

Appendix A: Companion reports

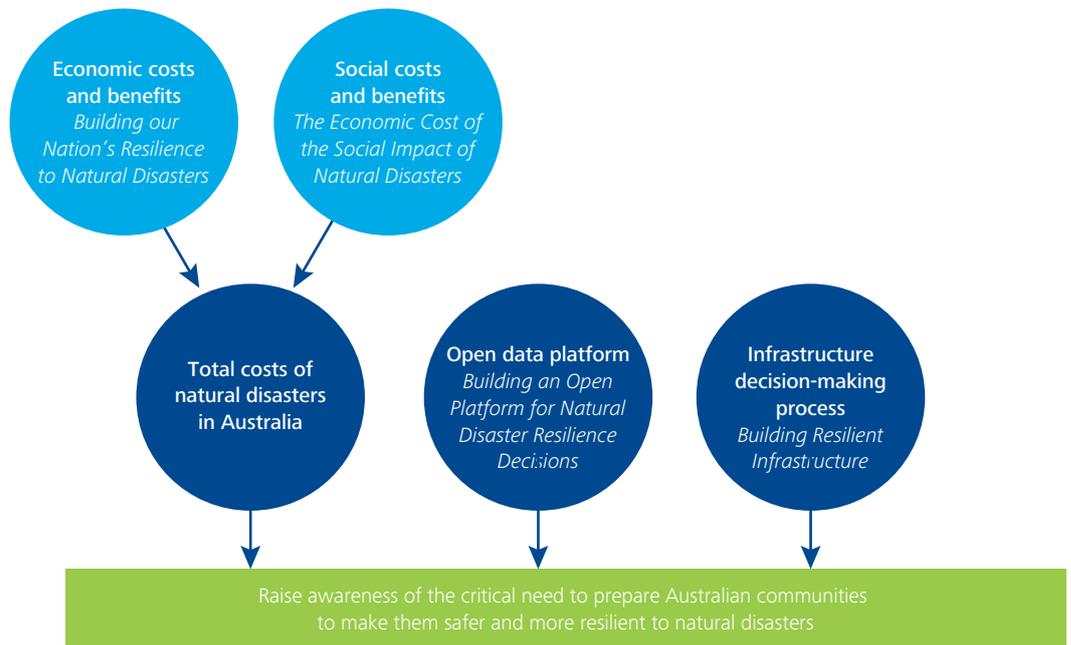
This appendix summarises the key findings and recommendations of **three companion reports** commissioned by the Roundtable:

- ***Building our Nation's Resilience to Natural Disasters*** (2013) reviewed the economics of mitigating disaster risks facing Australian communities
- ***Building an Open Platform for Natural Disaster Resilience Decisions*** (2014) provided an overview of natural disaster data and research in Australia, and reinforced the need for better coordination and transparency of disaster risk and resilience information

- ***The Economic Cost of the Social Impact of Natural Disasters*** (2016), developed in parallel with this report, expands on our 2013 report by valuing some of the broader social impacts of natural disasters to better understand the total cost of natural disasters in Australia.

The figure below summarises how these three reports relate to each other. Each of the companion reports is outlined in brief on the next page.

Figure A.1: Summary of the Roundtable's work on natural disaster resilience



Source: Deloitte Access Economics (2016)

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Building our Nation's Resilience to Natural Disasters (2013)

The report highlighted the need for a new approach to investment in pre-disaster resilience across Australia, to reduce the economic costs, relieve long-term pressures on government budgets, and most importantly, minimise the longer-term social and psychological impacts of natural disasters.

Quantifying natural disaster costs

Over the period from 1967 to 2012, Australia experienced an average of at least four major natural disasters per year, where the insured loss exceeded \$10 million (Insurance Council of Australia, 2013). In addition, there have been numerous smaller-scale disasters with equally devastating local consequences. Chart A.1 illustrates the extent of insured losses from natural disasters in Australia over the period from 1980 to 2012.

It is important to recognise that these losses only represented a proportion of the total economic costs of natural disasters. In addition to insured losses, total economic costs include the cost of damage to uninsured property and infrastructure; the cost of emergency responses; and intangible costs such as death, injury, relocation and stress. Historically, these total costs have been estimated to be two to five times greater than insured costs alone, for most types of disaster (BTE, 2001).

