

Risk sharing in the Climate Emergency

Financial regulation
for a resilient, net zero,
just transition

The University of Cambridge Institute for Sustainability Leadership

The University of Cambridge Institute for Sustainability Leadership (CISL) partners with business and governments to develop leadership and solutions for a sustainable economy. We aim to achieve Net Zero, protect and restore nature, and build inclusive and resilient societies. For over three decades we have built the leadership capacity and capabilities of individuals and organisations, and created industry-leading collaborations, to catalyse change and accelerate the path to a sustainable economy. Our interdisciplinary research engagement builds the evidence base for practical action.

Authors

Lead author:
Dr Ana Gonzalez Pelaez,
Fellow, CISL

Co-authors:
Geoff Summerhayes,
Executive Board Member,
APRA (2016–20) and Chair
Sustainable Insurance
Forum (2018–20)

Nigel Brook, Senior Equity
Partner, Clyde & Co

Co-ordinators:
Dr Bronwyn Claire,
Senior Programme Manager,
ClimateWise, CISL

Rachel Austin,
Senior Project Manager,
ClimateWise, CISL

Citing this report

University of Cambridge
Institute for Sustainability
Leadership (CISL) (2021).
*Risk sharing in the Climate
Emergency: Financial
regulation for a resilient, net
zero, just transition.*

Copyright © 2021 University
of Cambridge Institute for
Sustainability Leadership.
No part of this document
may be reproduced,
distributed or transmitted
in any form without prior
written permission.

CLYDE & CO

This report has been
prepared with the
support of Clyde & Co.

Acknowledgements

Advisory Board

Butch Bacani, Programme
Leader, UNEP Principles for
Sustainable Insurance

Dolika Banda, former CEO,
African Risk Capacity

Dominic Christian, Chair of
ClimateWise

Mike Consedine, CEO, US
National Association of
Insurance Commissioners

Jonathan Dixon, Secretary
General, International
Association of Insurance
Supervisors

Rowan Douglas, Chair
Operating Committee,
Insurance Development
Forum

Hannah Grant, Head of
Secretariat, Access to
Insurance Initiative

Ho Hern Shin, Deputy
Managing Director (Financial
Supervision), Monetary
Authority of Singapore

Prof Saleemul Huq, Head of
Expert Committee, Climate
Vulnerable Forum

Tomás Soley Pérez, General
Insurance Superintendent,
Costa Rica; Chair, IAIS
Financial Inclusion Forum.

Prof Yoshi Kawai, Chair,
Global Asia Insurance
Partnership

Jan Kellet, Head of UNDP
Insurance and Risk Finance
Facility

Dr Youssef Nassef, Director
of Adaptation Division,
UNFCCC

Dr Fernando Restoy, Chair,
Financial Stability Institute,
Bank for International
Settlements

Dr Emily Shuckburgh,
Director, Cambridge Zero,
University of Cambridge

Anna Sweeney, Chair,
Sustainable Insurance
Forum and Head of
Insurance, Bank of England

Prof George Thomas,
Insurance Institute of India

Prof Lily Wang, Dean,
Hainan Green Finance
Research Institute

Dr Mamiko Yokoi-Arai,
Deputy Head of Financial
Markets, OECD

Note: Input and guidance
received from members of
the Advisory Board does not
imply or represent an official
position, opinion, judgement
or endorsement on their
part or on the part of their
organisations.

Forewords: Mark Carney,
Ekhosuehi Iyehen, Youssef
Nassef

Clyde & Co: Elnaz Amiri,
Natalie Armstrong, Ellen
Baker, Gabriella Bligh, Emily
Caldwell, Catriona Campbell,
Sarah Hill-Smith, Iris Kyriazi,
Harry Little, Conor Macaire
Duncan, George Nix, Jane
O'Reilly, Sally Waugh, Lucia
Williams, Zaneta Sedilekova,
Emma Turton.

Additional contributions: Wai
Seng Fong (MAS), Diana
Fox Carney (BSIA), Jennifer
Gardner (NAIC), William
Harding (SIF), Celia Gonzalez
Haug (SUGESE), Giorgis
Hadzilacos (BoE), Catherine
Hock (ICMIF) Hui Lin (a2ii),
Justin Mundy (SLM), Jesper
Pan (MAS), Olga Salashina
(ASSAL), Matt Scott (WTW),
Hanne van Voorden (IAIS), Yi
You (HGFR). See full list of
acronyms on page 54

Personal thanks:
Ann Carrington Brook,
Henrietta Summerhayes,
Rebecca and Sergio
Douglas-Gonzalez.

Contents

Forewords	5,6
Executive Summary	7
Introduction	10
Climate policy as a risk management system	10
Financial regulation as a climate risk management system	10
The Sustainable Development Goals (SDGs) in this report	11
Part 1- The risk-sharing domain	
Risk-sharing systems	12
Size of the global risk-sharing domain	13
1. Tax-based risk sharing	13
2. The insurance industry	14
3. Public-private disaster risk insurance systems	14
Part 2 - Risk-sharing pools to enable risk management	15
SECTION A: The unique approach of the insurance sector to risk	15
2.a.1 Understanding the components of risk	15
2.a.2 Risk assessment and quantification for short to medium-term risks	17
2.a.3 Risk assessment and quantification for long-term risks	18
2.a.4 Risk disclosure, solvency and regulatory capital requirements	18
2.a.5 Risk pools: governance, sustainability and risk reduction	19
2.a.6 Transparency of risk signalling and systemic risk intelligence	19
SECTION B: The PCL framework: guiding risk sharing policy in the climate transition	20
2.b.1 What is the PCL framework?	21
2.b.2 Further integrating the PCL with insurance capabilities	22
2.b.3 Supporting highly vulnerable and lower income countries	22
Part 3 – Insurance Regulation And Climate	23
SECTION A: The architecture of global insurance regulation	23
3.a.1 The importance of regulatory mandates	23
3.a.2 Growing interaction of insurance regulation with global financial policymaking	23
3.a.3 How insurance supervisors implement their mandates	24
SECTION B: Climate in insurance regulation	25
Climate-specific instruments table	25

