

**BUILDING BRIDGES:
SUPPORTING ADAPTATION
IN INDUSTRY
VCCAR THINK TANK
CONTEXT PAPER**

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Introduction

Victorian business and industry play an important part in the Australian economy, producing almost one quarter of the nation's GDP.¹ Ensuring long-term economic sustainability requires that overall productivity is maintained and that key industry sectors continue to grow. Understanding how this can be achieved on a sector-by-sector basis, requires an appreciation of the changing threats and opportunities the economy is likely to face in a changing climate.

With the exception of a few sectors such as tourism and primary industries, adaptation has not been a priority for business and industry due to more pressing concerns.² However, an awareness of how climate change may impact on businesses is growing. For example, the failure to adapt to climate change was listed this year as a key global risk by the World Economic Forum (see attachment A).³ The increased focus of major organisations and some peak bodies on building resilience highlights this growing awareness. However, many of the adaptation actions currently undertaken are in response to direct events and there is a need to develop a more anticipatory and less reactive approach to addressing this issue.

Although adaptation presents new risks, it is also an area of innovation, offering new opportunities to Victorian industry and businesses. To capitalise on these opportunities, business and industry will need to adopt innovative approaches to develop and implement new technologies and systems of operation that respond to changing social, environmental and commercial conditions. Some of the tools needed to achieve this are already in use and a core task is to identify and understand how these tools can be best used to adapt. It is also important to understand more clearly who is responsible for which aspects of adaptation and how they are responsible.

Research on adaptation is still developing, with industry-oriented research focusing primarily on the most highly exposed sectors of primary industry, natural resource management, tourism and infrastructure. This focus is more recently extending to sectors such as construction, community services and health, as the pervasive nature of changing climate risks becomes more apparent. Future research will need to address emerging industry needs and be accessible, relevant and useable.

Both the research and government sectors have a pivotal role in supporting industry adaptation by assisting in understanding what these risks mean to businesses, what actions can be undertaken and the implementation of these actions. It will also be important to understand how best vulnerable sectors should be supported. This provides an opportunity for public, research and industry sectors to develop long-term working relationships focussing on building knowledge and capacity in an environment of substantial change.

Business and industry are the foundation upon which our communities are built and have a central role building and maintaining community resilience to climate change. Ensuring that they are informed, prepared and actively adapting is pivotal to ensuring a liveable and prosperous future for Victoria.

Workshop aims

- Identify the priority research areas needed to support private sector adaptation.
- Identify the key values and benefits of adaptation research for industry and business needed to support a business case for future research.
- Understand more fully the resources needed for industry-focussed adaptation research.

What is adaptation?

Even with concerted efforts to reduce greenhouse gases, some climate change cannot be avoided, with most changes to 2040 being 'locked in'. All businesses will need to adapt in some way to accommodate this. If they don't adapt in a planned way, they will have to respond to changes as they happen, increasing the likelihood of loss and damage. Planned adaptation will need to be geographically and sectorally specific in addition to being suited to a specific business or industry.

Many different definitions of adaptation are in use, most revolving around actions and processes. A widely-accepted definition of adaptation accommodating this comes from Smit and Wandel: "... a process, action or outcome in a system to allow the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk or opportunity".⁴ In understanding this definition, it helps to see an individual business as a system with many interacting parts (staff, capital infrastructure, intellectual capacity and culture); and also to recognise that this business system is part of a larger system involving suppliers, logistical supply chains, customers, competitors and the policy and regulatory environment.

Why is adaptation different to mitigation?

Mitigation and adaptation are two related but different aspects climate risk management: risk reduction and risk response. Mitigation's is intended to reduce climate change risk by reducing greenhouse gas concentrations in the atmosphere by reducing emissions, sequestration of carbon dioxide. It requires a mix of policy and actions operating within global and national frameworks and quantifiable accounting.

Adaptation is context and geographically specific, working predominantly at local to regional scales involving actions by individuals, communities, businesses and government. Its primary focus is to reduce the negative impacts of the current climate and to prepare for future conditions, but will also identify and pursue opportunities in a changing climate.

Adaptation is a social process that integrates local knowledge of climate risks and how they are managed, with research findings on how risks may change. Adaptation success is difficult to measure, and without general guidance, it is up to each business to develop their own measures of success.

The role of resilience

Building resilience is a growing aspect of climate change policy and planning, featuring in both the state Adaptation Plan⁵ and State Emergency White Paper.⁶ Resilience has also become a key focus of organisations such as Economic Development Australia, who see it as a core need for future industry and business.

Understanding when and where changing risks may lead to critical thresholds being exceeded is an essential requirement for managing and maintaining resilience. Exceeding a critical threshold such as a loss of operations, prohibitive input costs or specified level of accrued financial can result in a loss of resilience. It is particularly important to be able to identify the signals that precede these thresholds and take action before the threshold is reached.⁷

Resilience means different things to different people, having no commonly accepted definition, making it a difficult concept to put into operation. A recent definition adopted by the Arctic Council is "The capacity of a social-ecological system (or organisation) to cope with a hazardous event or disturbance, responding or reorganizing in ways that maintain its essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation".⁸

While businesses are usually able to identify their own capacity and measures for resilience, a generally applicable set of criteria remain to be developed. Similarly defining successful adaptation remains elusive. This is a widely recognised issue and a key area of adaptation research. Maintaining resilience is a continuous task and businesses should aim to be 'adapting well' to continuous change rather than being 'well adapted' to a particular set of conditions to ensure this.

The role of uncertainty

"Uncertainty about climate change impacts and the limited availability of high-quality risk data are significant barriers to action. The uncertainty associated with the nature, timing, location, and/or severity of climate change poses a challenge for deciding how and when to invest in resilience beyond 'business as usual'."

Weathering the Storm: Building Business Resilience to Climate Change, Centre for Climate and Energy Solutions July 2013

Because the climate is a complex, dynamic system there will always be a significant level of uncertainty associated with adaptation planning. This can be a major barrier to businesses contemplating whether and how to adapt.

It can help to differentiate between the types of uncertainty in the adaptation process. Major areas of uncertainty related to adaptation in business and industry include:

- Scientific uncertainty about the nature of future climate risks.
- Operational uncertainty related to activities related to innovation and unknown outcomes of adaptation actions.
- Policy uncertainty relating to changing regulation and funding available for industry and businesses for adaptation activities.

Business and industry needs to understand that science cannot reduce the uncertainties surrounding future climate to the level they may want – mainly due to the chaotic nature of climate and how effective climate policy may prove to be. Therefore, some level of uncertainty will always need to be accommodated when dealing with adaptation, as is the case with many other areas of business.

The changing risk landscape

"The risks associated with environmental changes are often non-linear. Rather, they can blow out, with dramatic step changes. For example, a really big storm surge today might occur, on average, once a century. But research suggests that with only a 10cm sea-level rise, such extreme events are likely to occur several times a year."⁹

Dangerous Degrees, The Climate Institute (2013)

One of Victoria's major natural assets is its climate. However, a climate's inherent variability results in Victoria being one of the world's most fire prone regions, subject to floods and drought, and to storms of both tropical and sub-Antarctic origin. While average conditions are becoming milder, a hotter and more hydrologically active climate is producing historically unprecedented extremes. Across Australia, these events have been more extreme and produced more severe impacts than conventional climate scenarios and impact models are suggesting. Some Victorian businesses and communities are still recovering from these recent events.