These costs are expected to rise as a result of continued population growth, concentrated infrastructure density and migration to particularly vulnerable regions. While the current annual total economic cost of natural disasters is around \$6.3 billion, on average this annual cost is expected to double by 2030 and reach \$23 billion in real terms by 2050, as illustrated in Chart A.2. These forecasts do not reflect any expected increase or shift in the currently observed level and severity of disasters that might be caused by climate change.

These rising costs have significant financial implications for all levels of government, which contribute to the cost of recovery, particularly through the Natural Disaster Relief and Recovery Arrangements. Using historical data, Deloitte Access Economics estimates that natural disasters cost the Australian and state governments an average annual real cost of \$700 million per year, around 11% of total economic costs. It is estimated that 80% of government expenditure is outlaid by the Australian Government. Based on the forecasts of total economic costs above, it is expected that governments will eventually face an annual cost of around \$2.3 billion in real terms, as illustrated in Chart A.3.

The expected future cost of natural disasters clearly highlights the need for governments to place a greater emphasis on improving Australia's resilience. Prioritising pre-disaster investments towards cost-effective resilience initiatives can substantially reduce government expenditure on response initiatives. Doing so will rely on access to accurate, consistent data, and findings from targeted research programs, which provide an essential evidence base for determining the cost-effectiveness of resilience measures.

The case for resilience

Deloitte conducted three cost-benefit analyses of different resilience activities, to illustrate how investing in resilience could generate net benefits for Australian communities.

Overall, it was found that:

- A program focused on building more resilient new houses in areas of southeast Queensland with a high cyclone risk would reduce cyclone-related damage by around two-thirds, and generate a benefit-cost ratio (BCR) of up to 3.0. It is a particular challenge to retrofit resilience into existing houses, but the BCR of retrofits approaches 1.0 in high-risk areas
- Raising the Warragamba Dam wall by 23 metres would reduce annualised average flood costs by around three-quarters, and generate a BCR of between 2.2 and 8.5. This would reduce the present value of flood costs between 2013 and 2050 from \$4.1 billion to \$1.1 billion, a saving of some \$3.0 billion

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Chart A.2: Insured costs of natural disasters (\$bn), 1980 to 2012

Source: Insurance Council of Australia (2013)

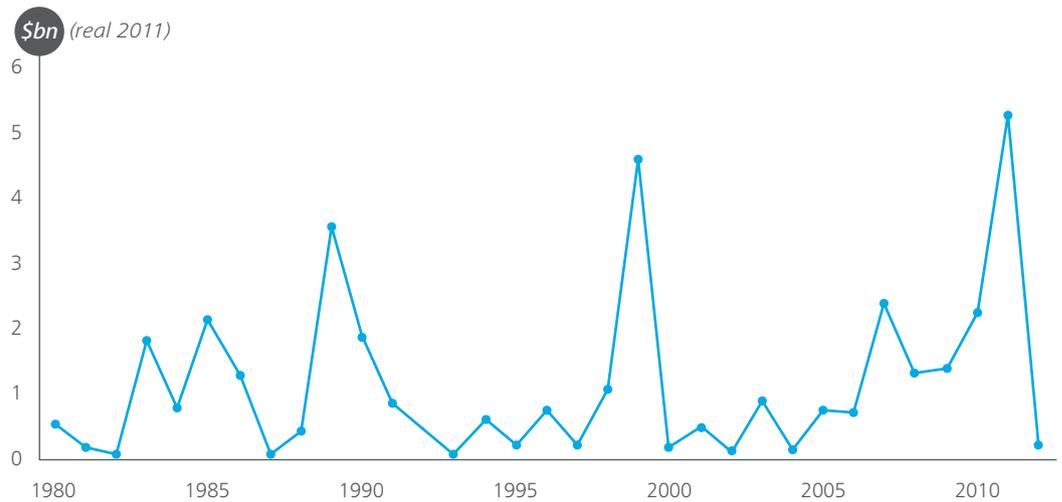


Chart A.3: Forecast total economic cost of natural disasters (\$bn), 2011 to 2050

Source: Deloitte Access Economics (2013)

