Industry groups have suggested that the following government-led activities may support climate change adaptation in the sector:

- Better information about the potential effects of climate change on aspects of business, such as impacts of flooding on supply chains, effects of heatwaves on workers and clients, should be provided to business to support accurate business risk assessment and responses. This could be in the form of industry-specific scenarios and case studies.
- Education and training programs can support the sector to understand its exposure to climate-associated risk and to deal with the risk in an appropriate manner.
- Harmonisation of related initiatives with existing frameworks (e.g. sea-level rise benchmarking across state boundaries will help to increase certainty for business and enhance the likelihood of coordinated and well-informed responses.
- The development of sector-specific performance indicators and metrics to support performance measurement will enable internal decision-making, disclosure to shareholders and ultimately longer-term improvement in performance.
- There is a need for government support for government-owned land and water management initiatives towards improving the capacity of industry with effectively disclose their climate change risks and their responses to manage risk.
- Involving independent peak bodies to become trusted disseminators of information and knowledge.
- Active to achieve red tape, not to reduce the requirement that needs to be addressed, but to remove overhead and apparent contradictions.
- Provision of financial incentives for adaptation planning, possibly funded from carbon tax revenue (or an equivalent mitigation fund).

Stakeholder engagement is critical when developing adaptation policies that may affect the private sector. As an example, early attempts at land-use planning controls in adaptation in Queensland and New South Wales have been restricted because if a failure to understand and manage potential trade-offs (e.g. fear of property price impacts, insurance affordability, and stranded assets).

Governments seeking to provide information on climate change to business and industry should consider their insurance affordability and stranded assets).

Case Study: Extractive resource development in a changing climate: learning the lessons from recent studies in selected industries

Australia’s national and regional economic structures are highly dependent on mining-led export earnings. A study of coal mining operations in Queensland examined drought (water quality) and flooding (water quantity) challenges that are relevant to the future viability of the industry and local communities. Key findings included:

- There is a lack of preparedness to deal with sudden changes in the natural climate and extreme weather events that are not part of long-lived industry memory caused by high staff turnover, reliance on contractors, short sightedness, and production-driven planning agendas.
- Short-term planning cycles affect decision-making. Decisions are largely driven by production imperatives rather than long-term strategic planning. This means that industries are highly reactive and responsive to climate variability and change.
- These industries need to be aware of the benefits that can be derived from understanding and adapting to climate change.
- Industry will benefit from using seasonal and short-term climate forecasts to plan ahead of the worst weather events.
- Inadequate internal and external communication can be a barrier. Early and timely collaboration between all stakeholders can help reduce the economic and environmental costs of adaptation decisions.
- Many private sector businesses, with planning cycles of just a few years, do not recognise the need to plan for extreme weather events.
- Industry has the capacity to respond to the challenge of climate change (both risks and opportunities) but requires leadership and support from all levels of government.
- There is a need for better informed business about the risk to various business sectors associated with climate risks, and on approaches to deal with these risks. This includes the need to consider supply chains, and customer and staffing issues.
- There is a need for a harmonisation of adaptation methods across state jurisdictions.

Ensuring business and industry are ready for climate change

The business and industry sector is exposed to risk associated with the effects of climate change. It is expected that the sector is to make aware of the risks, and to assist in managing the risk appropriately.

Some of these risks include:

- The Australian private sector is at present engaged with climate change risks and adaptation, although exemptions exist, especially in the resources and agricultural sectors. Government has a role to play by building engagement through education and recognising and promoting good practice.
- Carbon issues (greenhouse gas mitigation) dominate the climate change discussions in the private sector and cause some confusion around the role and purpose of adaptation.
- Many private sector businesses, with planning cycles of just a few years, do not recognise the need to deal with climate change.
- Industry has the capacity to respond to the challenge of climate change (both risks and opportunities) but requires leadership and support from all levels of government.
- There is a need for better informed business about the risk to various business sectors associated with climate risks, and on approaches to deal with these risks. This includes the need to consider supply chains, and customer and staffing issues.
- There is a need for a harmonisation of adaptation methods across state jurisdictions.
- Adaptation policy/regulation can be seen as a threat to the private sector (leading to, for example, increased transaction costs and stranded assets). Failure to identify and address the potential trade-offs in adapting to climate change can undermine successful policy implementation. Efforts should be made to reduce transaction costs by streamlining policies and regulation wherever possible.
- Consumers should be empowered to drive adaptation responses from business and industry.