The main perception of adaptation is that it can be addressed incrementally over time because climate change is gradual and significant impacts will only occur decades into the future. However, recent research indicates that rather than gradual incremental change, the climate changes in a step-like fashion, producing rapid shifts in rainfall regimes or changes in the incidence of extreme events.¹⁰ Clusters of unpredictable extreme events, such as the succession of droughts, fires, storms and floods that affected Australia between 2006 and 2012, were certainly hotter, and may have been wetter (floods) and drier (drought) due to climate change. Similar events occurring in the future have the potential to significantly harm a wide range of economic, social and natural values.

Although experience of past events can inform understanding of some potential futures, it is not complete and new 'thinking frameworks' are needed to deal with unprecedented and potentially rapid changes in future climate risks. The most exposed businesses will need to undertake both short and long-term planning if they are to prepare for impacts likely to be experienced in future. Failure to address long-term issues may create greater vulnerability for a business or sector as a whole.

The costs of climate impacts

Victorian businesses are currently experiencing both direct and indirect costs associated with impacts of climate change.¹¹ For example, the Black Saturday Bushfires in February 2009 are estimated to have cost \$926 million (after government aid)¹² in insurance payouts and \$4 billion overall.¹³ The Victorian Treasury has estimated their losses from extreme weather events “as more than \$4 billion over the last ten years” within Victoria.¹⁴ Costs borne by businesses and communities not met by government or insurance are additional to this figure.

Nationally, the cost of natural disasters is projected to increase annually by 3.5% to \$23 billion per year by 2050.¹⁵ Economic assessments of future impacts associated with rapid change show such events are likely to be more costly than currently anticipated, so this figure may be an underestimate. When combined with population growth in high-risk regions, the resulting increases in damages and loss could be substantial.



The impacts costs of abrupt changes are higher than if change is assumed to be gradual. A case study undertaken for fire in Victoria calculated that after a rapid change in fire risk mid-century, estimated by using direct climate model output rather than smoothed data, that losses over the next 15 years were \$6 billion higher than would occur if change were gradual (assuming today's populations and settlement patterns).¹⁶ Analysis of climate model output for south-eastern Australia shows such changes to be common, occurring in about half of over 20 simulations. Any business or community unprepared for such changes would be exposed to unprecedented levels of damage.



Case Study A: Effects of increasing heat events for business and industry

"In light of projected continued global warming, and associated increase in heat waves, more attention needs to be given to environmental heat as a human health hazard in the Occupational Health and Safety arena. Without adoption of effective heat protective strategies economic output and fitness levels will diminish,"¹⁷ having "a significant impact on the productivity of many workers".¹⁸

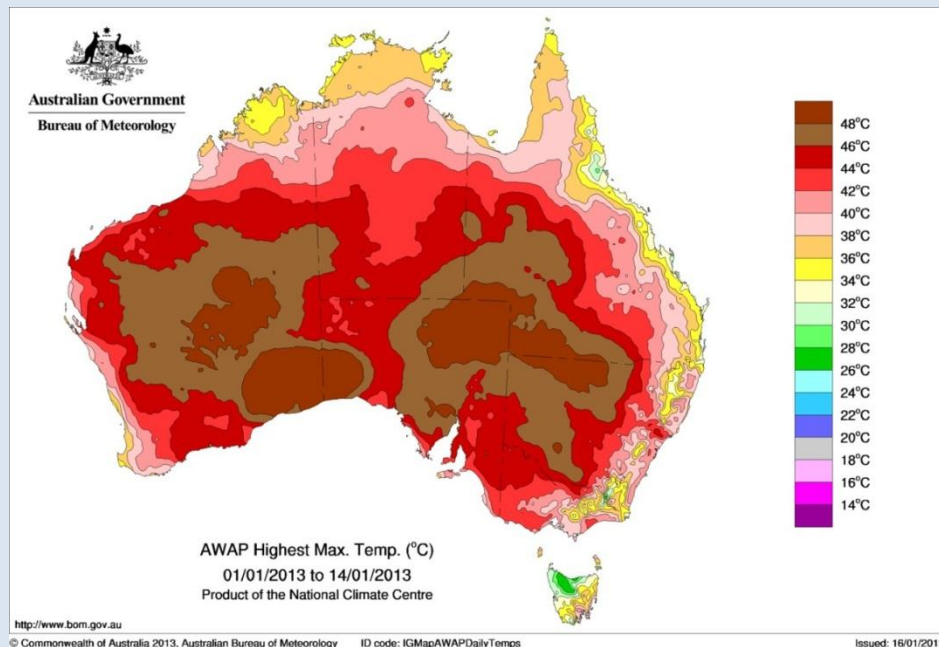


Figure 1: A heatwave in January 2013 led to record high temperatures across Australia, with an average daily maximum temperature exceeding 39°C over 7 consecutive days.¹⁹

Recent reports conclude that the impacts of increasing temperature rises on productivity are likely to be substantial. Heat stress is a significant risk to exposed businesses such as construction, heavy industry and defence. Extreme heat can also increase the rate of equipment failure and maintenance costs. For example, mining industry equipment may need to be serviced more regularly.²⁰ The effects of heat on essential infrastructure such as electricity (brown outs, reduced conductivity), communications (infrastructure failure) and rail (buckling tracks) is well documented. These can impact all areas of business and industry but the full cost of such risks to business and industry has not yet been calculated.

Heat can also have health impacts for employees, resulting in costly payouts and potential legal action against employers. In the three years to July 2011, 497 claims for workplace fatigue and heat stroke were awarded a total of \$4.3 million by the NSW Workers Compensation Scheme.

The annual total days of extreme heat in Victoria have increased faster than expected. Since 1996, total days above 35°C have been at the level previously estimated for 2030.¹⁰ Record high temperatures in January this year (see Figure 1) and associated impacts documented Australia-wide suggest that adaptation to extreme heat needs to be given priority.

Threats and opportunities for Victorian industry and businesses

"Businesses need to think about how they might be affected and what products might help them because it is not always obvious. We had an IT business who because they were on a higher level in a building didn't think that their business would be at risk of flooding. However the basement got flooded and this resulted in the electricity being shut down. No electricity meant no computers and no computers meant no business. They were totally unprepared for what this could do to their business"

Cameron Skews, Marketing Manager, Australian and New Zealand Institute of Insurance and Finance

The primary impacts from slow onset climate-related events (such sea level rise) and immediate climate events (such as storms or heatwaves) can affect the long-term viability of businesses through:

- disruption to businesses operations
- reduced productivity
- damage to infrastructure and assets
- disruption to supply chains
- reduced resources
- injury to employees

Secondary impacts from these events are more diffuse and harder to document but can include:

- changes in markets
- loss of income
- closures of businesses
- health impacts
- reduction of available resources
- increased operational costs
- decrease in financing option and reduction in the value of some businesses
- legal actions

(see Attachment B for details).