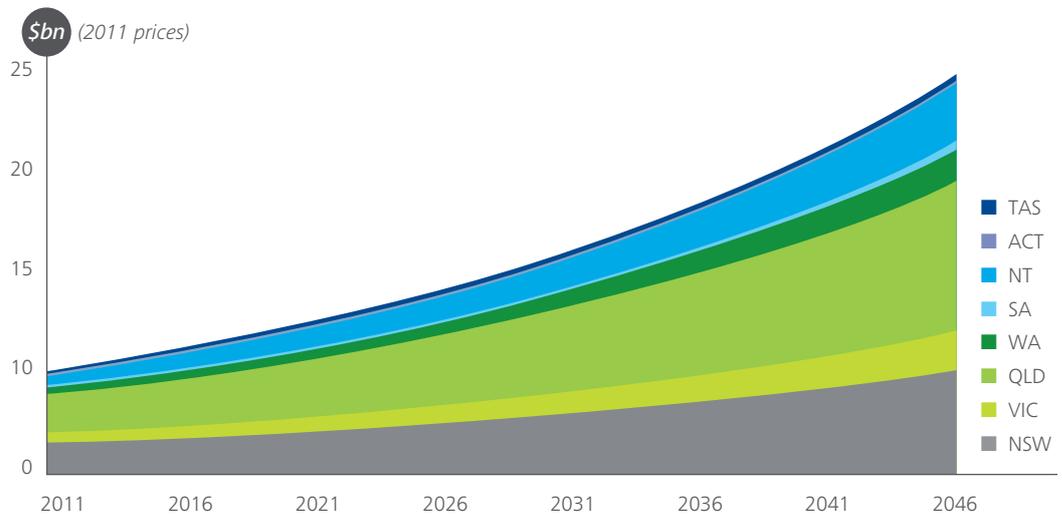
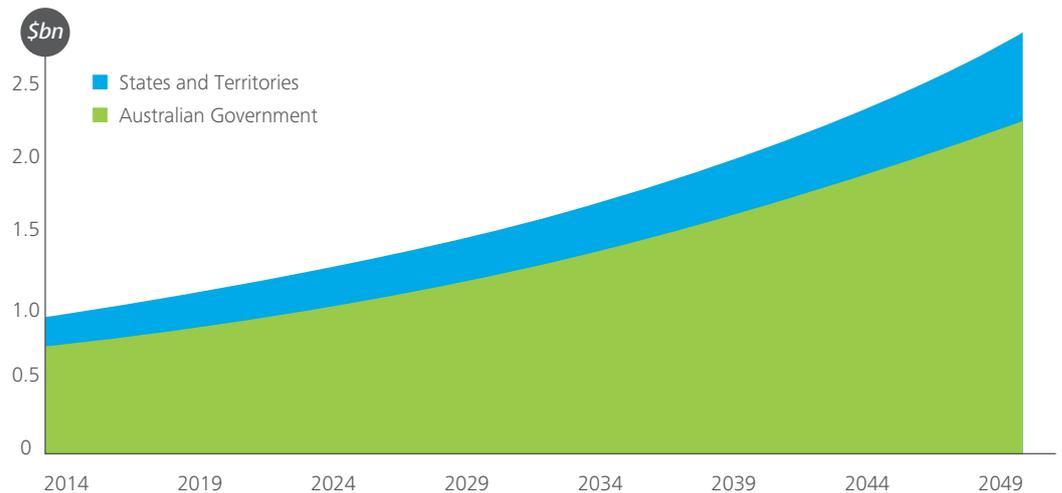


Chart A.4: Forecast annual cost to governments of natural disasters (\$bn), 2011 to 2050

Source: Deloitte Access Economics (2013)



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- Building more resilient housing in high-risk bushfire areas generates a BCR of about 1.4; better vegetation management results in a BCR of about 1.3; and moving electricity wires underground results in a BCR of about 3.1.

These examples demonstrate that practical resilience measures – which target high-risk locations using an appropriate combination of infrastructure, policy and procedure – have the potential to generate economic benefits. The case studies also highlight the importance of having access to comprehensive information on disaster risk and the effectiveness of adaptation strategies as part of the cost-benefit analysis process.