References


Agriculture and food industries. Future effects, impacts and issues

Financial services.

Table 1: Examples of climate risks and impacts on different sectors of the economy (based on Smith, 2013a,b; Johnston, 2013; West & Brereton, 2013).

Adaptation: what this means for managing the private sector

For the private sector, adaptation is key to:

1. Maintaining economic stability;
2. Managing climate legal risk and responding to adaptation regulations;
3. Ensuring that any market failures are addressed (Productivity Commission, 2012).

Future effects, impacts and issues... continued

Future effects, impacts, and issues... continued

Climate change effects on businesses will depend on the nature of the enterprise and the degree of exposure. Businesses with a short-term outlook are more exposed to issues associated with climate variability than climate change (although in the short term they may be affected by climate change adaptation regulations). Others, particularly in the infrastructure-related sector or those with longer-term investment horizons, are more likely to be exposed to the effects of climate change.

Australia already has a highly variable climate, and under climate change some extremes, such as heatwaves and bushfires, are likely to become more frequent. Some changes are already observed: annual mean temperatures have increased by 0.7°C since 1910 and the frequency of extreme heat days has been more than double the frequency of extreme cold days during the past year compared to 1986–90 (BOM, 2013).

Projected future changes to the Australian climate include (Whetton, 2011):

• Annual average warming by 2050 (above 1990 temperatures) of about 1.0°C over Australia, with warming of 0.7°C in coastal areas and 1.2°C inland;

• A warmer climate in southern areas of Australia, especially in winter, and in southern and eastern areas in spring;

• Southeast around Australia is expected to be cooler. The most intense global extreme that has the highest agreement across models is for an increase of 1.5°C to 2.0°C by 2050 compared to 1990. In a worse scenario, warming could be 3°C by 2050 and 5°C by 2100. Australia can expect regional-scale, with parts of the east coast projected to be above the global projections (CSIRO & ACER CRC, 2011).

Drought frequency is expected to increase, particularly in southern eastern Australia. There is less agreement amongst models for future trends in intense rainfall.

The highly diverse business and industry sector in Australia will be strongly influenced by the changing climate. Perhaps the most extreme example of this is the Tasmanian wine industry (e.g. Brown Brothers and Shaw & Smith) who have expressed that “climate change was a key driver for diversifying their product mix” (Brown Brothers, 2013). Understanding adaptation for the private sector is complex. For example, businesses in developed countries are often exposed to the effects of climate change – this being the case, it is vital that effort is devoted to ensuring that businesses and their supporting infrastructure are resilient to anticipated impacts.

Climate change can offer opportunity in many businesses. Businesses can position themselves to make the most of new situations, for example by developing new products to support customers to adapt. Business opportunities associated with climate variability and climate change are evident in many areas, for example, tourism (based on Smith, 2013a,b; Johnston, 2013; West & Brereton, 2013).

Opportunities include:

• tour operators and travel agencies targeting increasing numbers of tourists seeking cooler climates;
• businesses selling products that can be transported over long distances at the lowest cost, such as some high-tech industries or service industries;
• some agricultural producers (e.g. dairies) who can move into new regions that are affected by drought or flooding, or expanding the amount of area they can cultivate.

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• some agricultural producers (e.g. dairies) who can move into new regions that are affected by drought or flooding, or expanding the amount of area they can cultivate.
Climate effects on businesses will depend on the nature of the enterprise and the degree of exposure. Businesses with a short-term outlook are more exposed to issues associated with climate variability than climate change (although in the short term they may be affected by climate change adaptation regulation). Others, particularly in the infrastructure-related sector or those with longer time horizons, may be more exposed to the effects of climate change. The Bangkok floods in 2011 sent tremors of impact through the Australian private sector supply chain and gave a stark reminder about the interactions between climate change and other risks. However, whether businesses develop climate-related contingent liabilities, there are opportunities to adapt and therefore reduce exposure and/or take advantage of opportunities.