Continued

Contents

Part 4 - Paradigm shift 1 – insurance-informed risk quantification across public and private financial systems	27
SECTION A – Priorities for the insurance sector	28
Action 1 – Insurance sector improvements	28
Action 2 – Evaluating the contingent climate liabilities of insurers	29
Action 3 – Integrating risk assessment from short-term to intergenerational timescales	30
Action 4 – Serving the uninsured: risk signalling and measuring the protection gaps	31
Action 5 – Updating risk assessment and asset classes for low carbon and resilient infrastructure investments	31
SECTION B – Priorities for the financial sector	32
Action 6 – Adopting insurance-based physical climate risk quantification across wider financial sector regulation	33
Action 7 – Transforming financial system resilience through climate-related contingent liabilities and regulatory capital requirements	33
Action 8 – Monitoring systemic physical climate risk	33
Action 9 – Data trusts for systemic information sharing	34
Part 5 - Paradigm shift 2 – sharing and managing systemic risk across the public and private financial systems	35
SECTION A: Resilience	35
Action 10 – Confirming development and financial inclusion mandates to address the climate protection gap	35
Action 11 – Integrating physical climate risk sharing across financial markets	36
Action 12 – Integrating climate insurance with national social protection systems	37
SECTION B: Net zero	37
Action 13 – Financial emissions: carbon assessment and disclosure of underwriting portfolios	37
Action 14 – Climate stewardship: carbon underwriting budgets	38
Action 15 – Insuring the green economy	38
SECTION C: Just transition to resilience and net zero	39
Action 16 – Integrating disaster risk financing and regulation with NAPs, NDCs and the development sector	39
Action 17 – Integrating pre-arranged finance with humanitarian and crisis finance	39
Action 18 – Capacity building for inclusive insurance	40
Action 19 – Integrating climate insurance with sovereign debt systems	40
Action 20 – Research on insurance for communities affected by the net zero transition	41
Conclusions	42
Call to action	43
Recommendations	48
Annex 1: Contribution of the insurance sector to the four private financial sector priorities	50
References	51

Foreword



Dr Mark Carney

United Nations Special Envoy on Climate Action and Finance

"In the face of the unfolding climate emergency, this report provides a timely and valuable overview of the lessons we can already draw from the global insurance system - across public, private and mutual sectors - and the opportunities for that system to help increase our systemic resilience to the worst effects of climate change.

The authors rightly point out that "insurance systems sit among our most significant scientific, cultural and economic assets," enabling markets and wider society to quantify, share and govern risks at local to global scales.

The report then zeros in on the mandates and actions that are necessary to maximise the value of these assets: from regulatory approaches to finding ways to ensure that we integrate and respond to the powerful signals about risk that are generated.

The global financial system is leading the way in the run up to COP26. This collaboration between senior regulators, policymakers and industry extends that leadership by informing a pathway beyond Glasgow that aims to secure a smoother and more equitable transition to a resilient, zero-carbon future."

A handwritten signature in black ink, appearing to read 'M Carney', with a stylized flourish at the end.

Foreword



Ekhosuehi Iyahun

Secretary General, Insurance Development Forum

“This report is a landmark and a launchpad. It provides the missing architecture to reveal the vast insurance continuum and how it plugs into the UNFCCC processes and our shared climate objectives. Upon this science-based, global system, the authors demonstrate how inclusive risk pools provide the key to orchestrate and steward the just, resilient, net zero transition for all.

Landmarks attract people. The spectrum of regulatory and other leaders that have been drawn together by CISL to provide input is unprecedented. Together they have prepared a launchpad for twenty practical and immediate actions to protect lives and livelihoods across geographies and generations.

The Insurance Development Forum combines industry, United Nations, World Bank and Governments to implement the UN 2030 Agenda. Building on our work with regulators and supervisors, we look forward to helping implement these urgent actions and mandates. Beyond the launchpad, this report will serve as a guide and tracker for our collective mission.”

A handwritten signature in black ink, appearing to read 'Ekhosuehi Iyahun'.



Dr Youssef Nassef

Director, Adaptation Division, United Nations Framework Convention on Climate Change

At a time when rapid transformative action is essential to address the climate emergency, this inspiring report highlights the centrality of risk management in climate change mitigation and adaptation, and points to the unique contribution of the insurance industry and regulators to a better understanding of climate risks, and to building a resilient future.

The insurance industry is proactively advancing policies to quantify risk and to expand risk-sharing pools in support of efforts to create a resilient net-zero future. The report identifies responses to climate impacts and the means for transitioning to sustainable economies and societies in a net-zero world.

The report also highlights the means for optimizing risk management, including through the PCL framework, to ensure that governments and communities have at their disposal the tools for the most effective allocation of resources in responding to the adverse effects of climate change.

A handwritten signature in black ink, appearing to read 'Dr Youssef Nassef'.

