

The escalating risk to
the global asset base
from climate impacts

How the 'resilience
dividend' makes
businesses more
competitive

Why public and private
sectors must collaborate
to fund climate resilience

Climate change and business survival



Within 20 years we estimate US\$200bn of investment each year will be needed globally to combat losses from climate impacts. A third of this will offer strong returns on investment. The balance will need more innovative public-private finance.

Whether it's too wet, too dry, too hot or too windy, extreme climate events can shock load finely balanced systems and trigger collapse.

Scientific evidence that change is taking place and climate events are becoming more severe is now incontrovertible. The effects are laid bare for all to see in news bulletins: destruction and accelerated degradation of buildings and infrastructure, ill health caused by heat stress and disease, shortages of vital resources, and loss of communication and mobility. The economic and social consequences as organisations falter and fail can be profound.

This report makes clear that there is a business dividend from investing in resilience – whether that is in the form of improved protection or better emergency planning. But it also highlights a looming US\$130bn per annum global funding gap. This represents resilience and adaptation measures offering marginal direct business benefit, but that will nonetheless hit the bottom line as climate change worsens.

As we move into an era of increasing climatic volatility, public and private sectors must seek out new ways to share risk and unlock investment to make assets – and the businesses and societies they support – more resilient.

Keith Howells,
Chairman, Mott MacDonald

Why you should read this report

Increasingly severe and frequent climate events are causing rapidly rising losses reported by businesses and governments worldwide. In many instances, organisations are suffering long-term harm to assets, productivity, service provision and reputation.

Investing to build climate resilience will enable organisations to minimise their losses and rebound swiftly following climate events, ultimately enabling them to outperform poorly adapted and less prepared competitors.

This report sets out the importance of:

Recognising the escalating risk posed by climate events and taking action to build resilience.

Understanding the need for investment in resilience to maintain business continuity and competitiveness.

Collaborating with public and private sector partners to find new ways to finance protection and adaptation.

Addressing climate impacts alongside 'business as usual' strategic, risk management, policy and regulatory, contractual and investment planning.

Fostering the culture shift that will be required to build resilience.

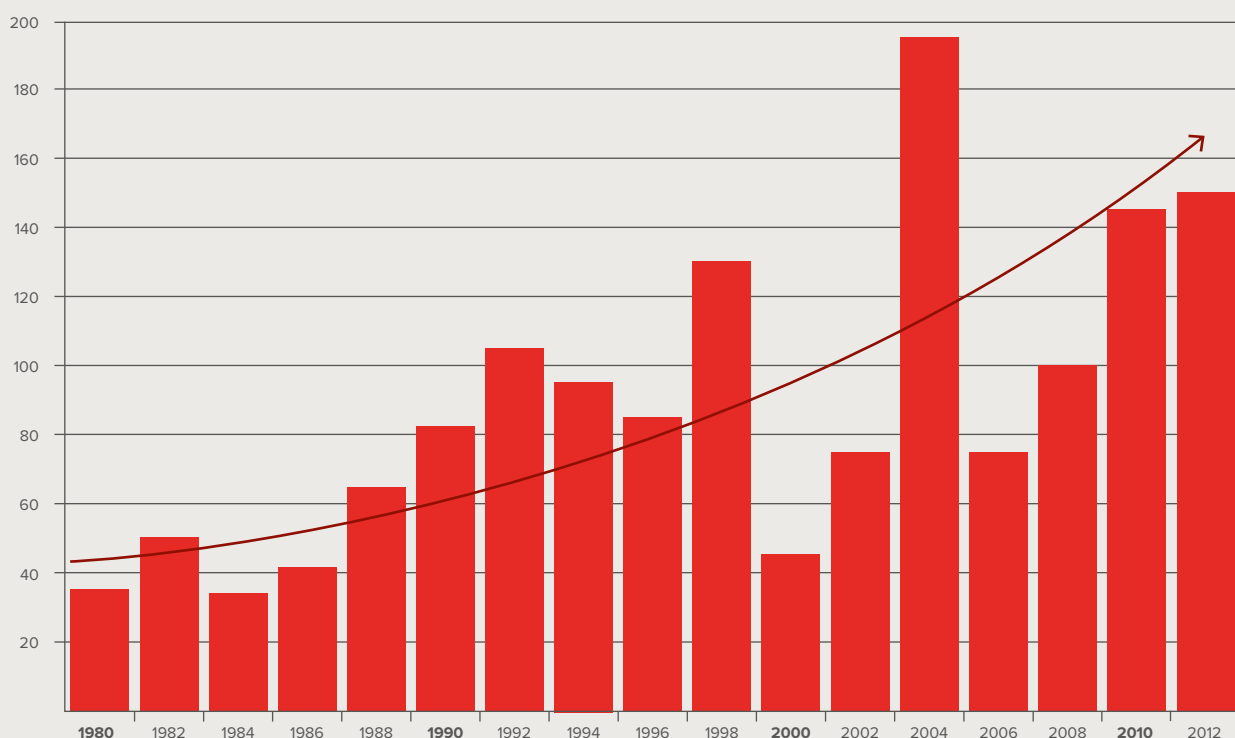
This report is aimed at leaders and decision makers in business, financial institutions and government. It is intended to inform discussion and elicit action that will enable you to:

- Protect investment, productive capacity and service quality, reduce risk and sustain profitability.
- Act in the best interests of clients, stakeholders and wider society.
- Build awareness of local, regional and national resilience risks and opportunities.
- Initiate informed discussion with private and public sector organisations – to exercise influence and build support.

The cost of climate events is rising exponentially...

Losses attributed by global insurers to climate events have been increasing for the last 30 years. The trend line is rising sharply and is projected to steepen further over the next two decades, reaching US\$1trn.¹

Global losses resulting from climate events, US\$bn



...requiring ever greater investment in resilience.

While businesses will fund resilience where there is a clear return on investments, the gap between what is spent and what's required will steadily increase over the next 20 years, reaching US\$130bn/annum.