Recommendations

This report put forward three key recommendations:

- **Improve coordination of pre-disaster resilience by appointing a National Resilience Advisor and establishing a Business and Community Advisory Group**

Developing resilient communities should be elevated to the centre of government decision-making, to support effective coordination across all levels of government, business, communities and individuals. This should be directly supported by a Business and Community Advisory Group, to facilitate a more coordinated response and ensure businesses and not-for-profits are represented at the highest levels of policy development and decision-making.

- **Commit to long-term annual consolidated funding for pre-disaster resilience**

All levels of government – led by the National Resilience Advisor – should commit to consolidating current outlays on mitigation measures, and to funding a long-term program that significantly boosts investment in mitigation infrastructure and activities. Critical to this success will be the consolidation of existing information and commissioning additional data where needed. This will help governments, businesses and the community develop and implement effective local responses.

- **Identify and prioritise pre-disaster investment activities that deliver a positive net impact on future budget outlays**

A program of mitigation activity should be developed, based on a cost-benefit analysis that demonstrates a clear positive outcome from investing in pre-disaster resilience measures. The prioritisation of these activities should be informed by analysis of research, information and data sets, allowing key investment decisions at all levels, including government incentives and price signals from the private sector.

Building an Open Platform for Natural Disaster Resilience Decisions (2014)

This report investigated the decision-making challenge, and identified the strengths and weaknesses of Australia's approach to natural disaster data and research. It made recommendations on how to support Australia to design a more sustainable and comprehensive national approach to safer and more resilient communities.

Accurate data and research is fundamental to better understanding natural disasters and their impact on communities, business and government. It is essential to supporting better decision-making and to prioritising mitigation investments needed to build a safer Australia. Optimal decisions on resilience investments requires access to high-quality data and research.

Providing wider access to accurate, relevant natural disaster data and research could increase government savings by between \$500 million and \$2.4 billion in present-value terms, over the period to 2050. Data and research that facilitates targeted and prioritised investment could deliver higher overall BCRs of between 1.3 and 1.5. Based on this, total savings to government could rise to anywhere between \$12.7 and \$14.6 billion in present-value terms, over the period to 2050.

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The decision-making challenge

Natural disaster resilience is an interdisciplinary issue. Multiple agencies are involved in collecting data and conducting research. This produces numerous platforms for accessing and using the necessary information; leads to increased search costs; and often creates complexity and disparity in understanding.

The key set of inputs required by end-users consists of:

- **Foundational data:** data that provides the basic standard layers of locational information. This includes the characteristics of assets at risk, community demographics, topography and weather details, which are also used for other purposes
- **Hazard data:** hazard-specific information on the risks of different disaster types, providing contextual details about the history of events and the risk profile of Australian locations
- **Impact data:** data on the potential and actual impacts associated with natural disasters, including information on historical costs and damage, and the current and future value at risk
- **Research activities:** actions that draw on data and seek to answer specific questions across a range of areas. There is often also feedback from research to data, because research outputs build on the existing stock of data that is available.

A broad range of end-users across communities, business and government are affected by this challenge, and their needs vary significantly. To realise the full potential of decisions aimed at increasing the safety, resilience and productivity of Australian communities, this data and research must be accessible in consistent formats that are fit for this variety of purposes.

Gaps and barriers to optimal decision making

The Australian approach to natural disaster research and data involves no comprehensive mechanisms to ensure inputs are available in a consistent and appropriate format.

Data

There is evidence of **gaps in the critical data inputs** required to inform resilience investments.

This significantly limits the ability of stakeholders to understand the exposure of communities and the extent of losses that might arise.

These issues are compounded by barriers that restrict end-users' access to critical data. Barriers include:

- **Reluctance to share data** – the potential legal implications of data sharing are of particular concern for local government
- **Restrictive licensing arrangements**, which prevent wider distribution and use of data
- **The high cost of data collection**, which encourages a piecemeal approach to developing critical data inputs
- **A lack of coordination and standardisation**, which prevents end-users from pooling data from different sources
- **The high cost of providing accessibility and transparency**, which weakens incentives for data sharing if the broader range of benefits are unclear.

These barriers lead to duplicated efforts in data collection, higher transaction costs when using data, and restricted access for end-users. To the extent that the benefits for the full range of end-users exceed the costs of providing data, the current arrangement is inefficient, and fails to deliver the best outcome for Australian communities and taxpayers.