Executive summary

This report proposes twenty immediate actions needed from policymakers, financial regulators and industry to expand risk sharing systems as an essential policy response to the Climate Emergency. The aim is to:

- **Govern, manage and reduce climate risks, urgently, for a just-transition to resilience and net zero for all.**
- **Further integrate climate policy and financial regulation to ensure developing and developed economies achieve their climate objectives.**

We describe the Climate Emergency as the product of multiple systemic risks (human, social, financial, economic and environmental) resulting from the carbon-based economy affecting the climate system. All countries and communities face growing and ultimately existential risks from the Climate Emergency, some more than others, but ultimately we all, together, face a collective systemic risk management challenge.

To manage these risks individually and structurally, we have to share them at scale. This report shows how. Insurance and wider financial regulation hold the key that policymakers must turn now.

While often overlooked, risk sharing systems (public, private, mutual) sit among our most significant scientific, cultural and economic assets. Throughout history, individuals have come together to protect what they value and secure more hopeful futures by sharing risks through collective pools of resources.

Modern risk-sharing systems extend from social protection to informal community networks and the insurance industry. They have crucial roles that must not be forgotten to confront the climate crisis. Together they represent approximately one third of the global USD80 trillion GDP. However, their distribution is uneven and, even where they exist, the response allocated to climate risks is only puny and tentative.

This report provides concrete solutions to change that. In the Climate Emergency, everyone should have the means to be protected and those who are most affected should be supported, especially the poorest and most vulnerable, among countries and within them.

Key findings:

- 1 - To match the scale of the Climate Emergency we need an urgent expansion of the availability of sustainable risk pools to protect all populations and assets. All the actors of the risk-sharing domain (tax-based and premium-based, from community programmes to multi-national level) need to be integrated in a public-private-mutual risk-sharing continuum. This is in line with SDGs 1, 8, 10, 13 and 17.
- 2 - A widespread application of risk-sharing pools will benefit populations and economies in two ways:
 - a) Protecting greater numbers of people and assets straight away from physical and transition-related climate risks.
 - b) Stewarding the behaviours of individuals, society and capital. Sustainable risk sharing pools provide practical and flexible governance mechanisms for a just transition to resilience and net zero.
- 3 - To share climate risks at scale, they must be measured consistently. Within risk-sharing systems, the insurance sector (premium-based risk-sharing) has unique risk quantification and management skills, overseen by regulation. We propose these approaches spread across wider financial regulation, from microfinance to global financial institutions, to achieve a climate-smart financial system.
- 4 - The UNFCCC (governments), the IAIS (insurance supervision) and FSB (wider financial system) share risk-based mandates and growing awareness of their structural interdependencies. These communities can cooperate to create extensive risk pools to better manage systemic climate risks.
- 5 - This massive upscaling of risk sharing and management across populations, generations and economies requires urgent reforms, ushered by policy. We have identified the mandates and docking points for policy signals to implement 20 concrete actions.

This call-to-action establishes priorities for the insurance and wider financial sector to support the climate objectives of resilience, net zero and just transition. If applied, they will enable a radical global transformation to protect lives and livelihoods, now and in the decades ahead.

Structure

The **introduction** explains the climate agenda as a global systemic risk management process that should integrate further with the global financial system to achieve mutually aligned objectives.

Part 1 sets the scene by presenting the wide range of risk-sharing systems operating across our societies. It also identifies the spectrum of actors (public, private and mutual) that will need to work together in the Climate Emergency to match the scale of actions required.

Part 2 identifies the unique contributions that insurance risk sharing and management can make to the systemic climate crisis. In this context, the emerging PCL (Preventative adaptation, Contingent arrangements, Loss acceptance) framework provides a means of integrating insurance capabilities into climate policy decisions.

Part 3 provides an overview of the roles and structure of global insurance regulation and its interaction with wider financial standard setters. This section identifies the mandates and docking points for policy signals required to implement the call to action in the subsequent parts.

Part 4 proposes insurance reforms and, crucially, an insurance-informed paradigm shift across the financial system. The objective is to measure and manage current and future climate risks today. We identify actions required for implementation.

Part 5 identifies risk sharing at a large scale across the public and private financial sectors as a second paradigm shift. This section is structured around the three climate objectives of resilience, net zero and just transition. We propose actions for each of them that, if applied, will enable a radical global transformation to protect lives and livelihoods.

Recommendations: Out of all the actions proposed in part 4 and part 5, we have selected six that need urgent policy signals.

Methodology

This report is a call to action and the methodology consists of two mutually reinforcing pillars:

- Informative (parts 1, 2 and 3): Provide the foundations for the actions proposed later in the report.
- Actions (parts 4, 5 and Recommendations): Parts 4 and 5 lay out a series of actions, including highlighting relevant actors and next steps. Each individual action could justify a report in itself. The overall aim is to provide a comprehensive inventory to identify avenues for action.

The report refers to examples and data selected from official sources to illustrate and expand upon points and observations on risk-sharing systems for the Climate Emergency. The use of particular sources should not be interpreted as indicating a preference over alternatives that may offer similar evidence.

The research involved the following:

- The co-authors combined relevant expertise from academia, industry and regulation.
- The Advisory Board included regulatory, policy and industry leaders whose active experience in the field has informed the writing process. Feedback was structured in formal group calls and individual exchanges.
- Surveys and research conducted by some Advisory Board members.
- Engagement with institutions involved in CoP26 processes.
- Discussions and email exchanges with experts including climate scientists, catastrophe modellers and regulatory advisors.
- Literature review.

Report terminology

Climate Emergency

The product of multiple systemic risks (human, financial, economic, climate, environmental) resulting from the carbon-based economy.

Climate risk

Physical risk: The risk of damage and losses from physical phenomena associated with both climate-related trends (eg changing weather patterns, sea level rise) and events (eg natural disasters, extreme weather).