Potential losses as % of asset base without resilience investment

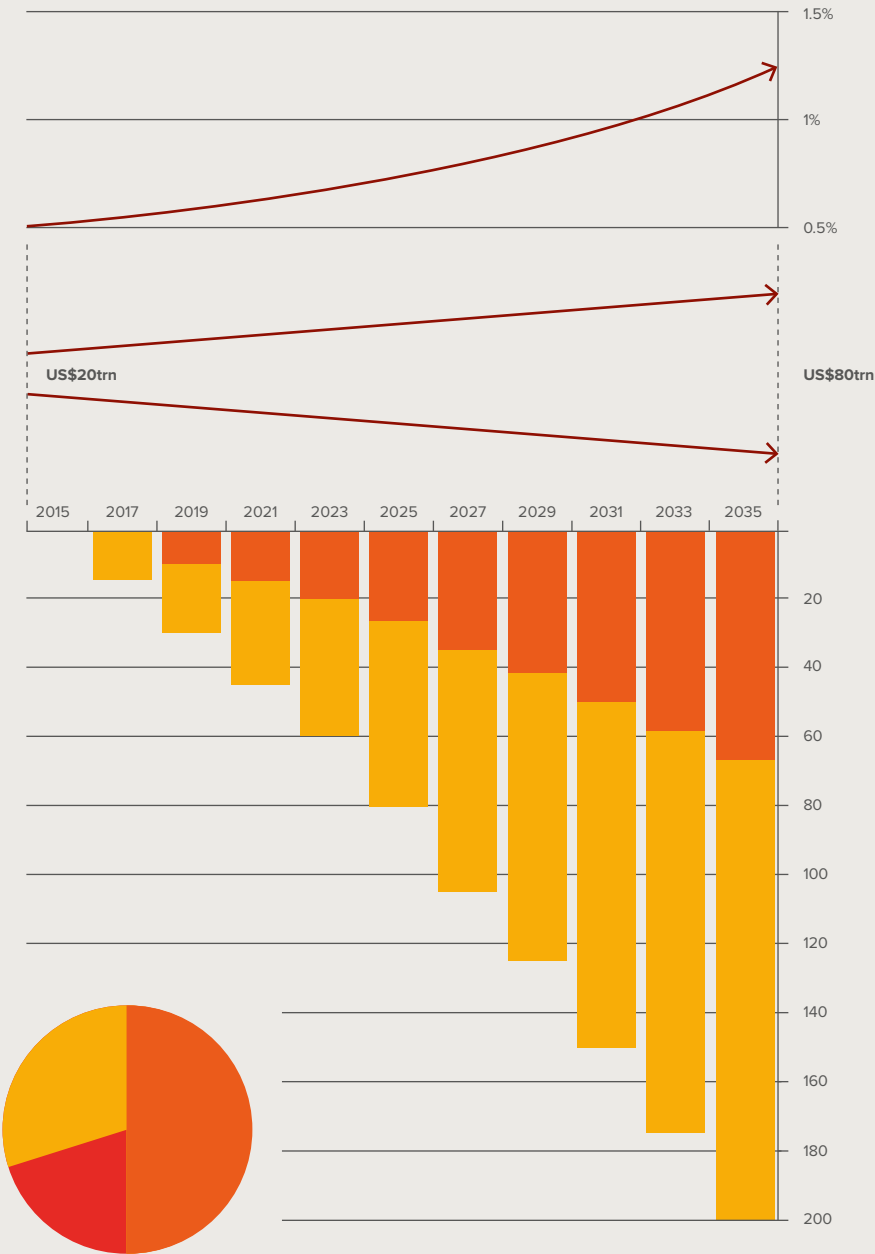
Value of global asset base

Annual investment required to prevent all bar residual losses, US\$bn

- Businesses should invest to save: 30% of the required investment will protect against 50% of potential losses, offering a bottom line benefit.
- Public-private sector collaboration and innovation are needed to mobilise 70% of the required investment, protecting against 30% of losses: low direct benefit but vital for business continuity.

Cost-benefit of protecting against losses:

- Invest to save
- Marginal direct value: funding gap
- Residual losses



Climate impacts snapshot

Service at risk

Unpredictable weather systems are disrupting the operation of power infrastructure globally. Power lines and substations have been repeatedly knocked out by windstorms and floods in the UK, disrupting supply to customers and impacting economic productivity.





Global temperatures are climbing. The increase so far is already unleashing acute events. Building resilience is essential.

“25% of businesses do not survive a climate disaster.”

Judith Rodin

President of the Rockefeller Foundation and co-chair of the NYS 2100 climate resilience commission

A 2°C increase in global mean temperatures above pre-industrial levels will precipitate disastrous and irreversible consequences for global climate systems, warns the United Nations' Intergovernmental Panel on Climate Change (IPCC).

The IPCC asserts that there is a chance that such a rise can be averted – but we are already half way there and further rises are locked in. The 1°C rise so far experienced has triggered increasing instances of acute (short-term) climate events. The IPCC estimates that even if governments worldwide can implement the ambitious emissions reduction programme agreed in Paris in 2015, targeted to limiting the global mean temperature rise to 2°C, there remains a 33% possibility that we will exceed it. If nothing changes, we will pass the 2°C line within three decades, and the World Bank is warning of a 3.7°C rise.

More frequent and severe climate events are therefore a near- and medium-term certainty.

Resilient businesses need integrated planning

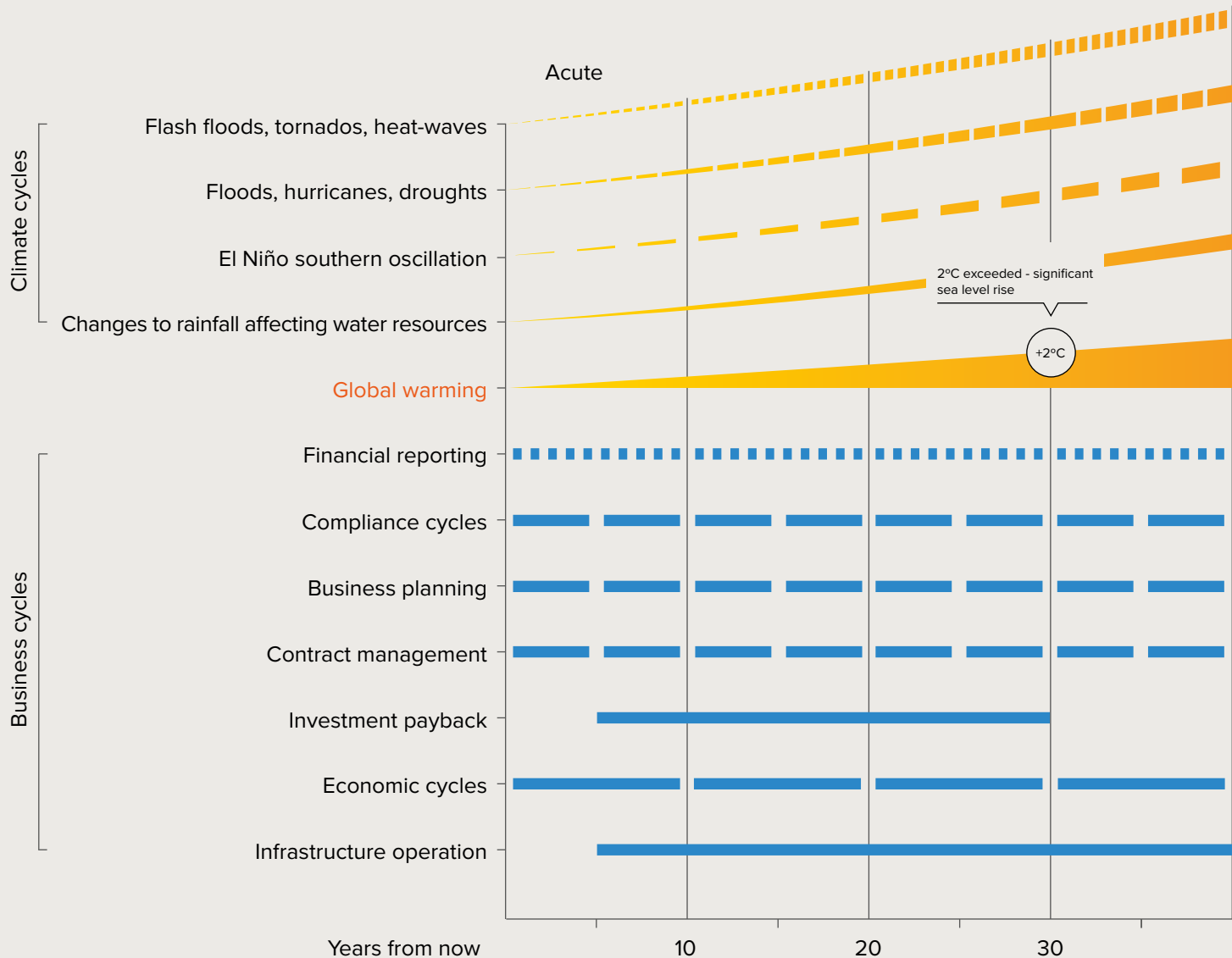
Just as there are time cycles for business planning, which embrace financial reporting, industry regulation, investment, contracts and asset operation, climate systems also operate to regular patterns. Business leaders need to recognise this link and plan for extreme climate events just as they need to plan for the impacts of currency rate fluctuations, political elections, regulatory periods or economic cycles. What marks climate events above other business risks is that, while they are predictable, there is currently a lack of appreciation of their consequences.

An increasing rate of global climate warming will amplify the effects of the acute climate events that occur in seasonal or annual cycles, such as flash floods, heat waves and droughts. Worldwide, these events are already having serious impacts on businesses, affecting their ability to deliver on contracts, financial results and insurance premiums.