Small to medium businesses are particularly vulnerable to these secondary impacts as illustrated after the Black Saturday Fires in Marysville, where after 6 months 60% of businesses had failed and after 12 months, 80% had failed.²¹

These impacts react in a systemic way through the business system as illustrated in Figure 2. The centre of the 'risk disk' shows direct impacts, the centre circle shows how business operations are affected and the outer circle shows how the broader environment business operates in is affected.

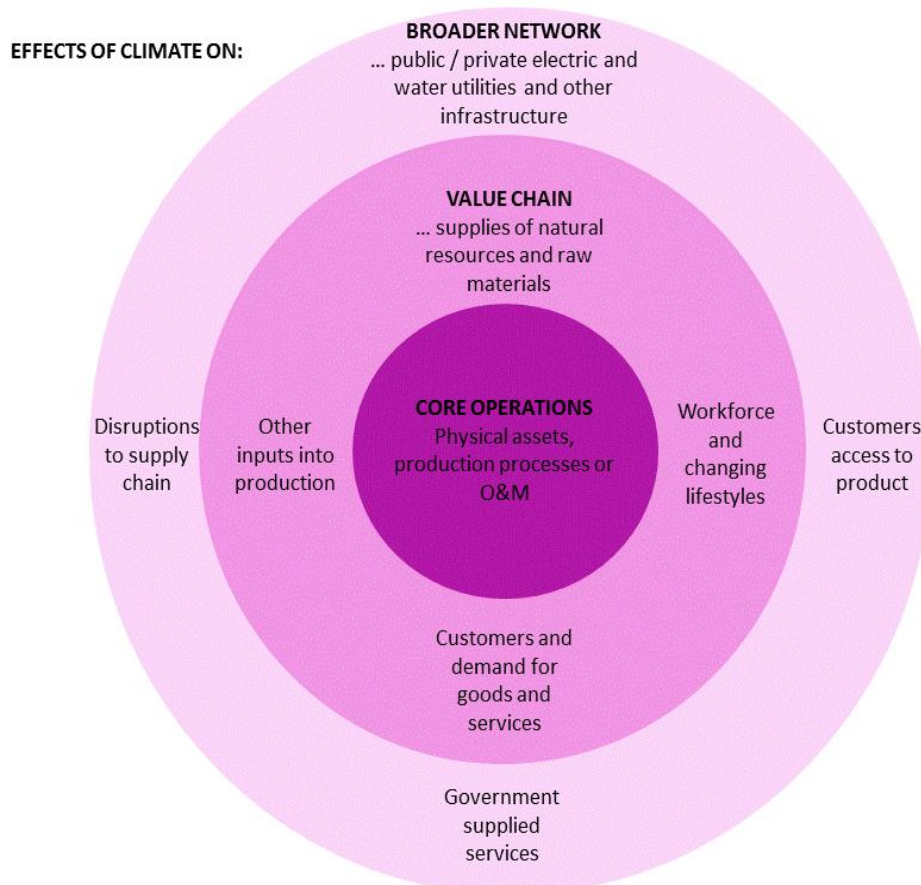


Figure 2: The "Risk Disk": Various risks and impacts of climate change on business (Modified from Sussman and Freed 2008:13)²²

Climate change also offers opportunities, such as the development of new markets. A recent analysis conducted by Environment Business International put services for climate change adaptation services in America at \$700 million and \$2 billion globally, growing at 12 to 20 percent through 2020.²³

The key areas identified were:

- climate risk assessment and analysis
- climate adaptation planning, and
- adaptation design, engineering and construction.

This expansion is mainly being driven by existing businesses; new adaptation start-ups are comparatively small in size.²⁴

Further opportunities for building business capacity include the improvement of operations, services delivery and products. Other opportunities include the replacement of products seen as maladaptive or unsustainable, those that become unavailable due to climate change, and provision of social and environmental services contributing to increased community resilience. Selected threats and opportunities on a sector-by-sector basis are detailed in Table 1.

Table 1: Climate-related threats and opportunities relevant to adaptation on a sector by sector basis (ABS Sectors).

Sector	Threats	Opportunities
Agriculture, Forestry and Fishing	Production losses, asset damage, reduced/more costly inputs, trade exposure. Injury to employees.	Productivity gains, production and lifestyle diversification, new products, environmental services (carbon, water, biodiversity). Identification of the benefits.
Mining	Production losses, asset damages, supply chain disruption	Raw materials for new tech, development of resilient strategies for export, small footprint mining methods, policy and infrastructure design.
Manufacturing	Supply chain disruption, reduced productivity, services delivery disruption, increased cost, trade exposure. Damage to assets. Injury to employees.	Adaptation products, new technologies, value adding and design, the development of new technologies. Development of strategies and redundancies to ensure business continuity.
Electricity, Gas and Water Supply	Supply delivery disruption, network disruption. Infrastructure damage. Increased maintenance costs.	Transformation through changes in demand and supply, new markets, flexible networks, new sources, change to service from supply, build in redundancies. Development of new technologies and processes.
Construction	Delays, supply chain disruption, asset write-offs, diminished capital. Harm to employees.	Development of new materials and processes, Climate-ready materials and design. Awareness building in relation to risks.
Wholesale Trade	Supply chain disruption, reduced raw materials, increased transport and storage vulnerabilities. Damage to products.	Flexibility of supply sources and logistics, alternative sources and routes. Improved storage facilities.
Retail Trade	Supply chain disruption, reduced raw materials, asset damage. Reduced customer base.	Diversification of supply chains, continuity planning.
Accommodation, Cafes and Restaurants	Damage to assets. Diminished capital. Increased costs and lack of food products, spoilage of food.	Strategic sourcing of food, alternative energy supplies, inclusion of redundancies, new markets.
Transport and Storage	Infrastructure damage, damage to assets, disrupted access, energy supply disruption and spoilage of product.	Flexible arrangements for disaster and recovery, new technologies and materials, diversification
Communication Services	Infrastructure damage, disruption of service delivery, increased maintenance costs. Data supply disruption.	Flexible arrangements for disaster and recovery, new tech for adaptation, backup systems and redundancy, network switching
Finance and Insurance	Large insurance losses, finance shortages, greater market volatility. Data supply disruption.	New services and products for adaptation, lengthening of current planning cycles.

Sectors	Threats	Opportunities
Property and Business Services	Economic dislocation at regional scale, increased maintenance costs.	New ownership models, part in setting standards.
Government Administration and Defence	Limited capacity for effective response and coordination. Communication disruption. Possible legal action at the local level.	Policy, emergency and disaster, funding for adaptation, support for building adaptive capacity, strategic scenario building and 'disaster games', more integration.
Education	Disruption to services. Harm to employees and clients. Damage to assets.	Policy development and awareness building and training in relation to rapid changes, greater integration of facilities into community safety. Development of new educational products to support emerging skills needed.
Health and Community Services	Lack of capacity to deliver services to vulnerable communities. Resource limits.	Capacity building for sector, the development of appropriate information and strategies, more integration between allied health and community services, ICT tools.
Cultural and Recreational Services	Loss of services and basic system functions. Community disconnection, loss of natural capital. Injury to employees or clients.	Models for community engagement, making the invisible economies visible. Engaging diversity across cultural and social systems, new markets for environmental services.