Transition risk: Risk arising from disruptions and shifts associated with the transition to a low carbon economy, which may affect the value of assets or the costs of doing business.

Liability risk: The risk of claims against policyholders, for example for loss caused by climate change or failure to manage climate risks, as well as direct climate-related actions against insurers.^{1,2,3}

Insurance

Pre-arranged risk-sharing mechanisms across populations, at local to global scales, through premium-like payments; using public, private, mutual or hybrid systems.

Insurance regulation and supervision

As per International Association of Insurance Supervisors (IAIS) terminology, ‘regulation’ covers rule-making aspects, and ‘supervision’ the ongoing oversight. The term ‘insurance supervisors’ covers both regulatory and supervisory activities.

Risk sharing and risk transfer

In this report we use the terms ‘risk sharing’ and ‘risk transfer’ interchangeably to describe the primary function of insurance. In fact, risk is not transferred but shared between members of a risk pool. By joining a risk-sharing pool (eg buying an insurance policy), members implicitly commit to support each other, as well as protect themselves, when threats occur. A policyholder is both transferring their own risk and assuming risk from other members of the pool. If the risk pool is not managed sustainably and is exhausted by others’ claims, there will be insufficient funds to meet further claims. This is why insurance risk pools are regulated and governed by strict rules of individual and collective behaviour (eg an underwriter requiring a smoke alarm to obtain house insurance or a regulator requiring insurers to set up adequate reserves to meet potential future claims).

Risk-sharing systems

The full range of collective, risk-sharing mechanisms to protect populations and assets against defined risks. They include tax-based protection (eg welfare, social security, public health systems), the informal sector of community self-help and the insurance sector.

Systemic risk

As defined by the International Monetary Fund (IMF), Bank for International Settlements (BIS) and Financial Stability Board (FSB) in 2009 and adopted by the IAIS: “risk of disruption to financial services that is caused by an impairment of all or parts of the financial system and has the potential to have serious negative consequences for the real economy. Fundamental to this definition is the notion of negative externalities from a disruption or failure of a financial institution, market or instrument.”⁴

Introduction

Climate policymakers and financial regulators each apply risk-informed mandates to moderate the impacts of complex global systems onto populations and economies. Helpfully, their approaches are becoming more aligned as the interdependencies of climate and financial systems grow. ^{5,6,7}

Yet, the enormous potential of these parallel risk-informed mandates to address the Climate Emergency remains critically underutilised. This report bridges the gap. It elaborates how the mandate of greenhouse gas stabilisation under the United Nations Framework Convention on Climate Change (UNFCCC) and the mandate of financial stability under the Financial Stability Board (FSB) can be further aligned through risk-sharing systems.

Climate policy as a risk management system

It is often overlooked that the climate process is established upon a risk management approach. The Intergovernmental Panel on Climate Change (IPCC) provides an ongoing science-based climate change risk assessment to establish realistic scenarios, probabilities, stress tests and tolerance thresholds. The latest IPCC risk assessment advises that, if met, current Nationally Determined Contributions (NDCs) would lead to an estimated rise of approximately 2.7C, while business-as-usual higher emissions scenarios produce estimates of a +3.6C to +4.4C world by 2080–2100: (Shared Socioeconomic Pathways 2–4.5, 3–7.0, 5–8.5)⁸.

Based on earlier IPCC risk assessments, at CoP21 Paris 2015, countries agreed to limit global warming to “well below” +2C, with a target of +1.5C, and increase adaptation measures to keep systemic risks within tolerable levels.⁹ To align with these targets and as part of the UNFCCC process, countries submit NDCs of planned emissions reductions and National Adaptation Plans (NAPs).

In preparation for CoP26 in Glasgow, the climate process coalesced towards three overarching climate objectives:

- **Race to Zero** greenhouse gas (GHG) emissions by mid-century, with steep reductions by 2030.
- **Race to Resilience** to protect lives, livelihoods and assets exposed to physical climate risks.
- **A Just Transition** to ensure that the low carbon, resilient transition is fair to those least able to cope with the consequences of climate change and the economic and social impacts of net zero reforms.

From these essential objectives, the UNFCCC risk management challenge is to balance the pace and trade-offs of the net zero, resilient transition with scientific, economic, social and political pressures.

Financial regulation as a climate risk management system

Like the UNFCCC, financial regulators, including insurance supervisors, use risk-informed frameworks to oversee the safety and soundness of financial institutions and the stability of the financial system as a whole.

The global financial governance system is developing its understanding of how climate risks relate to central bank and regulator mandates across banking, investment, insurance and pensions.¹⁰ The distinctive and unique characteristics of climate risks were summarised by the Bank of England in 2018:¹¹

- far-reaching in breadth and magnitude
- uncertain and extended time horizons
- foreseeable nature
- dependency on short-term action.

These characteristics of climate risk, and the resulting financial exposures to firms and consumers, are forcing regulators to reinterpret the implementation of their core financial stability and prudential mandates.

Crucially, climate risks are creating a new set of time horizons for most of the financial sector, extending decades into the future, as a shift from short-term practices.¹²

Our actions today will determine the degree and impact of current and future risks. These all depend on whether we rapidly mobilise to fund and share the costs, risks and rewards of the Climate Emergency in a viable and just way. Chapters 1, 2 and 3 provide the basis on which we can do this, and chapters 4 and 5 set out the call for action into individual, urgent and concrete actions.

The Sustainable Development Goals in this report

This report supports directly Goal 13: “Take urgent action to combat climate change and its impacts.”