Impacts of a variable climate on specific businesses (or on particular parts of businesses) are discussed below. For the private sector, adaptation is about three key elements:

- **Understanding** the need for businesses to adapt to climate change and the risks they face as a result of this effect.
- **Planning** to identify opportunities associated with adaptation to climate change.
- **Involvement** of businesses' key stakeholders in identifying opportunities or autonomously asking for opportunities.

The principal direct risks to businesses from future climate change, especially in the shorter term up to mid-century, are likely to come from changes in temperature and variability and water-related impacts. These extremes include flood, extreme temperature, storm surge, drought, high wind, and indirectly, occurrence of bushfires linked to higher temperature and lower humidity. These direct flood-related effects will also face indirect risks through the impacts of climate change on supply chains, particularly designed adaptation regulation, infrastructure, or strategic response to climate change. Climate change effects on businesses will depend on the nature of the enterprise and the degree of exposure. Businesses with a short-term outlook are more exposed to issues associated with climate variability than climate change (although in the short term they may be affected by climate change adaptation regulation). Others, particularly in the infrastructure-related sector or those with longer time horizons, may be more exposed to the effects of climate change.

Projected future changes to the Australian climate include (Withnell, 2011):

- **Annual average warming** by 2050 (above 1961-1990 temperature) of about 1°C across Australia, with warming of 0.7 to 0.9°C in coastal areas and 1.2 to 1.9°C inland.
- **A rise in temperature in southern areas of Australia, especially in winter and in southeastern and southern areas in spring**.
- **A sea-level rise around Australia is expected to be the most rapid global estimate from the Intergovernmental Panel on Climate Change (IPCC, 2007) for an increase of 16 to 50 mm by 2050-2099 compared to 1900. In a recent paper authored by several IPCC authors in the journal Nature, Australia's sea levels are projected to rise by 21 cm by 2050-2099 compared to 1900.**

Future effects, impacts and issues — continued

For the private sector, adaptation to climate change involves three key elements:

1. **Understanding**: understand climate variability and change and the implications of both for businesses.
2. **Planning**: plan for the potential impacts of climate change and assess opportunities for new business strategies.
3. **Involvement**: ensure that businesses' key stakeholders are involved in identifying opportunities or autonomously asking for opportunities.

Future effects, impacts and issues — continued

Future effects, impacts and issues — continued

Future effects, impacts and issues — continued

Agriculture and food industries. A warming climate is likely to affect the potential to grow certain crops in some places, which may have impacts on imports and prices. Given the high dependence on imported grains, and to a lesser extent oilseeds, this may lead to increases in the prices of these two industries, as well as transport and marketing costs. The impacts on the supply chain will come only recently from the availability of short-term climate-related market impacts, especially in Australia.

Financial services. Insurance becomes unavailable or unaffordable at certain locations then the portfolio of lenders may be affected. Risk response (e.g. in mortgage) may affect asset value and organizational reputation, whereas failing to respond may expose a listed company to shareholder litigation.

Adaptation: what this means for managing the private sector

Adaptation includes actions to adjust activities to remove or reduce impacts of climate change. Adaptation includes changes in management and behavior, as well as developing new products or services, which may involve research and development costs. For SMEs, peak bodies will play an important role in implementation of adaptation (SAM, 2013). The business sector is also challenged by the language of climate change. Terms such as mitigation have traditionally been used to describe risk reduction, but are now used to describe carbon abatement.

Challenging adaptation to the private sector for businesses, the Australian government. Australia is often described as the developed country most exposed to the effects of climate change - being the case, it’s vital that effort is devoted to ensuring that businesses and their supporting infrastructure are resilient to anticipated impacts.

Climate change can offer opportunity to many businesses. Businesses can position themselves to make the most of new and/or emerging markets.

Adaptation policies can be seen as a threat to businesses (EPA, 2011) to businesses (Kuruppu et al., 2013) to businesses in the form of regulatory or market changes, increasing or decreasing water availability, increasing or decreasing water costs, and increasing or decreasing flood risk. Businesses face a number of challenges that may prevent them from adapting to climate change, such as:

- **Cost of adaptation**: Businesses need to consider the costs and benefits of adaptation, including the costs of potential policy changes, such as increased regulatory requirements or increased costs of adaptation measures.
- **Lack of awareness**: Businesses may be unaware of the potential impacts of climate change on their operations, or they may not recognize the benefits of adaptation measures.
- **Legal and regulatory barriers**: Businesses may face legal and regulatory barriers to adapting to climate change, such as leasing restrictions or permitting requirements.
- **Inadequate information**: Businesses may lack the information they need to effectively adapt to climate change, such as detailed climate projections or guidance on adaptation strategies.
- **Resource constraints**: Businesses may lack the resources to undertake adaptation efforts, such as financial resources or technical expertise.