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Research

The research found that **less funding** is directed towards understanding **the effect of mitigation, value at risk and the process of coping with natural disasters**, compared with other areas of research such as risk management, vulnerability, hazard detection, policy and decision support. This limits the ability of decision makers to understand the baseline costs associated with exposure to natural disasters, and the benefits that could be achieved through mitigation.

There are strong networks among Australian researchers but from an end-user perspective it is **difficult to identify what relevant research activities are happening**, and how to use research findings to better inform decisions about resilience. Although projects undertaken by the newly established Bushfire and Natural Hazards Cooperative Research Centre (launched in December 2013) explicitly involve end-users, this practice should be adopted more broadly. Increased transparency and better evaluation of the outcomes of research activities would support this change.

Recommendations

Consistent with the recommendation of *Building our Nation's Resilience to Natural Disasters*, a National Resilience Advisor within the Department of Prime Minister and Cabinet would be well placed to address these issues. The business of developing resilient communities should be elevated to the centre of government decision-making efforts, enabling effective coordination of activities across all levels of government, business, communities and individuals.

This report makes three recommendations for an enhanced approach to natural disaster information, focusing on the potential benefits of making optimal end-user decisions around data and research.

- **Efficient and open – deliver a national platform for foundational data**

Given that foundational data is used for a broad range of purposes beyond the scope of natural disaster issues, the Australian Government should provide a single point of access for all Australians. Although the Bureau of Meteorology and the Australian Bureau of Statistics provide weather information and data on community demographics respectively, this would be improved by allocating responsibility for consistent topography and geocoded asset data at the national level. A national portal for this would support the prioritisation of resilience measures across local government and state borders, in the national interest.

- **Transparent and available – remove barriers to accessibility of data and research**

Access to data and research is restricted. Greater transparency across the system is required to include the full range of end-users and allow for the development of an access system that weighs up overall costs and benefits. There is a need to clearly delegate responsibility for hazard and impact data (such as hazard mapping) and develop a stronger approach to involving end-users in research. This should also address concerns with legal liability and unnecessarily restrictive licensing, and help ensure standardisation across jurisdictions.

- **Enabling effective decision-making – establish a prioritisation framework**

A national prioritisation framework for investment in resilience should be established, consistent with the approach adopted by Infrastructure Australia.¹² This will support best-practice use of natural hazard data, allowing research to be collected and disseminated, and ensuring that investments in resilience produce optimal outcomes based on consistent, evidence-based cost-benefit analyses. This approach would build a common understanding of the nation's areas of highest risk, and the most effective measures for reducing that risk and prioritising the research agenda.

12. Infrastructure Australia's Priority List identifies projects of national significance and informs the Australian Government of the highest-priority projects. Infrastructure Australia provides guidelines for cost-benefit analyses, step-by-step methodologies for different investment types and links to standardised data sources, to assist in the preparation of submissions. Further details on this approach are provided in Chapter 2.

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The Economic Cost of the Social Impact of Natural Disasters (2016)

Natural disasters affect all states and territories in Australia. They have an enormous impact on people, the environment and our communities. In Australia, natural disasters have incurred billions of dollars in tangible costs¹³ to individuals, businesses and governments.

Beyond the known economic costs, it is well recognised that natural disasters have wide-ranging social impacts that are not only high in immediate impact, but often persist for the rest of people's lives. While there is considerable evidence of social impacts, our knowledge of their economic cost is not well understood.

Where data permits, this report identifies and quantifies the social impacts of natural disasters, including those on health and wellbeing, education, employment and community networks. When considered alongside the tangible costs highlighted in *Building our Nation's Resilience to Natural Disasters* (2013), a much richer picture emerges of the total economic cost of natural disasters to Australia.

This report finds that in 2015, the total economic cost of natural disasters in an average year – including tangible and intangible costs – exceeded \$9 billion, which is equivalent to about 0.6% of gross domestic product (GDP) in the same year. This is expected to almost double by 2030 and to average \$33 billion per year by 2050 in real terms (Chart A.6), even without considering the potential impact of climate change.

Clearly comprehensive information on all costs of natural disasters is required to understand the full impact of natural disasters on our communities and economy and; to also understand the extent to which expenditure on mitigation and resilience measures is effective.