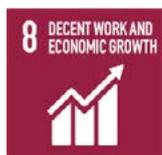


Goal 13 underpins all the other 16 Sustainable Development Goals (SDGs) as “climate change presents the single biggest threat to sustainable development everywhere and its widespread, unprecedented impacts disproportionately burden the poorest and most vulnerable.”¹³

Therefore, by supporting Goal 13, the actions and recommendations in this report contribute to aspects of all the SDGs. In addition, four specific targets are directly impacted:



Target 1.3 – Commits countries to implement nationally appropriate social protection systems for all



Target 8.10 – Encourage and expand access to banking, insurance and financial services for all

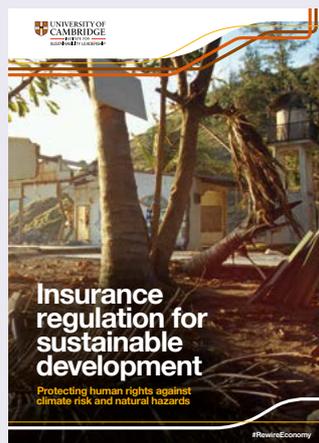


Target 10.5 – Improve regulation... and strengthen the implementation of such regulations

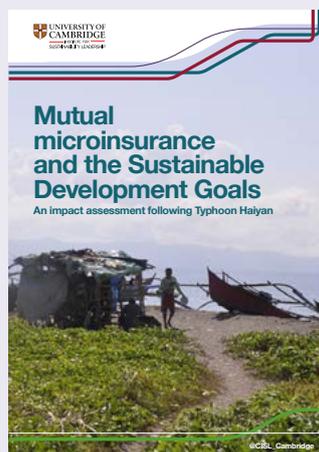


Target 17.17 – Encourage and promote effective public, public-private and civil society partnerships

Two previous CISL reports have provided a detailed analysis of the role of insurance in relation to the SDGs:



Insurance Regulation for Sustainable Development (2015) was the first to frame insurance functions through the lens of the SDGs, map how insurance could support SDG goals and targets, and illustrate how supportive insurance regulation is an essential policy instrument to increase insurance access around the world (public, private, mutual) and advance climate and natural hazard resilience.¹⁴



Mutual Microinsurance and the Sustainable Development Goals (2019) represented a two-year study in areas devastated by Typhoon Haiyan in The Philippines. For the first time, operational insurance functions and outcomes were assigned to the delivery of SDG targets and aligned with insurance-related indicators. The report also documented how insurance regulation is fundamental for financial inclusion and economic resilience.¹⁵

Part 1 -The risk-sharing domain

RISK-SHARING SYSTEMS

Defining feature: Full range of collective, risk-sharing mechanisms to protect populations and assets against defined risks.

- **Tax-based protection**
(eg welfare, social security, public health systems)
- **Informal risk-sharing sector**
(eg community networks)
- **Insurance sector**

INSURANCE SECTOR

Defining feature: Some form of premium-like payment, in advance, in return for protection against defined risks. This represents the main scope of insurance activities usually overseen by insurance regulators and supervisors.

- **Public sector**
- **Hybrid: public + private resources**
- **Insurance industry**

INSURANCE INDUSTRY

Defining feature: Some form of premium-like payment, in advance, in return for protection against defined risks. This represents the main scope of insurance activities usually overseen by insurance regulators and supervisors.

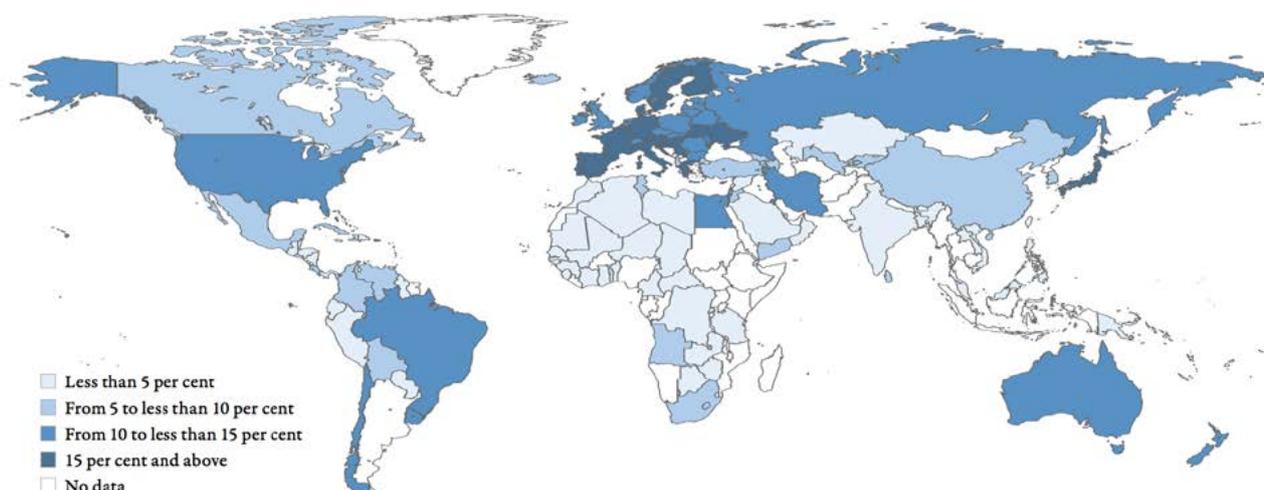
- **Risk carriers (underwriters): insurers, including microinsurance, reinsurers and capital markets**
- **Risk advisers and intermediaries**
(including insurance and reinsurance brokers)
- **Distribution systems: agents, packaged, digital, corporate**
- **Supporting organisations including: technology, risk modelling and actuarial firms, credit rating agencies, claims adjusters, law firms, investment consultants and marketing and distribution partners**
- **Capital markets development: insurance-like protection, for example, insurance-linked securities (eg catastrophe bonds) and weather derivatives**

Size of the global risk-sharing domain

The previous graphic has classified the wide range of risk-sharing systems that operate across our societies. It also identifies the spectrum of actors (public, private and mutual) that will need to work together in the Climate Emergency to apply the actions proposed in parts 4 and 5.