Implications for policy

Governments need to provide leadership in business through that, by leading by example. Governments need to work together in preparing and implementing adaptation policies, and to ensure that these policies are consistent with the principles of sustainable development. Governments need to ensure that policies and regulations target the most critical areas and that they are effective in reducing the impacts of climate change.

Future effects, impacts and issues — continued

Table 1: Examples of climate risks and impacts on different sectors of the economy (based on Smith, 2013a; Johnston, 2013; West & Brereton, 2013).

<table>
<thead>
<tr>
<th>Climate Change Effects</th>
<th>Sector</th>
<th>Risks/Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV03: Floods</td>
<td>Construction</td>
<td>Increased failure risk in hydraulic structures (e.g. levees)</td>
</tr>
<tr>
<td>DV03: Droughts</td>
<td>Agriculture</td>
<td>Reduced crop yield (e.g. due to crop failure followed by a large flood)</td>
</tr>
<tr>
<td>DV03: Extreme heat</td>
<td>Construction</td>
<td>Increased failure risk in hydraulic structures (e.g. levees)</td>
</tr>
<tr>
<td>DV03: Storms</td>
<td>Energy transmission</td>
<td>Increased extreme temperature (e.g. due to storm surge)</td>
</tr>
<tr>
<td>DV03: Sea-level rise</td>
<td>Sea-level rise</td>
<td>Increased failure risk in hydraulic structures (e.g. levees)</td>
</tr>
<tr>
<td>DV03: Competition for water</td>
<td>Construction</td>
<td>Increased failure risk in hydraulic structures (e.g. levees)</td>
</tr>
</tbody>
</table>

The impacts and risks faced by different sectors of the economy are shown in Table 1. For example, the agriculture sector may be exposed to risks such as increased failure risk in hydraulic structures (e.g. levees) due to increased extreme temperature (e.g. due to storm surge). The insurance industry may be exposed to risks such as increased failure risk in hydraulic structures (e.g. levees) due to increased extreme temperature (e.g. due to storm surge). The construction sector may be exposed to risks such as increased failure risk in hydraulic structures (e.g. levees) due to increased extreme temperature (e.g. due to storm surge).
Current effects, impacts, and issues...

Climate change effects on businesses will depend on the nature of the enterprise and the degree of exposure. Businesses with a short-term outlook are more exposed to issues associated with current climate variability than climate change, although in the short term they may be affected by climate change adaptation regulations. Others, particularly in the infrastructure-related sector or those with regional business, are likely to be affected by the longer-term impacts of climate change. The Bangladesh floods in 2011 sent tip-offs of impacts through the Australian private sector supply chain and were a stark reminder about the potential new risks from climate change. Whether dealing with climate variability or climate change, businesses need to ensure that they are ready for climate change.

Adaptation: what this means for managing the private sector

For the private sector, adaptation is a key element of their strategy to manage climate change.

Future effects, impacts and issues... continued

For SMEs, these may be either related to the business as a whole, or to specific areas of the business such as retail, construction, tourism, or agriculture. The business sector is also challenged by the language of climate change. Terms such as ‘mitigation’ have traditionally been used to describe risk reduction, but are now used to describe carbon reduction.

The business sector is also challenged by the language of climate change. Terms such as ‘mitigation’ have traditionally been used to describe risk reduction, but are now used to describe carbon reduction. Adapting/adapting for the private sector presents new challenges. Australia is often described as the developed country most exposed to the effects of climate change - this being true, if the vital effort is devoted to ensuring that businesses and their supporting infrastructure are not at risk. Climate change can offer opportunities to many businesses. Businesses can position themselves to make the most of new situations, for example by developing new products to support customers to adapt. Business opportunities associated with climate change tend to be most likely to come from the private sector. In the 2011 Climate Change and Greenhouse Gas Emissions Report, the Australian National Greenhouse and Energy Reporting Agency reported that the private sector accounted for 71% of emissions, with the 2012 report due to be published in the coming months. The business sector is also challenged by the language of climate change. Terms such as ‘mitigation’ have traditionally been used to describe risk reduction, but are now used to describe carbon reduction.
Implications for policy … continued

Industry groups have suggested that the following government-led activities may support climate change adaptation in the private sector:

• Better information about the potential effects of climate change on aspects of concern to business, such as impacts of flooding on supply chain, effects of heavier on workers and clients, should be provided to business to support accurate business risk assessment. This could be in the form of industry-specific scenarios and case studies.