This report uses three case studies from different regions and periods – the 2010–2011 Queensland floods, the 2009 Victoria Black Saturday bushfires and the 1989 Newcastle earthquake – and assesses the tangible and intangible costs of the most recent two events. The report estimates the intangible costs to be as high as the tangible costs, and possibly higher. **In fact, the long term economic cost of natural disasters may be underestimated by more than 50%.**

Chart A.5: Breakdown of costs between reports

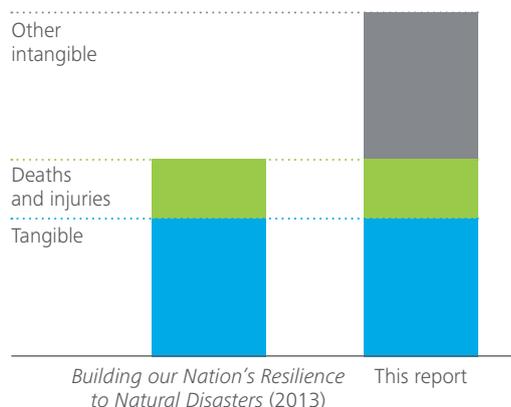
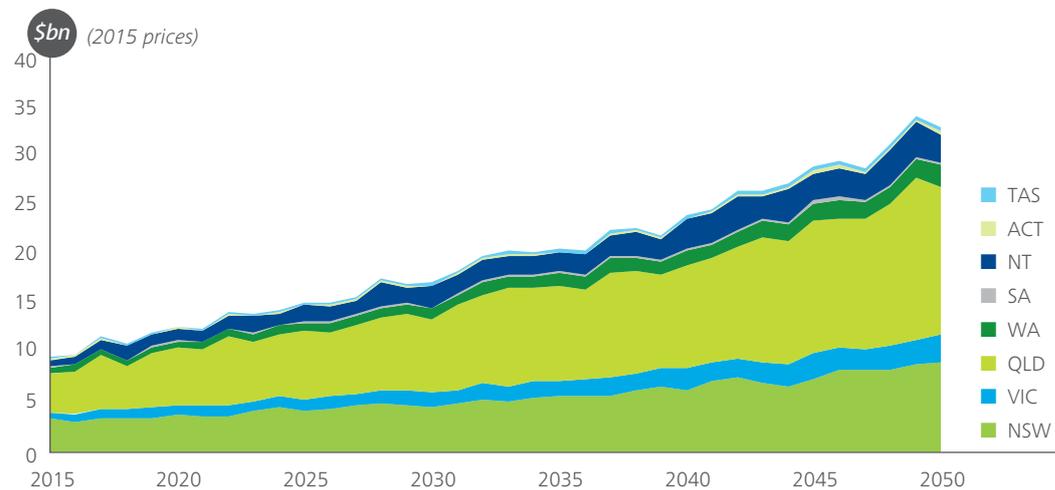


Chart A.6: 2015–50 forecast of the total economic cost of natural disasters, identifying costs for each state



Source: Deloitte Access Economics analysis

13. In line with the Productivity Commission report, costs in this report are defined as:

- **Direct tangible costs:** those incurred as a result of the hazard event and have a market value such as damage to private properties and infrastructure
- **Indirect tangible costs:** the flow-on effects that are not directly caused by the natural disaster itself, but arise from the consequences of the damage and destruction such as business and network disruptions
- **Intangible costs:** capture direct and indirect damages that cannot be easily priced such as death and injury, impacts on health and wellbeing, and community connectedness.

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This report only quantifies those intangible social impacts where there is sufficient data to do so, thus it provides a conservative estimate. Regardless of if they can be quantified, all identified outcomes are important and should be considered in any disaster mitigation decision-making process. Between 2009–10 and 2012–13, \$11.0 billion was spent on disaster recovery, while only \$225 million was spent on mitigation (Productivity Commission, 2015). The majority of relief and recovery assistance was provided through the Natural Disaster Relief and Recovery Arrangements (NDRRA), and in particular Category B payments which relate to essential public assets, financial support to small business and primary producers, and counter disaster operations.