Building on that classification, we briefly summarise the current size of the global risk-sharing domain with two objectives: 1) to illustrate its substantial presence across many countries, as a cultural asset of social solidarity, across public, private and mutual arrangements, well beyond the private insurance industry alone; 2) to indicate how unevenly the risk-sharing domain is distributed globally, which will then serve as the basis for the massive expansion proposed in parts 4 and 5 to address the Climate Emergency and propel a just transition to resilience and net zero.

The public, private and mutual risk-sharing domain represents approximately one-third of the total global gross domestic product (GDP) (USD84.7 trillion in 2020),¹⁶ but its distribution is highly differentiated across countries. The level and composition of risk protection spending is influenced by the size, development and characteristics of the economy, by the evolution of the social contract and by cultural and political factors. Even countries considered generally similar can exhibit notable differences in patterns of risk sharing.



Source: ILO, World Social Protection Database, based on SSI.

Tax-based risk sharing

Social protection and welfare coverage are compiled in the Social Protection Platform of the International Labour Organization (ILO). Approximately 18.9 per cent of global GDP, about USD15 trillion, is allocated to social protection, of which about a third is spent on healthcare. Sixty-six per cent of the global population has access to some form of public healthcare.¹⁷

In Africa, 17 per cent of the population receive some form of social protection cash benefit, 39 per cent in Asia Pacific, 68 per cent across the Americas and 84 per cent in Europe and Central Asia.¹⁸

In many countries, mandatory and voluntary private insurance expenditure and tax incentives with social purposes significantly augment these figures of risk sharing for social protection.¹⁹

The map shows the stark reality that 55 per cent of the world's population do not have any cash social protection,²⁰ most of whom live on less than USD5.50 per day (a poverty line calculated to include both upper and lower middle income countries). Covid-19, in addition to climate change and conflict, have worsened the situation. For the first time in over 20 years, extreme poverty (less than USD1.90 per day) has increased, affecting almost 10 per cent of the world's population.²¹

Sustainable Development Goal 1.3 commits countries to implement nationally appropriate social protection systems for all, to reduce poverty. Parts 4 and 5 of this report provide urgent actions to contribute to this goal through climate risk sharing (from local to global, public and private).

The insurance industry

Overall premiums paid to the global insurance industry (private and mutual) were USD6.2 trillion in 2019 (approximately 7.2 per cent of global GDP), of which USD5.1 trillion was in developed economies, USD617 billion in China and USD544 billion in other emerging and developing markets. Non-life insurance business represented 53 per cent and life insurance 47 per cent of these global totals.²²

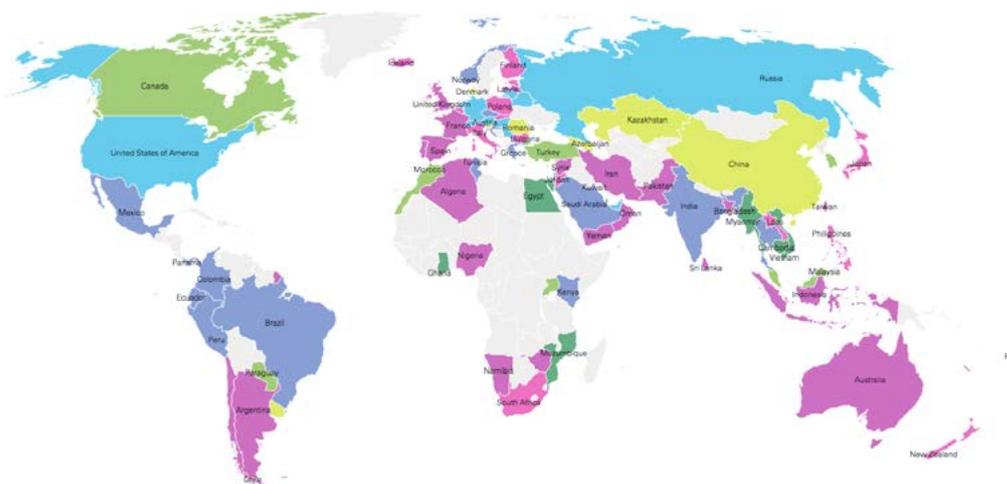
In 2017, approximately 26.7 per cent of global insurance premiums were underwritten by the mutual and co-operative sector, serving approximately 900 million policyholders.²⁴

As in the case of social protection, the global insurance coverage map reveals sharply a risk-sharing emergency that requires urgent actions to reduce climate risks across geographies and contribute to a resilient, net zero, just transition for all. For example, in 2017–18, the global (re) insurance industry covered USD219 billion in weather-related claims. An additional USD280 billion of uninsured losses fell on individuals, businesses, relief agencies and governments.²⁵