Table 1: Adapted from Jones et al (2013)²⁵

Key drivers and defining factors

Adaptation for business and industry has two key drivers that align with business objectives: adaptation to maintain businesses viability and adaptation to ensure business growth. This is consistent with the State Government objective of securing Victoria's position as a leading state "best positioned to accommodate and sustain growth and expansion".²⁶ In a changing climate, competitive advantage will be gained by economies that make the most of their natural, social and economic resources and are resilient to changing climate extremes.

Both these objectives can be affected by internal and external factors that define the type of adaptation actions that can be undertaken and how they are undertaken.

Internal factors include:

- Available resources such as skills, knowledge and finance
- Current strategic directions and planning
- Current processes and systems
- Business and institutional frameworks

External factors include:

- Geographical context
- Regulatory environment
- Surrounding community
- Policy stability and change
- Markets
- Resource availability

The challenge for many businesses is that many of them work on short cycle planning due to the nature of their businesses and so investing in adaptation may not be considered a viable option. For businesses that have longer term planning needs such as a company who constructs infrastructure adaptation is more likely to be considered.



Some areas of the economy such as park management and the primary industry sector have always dealt with environmental uncertainty and change. Change is understood by practitioners in these fields and is factored into working practices. However, with the impacts now being felt, current practices are being challenged by the opposing drivers of resource constraints and increasing impacts.

Observations from Park Management

"The combination of climate change and human habitation is observably affecting the environment and rapidly changing our national parks and reserves. Just one example is more frequent, hotter fire events, changing ecological systems on a large scale. Across the country a large number of fires in the last two decades have covered many millions of hectares, and in some areas burned so hotly they have destroyed the underlying seed beds traditionally resistant to fire, resulting in permanent loss of multiple plant species across large areas, and the associated fauna linked to those species.

Events like these demand increased resources to manage properly over time – not to restore them, but simply to support an orderly natural repair of the system without them being overcome by the encroachment of invasive pest plants and animals. But in a fiscal environment of increasingly limited resources, it is harder and harder to manage parks systems well. It's increasingly becoming a case of what to address and what to simply give up on.

Eventually, the social and economic costs of this lack of investment will become clearer to governments and the wider community, but my concern is that by then a lot of the issues will be too late to address. Environmental Tourism in our national parks is one of Australia's economic 'golden eggs'. But we appear to be cooking the goose."

David Clark, CEO Parks Forum

Key industry adaptation needs

Because adaptation is context specific, different business sectors have different needs (see Attachment C). However, key needs common for most sectors as articulated by people interviewed prior to the roundtable were:

- **Accessible and sector-specific adaptation information** that is fit for task.
- **Greater understanding of how to mainstream adaptation across organisations** and knowledge of which process and methodologies are most suitable for this task.
- **Coordination of networks** to enable program development and knowledge exchange within and between organisations.
- **Decision making and planning support** to enable better preparedness to, and recovery from, events such as bushfires, floods and heatwaves.
- **Appropriate finance and finance-related products** to support businesses to prepare and recover from climate related events.
- **Collaborative working relationships** that span public, private, research sectors and community to build resilience.
- **Governance**, a clearer understanding of roles and responsibilities.
- **Long-term policy** is needed to support adaptation activities and the long-term investments needed to enable this.
- **Greater understanding of possible future legal ramifications.**
- **Better understanding of opportunities particularly in relation to future and emerging markets.**
- **The need to be able to make the business case for adaptation** a greater understanding is needed of the tangible (monetary) and intangible (non-monetary) to enable more complete valuation and understanding of the benefits associated with adaptation to support businesses cases.

Specific funding needs

The present lack of long-term, incentive-based funding models that allow businesses to plan effectively is a barrier to business engaging with adaptation. Future funding possibilities for industry could include:

- Funding models that address both soft and hard infrastructure requirements of business and industry. Current siloed funding is piecemeal and lacks vision, so is more likely to result in maladaptation.
- Conventional processes such as drip-feed funding can work if programs are guaranteed over the long term. This enables bodies that access these funds to invest in long-term strategies using shorter-term investment cycles.
- Reimbursement models, such as the one used by Austrade, where a percentage of expenditure on specific tasks are returned after the actions have been implemented. This is particularly useful for stimulating early innovation in the private sector.
- Simplifying current funding models.

Adaptation research in the context of business



Many of the tools needed to enable adaptation already exist within business frameworks. These frameworks can be modified to incorporate adaptation strategies and actions. Some examples are:

- Risk management
- Transformation and change management
- Business improvement
- Business continuity management
- Quality assurance
- OH&S
- Innovation

However, these methods are not always fit for task and some will need modification to accommodate the specific needs of adaptation. A comprehensive review of companies in the Standard and Poor (S&P) Global 100 Index, showed that the most common activity undertaken was the inclusion of adaptation planning in conventional business continuity or risk management plans. However, the review noted that “existing enterprise management systems may underestimate climate risks” and also that “relatively few companies have undertaken comprehensive vulnerability assessments”.²⁷ This presents challenges to some businesses, particularly small to medium enterprise of which many are resource constrained and time poor. Consideration will need to be given as to how to most effectively support adaptation vulnerable sectors.

Building business resilience through adaptation is an area of innovation that combines new knowledge and technology with existing technology and systems, with the aim of making business more responsive to climate risks, both before and after they occur.

The adaptation process can be viewed as consisting of two key phases: the **problem phase** and the **solution phase** (see Figure 3). This separation is widely supported by research from psychology, behavioural economics, decision-support and management disciplines.

The key task of the **problem phase** is **diagnostic** and aims to identify the nature of the problem. This is done by identifying the risks associated with potential climate change impacts and prioritising them, within the scope of a given set of aspirations and goals. The primary framing that currently directs the frameworks and tools used is **risk**.

The key task of the **solution phase** is **treatment** of the problem. This is achieved through the development and implementation of adaptation actions. It is useful to frame this phase using **innovation** as it provides a known business context and is supported by existing operational methodologies.²⁸

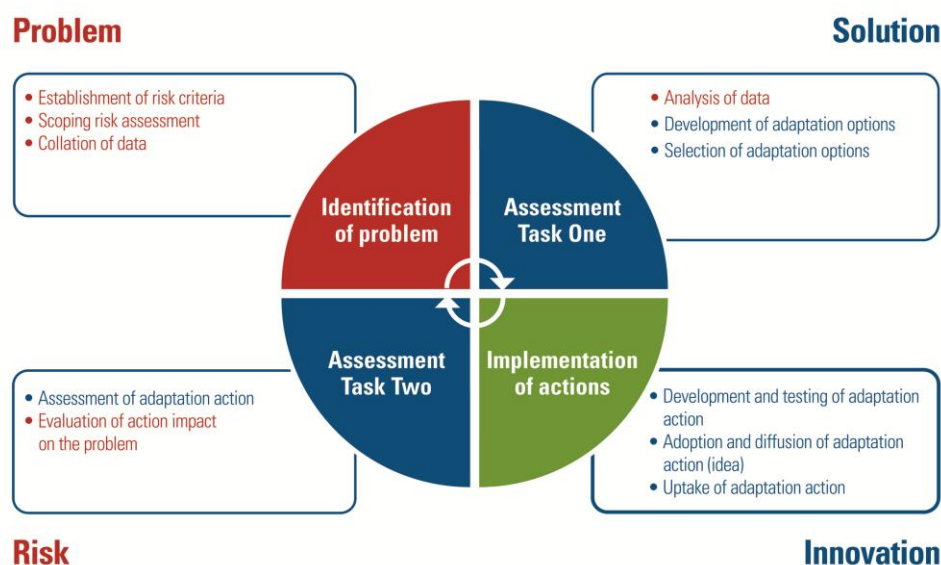


Figure 3: Problem-solution process framework for adaptation (Young 2013).²⁸

N.B: As adaptation is context specific some of the key steps listed in the above figure may be subject to change or not be necessary.