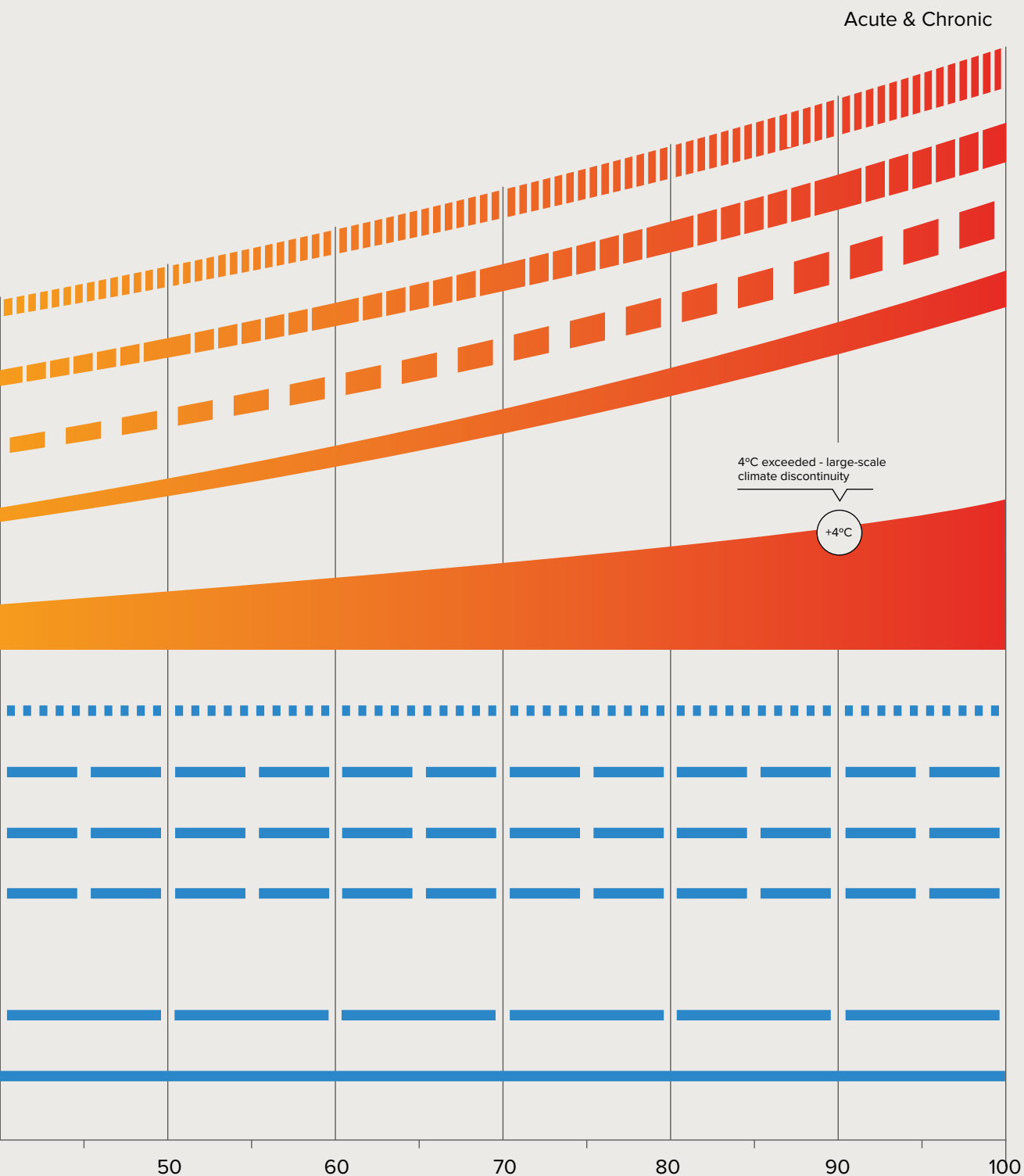
In the next 10 to 20 years extreme weather events that we currently experience just occasionally will become more normal. Beyond 20 years we will see the emergence of chronic (long-term) climate impacts, such as changes to rainfall that affect the quality and availability of water resources, pronounced changes to average temperatures that affect heating and cooling demands, marine ecology and sea level rise.

All will put asset systems and organisations under escalating severe stress with increasing risk of isolation from contiguous assets and the organisations on which they depend. Consequences of such a failure were seen when the rail line at Dawlish in south west England was damaged by a storm in February 2014, during a record-breaking wet and windy winter. The damage cut off rail links with much of Cornwall and Devon for several weeks, and is estimated to have cost the economy £1.2bn.²

The climate change timeline corresponds with infrastructure planning, investment and operating cycles.



Infrastructure owners, operators and investors need to integrate climate change with their strategic plans to protect against acute events that are already occurring, and prepare for the added impact of chronic events in the future.



Climate impacts snapshot

System overload

In 2003 an unprecedented heat-wave killed between 25,000 and 65,000 people across Europe. Healthcare systems had not anticipated the effects of extreme heat. As a result there was inadequate public information and advice. Compounding the problem, a substantial number of health workers were on holiday, which meant that hospitals were understaffed when demand for care peaked.

Economic and political instability

The European heat-wave of 2010, which was even more intense than the 2003 heat-wave, resulted in a 40% reduction in the Russian grain harvest. To control domestic food prices, the Russian government imposed export bans. Combined with harvest shortfalls in Australia and Pakistan, this contributed to a doubling of grain prices globally that has been causally linked with the Arab Spring political uprisings in North Africa and the Middle East.

Third party failure

Cascade failures were seen following Hurricane Sandy, the most destructive hurricane of 2012, which led to an estimated damage and reconstruction bill of US\$80bn. New York's main water treatment system failed because the power stations were shut down and lack of fuel supply meant back-up generators were inoperable.





Climate events impose shock loading on finely balanced businesses and the asset systems on which they depend, with potentially crippling effects.

Provision of reliable, high quality service to customers frequently depends on a complex network of physical assets and third party suppliers, each with its own life support network. We call these networks ‘asset systems’.*

The creation and operation of asset systems takes place within an intricate environment involving social, economic, financial, policy and regulatory dimensions. This market environment provides organisations with opportunity, but also presents uncertainties and risks that require continual analysis and management.

Private and public sector organisations alike face the same fundamental challenges of securing investment, generating profitable revenue and providing either economic or social returns.

This fine balance between asset system integrity and market factors is under constant asymmetric pressure from:

- Social progress – people the world over are striving for better living standards, with the expectation of improved service quality and better value for money.
- Population growth – the increasing number of people demanding services places asset systems under ever greater load, stretching operational and asset maintenance capacity.
- Interconnectivity – reliance of one system on another has become more pronounced with the drive for capital investment efficiencies and development of pervasive communication and information technology systems.

Measuring the impact of cascade failures

As asset systems become overstressed they start to fail more frequently. Degradation or loss of service provision can result in breach of contractual and regulatory obligations, leading to more onerous terms, tighter scrutiny and potentially shifts in policy. Loss of revenue and profitability can result in low investor confidence and harder borrowing terms exactly when additional finance is required. All this is in addition to the service disruption itself and the direct impact on consumers. Such loss of management control over risk, uncertainty and reward has sunk many businesses before.

The question of how to respond to the twin pressures of population growth and social progress in the face of restricted finance and resource scarcity has emerged as a topic of keen debate. The risk and uncertainty of climate impacts makes this complex issue ever more challenging.

When climate events hit an insufficiently resilient asset system they can exert a shock load that triggers a collapse of the system’s functionality. Events can damage physical infrastructure, wipe out stock, disable supply chains and trigger cascade failures through interconnected asset systems. Asset system failures can result from the failure of multiple major components, but are frequently caused by the knock-on effects of failure in an overlooked minor asset.

“Businesses need to shore up their supply chains and physical infrastructure to guard against disruption.”

Hank Paulson

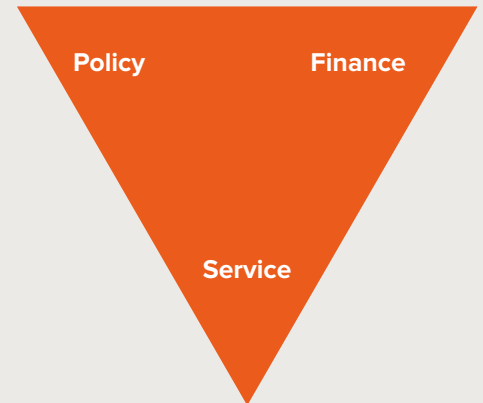
Former US Secretary of the Treasury
and head of the Paulson Institute

*The mobile phone network is one example of an asset system. It relies on constant power supply, with standby generators ready to kick in should mains supply fail. However, generators in turn require fuel deliveries, which depend on the road network and transport logistics.