Total premiums as % of GDP²²

World	7.2%
US & Canada	11.5%
Advanced Asia Pacific	9.6%
Advanced EMEA	7.7%
Emerging Asia Pacific	3.9%
Emerging EMEA	1.9%

adjusted for inflation



Public-private disaster risk insurance systems

In addition to social insurance and welfare systems detailed above, national and regional governments contribute to disaster risk insurance systems to protect populations and industries from man-made risks (including nuclear accident liabilities or terrorism) and risks from natural catastrophes. There are three main types:

a) Subsidies for selected insurance classes:

For example, global public subsidies for agricultural insurance have been evaluated to be approximately two-thirds of global agricultural premiums.²⁶

b) Sovereign disaster risk financing:

In the last two decades, this concept has expanded to include multi-sovereign risk pools, including the Caribbean Catastrophe Risk Insurance Facility (CCRIF), African Risk Capacity (ARC) and the Pacific Risk Information System (PCRAFI). The global spectrum of these systems was surveyed by the Organisation for Economic Co-operation and Development (OECD) in 2015.²⁷

c) Humanitarian responses:

A 2021 analysis of international humanitarian responses to natural hazards in nine developing countries indicated that only 2.3 per cent of funding was pre-arranged.²⁸ Between 2018 and 2020, the international system spent approximately USD31 billion per year on humanitarian responses,²⁹ which would suggest only USD700 million was pre-arranged.

Insurance density (total) insurance premiums per capita²³

Part 2 - Risk-sharing pools to enable risk management

This part identifies the distinctive contributions that insurance-informed risk-sharing pools can make to the systemic climate crisis and to climate policy. This report focuses on the insurance sector as underwriters, with a reference in part 4 as asset owners.

Section A: The unique approach of the insurance sector to risk

Insurance risk-sharing pools are integrated risk management systems combining the following building blocks.

2.a.1 Understanding the components of risk

The insurance sector has adopted an engineering-based understanding of the components of risk assessment and blended them with actuarial science. This has created a unique set of metrics and methodologies inside the financial system.

Risk is not simply the chance of a threat or an uncertainty, but a combination of three elements, which, in turn, hold the key for sustainable development and opportunity:

- a) The **likelihood** (probability) of defined uncertainties or threats occurring. For example, a major hurricane striking a city in the next 12 months or a carbon-reduction policy being implemented by a government that could leave people without jobs.
- b) Scale and attributes of the **exposed** entities to uncertainty or threat. For example, the size and demography of a city, the livelihoods of its inhabitants and the types of homes exposed to an uncertainty, such as a hurricane or closure of a factory under carbon-reduction legislation.

- c) The **vulnerability** of those exposed entities to the level of uncertainty or threat. For example, how well buildings in a city withstand a hurricane or the ability of a factory to adapt to new emissions requirements.

An assessment of these three features of risk (probability, exposure, vulnerability) is the bedrock of understanding opportunity and sustainable growth.

Risk management is the process that informs actions that optimise desired outcomes, while reducing or avoiding the likelihood of bad or catastrophic ones.

Some examples of the three types of climate risk in relation to the three building blocks of risk

Climate risk	Threat or uncertainty	Exposure	Vulnerability
Physical	Typhoon →	Home →	Roof construction type
	Heatwave →	Health and productivity →	Age / occupation / air conditioning access
Transition	New energy policy →	Oil-dependent factory workers →	Factory adaptability / retraining / alternative employment opportunities
	New low carbon technology →	Main income from existing supply chain →	Flexibility to access alternative existing supply chains or adapt to new technology
Legal liability	Increasing incidence of wildfires →	Electrical utility →	Inadequate maintenance of powerlines and nearby vegetation
	Acceleration of energy transition →	Directors approve building of gas-fired power plant →	Corporate governance standards / culture

2.a.2 Risk assessment and quantification for short to medium-term risks

This feature, often misunderstood, is central to the paradigm shift across the financial system that we propose in part 4.

Since the early 1990s, (re)insurers have used catastrophe models to assess and quantify the likelihood and financial impact of natural hazards. While not infallible and subject to constant improvement, catastrophe models, and risk-informed capital, have given enough resilience to the industry during the unprecedented global natural catastrophe loss years of 2005, 2011 and 2017. As part 4 will argue, these techniques must be harnessed and built upon to make all financial markets resilient in the Climate Emergency.

In the last decade, catastrophe models have incorporated climate science inputs to consider trends related to natural variability and climate change to better understand current risk, not simply historical patterns.³⁰ Until recently, regulation has typically required (re)insurers to undertake stress tests for the upcoming underwriting year only. Yet, catastrophe models have not been used to project forward because there have not been operational or regulatory requirements to do so. As regulators begin to require physical risk projections for decades ahead, catastrophe models are being conditioned, with climate model inputs, to simulate future, not just present, loss scenarios.^{31,32,33}

This quantification of risk, using standard metrics, has permitted the modelled risk to be commoditised, which has reduced underwriting uncertainty and created several opportunities: it has lowered insurance and reinsurance premiums, expanded insurance coverage, encouraged investors to make capital available to increase global insurance capacity and permitted the creation of financial instruments (such as catastrophe bonds and insurance-linked securities) that diversify this risk in other parts of the financial sector.³⁴

Over the years, risk modelling methodology and metrics have been extended far beyond natural hazards to encompass all the risks insurers face within their portfolios.³⁵ Some of these, such as legal, financial, regulatory and policy risks, are relevant to climate transition and liability risks.

Catastrophe risk modelling

Until the early 1990s, non-life insurers and reinsurers used past claims experience as the primary means of assessing natural hazard risks. Unprecedented losses in the late 1980s from asbestos liability and natural catastrophe risks, culminating in Hurricane Andrew in 1992, led to a systemic global market crisis.