The research methods for each of these phases are quite different (Table 2) and examining these phases individually can assist in ascertaining what sort of research might be needed, when it might be needed and the value of research at that stage.

Table 2: Aims, tasks and areas of research required to apply the problem-solution

Phase	Key aim	Research required	Tasks
Problem phase	To understand what the problem is, how it currently works and how it may work in the future.	Climate sciences Economic, social and environmental Business systems and commercial	Assist with the collation, analysis and valuation of climate impacts. Develop and provide knowledge and information to enable better understanding of the problem, e.g., possible future impacts and risks, how they work and when and where they may manifest and how will effected Develop research communication that is fit for purpose.

Phase	Key aim	Research required	Tasks
Assessment phase one	To support decision making on potential risks identified and possible solutions.	Climate sciences Economic, social and environmental Business systems and commercial	Provide support in the form of guidance regarding analysis of options. Prioritise risks, identify and evaluate adaptation options. Assist decision making. Develop research communication that is fit for purpose.
Solution phase	Develop, test, monitor and analyse adaptation actions during the implementation process.	Climate sciences Economic, social and environmental Business systems and commercial	Analyse, monitor and evaluate adaptation actions during the implementation process. Assist the development of frameworks to assist implementation including evaluation frameworks. Support decision making and assist understanding during this process. Develop research communication that is fit for purpose.
Assessment phase two	To analyse and evaluate the effectiveness of the adaptation action, and its implementation.	Economic, social and environmental Business systems and commercial	Monitor adaptation actions and subsequent outcomes. Analyse the adaptation action and evaluate the outcomes against measures of success. Support decision making. Develop research communication that is fit for purpose.

Current adaptation research

The primary research institutes that facilitate and disseminate adaptation research relevant to Victorian industry and businesses are the National Centre for Climate Change Adaptation Research Facility (NCCARF), the Victorian Centre for Climate Change Adaptation Research (VCCCAR) and CSIRO. The full extent of private industry research is not easily discoverable, as not all programs produce reports that are publically available. To date, the majority of research has focused primarily in the public sector and the natural environment.

Publically available reports focus on the following sectors:

- Primary industries: e.g., dairy industry, farming, viticulture
- Natural resource sectors: forestry, water, commercial fishing, extraction of natural resources (mining)
- Tourism and recreation
- Infrastructure: built assets, energy

More recent research covers sectors such as health and community services, small to medium businesses, construction and food manufacturing. Programs specifically covering adaptation and industry include the Victorian Climate Change Adaptation Program (primary industry) and CSIRO's Climate Adaptation Flagship primary industries theme Adaptive Primary Industries, Enterprises and Communities. These programs principally address regional and primary industry issues.

Peak bodies such as The Australian Insurance Council, the Municipal Association of Victoria and the Australian Industry Group have also undertaken research. Much of this research is being undertaken by private consultants and not all is publically available. Much of the research undertaken by individual companies is commercial in confidence. This poses an interesting question in relation to the how the relationship between the public, research community and the private sector should be negotiated, taking into account the different governance arrangements for providing private benefits and the public good.

Such questions need to focus on:

- The aim and purpose of the research
- The needs of particular businesses and industry sectors
- The role of consultants and research institutes
- What should be funded and by whom

Research needs for industry and business

"There is a lot of really interesting research out there but it is difficult to implement, what we need is research we can implement"

Mark Allan, Chairman Property Council of Australia (VIC) Sustainable Buildings Committee Associate Director Billard Leece Partnership – Architects, Chairman Victorian Sustainable Buildings Committee Property Council of Australia, Hon Senior Fellow University of Melbourne (Engineering).

Effective adaptation involves actions that are supported across the private, public and research sectors. To ensure research is relevant and useable for end users, the research agenda needs to be informed by industry needs. This requires an activity based approach which involves collaboration between practitioners, key decision makers, policy makers and researchers throughout the research process. This can also assist capacity as it is informed and informs all stakeholders and serves the needs of the end users.

Building collaborative research models

Recent research being undertaken into the Primary Health and Community Welfare Sector in Victoria by VCCCAR illustrates the type of collaborative model being used in the adaptation research to address end user needs. This research is design as a three phase action research model. The first two phases are focused on understanding the needs and context of adaptation in each of these sectors. The third phase is designed "to engage in cycles of participatory action-led learning and reflection around climate change adaptation 'tools', in order to learn more about each organisation's individual context and identify further options for adaptation action". The aim of this research is to produce "practical adaptation outcomes for the participants and their organisations, an increase in adaptive learning capacity, and valuable research insights for the researchers involved; potentially in a co-research mode with project participants"²⁹.

This is not a new concept and was successfully used to develop successful adaptations to irrigation salinity in northern Victoria in the 1960s to 1980s. Community-based research trialled a number of innovative practices for on-farm water management, involving locally-based knowledge and imported key technologies. The practices changed current perceptions that irrigation salinity could not be tackled at the farm scale, leading to the transformation of one of the most degraded rural areas in the state, into one of the most productive.



The following research needs were articulated in interviews undertaken prior to this workshop:

- **Accessible and sector-specific research products** that are relevant, useable and assist decision making.
- **Economic:** More comprehensive sector-specific costing and valuing of the current and future impacts of climate change. In particular greater understanding of how to and what to value, particularly in relation to the benefits of adaptation. This is especially important for environmental and social sectors such as parks management, and the health and community sectors. Also more research in the area of what the secondary impacts cost.
- **Sector-based risk and vulnerability assessment** for all sectors.
- **The risks for businesses associated with impacts of climate events on critical infrastructure** for all sectors.
- **Better understanding of opportunities including future and emerging markets.**
- **Greater understanding of future climate events and the potential impacts** for all sectors. In particular the risks for businesses associated with impacts of climate events on critical infrastructure.
- **Greater understanding of sector based thresholds in relation to climate change** to allow for better planning to increase business resilience.

The State policy context

Adaptation policy in Victoria is informed by two recent documents released by the Victorian Government: the *Climate Change Adaptation Plan for Victoria*, released in March 2013; and the *White Paper on Victorian Emergency Management Reform*. These documents are complementary – the White Paper focuses on improving emergency and disaster response to extreme events (disaster resilience), whereas the Adaptation Plan focuses on planning for changing conditions due to climate change. Both aim to increase resilience to changing hazards within government, industry and the community.