• Education and training programs can support the sector to understand its exposure to climate-related risks and to deal with the risks in an appropriate manner.

• Harmonisation of information across national planning frameworks (e.g. sea-level rise benchmarks across state boundaries will help to increase certainty for business and enhance the likelihood of co-ordinated and well-informed responses).

• The development of sector key performance indicators and metrics to support performance measurement will enable internal decision making, disclosure to shareholders and ultimately longer-term improvement in performance.

• There is a need for government support to government and investment strategies and approaches (e.g. assisting industry with mechanisms to effectively disclose their climate change risks and their response to manage risk, that required early adaptation actions).

• Enabling independent peak bodies to become trusted disseminators of information and knowledge.

• Active in observance red tape, not to reduce the regulatory burden that need to be addressed; to remove overlaps and apparent contradictions.

• Provision of financial incentives for adaptation planning, possibly funded from carbon tax revenue (or equivalent mitigation fund).

Stakeholder engagement is critical when developing adaptation policies that may affect the private sector. As an example, early attempts at flood planning control in Queensland and New South Wales have been rescinded because it is feared to understanding and manage potential trade-offs (e.g. fear of property price impacts, see: Whetton P 2011. Australia’s national and regional economic structures are highly dependent on mining-led export earnings. A study of coal mining operations in Queensland examined drought supply chain, and flood supply chain challenges relevant to the future viability of the industry and local communities. Key findings included:

• There is lack of preparedness to deal with sudden changes in the national climate due to the short-lived industry memory caused by high staff turnover, reliance on contracts, short sightedness, and production driven planning agendas.

• Short-term planning cycles often result in decision-making. Decisions are largely driven by production imperative, rather than long-term strategy. Often short-term decisions are highly tentative and responsive to climate variability and change. These include being short from drought preparedness to flood preparedness, and right-hand-side thinking to protect against a single scenario.

• Industry will benefit from using seasonal and short-term climate forced knowledge to plan ahead of the wet season.

• Inadequate internal and external communication can be a barrier. Early and timely collaboration between all stakeholders can help break down barriers to climate change adaptation and foster robust engagement across the business and industry sector.

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• Industry will benefit from using seasonal and short-term climate forced knowledge to plan ahead of the wet season.

• Inadequate internal and external communication can be a barrier. Early and timely collaboration between all stakeholders can help break down barriers to climate change adaptation and foster robust engagement across the business and industry sector.

Case Study: Extractive resource development in a changing climate: learning from recent weather events in Queensland, Australia: Implications for the resource industry (Sharma et al., 2013).

Australia’s national and regional economic structures are highly dependent on mining andexport earnings. A study of coal mining operations in Queensland examined drought supply chain, and flood supply chain challenges relevant to the future viability of the industry and local communities. Key findings included:

• There is lack of preparedness to deal with sudden changes in the national climate due to the short-lived industry memory caused by high staff turnover, reliance on contracts, short sightedness, and production driven planning agendas.

• Short-term planning cycles often result in decision-making. Decisions are largely driven by production imperative, rather than long-term strategy. Often short-term decisions are highly tentative and responsive to climate variability and change. These include being short from drought preparedness to flood preparedness, and right-hand-side thinking to protect against a single scenario.

• Industry will benefit from using seasonal and short-term climate forced knowledge to plan ahead of the wet season.

• Inadequate internal and external communication can be a barrier. Early and timely collaboration between all stakeholders can help break down barriers to climate change adaptation and foster robust engagement across the business and industry sector.

The business and industry sector is exposed to risk associated with the effects of climate change, and in many cases, is not made aware of the risks, and assisted to manage the risk appropriately.

