRAMEWORK

The key conceptual components that were found necessary to support the application of the risk ownership process framework were **values, systemic risk, strategic planning and values-based decision-making** (Figure 10). These aspects were found to be important as they determine the 'thinking' framework needed for understanding how actions are applied in this area.

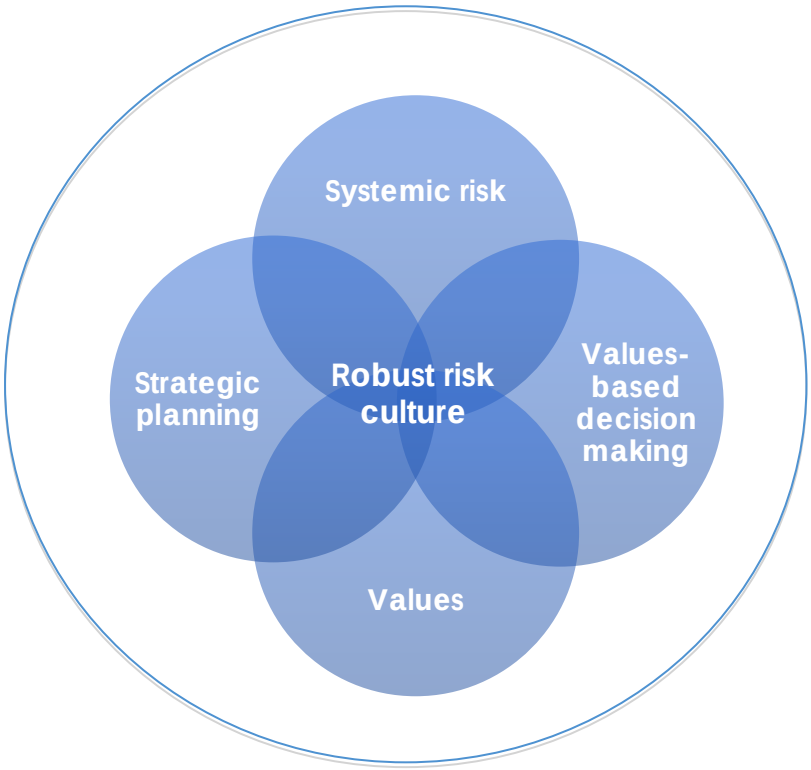

FIGURE 10: CONCEPTUAL COMPONENTS OF RISK OWNERSHIP FRAMEWORK.

Details pertaining to these areas have been covered in earlier sections of this summary under the Section 4 Summary Key Research Theme Areas.

9.2 PROCESS FRAMEWORK FOR RISK OWNERSHIP

The purpose of this process framework is to provide a starting point for integrating risk ownership practice into current risk planning processes. It focuses on the National Emergency Risk Assessment Guidelines (NERAG)

Objectives of this process were to:

- Support more effective strategic planning and management of natural hazard risk through better identification and uptake of risk ownership.
- Identify key risk owners at the beginning of the risk process and include them as an active part of decision making.
- Provide a process framework that uses values as a starting point for risk assessments to provide a pathway for better management and implementation of systemic risk.
- Assist the development of arrangements that support longer term activities, such as the building of resilience and the short-term activities that support this.
- Support development of new knowledge and the collation of new types of data and strategic decision making.