The report demonstrates that the social costs of natural disasters equal the more traditionally defined economic costs – and are sometimes even higher. It is clear that a greater effort should be invested in the preparedness of individuals, in particular long-term psycho-social recovery. This would include community development programs and support for areas such as health and wellbeing, employment and education.

Our research leads to four recommendations to help reduce the long-term social impacts and economic costs of natural disasters.

- Pre- and post-disaster funding should better reflect the long-term nature of social impacts

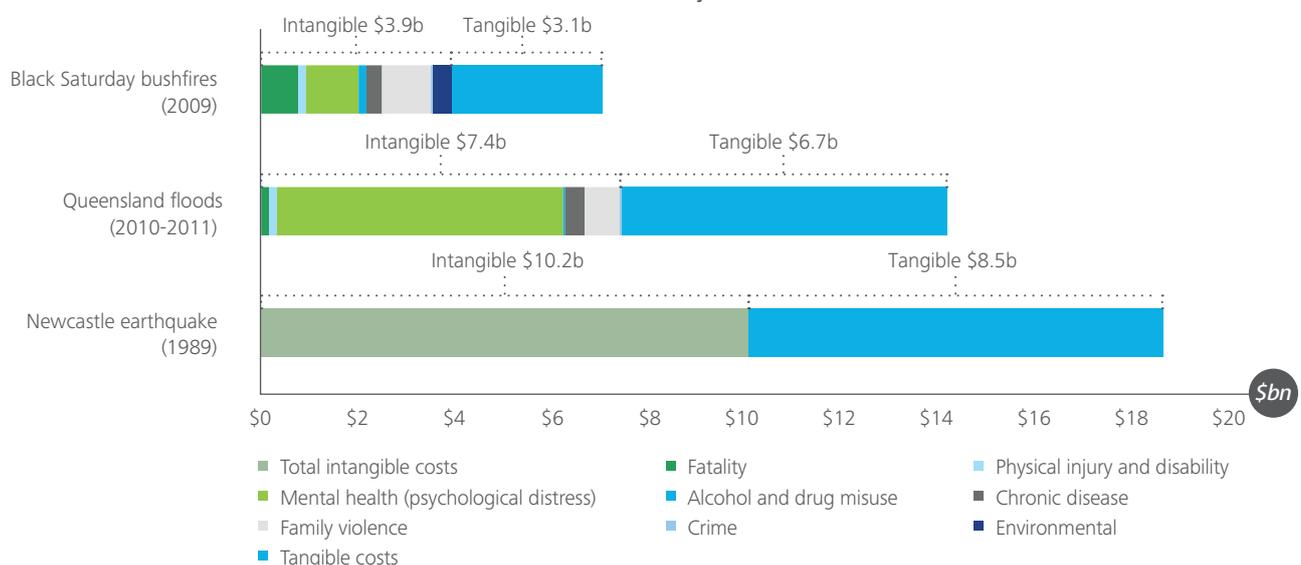
The analysis shows that the intangible costs of natural disasters are at least as high as the tangible costs. Significantly, they may persist over a person’s lifetime and profoundly affect communities.

While building resilience into infrastructure is important, it should be accompanied by measures to ensure social and psychological wellbeing. **It is crucial that funding and policies** acknowledge the long-term social impacts of natural disasters.

As well as funding emergency services during disasters, infrastructure and recovery after disasters, government, business and the not-for-profit sector must also invest in services to support people, small businesses and communities well after the debris is cleared. These services are most effective when coordinated across sectors and when communities connect to foster a culture of resilience.

This report supports a national, long-term preventative approach to managing natural disasters and protecting our communities. This will require long-term commitment and multi-year funding to achieve. Critical to ensuring long-term impacts are minimised is “strengthening local capacity and capability, with

Chart A.7: Total economic cost of Queensland floods and Black Saturday bushfires



Source: Deloitte Access Economics analysis.

Note: Due to insufficient data, the total economic cost of the 1989 Newcastle earthquake was estimated using the tangible to intangible cost ratio of the 2010-11 Queensland floods and 2009 Black Saturday bushfires.

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greater emphasis on community engagement and a better understanding of the diversity, needs, strengths and vulnerabilities within communities” (COAG’s *National Strategy for Disaster Resilience*, 2011).

A significant body of evidence shows that resilient and prepared communities are more likely to withstand the negative impacts of natural disasters. Likewise, strong social capital correlates to a more effective recovery.