Key Points

• The Australian private sector is not yet engaged with climate change risks and adaptation, although exemptions exist, especially in the resource and agriculture sectors. Government has a role to play by building engagement through education and recognising and promoting good practices.

• Carbon issues (greenhouse gas mitigation) dominate the climate change discussions in the private sector and cause some confusion around the role and purpose of adaptation.

• Many private sector businesses, with planning cycles of just a few years, do not recognise the need to adapt to climate change.

• Industry has the capacity to respond to the challenge of climate change (both risks and opportunities) but requires leadership and support from all levels of government.

• There is a need for better information about the risks to various business sectors associated with climate change, and on approaches to deal with these risks. This includes the need to consider supply chains, and customer and staffing issues.

• There is a need for a harmonisation of adaptation methods across state jurisdictions.

• Adaptation policy/ regulation can be seen as a threat to the private sector (leading to, for example, increased transaction costs and stranded assets). Failure to identify and address the potential trade-offs in the development and implementation of climate policy (e.g. negative impacts of bushfire early care undermines Policy implementation. Efforts should be made to reduce transaction costs by streamlining policies and regulation wherever possible.

• Consumers should be empowered to drive adaptation responses from business and industry.
Industry groups have suggested that the following government-led activities may support climate change adaptation in the private sector:

- Better information about the potential effects of climate change on aspects of business, such as impacts of flooding on supply chains, effects of heatwaves on workers and clients, should be provided to businesses to support accurate business risk assessment and responses. This could be in the form of industry-specific scenarios or case studies.
- Education and training programs can support the sector’s understanding of climate-related risks and to deal with the risk in an appropriate manner.
- Harmonisation of climate change policies and frameworks. More broadly, the sector will help in increasing certainty for business and enhance the likelihood of coordinated and well-informed responses.

- The development of selective key performance indicators and scenario-based risk performance measurement and reliable internal decision making, disclosure to stakeholders and ultimately long-term improvement in performance.
- There is a need for government support for adaptation and investment strategies and approaches (e.g. aesthetic industry with mechanisms to effectively disclose climate change risks and their response to manage risk that encourages early adoption of adaptation actions).

- Enabling independent peak bodies to become trusted sources of information and knowledge.

- Active to show delivery of not only to reduce the requirement that needs to be addressed but also to improve overall and apparent contradictions.

- Provision of financial incentives for adaptation planning, possibly funded from carbon tax revenue (as an alternative mitigation fund).

Stakeholder engagement is critical when developing adaptation policies that may affect the private sector. As an example, every attempt at a funds planning corridor in Queensland and New South Wales has been described because it fails to understand and manage potential trade-offs (e.g. fear of property price impacts on insurance affordability and stranded assets).

Government seeks to provide information on climate change to business and industry, and should consider their delivery mechanisms carefully, ensuring that the message is seen as an ‘honest broker’. This may require the use of intermediaries.

Case Study: Extractive resource development in a changing climate: learning the lessons from recent and apparent contradictions.

Key Points

- The Australian private sector is not yet engaged with climate-change risks and adaptation. Although exceptions exist, especially in the resources and agriculture sectors, Government has a role to play in building engagement through education and recognising and promoting good practices.

- Carbon issues (greenhouse gas mitigation) dominate the climate change discussions in the private sector and cause some confusion around the role and purpose of adaptation.

- Many private sector businesses, with planning cycles of just a few years, do not recognise the need to consider the role of climate change.

- Industry has the capacity to respond to the challenge of climate change (both risks and opportunities) but requires leadership and support from all levels of government.

- There is a need for better information about the risks to various business sectors associated with climate change, and on approaches to deal with those risks. This includes the need to consider supply chains, and customer and staffing issues.

- There is a need for a harmonisation of adaptation methods across state jurisdictions.

- Adaptation policy/ regulation can be seen as a threat to the private sector (leading to, for example, increased transaction costs and stranded assets). Failure to identify and address the potential trade-offs in implementing a climate change adaptation policy can undermine the policy implementation. Efforts should be made to reduce transaction costs by streamlining policies and regulation wherever possible.

- Consumers should be encouraged to drive adaptation responses from business and industry.

The business and industry sector is exposed to risk associated with the effects of climate change. The key point is that the sector is made aware of the risks, and assisted to manage the risk appropriately.