One of the four major stakeholder partnerships within the Adaptation Plan is to engage with the private sector to inform and support business in understanding and managing their climate risks. The principles informing these partnerships are that risk management is generally best undertaken by those who are directly affected, and who are in a position to manage these risks. Measures for the private sector favoured by the plan are: regulatory frameworks for industry that allow businesses to manage their own risks, remove disincentives for private adaptation and promote market mechanisms for adaptation are favoured by the plan. The Adaptation Plan also suggests that climate-related risks can be allocated with the other risks that businesses generally have to manage.

Three priorities for private sector support within the plan are:

1. Facilitating place-based risk management, including through hazard identification management and land-use planning.
2. Setting the right conditions for businesses to adapt such as removing barriers to effective adaptation, providing access to information to support appropriate risk allocation and promoting business innovation.
3. Supporting the development of effective insurance markets for climate risk.

The Victorian government has key roles in:

- providing information and helping to build adaptive capacity,
- removing barriers to effective adaptation,
- providing access to information to support appropriate risk allocation; and
- promoting business innovation.

Access to research is seen as a public good – particularly where information on climate and climate risks can help organisations shape their own resilience needs, and where that research would be too costly to generate in house. Organisations such as Victorian Climate Change Centre Adaptation Research and bodies such as the Local Government greenhouse alliances and Municipal Association Victoria are currently engaged in such roles.

For disaster management, priorities are business continuity, emergency relief and loans, and post-event advice on recovery. A new *Strategy for Critical Infrastructure Resilience* is being developed this year (2013) to replace Part 6 of the *Terrorism (Community Protection) Act*. Infrastructure resilience is based on the sectors: banking and finance; communications; energy; food; health; police and emergency services; transport; and water. Again, it is stated that owners and operators of private infrastructure are best placed to undertake planning and preparation to protect their assets.

The Federal policy context

Over the last five years, the Australian Government has increased its focus on adaptation to one of the three pillars of its comprehensive climate change strategy investing \$129 Million in the program. The Council of Australian Governments (COAG) agreed to the National Climate Change Adaptation Framework in April 2007. This framework covers a range of cooperative actions between all levels of

government to address the key needs of business and the community for targeted information on climate change impacts and adaptation options. A new national adaptation strategy, *Adapting to Climate Change in Australia*, by the then Department of Climate Change and Energy Efficiency was published in 2010 with the following priorities:

- coastal management,
- water,
- infrastructure,
- natural systems of national significance,
- prevention, preparedness, response and recovery with regard to natural disasters and
- agriculture.

National vulnerability assessments have been produced for coasts, biodiversity, world heritage sites, the national reserve system, and fire regimes. A *National Strategy for Disaster Resilience* released in 2012 by the Commonwealth Attorney General Department, has also been tabled by COAG, with several government programs in place to develop the strategy agenda. The *Climate Adaptation Outlook: A Proposed National Adaptation Assessment Framework* was released in 2013 by the Department of Industry Innovation, Climate Change, Science Research and Tertiary Education. This is the start of a structured series of reports on how well-placed Australia is to manage the impacts of unavoidable climate change.

The National Climate Change Adaptation Research Facility, the main Commonwealth-funded adaptation research body, was not funded beyond June 30 this year. However, the new Coalition government made an election promise to contribute \$9 million to NCCARF over the next three years but it is unclear when this will be put in place. With very different arrangements for adaptation amongst the various state governments, the research-outreach relationship between federal and state governments remains unclear.

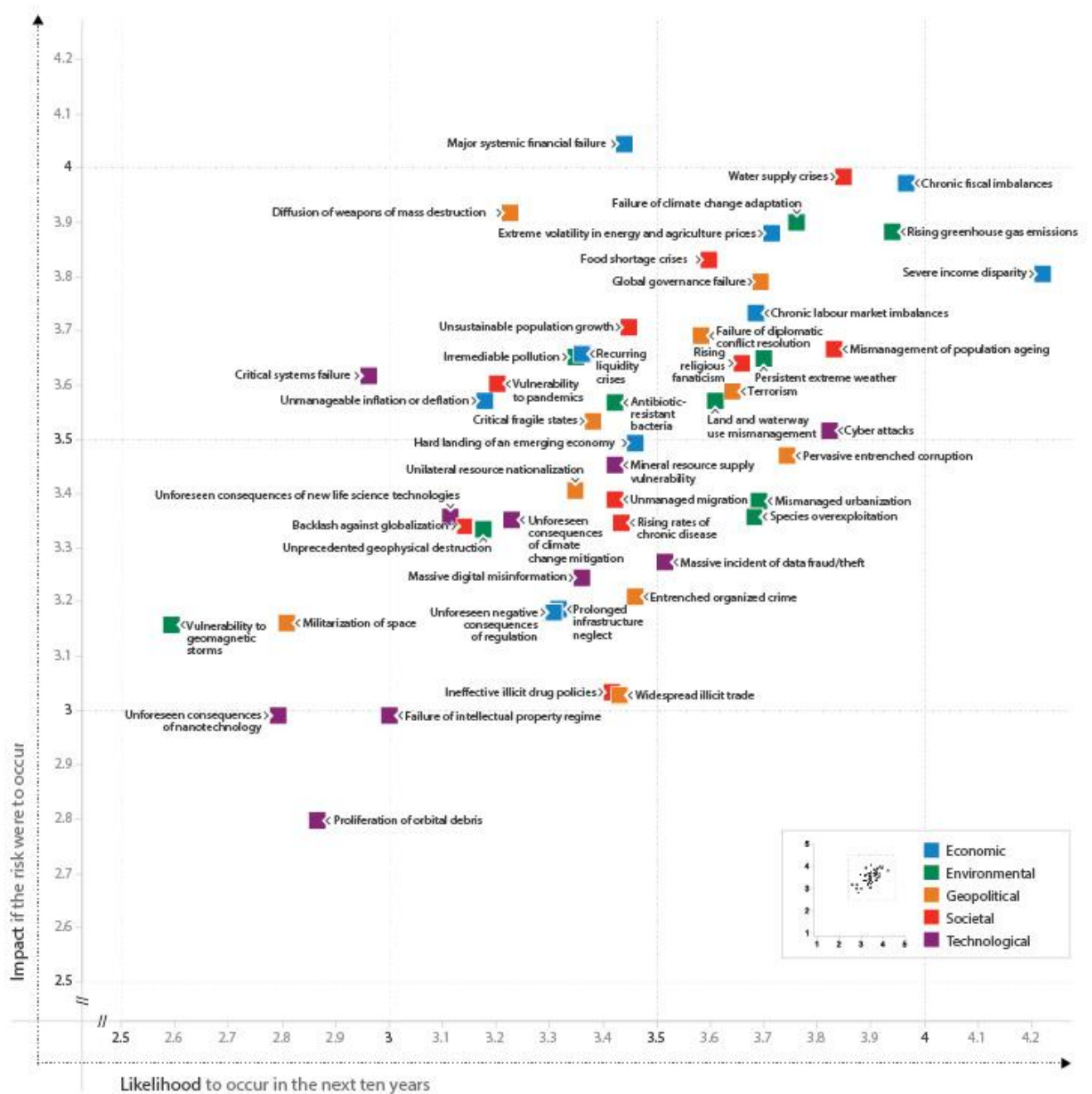
Conclusion

With over 500,000 businesses in Victoria, effective support for private sector adaptation needs to consider the diversity and breadth of these businesses. Climate change impacts and adaptation options will vary considerably by type of business, scale and location. This means that different businesses will face different challenges dependent upon their context. Understanding the appropriate timing for undertaking adaptation measures will also be important, given the varying nature of their sensitivity to climate impacts and their different planning and investment horizons. Currently it is unclear what sort of adjustments may be needed to maintain viability of businesses and industry compared to other regions and it is likely even greater investment will be needed for future growth.