Why asset systems fail

Successful organisations strike a fine balance between three critical criteria:

- **Ability to provide customer service**
- **Policy and regulation**
- **Finance – investment and cash flow...**



...while continuously adjusting for:

- **Market uncertainty**
- **Trading risk**
- **Financial reward...**



...and depending on reliable asset systems:

- **Infrastructure**
- **Supply chains**
- **Personnel**



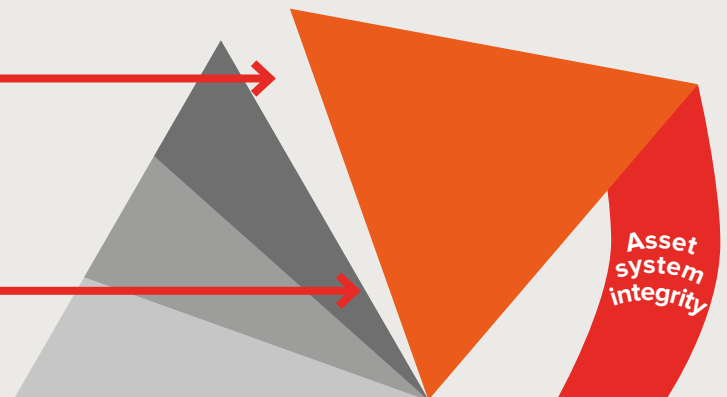
This fine balance is under pressure from:

Population growth

The intensity of demand on existing services – and for new services – is growing all the time.

Social development

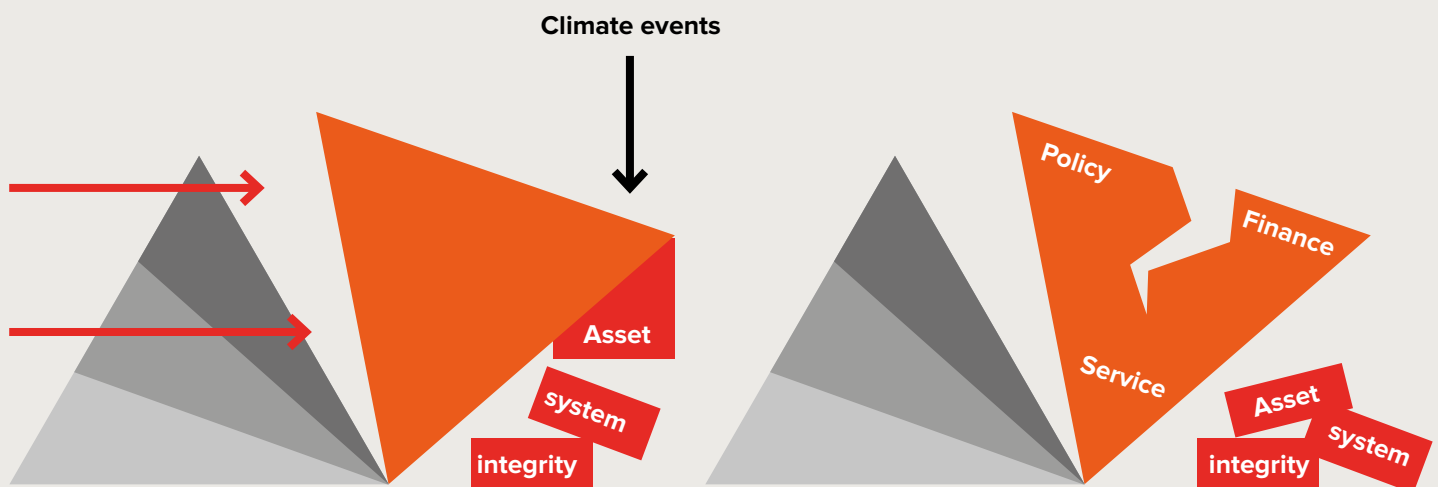
As living standards improve, people expect ever better service and value for money, against a backdrop of increasing resource scarcity.



There's constant danger that these pressures will overstress the organisation's commercial, risk and financial management. And its asset systems.

Survival requires investment to strengthen asset systems and close performance gaps, restoring equilibrium and assuring continuity in service provision.

But climate events exert shock loading...



Without adequate resilience measures in place, this load can result in the collapse of asset systems and, ultimately, failure of the organisation.



Climate impacts snapshot

Supply chain disruption

Globalisation has resulted in vast and complicated supply chains stretching around the world. Multiple layers of suppliers – of materials, components, products and services – mean that impacts at any point in the chain can have far-reaching effects. Disruption can affect not just those companies within the supply chain but also the wider economy.

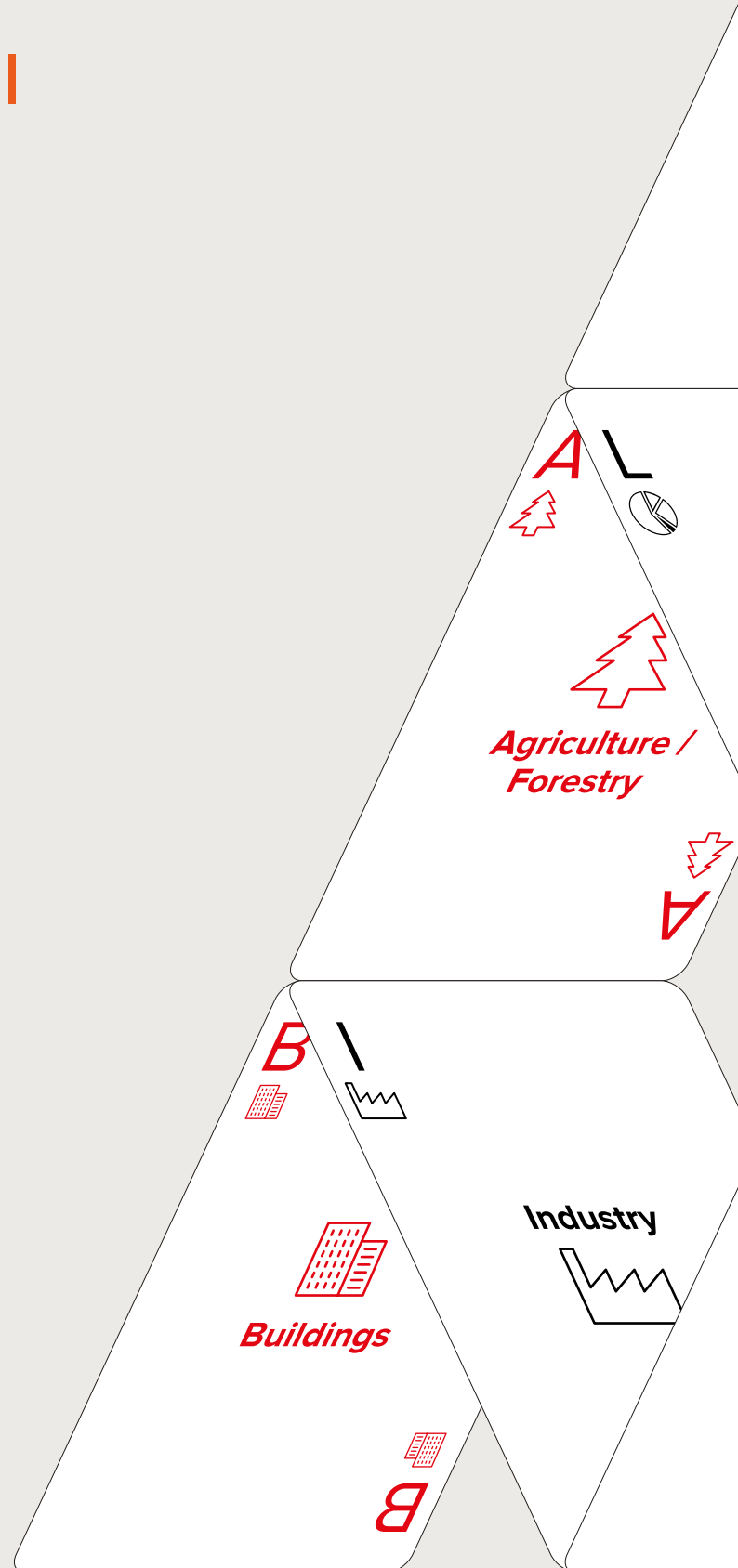
In 2011 Thailand experienced the worst floods in decades, with 2.5M people across two thirds of the country affected. And because Thailand is an important supplier of components to the manufacturing sector globally, the floods had an estimated US\$46.5bn worldwide economic impact, 71% of which was borne by the electronics and automotive sectors.