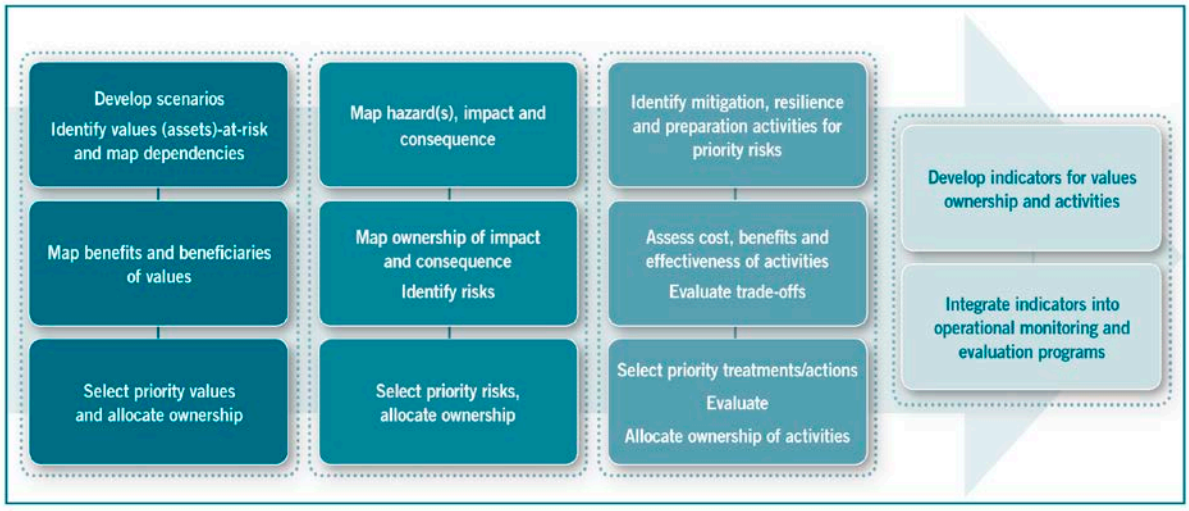

FIGURE 11: VALUES-BASED DECISION-MAKING PROCESS.

The process framework (Figure 11) provides key tasks which can be integrated into current risk assessment and planning processes. Its aim is to support better strategic management of risks associated with natural hazards. It does this through providing a series of tasks that support the allocation of risk ownership as part of strategic planning activities.

The Emergency Management Sector is a diverse community and as a result, how organisations choose to integrate aspects of the risk ownership process framework into current risk planning will vary. What is applied and how it is applied will depend upon the objectives, capabilities and resources of an organisation. The process offers suggestions for basic, intermediate and advanced implementation options. For smaller organisations or communities it may start with a basic approach. A well-resourced organisation may have the capability to start at the intermediate level.

This process is not intended to replace current risk processes, but to enhance and add value to what is already there. It is intended for use by government, community and private organisations. It is designed so it can be used with organisations with different capacities and offers possible levels of application, basic, intermediate and advanced.There is also guidance provided in relation to economic tools and methods that can be used to support this process and their application.

9.3 INTEGRATING THE PROCESS INTO CURRENT RISK ASSESSMENTS

Implementing this framework is not a short-term activity and will need time, commitment and resources before it becomes a fully established part of the risk assessment process and operational activities.

An example of how the key tasks associated with this framework can be integrated into the assessment process phases is shown in Figure 12. It illustrates where key tasks are placed within the current phases of the risk assessment process. The orange squares show where there are new steps that need to be included. The white squares show common risk tasks may that need to be adjusted to accommodate strategic timeframes and also non-monetary values.