Research plays an important part in supporting adaptation in industry and businesses, and is relatively underdeveloped compared to other areas of adaptation research. However, the type of research undertaken should be determined by what the emerging needs for business and industry are in relation to this issue. This will require collaborative working relationships across different sectors to achieve appropriate outcomes for business and industry. Increasing understanding of adaptation and the actions needed is crucial if we are to remain economically viable and continue to grow in the face of the changing climate. The development of research to support the knowledge needed for effective action is a key investment for Victoria's economic future.

Attachment A

Global risks landscape 2013, World Economic Forum 2013



Attachment B

Climate Change Impact	Primary impact	Secondary impacts
Individual Storm Event	Damage to and loss of infrastructure Disruption to services and production, supply chains Possible endangerment of life Potential disruption to energy supply Potential communication disruption Loss of business services or productivity Stress experienced by support services responding to the event	Decreased income Increase cost to business through insurance premiums, cost of infrastructure replacement Possible increased cost to consumer Decrease in some primary resources leading to market shortages
Collective Storm Events (e.g., some areas in regional Victoria have recently been flooded three times in 12 months.)	Cumulative damage and loss of infrastructure Cumulative disruption to services, supply chains and production Possible endangerment of life or wellbeing of employees Loss of business and reduction in profit Disruption to energy supply Limited capacity of support services to deal with ongoing events Disruption of data and communication	Increased cost to business through insurance premiums and need to replace infrastructure Potential reduction of insurance payouts leading to increased expenditure Warranty life of products shortened Potential refinancing difficulties for vulnerable industries Decrease in business Increased cost to consumer leading to less disposable income in some areas Associated health and wellbeing issues with employees Migration of existing community members to other locations
Bushfire	Damage to and loss of infrastructure Disruption to services, supply chains and production Endangerment of life, serious injury Loss of business and reduction of profit Damage to or destruction of community Disruption of data and communication	Lack of financial capacity, particularly SMEs Increase in insurance premiums for property and liability Lack of infrastructure and financial support impacts Associated health issues Change in market structures Migration of existing community members to safer locations

Climate Change Impact	Primary impact	Secondary impacts
Flood (overland)	Damage to and loss of infrastructure Disruption to services, supply chains and production Possible disruption to energy supplies Possible endangerment of life Loss of business and reduction of profit Destruction of community Disruption of data and communication	Lack of financial capacity particularly SMEs Increase in insurance premiums for property and liability Lack of infrastructure and financial support impacts Associated health issues Migration of existing community members to other locations
Heat wave	Damaged to infrastructure e.g., train tracks Disruption to production due to OH&S requirements Disruption to power supplies and supply chains Increased energy costs due air-conditioning and cooling costs Possible endangerment of health of employees Damage of products e.g., food, pharmaceutical products.	Potential increase in work cover cases Associated health issues Increase of prices with some resources Loss of business and reduction of profit
Drought	Damaged of infrastructure e.g., water pipe damage due to increased tree root activity, building stress Potential loss of business or reduction of profit Water restrictions Degradation of land, vegetation loss Decrease in agricultural products Reduced water quality	Increase in costs to consumer due to the decrease in some resources such as agricultural sector products Decrease in refinancing options, increase in debt Associated health issues Loss of community Change in consumer needs Inability to farm in certain areas Migration of existing community members to other locations

Climate Change Impact	Primary impact	Secondary impacts
Inundation (slow onset sea level rise)	Devaluation of property Damage to assets and infrastructure Degradation of land Loss of coastal aquifers to salinity	Loss of value of primary assets for some families leaving them more financially exposed. Increase in insurance premiums for these areas Inability to farm in certain areas Potential legal challenges for damages Migration of existing community members to other locations
Consecutive unrelated climate events, e.g., fire then flood	Ongoing damage and loss of infrastructure Ongoing disruption to services, supply chains and production Possible endangerment of life or wellbeing of employees Loss of business and reduction of profit Disruption to energy supply Potential communication disruption Lack of support services to deal with ongoing events	Increase cost to business through insurance premiums and need to replace infrastructure Potential reduction of insurance payouts leading to increased expenditure Warranty life of products shortened Potential refinancing difficulties for vulnerable industries; e.g., SMEs Changes in consumer behaviour Decrease in market demand for some products and increase in others Increased cost to consumer leading to less disposable income in some areas Associated health issues Migration of existing community members to other locations

Sector	Needs in relation to adaptation
Logistics and supply chains	Plan for disruption, regional to international levels. An understanding of how these disruptions may occur, and the threats and opportunities this offers for businesses.
Building industry	Change has to be well planned and incremental. Education of organisations and consumers; e.g., consumers are more concerned with fittings than the structural integrity of dwellings, and with capital costs compared to running costs. Promotion of fit for climate housing needs. Changes in practice are driven by regulation, requiring fast-tracking of appropriate standards. Ongoing skills development in relation to best practice in relation to climate-resilient buildings.
Parks	Extreme weather events impact on parks organisations and management – and have been apparent for the last 20 years. Post event response is becoming more expensive, and the human cost is also increasing. Need standards for consistent monitoring and costing in addition to tools that can assess the full value of parks.
Small to medium businesses	This sector is financially vulnerable, as it is hard for many businesses to plan long-term. They need information that is accessible and relevant. Many small businesses are not always connected into networks, so communication is an issue. There is also a need to understand more fully the possible long term effects in some sectors. Support for planning.
Tourism	80% SME and micro businesses, very vulnerable to climate shocks. Improved communication is needed and greater understanding of the possible impacts.
Health	Evidence-based tangible activities and strategies are needed. Capacity building in relation to responses to climate change and also greater understanding of organisational aspects of climate risk.
Agriculture	Agriculture is already adapting because it has to, but farmers are financially vulnerable to cascading climate events. Need for policy that addresses economic and social and environmental aspects in an integrated way.
Finance	Expansion of financing tools and mechanisms to increase the level of social and environmental investments through bonds and other investment funds. The industry needs to explore how it can assist long-term financial planning and increase collaboration with the sectors they service. Collaboration within the finance sector can address how to maintain economic stability by preparing for rapid change. Higher risk due to rapid change will require higher levels of investment at all levels from infrastructure through to social investments. Greater policy surety is needed to allow proper planning of future investments.
Insurance	Possible need for a new regulatory structure that is more resilient to rapid and large increases in payouts that may exceed premiums. Consideration of how reinsurance will be affected by cascading events, and how it can promote future economic stability through the development of new products.