Before the floods, Thailand manufactured 43% of the world's hard disk drives. After, it accounted for just 30%. Shortage of supply caused global prices to rise by up to 190%.

The floods caused Japanese car makers Toyota, Honda and Nissan to lose production of 240,000, 150,000, and 33,000 cars respectively, and the lack of automobile parts impacted manufacturing capacity internationally. Nissan's diverse supply chain meant it was affected less seriously than the other manufacturers, and was the fastest to recover as a result.³

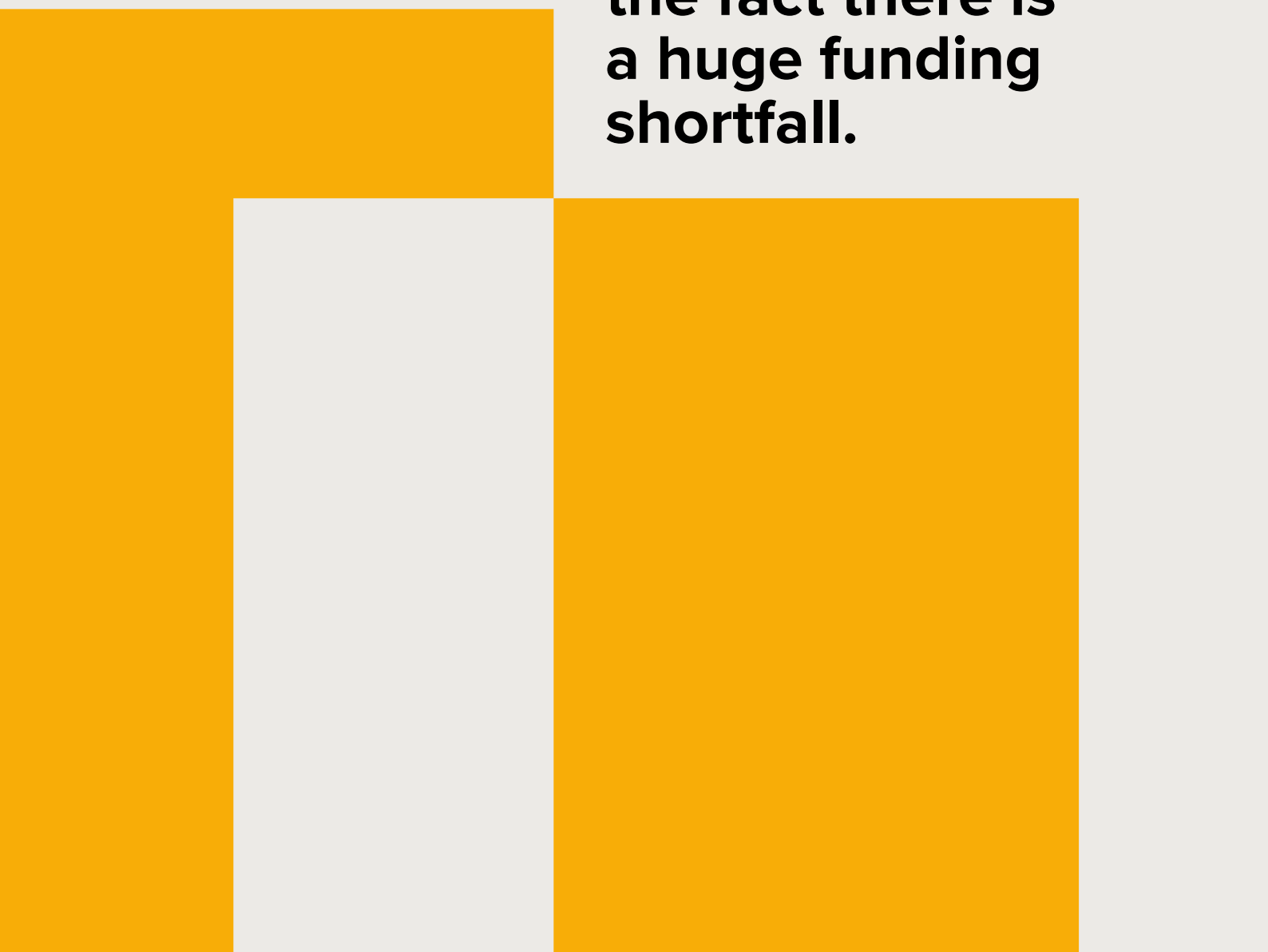
Who else do you rely on in our global system of systems?

Organisations and asset systems are increasingly interconnected and interdependent. Service disruption in one sector can have far reaching consequences as the failure cascades through others.





Strong payback readily justifies a third of resilience investment but the private sector must face up to the fact there is a huge funding shortfall.

An abstract graphic at the bottom of the page consists of several overlapping rectangular blocks. On the left, there is a large orange block. To its right, there is a white block. Further right, there is another orange block. At the bottom right, there is a large orange block that overlaps with the white one. The overall effect is a modern, geometric design using a limited color palette of orange and white.

Fuelled by population growth and the insatiable drive for social development, the world's stock of physical and social infrastructure is growing dramatically – its value is expected to increase from US\$20trn⁴ today by a factor of between three and five over the next two decades.⁵

However, the economic impacts resulting from increasingly severe climate events are forecast to grow much faster. At the moment, losses to both insured and uninsured assets due to climate impacts are estimated at US\$100bn/annum (0.5% of the value of the current asset base). This is expected to rise to US\$1trn/annum in 20 years' time (1.0% to 1.5% of the projected asset value).⁶ Without investment in climate resilience, the cumulative loss over the next two decades will well exceed US\$5trn.

It is crucial to appreciate that 'full resilience' does not mean 'no losses', as eliminating all risk is economically, if not technically, impractical. Instead, full resilience not only involves investment to strengthen assets against the effects of climate impacts but also encompasses mechanisms which allow assets to recover rapidly from failures, with manageable residual losses.

US\$1trn

Annual global economic losses resulting from climate change in 20 years' time if we don't invest in climate resilience

US\$200bn

Justifiable annual cost of climate resilience in 20 years' time

Addressing the funding gap

Analysis following recent climatic shocks in the developed world suggests that the current cost of remediating losses is on average four times the cost of protecting against climate impacts. Investing US\$1 to prevent US\$4 in losses will yield a substantial benefit to the global economy, and this benefit will grow over time.⁷

No matter what resilience measures are put in place, extreme events will always result in residual losses, which will need to be addressed through insurance and disaster recovery mechanisms. The concepts of diminishing returns and residual losses are well understood: the '80-20 rule' suggests it is cost-effective to protect against 80% of losses, with the remaining residual loss picked up by insurance, business and society as a whole.

Using this indicative 'rate of return' curve we have estimated payback from investment in resilience. Typically one third of the required resilience investment will deliver a 50% reduction in losses. This represents good business sense and needs to become business as usual, with resilience increasingly embedded in the design of new infrastructure.

The rate of return curve also suggests that protecting against the remaining 30% of non-residual losses will soak up two thirds of the required investment. Returns will be of diminishing, and often marginal, direct commercial benefit, making them unattractive for investment using conventional business case analysis.

But leaders must recognise how much their businesses depend on social, economic and environmental continuity. Having a resilient population will safeguard revenue. Even though wider resilience measures may not yield direct returns, it is in the interests of all organisations to see their activities in this wider market context. Although they fall below conventional benefit-cost thresholds, stemming 'marginal' losses will become increasingly crucial for business integrity and resilience.

Action is imperative – if not addressed these economic and financial costs will escalate over time, and will severely disrupt business and wider society.

Innovation is required to unlock investment.

Key challenges are the allocation and management of risk and creating connectivity between the resilience planning and investment of multiple players.

New funding mechanisms are needed so governments, international institutions and the private sector can pool resources, and share and manage risk.

Public and private sectors need to explore many more opportunities to mix funding, with governments acting to prevent loss of common services with perceived low economic value but high social or ecological value. This collaboration must pick up the investment where there is no business case.

Private sector organisations need to step up to the plate, being mindful that if they are not proactive in addressing the resilience funding gap, governments will have no choice but to impose purpose-designed resilience levies.