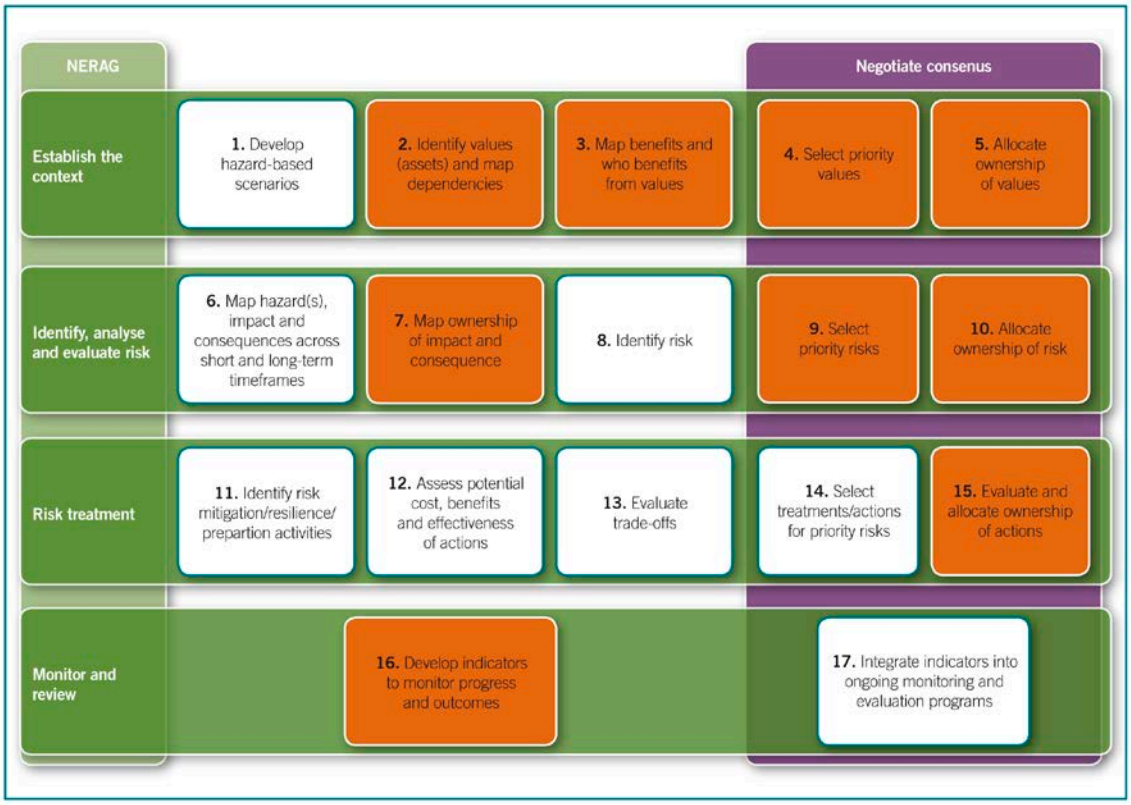

FIGURE 12: KEY PHASES OF THE NERAG PROCESS WITH RISK OWNERSHIP TASKS INCLUDED.

In relation to the assessment of strategic risk and the associated costs, methods and tools for evaluating this are still developing, particularly in relation to non-monetary values. Some organisations may choose to undertake an assessment to map knowledge gaps and capability to understand what can be currently used and what areas might be need to be developed.

10 FURTHER RESEARCH

This research has highlighted the complexity of decision making associated with the strategic management and ownership of natural hazard risks. Knowledge gaps and key questions identified during this research suggest a potential need for further research in a number of areas including:

- Effectiveness of integration of risk ownership into risk assessment practice and everyday understanding of systemic risk into decision-making frameworks for strategic planning.
- Identification of the current and emerging role of data and technology in strategic decision making.
- Identification and analysis of skills required and current skills gaps related to strategic decision making and identification of systemic risk across multiple hazards and temporal scales.
- Research to identify appropriate governance and indicators for this area of practice.
- Analysis of the effectiveness of current decision-making tools in use and their effectiveness.
- Analysis of the current balance of public-private ownership of values and risks to understand what balance is likely to be most sustainable across a number of different contexts into the future.
- Further explorations of the links between risk ownership and institutional arrangements surrounding natural hazard risk management.

11 CONCLUSIONS

'Plan for the future because that is where you are going to spend the rest of your life.'

Mark Twain

Risk ownership of natural hazards has traditionally been focused in the area of effective response, administered primarily through command and control mechanisms. However, the changing nature of natural hazards and the socio-economic context in which they occur is leading to the emergence of new and different types of risks. The need for community, businesses and government to build greater resilience to these risks requires a strategic focus that goes beyond the event and builds greater capacity in all areas of our society.

Effective long-term planning, preparedness and recovery require:

- Development of robust risk cultures across communities and public and private organisations.
- Organisational flexibility and responsiveness and the frameworks to support this.
- A willingness to work with what is unknown and to accept that there is no one perfect solution or answer. To ask 'what if' rather than state 'what is'.
- An understanding of current perceptions of how success, failure and risk appetites can impede progress.
- The development of values-based decision making and governance.
- Capacity and capability building that can be achieved in the face of resource constraints across all institutions.

Our work to date has highlighted the opportunity to transform how we as a society think about and respond to natural hazards and the need for greater understanding of what the risks are and who owns them across different areas of society. As risk ownership is often a 'negotiated process' (Young et al., 2016a), it is not without challenges. It requires collaboration and meaningful engagement to achieve fruitful outcomes. It is a long-term proposition that involves multiple parties and requires the development of fit for purpose frameworks to support this. Targeted resources, community engagement, long-term policy and investment and realignment of current expectations that match current capacities and capabilities across both the public and private sectors are needed if we to meet this challenge. Through this research we have developed a framework which aims to provide a starting point for practitioners and policy makers in this area.

At the heart of risk ownership are our communities and our businesses, and the need for common understandings and collaboration between them and our public sectors. Strategic decision making based upon what we value and ownership of the risk provides the bridge between the present and the future; one that can help us act decisively and collaboratively in the present, whilst thinking and planning ahead. It is a crucial factor if we are to prepare and effectively respond to natural hazards now and in the future.

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