- **A collaborative approach involving government, business, not-for-profits and community is needed to address the medium- and long-term economic costs of the social impacts of natural disasters.**

Individuals, businesses, governments and communities all feel the social impacts of natural disasters. These impacts are complex and touch all levels of government and cross all portfolios, from infrastructure and planning to health and education.

This highlights the importance of a collaborative effort to build resilience, including coordinated approaches that consider all aspects of natural disasters: direct and indirect, tangible and intangible. This collaborative perspective should be considered within planning processes, to ensure disaster resilience is integrated across various portfolios in accordance with the National Strategy for Disaster Resilience (NSDR).

A coordinated approach with sustained resourcing makes community awareness education and engagement programs more effective. Such programs help communities to work together to better manage the risks they confront (NSDR). This promotes communities that are better able to withstand and recover from a crisis.

- **Governments, businesses and communities need to further invest in community resilience programs that drive learning and sustained behaviour change.**

It is clear that funding of disaster mitigation measures should not only focus on building physical infrastructure such as flood levees, but include funding for social and psychological measures too. This would include community awareness, education and engagement programs that enhance social capital by building social networks and connections. While these preventative measures require up-front funding, they yield a return on investment by lessening the overall impact of a natural disaster on individuals, businesses, governments and communities.

Key considerations for program design include:

- Implementing appropriate incentives
- Programs that focus on learning and behaviour modification, in addition to general awareness
- The need for psychological preparedness
- Local solutions
- The need for solid data and evaluation
- Community connection to foster a culture of resilience.

Given how widespread the social impacts are after a natural disaster, it is important that communities, not-for-profits, emergency management agencies, businesses and governments collaborate to design and deliver preparedness programs and campaigns. These programs must educate communities as well as encourage and foster a culture of connectedness and resilience.

It is critical they be evidence-based to ensure cost-effective investment and continual improvement. It is important, too, to evaluate their effectiveness and draw out their key learnings.

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- **Further research is needed into how to quantify the medium- and long-term costs of the social impacts of natural disasters.**

While the complex social impacts of natural disasters are undisputed, there is currently a lack of consistent data to reliably quantify the cost. Direct and tangible impacts are usually considered as 'one-offs' but intangible social impacts tend to persist over time. Hence, data collection needs to better incorporate this temporal component to track and fully appreciate the long-term effects of natural disasters.

This report shows that the social impacts of natural disasters tend to be multiple and interrelated. Importantly, the experience of grief and trauma varies from person to person. It is therefore necessary to understand both the primary and secondary impacts of natural disasters on individuals and communities.

In *Building an Open Platform for Natural Disaster Resilience Decisions* we proposed a national platform to facilitate access to foundational data. In addition to this, there is a need to incorporate consistent longitudinal data to track social impacts. Areas that could benefit from better data collection include health and wellbeing, education, employment and communities. For example, datasets could incorporate information about people's experience of natural disasters such as timing and type.

Concluding remarks

This report highlights the significant economic costs of the social impacts of disasters. It provides four key recommendations in the form of strategies to help to reduce the long term impacts and costs of future natural disasters.

These recommendations reaffirm those made in *Building our Nation's Resilience to Natural Disasters* (2013) and *Building an Open Platform for Natural Disaster Resilience Decisions* (2014). Particularly, with regard to the need for national coordination and long-term, annual consolidated funding for pre disaster resilience, an open platform for foundational data, and for removing barriers to accessing data and research.

This report also supports the need to consider the social impacts of natural disasters when evaluating the benefits of resilient infrastructure in the investment decision-making process, as explored in *Building Resilient Infrastructure* (2016) and the need to build resilience before natural disasters happen.

“We will not be measured by the kilometres of road and pipes that we replace, we will be measured by how our people come through this”

Jim Palmer from Waimakiriri District Council after the Christchurch Earthquake, 2011

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Outreach Moree NSW
(Australian Red Cross)



January 10, 2012: Grantham, QLD. Local residents, friends and family attend the dawn unveiling of a memorial to victims killed in the floods in Grantham, Queensland on the morning of the first anniversary of the devastating 2011 Queensland floods
(Lyndon Mechelsen / Newspix)