1/3

**Clear business benefit:
a third of required
resilience investment
will prevent 50% of all
climate losses**

2/3

**Marginal business
benefit: public sector
help is needed to
mobilise remaining
resilience spend**

Public-private collaboration can reduce individual organisations' exposure to risk and deliver shared benefits.

An example is African Risk Capacity, an extreme weather insurance mechanism which helps African Union member states to rapidly recover from instances of drought. Individual countries pay into a pooled insurance fund that is wrapped with public sector funding, keeping premiums manageable and allowing reinsurance broker Willis to spread risk within the reinsurance market.

Another example is R!SE, launched at the United Nations in 2014. R!SE is designed to support a rapid scaling up of resilience capability through the exchange of strategic planning and climate change adaptation best practice. It is creating risk metrics for economic forecasting, new resilience certification, and principles for responsible investment and insurance.

Non-resilient businesses will struggle to secure insurance and investment.

Insurers are already backing away from assets that are vulnerable to climate events and in future insuring non-resilient assets will become impossible. The public sector cannot be relied upon as an insurer of last resort. Therefore, lowering risk to insurable levels and managing risks that are not insurable, such as the impacts of rising sea level, must be high on climate resilience strategies.

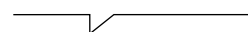
New regulation aimed at managing risk, such as Solvency II in the insurance sector and Basel III in the banking sector, requires companies to better define their risk exposure and to ensure that assets are accurately matched. Tighter regulation is likely to change the cost of capital going forward and potentially the availability of finance for long-term investment.

In parallel, irrecoverable loss of asset value will become more common, a phenomenon known in the financial and regulatory sectors as 'asset stranding'. Stranding makes it impossible to borrow against the value of existing assets to finance growth and adversely affects an organisation's ability to pay off debt.

The benefits of building resilience are exemplified by the borough of Avalon in New Jersey, USA. It has been given AAA bond ratings, enabling the municipality to benefit from access to lower cost finance and cheaper federal insurance, thanks to its proactive approach to climate resilience.

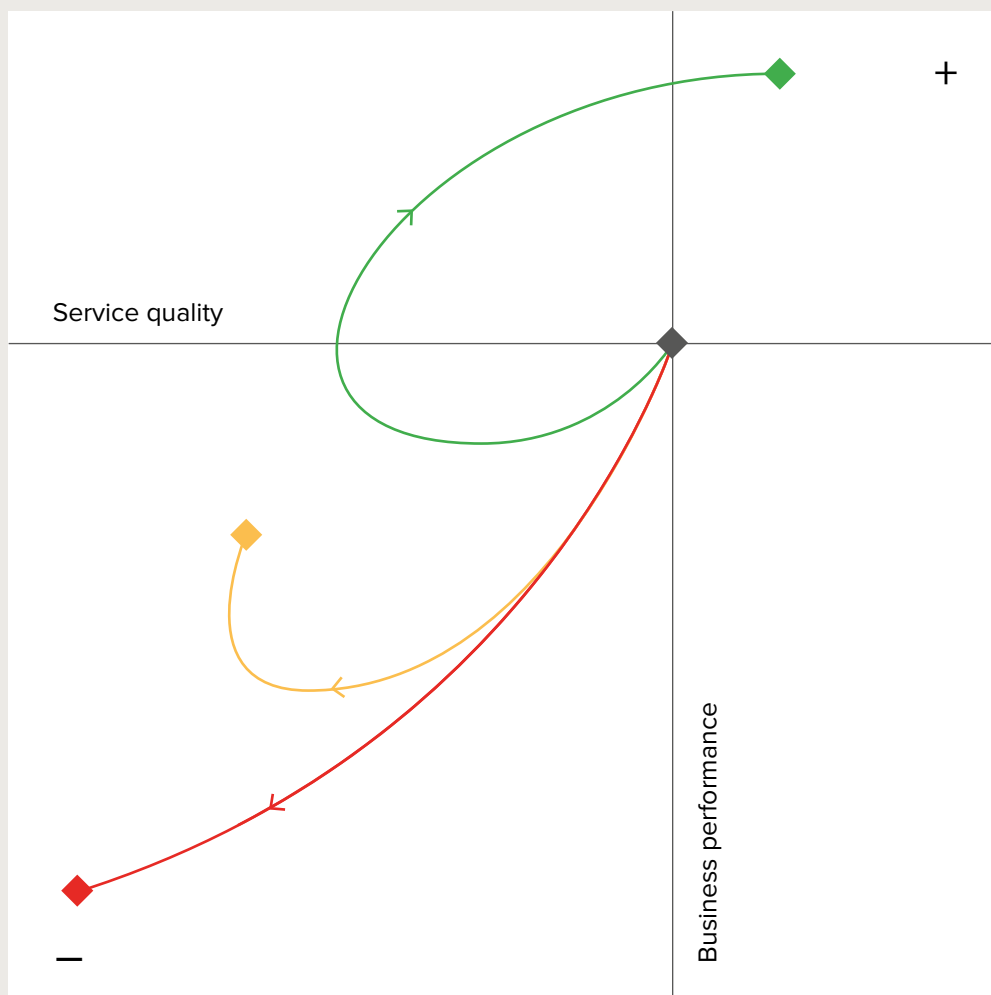
"In the reinsurance business one of the top risks is climate change – that is the assessed risk of those institutions with money on the line."

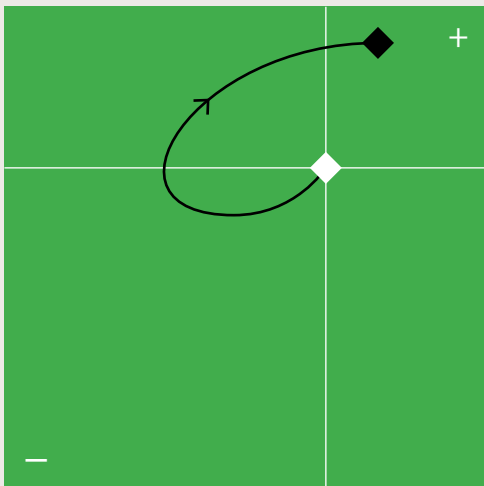
Mark Carney
Governor, Bank of England



The upside of investment – resilient businesses grow and prosper.

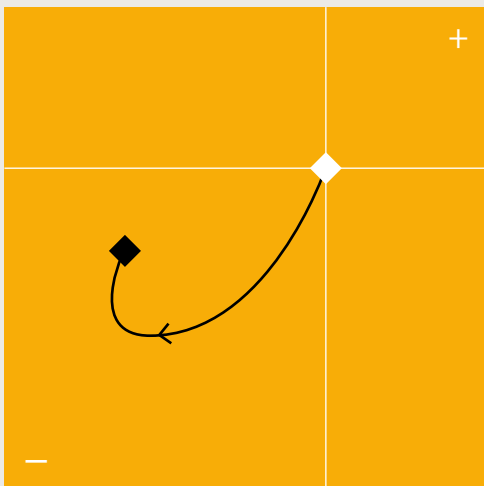
Fully resilient businesses not only deal with climate events; they rebound from events to gain a better position than their poorly adapted, less resilient competitors. Achieving continuity of operation and service provision gives organisations the opportunity to grow both market share and profitability, providing a clear ‘resilience dividend’.





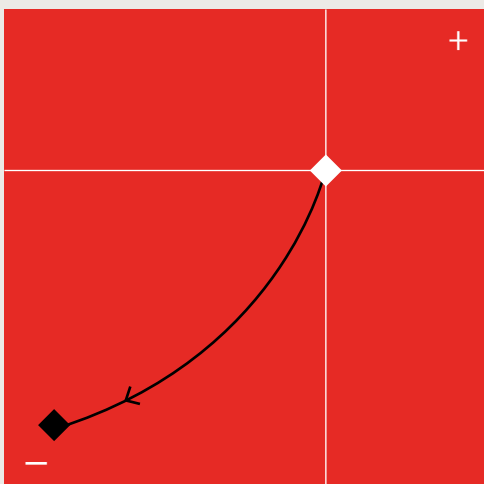
Grow and prosper

Adequate investment: The business has identified climate risks and protected against them. It survives the shock and recovers swiftly. It is able to outcompete less resilient rivals, gain market share and improve profitability thanks to the rebalance between supply and demand. The business is also better able to sell its goods or services going forward as it can show customers that it has the strength to withstand external risks.