Sector	Needs in relation to adaptation
Emergency Sector	Different modes of communication that engage more effectively with vulnerable aspects of the community, such as the CALD sector. Encouragement of pro-active responses in the sector and communities.
Manufacturing	Vulnerable to supply chain disruption, resources restrictions and physical risks to employees. Fit for purpose information can create a better understanding of adaptation and the opportunities and risks associated with it.
Community Sector	CSOs are highly vulnerable and poorly prepared to respond to climate change and extreme weather impacts. There is a need for inclusion into policy and research settings where the impacts of climate change are more fully supported.

References

- ¹ Securing Victoria's Economy, section 2.3.1 (2013) Department of Premier and Cabinet, Victoria <http://www.dpc.vic.gov.au/index.php/featured/securing-victorias-economy/22-html/409-securing-victorias-economy-html#securingvictoriaspositionasaleadingstate> viewed 12.09.2013.
- ² Meeting Notes, VCCCAR Climate Adaptation Industry Roundtable May, 25th of May 2012.
- ³ World Economic Forum (2013) *Global Risks 2013: 8th Edition*. World Economic Forum, Geneva.
- ⁴ Smit, B and Wandel, J (2006) Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, 16, 282-292.
- ⁵ Department of Sustainability and Environment (2013) Victorian Climate Change Adaptation Plan, Victorian Government Melbourne, 96 pp.
- ⁶ Department of Premier and Cabinet (2012) Victorian Emergency Management Reform, Victorian Government Melbourne, 46 pp.
- ⁷ Greg Hunt, Executive Officer SECCA, Climate Adaptation Pathways Workshop, Department of Industry Innovation, Climate Change, Science Research and Tertiary Education, 14 April 2013
- ⁸ Arctic Council (2013) Glossary of terms. In: *Arctic Resilience Interim Report* (2013). Stockholm Environment Institute and Stockholm Resilience Centre, Stockholm, Sweden.
- ⁹ The Climate Institute (2013) *Dangerous Degrees*, The Climate Institute, Sydney 6pp
- ¹⁰ Jones RN, Young CK, Handmer J, Keating A, Mekala GD and Sheehan P (2013) *Valuing Adaptation Under Rapid Change*. National Climate Change Adaptation Research Facility, Gold Coast, Australia, 172 pp.
- ¹¹ Kuruppu N, Murta J, P Mukheibir P, Chong J and Brennan, T (2013) *Understanding the Adaptive Capacity of Australian Small to Medium Enterprises to Climate Change*, National Climate Change Adaptation Research Facility, Gold Coast, pp. 133. p. 101
- ¹² Commissioner for Environmental Sustainability(2012) *Foundation Paper One: Climate Change Victoria: The Science, our People and our State of Play*. The Commissioner for Environmental Sustainability, Melbourne.
- ¹³ Teague B, McLeod R and Pascoe S (2010) *Final Report: Summary(2009)*, Victorian Bushfires Royal Commission, Melbourne, 42 pp.
- ¹⁴ Arup T (2013) (2013) Climate-driven disasters cost Victorians \$4 billion. *The Age*, 13 March 2013, <http://www.theage.com.au/victoria/climatedriven-disasters-cost-victorians-4-billion-20130319-2qe1o.html> viewed 6 September 2013.
- ¹⁵ Deloitte Access Economics (2013) *Building our Nation's Resilience to Natural Disasters, Australian Business Roundtable for Disaster Resilience and Safer Communities*, Deloitte Access Economics.
- ¹⁶ Jones RN, Young CK, Handmer J, Keating A, Mekala GD and Sheehan P (2013) *Valuing Adaptation Under Rapid Change*. National Climate Change Adaptation Research Facility, Gold Coast, Australia, 172 pp.
- ¹⁷ Kjellstrom T, Holmer I, Lemke B (2009) *Workplace heat stress, health and productivity – an increasing challenge for low and middle-income countries during climate change*, *Global Health Action*, 2 10.3402/gha.v2i0.2047.
- ¹⁸ Dunne JP, Stouffer RG and John JG (2013) Reductions in labour capacity from heat stress under climate change warming. *Nature Climate Change* 3doi:10.1038/nclimate1827.
- ¹⁹ Bureau of Meteorology (2013) Special Climate Statement 43 – extreme heat in January 2013. Bureau of Meteorology, Melbourne, 19 pp.
- ²⁰ Hodgkinson JH, Littleboy A, Howden M, Moffat K and Loechel, B (2010) *Climate Adaptation in the Australian Mining and Exploration Industries*, CSIRO Climate Adaptation Flagship Working paper No. 5. <http://www.csiro.au/resources/CAF-working-papers.html> viewed 1 September 2013.
- ²¹ Young, C. K. (2013). *Smart Futures: VCCCAR Regional Business Roundtable Final Report*, Victorian Centre for Climate Change Adaptation Research, Melbourne.

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- ²² Kuruppu N, Murta J, P Mukheibir P, Chong J and Brennan T (2013) *Understanding the Adaptive Capacity of Australian Small to Medium Enterprises to Climate Change*, National Climate Change Adaptation Research Facility, Gold Coast, pp. 133. p. 101.
- ²³ The upcoming avalanche of adaptation dollars 27th of August 2013, Dexter Gauntlett, Navigant Research, Sustainable business Oregon
<http://sustainablebusinessoregon.com/columns/2013/08/the-coming-avalanche-of-adaptation.html?page=2> viewed 9th of September 2013.
- ²⁴ Tom Downing, President of Global Climate Adaptation Partnership, personal communication, July 23 2013.
- ²⁵ Jones RN, Young CK, Handmer J, Keating A, Mekala GD and Sheehan P (2013) *Valuing Adaptation Under Rapid Change*. National Climate Change Adaptation Research Facility, Gold Coast, Australia, 172 pp.
- ²⁶ Securing Victoria's Economy, Section 3.1 (2013), Department of Premier and Cabinet, Victoria
<http://www.dpc.vic.gov.au/index.php/featured/securing-victorias-economy/22-html/409-securing-victorias-economy-html#securingvictoriaspositionasaleadingstate> viewed 12 September 2013.
- ²⁷ Crawford M and Seidel S (2013) *Weathering the Storm: Building Business Resilience to Climate Change*. Centre for Climate and Energy Solutions, Washington DC.
- ²⁸ Young C (2013) Problem Solution Framework, Adaptation and Innovation: Reframing Adaptation Implementation, NCCARF Adaptation and Partnerships National Adaptation Conference 2013.
- ²⁹ Fünfgeld H, Rance A, Millin S, Wallis P, Bosomworth K, and Lonsdale K (2013) *Climate change adaptation in the primary health and community welfare sector of Victoria: A literature review and analysis of institutional context and organisational needs for adaptation*. Melbourne: RMIT University, Monash University, Victorian Centre for Climate Change Adaptation Research, Melbourne.