Stumble and survive

Partial investment: The climate impact has a severe effect on the asset system, which affects production. Revenue is lost but damage to infrastructure is not bad enough to force its closure. However reputational damage means that the business will struggle to regain market share and to compete.



Crash and burn

No resilience investment: The shock of the climate impact forces the non-resilient business to close as repair costs are too high. For example, a flood might cause major damage to infrastructure and stock, resulting in irrecoverable failure of service provision.

Climate impacts snapshot

Tougher insurance terms

The Insurance Institute for Business & Home Safety found that the US\$20bn losses from Hurricane Andrew, which hit Florida in 1992, would have been halved if properties had been built in accordance with building codes subsequently introduced by the state. Louisiana State University estimated that if stronger building codes had been in place, wind damages from Hurricane Katrina, 2005, would have been reduced by 80%. A 2005 study funded by the US Federal Emergency Management Agency found that every US\$1 spent on mitigation would save US\$4 in losses. In the US, the insurance industry is a major advocate for stronger codes.

Damaged assets

In New York's Red Hook district, the Fairway store was severely flooded by the tidal surge that accompanied Hurricane Sandy, which resulted in its closure with consequent loss of profile and reputation. By contrast, the neighbouring Ikea store was designed with an elevated shop floor level and escaped the surge. Ikea also proved to have a stronger supply chain. The store remained open, playing a part in the relief effort, gaining a reputational as well as a trading benefit.





**Collaborate
widely.
Manage risk.
Build internal
capacity.
Know your
extended
supply chain.**

There is a clear case for investment in climate resilience as the asset base continues to grow and as climate impacts increase in severity and frequency.

Some investment will become common business practice as climate resilience is increasingly factored into asset design, and as business leaders address the barriers to implementing climate resilience measures.

However, there is an urgent need to address the shortfall in resilience funding. This will require new financial mechanisms which allow the public sector to mobilise full resilience investment by businesses.

There are a number of steps that businesses, lenders and governments can take to help address the shortfall in resilience funding.

1.

All

Bring together senior policy, finance, insurance and investment experts to explore and develop innovative financial mechanisms.

Drive greater connectivity between business, society and the environment by building public-private alliances around shared risks and purpose.

Build resilience risk management into strategic planning.

2.

Businesses

Design infrastructure and diversify supply chains to anticipate future climate resilience needs and avoid asset stranding.

Establish clear response and recovery plans, so that your organisation and key partners know what to do when disaster strikes and you can bounce back fast – and proactively communicate with customers and stakeholders, to establish understanding, provide reassurance and minimise reputational damage.

Integrate resilience with financial, technical, environmental, social and health risk assessments so that complex interrelationships and compounding impacts are identified.

3.

Investors and lenders

Ensure that climate assessments recognise up-to-date science and that recommended resilience measures are implemented.

Make management of climate risks an essential requirement for funding decisions and use evidence-based guidance to assess the climate resilience of your investments.

Work with governments and businesses to develop new financial and insurance products that offer attractive balance between risk and reward.

4.

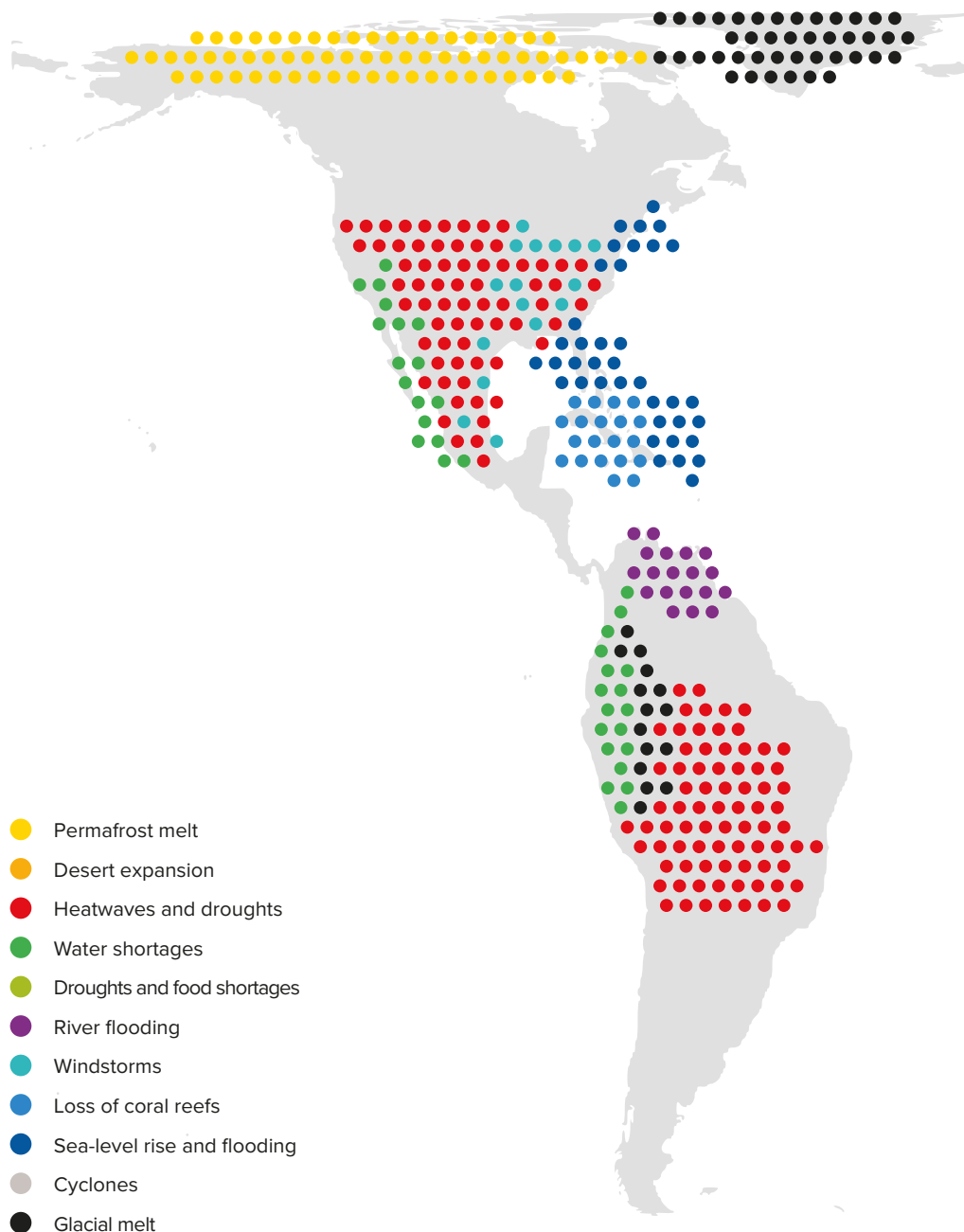
Government and policy-makers

Make whole-life climate resilience obligatory in planning procedures for all infrastructure and social assets to minimise the extent of economic and social losses.

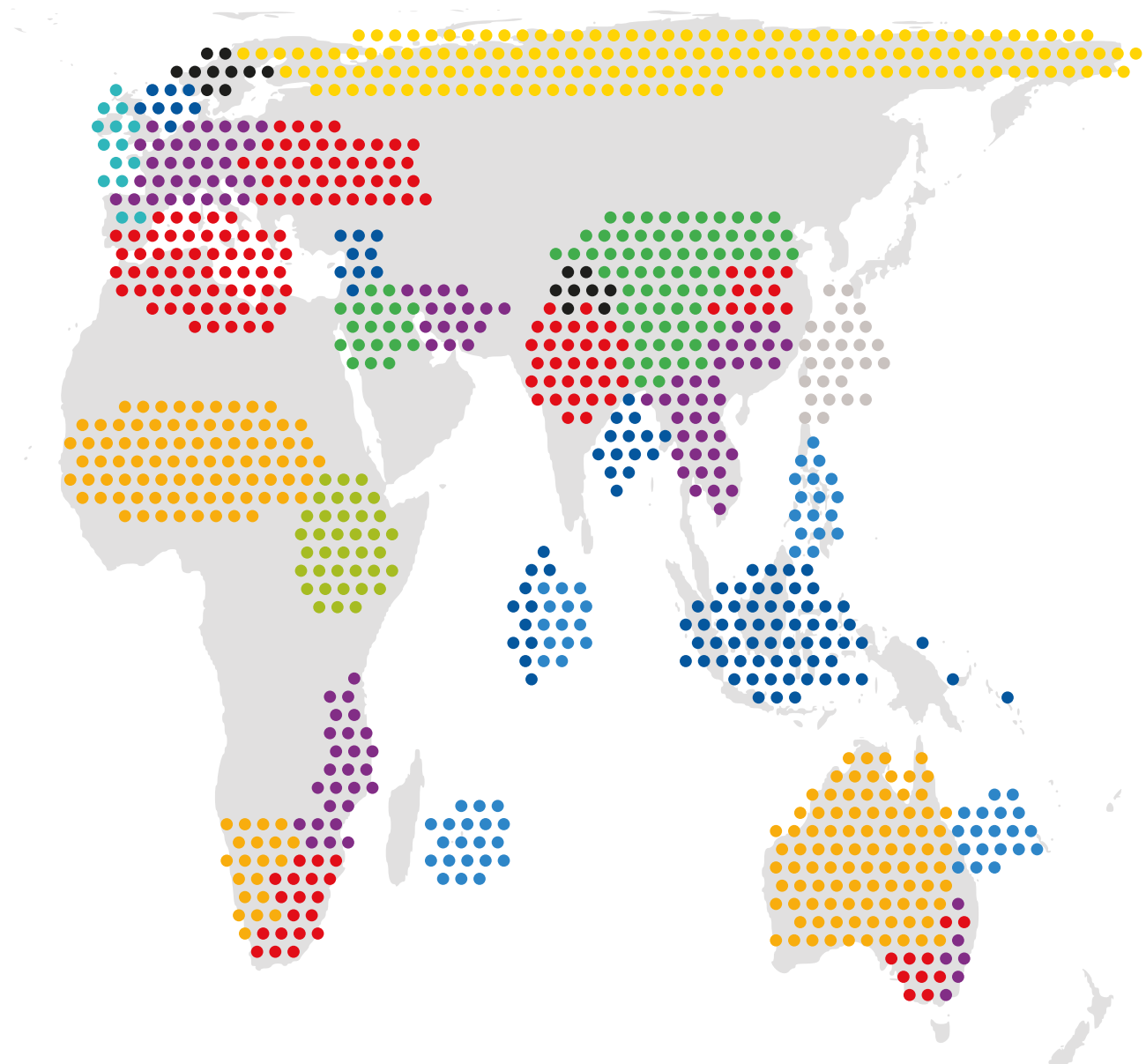
Forge links between science, policy and business communities, incorporating the expertise of industry practitioners into climate change assessments.

Establish clear long-term goals and support action with regulation and legislation.

The severity and frequency of climate events will intensify over time.



Climate events are already acute and will be supplemented by chronic events as our climate warms further. To survive, businesses must address the resilience of their direct asset systems – and also of the extended supply chains, customers and wider economic and natural systems on which they indirectly depend.







Climate impacts snapshot

Defensive failure

New Orleans, USA, had not been hit by a substantial hurricane for over 100 years when Hurricane Katrina landed in 2005. Despite repeated warning by the US Army Corps of Engineers over many years, investment to strengthen flood defences had been repeatedly deferred. Katrina breached levees and overwhelmed pumping systems. Poor disaster planning meant that the floods swiftly became a humanitarian as well as an economic disaster.

Who's talking about resilience?

US President Barak Obama

In 2013 the US government came off the fence and formally recognised the scientific proof of climate change: "The debate is settled. Climate change is a fact," he said in his State of the Union address.

UN Office for Disaster Risk Reduction

"Resilience is the ability of a system, community or society to resist, absorb, accommodate and recover from the effects of a hazard, preserving and restoring its essential structures and functions."

IPCC

"Adaptation is the process of adjustment to actual or expected climate effects. It seeks to moderate harm and exploit opportunities."

UN Office for Disaster Relief Reduction

Between 2005 and 2015 over 1.5bn people were affected by disasters globally and costs of over US\$1.3trn were incurred.

UN 2015 Global Assessment on Disaster Risk Reduction

"Economic losses from disasters such as earthquakes, tsunamis, cyclones and flooding are now reaching an average of US\$250bn to US\$300bn each year... Global annual investments of only US\$6bn in appropriate disaster risk management strategies can generate benefits of US\$360bn or an equivalent of more than 20% reduction in new and additional expected annual losses."

US Securities & Exchange Commission

Requires companies to disclose climate risks to shareholders and investors.

The 2008 UK Climate Change Act

Requires owner/operators in the energy, transport and water sectors to map and disclose assets at risk from climate events.

Most organisations need to adjust their culture and habits in order to build resilience.

There is an urgent need to address the shortfall in resilience funding. This will require new financial mechanisms.

Businesses will see a ‘resilience dividend’ as they will be in a stronger position than competitors to overcome risks and shocks.

“Understanding the potential impacts is one thing. Seriously planning for them is another. As my friend and Risky Business Project co-chair Mike Bloomberg likes to say, ‘If you can’t measure it, you can’t manage it.’ Well, now we’ve measured. It’s time to manage.”

Hank Paulson

Former US Secretary of the Treasury
and chairman of the Paulson Institute

End notes

- 14 World Bank, The costs of adapting to climate change for infrastructure, August 2010. Bentley, Infrastructure 500: top owners ranking, 2014
- 2 Devon Maritime Forum
- 3 Masahiko Haraguchi and Upmanu Lall, International Journal of Disaster Risk Reduction, Flood risks and impacts: A case study of Thailand’s floods in 2011 and research questions for supply chain decision making, 2014
- 5 McKinsey Global Institute estimates that new infrastructure investment will be US\$57trn between 2013 and 2030, Infrastructure productivity: how to save \$1trn a year, January 2013. New Climate Economy estimates that new infrastructure investment will be US\$89trn between 2015 and 2030, Better growth better climate, August 2014
- 6 Dr Evan Mills, Lawrence Berkeley National Laboratory, Responding to climate change – the insurance industry perspective, 2012
- 7 Ilan Kelman, CICERO, Norway World Bank, Disaster mitigation is cost-effective, 2014. Global Alliance for Disaster Risk Reduction, Building safer, resilient communities, 2007

The authors

Dr David Viner leads Mott MacDonald's climate advisory work, integrating resilience into infrastructure projects around the world, spanning the transportation, water, energy and telecommunications sectors. He is an internationally recognised and extensively published climate change expert with over 20 years' experience. David has made scientific contributions to the IPCC assessment reports and provided strategic advice to government, commercial and not-for-profit organisations. He has worked in over 50 countries and delivered programmes in over 80.

Madeleine Rawlins is a climate change specialist at Mott MacDonald, bringing expertise in climate finance and climate change mitigation as well as experience working on large energy projects around the world. She spent 15 years working on international climate change policy and has managed one of the largest carbon portfolios in the world. She has advised government agencies on climate change policy, led business groups operating in international carbon markets, provided businesses with strategic advice on regulatory compliance and developed risk management and due diligence approaches for climate change mitigation portfolios.

Ian Allison is global head of Mott MacDonald's Climate Resilience Initiative. In the last three years he has developed and promoted Mott MacDonald's response to the issues surrounding climate change and the management of climate impacts. He has over 35 years' experience developing essential infrastructure in the water sector and water resources management. Ian has advised government clients, private financial institutions and developers on project finance, and steered a number of UK water sector schemes to financial close. He has also advised clients across Europe how to tackle underinvestment and poor asset performance.

Mott MacDonald is a US\$2bn global engineering, management and development consultancy spanning buildings, communications, defence, education, environment, health, international development, industry, mining, oil and gas, power, transport, urban development, water and wastewater. Its services include planning, studies and design, infrastructure finance and technical advisory services, project and programme management, management consultancy and strategic asset management. The firm's climate resilience team advises clients internationally on climate risk, system security, resilience planning and business continuity.

Are you climate resilient?

To talk about asset systems, climate risk and ways to finance resilience, contact:

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