In response, underwriters, regulators and credit rating agencies implemented a new approach to natural hazard risk assessment, called catastrophe risk modelling. The innovation was to better quantify ‘what could happen next year’ rather than ‘what has happened’ in the past. Catastrophe models simulate and quantify realistic worst case scenarios using the hazard, exposure and vulnerability risk methodology introduced above. They blend four disciplines: engineering metrics and expertise, actuarial science, physical and human geography and, in recent years, they have started to incorporate climate science.

A critical component of the catastrophe model is the hazard module, which usually simulates 10,000 potential years of loss events (eg floods or hurricanes). “The goal is not to recreate the last 10,000 years of history, but to simulate 10,000 years of activity equivalent to current conditions”.³⁶

This creates an extensive database (event set) of simulated events to stress test portfolios, far beyond historical records alone, to evaluate the likelihood of high and low-loss years. For example, the simulated storms will have tracks, wind speeds and footprints that are then applied to the locations and details of exposed assets and related vulnerability functions. This enables the assessment of risk for an individual asset, or to accumulate these for the portfolio as a whole.

Climate science can also be applied to 10,000 simulated Atlantic hurricane seasons under, for instance, conditions expected in 2035. Due to warmer oceans, hurricanes are predicted to exhibit a distribution skewed towards more extreme (Category 4 and 5) storms with a northward shift of tracks, leading to cities like New York having higher annual risks and greater storm-surge heights from sea-level rise. The financial impacts of this 2035 projection can be compared with 2020 estimates to indicate the impacts of climate change.

2.a.3 Risk assessment and quantification for long-term risks

Discussion on climate risk quantification in the insurance sector has focused on so-called short tail insurance classes, like natural catastrophe reinsurance, that directly relate to underwriting physical climate risks. This raises questions on the sector's approach to long-term risks and the capability to assess future climate change on current and future underwriting and asset portfolios.

However, two parts of the insurance sector are focused on long-term risk quantification. Firstly, over half of the global insurance sector covers long-term life, pensions and health insurance. In this case, premiums paid today must cover risks and commitments that may not commence for decades and potentially persist for many years. These underwriters factor in long-term future changes in the external risk environment and in attributes of the risk pool.

Secondly, underwriters of so-called long tail classes, such as legal liabilities, must consider the potential long-term impacts of current actions on third parties or the changing future perceptions and legal landscape on current actions. As the scientific consensus on the impacts of fossil fuels translates into legal decisions, historic and contemporary actions by corporates and financial institutions are at growing risk of incurring legal liabilities that may fall upon insurers. Claims can be made years, or even decades, after a policy was issued.

These features of life, pensions and liability insurance require underwriters and actuaries to apply long-term scenarios and risk assessment techniques to evaluate the impact on portfolios. Indeed, this is where the majority of the insurance sector's risk quantification personnel, expertise and experience exists.

Until recently, these long-term risk quantification capabilities have not been applied operationally to climate risks. Recent developments are changing this as regulators consider the impact of climate change on life, legal liability and pensions portfolios.³⁷ Part 4 will refer to this in the suggested improvements for the insurance sector.

2.a.4 Risk disclosure, solvency and regulatory capital requirements

Uniquely, the outputs of catastrophe models are used to disclose an insurance company's risk to supervisors, which determine capital requirements to maintain adequate solvency for natural disasters. The 1:200 year maximum probable stress test has become the basis for confirming that insurers have sufficient capital to support their underwriting exposures and commitments. These types of solvency requirements for natural hazard risks are not yet required from other financial institutions or corporates.

The 2020 Annual Report of Swiss Re reports its one-year (2021) 99.5 per cent tail Value at Risk from all risks to be USD20.1 billion. This represents the average loss, at current risk levels, expected to occur once in 200 years (or less frequently) across all its underwriting and investment portfolios. Swiss Re must evidence to its regulator that it has a solvency (capital) margin significantly larger than this to be authorised to underwrite. Swiss Re also discloses the key risks stress test results that drive this total figure, including Atlantic hurricane (USD5.8 billion) and European windstorm (USD2.3 billion).³⁸

2.a.5 Risk pools: governance, sustainability and risk reduction

Insurance systems share risks between populations at local and global scales via public, private and mutual-cooperative mechanisms or hybrid systems. Sustainable insurance systems must ensure two aspects: security and affordability.

- a) **Financial security:** To be financially sustainable, insurance pools require constant risk evaluation and management. Insurance systems operate in a state of dynamic equilibrium, driven by changing attributes of the members and external risks, which may develop in a non-linear way. Tipping points or threshold equilibrium can threaten insurance pool performance or even viability. New trends, sudden extremes and long-term uncertainties must be managed to ensure pool sustainability and members' confidence in the insurance system.
- b) **Affordability:** Insurance security is strengthened with an increased size and diversity of risk-sharing communities. The protection needs to be affordable for a large enough proportion of the population to ensure societal protection and a sustainable business. Insurance systems share risk more widely for greater security. Pools grow and diversify through expansion by acquiring new members. This principle applies when a pool protects itself through reinsurance or into capital markets, through insurance-linked securities, and with public sector facilities.

Insurance systems apply individual and societal risk management rules to be sustainable. Members accept rules to reduce risk, keep premiums affordable and govern access to the shared pool of capital. Insurance systems also drive societal risk governance. For example, risk reduction laws, regulations and interventions are used to keep insurance pools sustainable and premiums affordable.

2.a.6 Transparency of risk signalling and systemic risk intelligence

An insurance price, usually expressed as an annual premium, signals complex and integrated risk intelligence in a clear, simple and comparable way.

The annualised risk metric, called pure premium, provides a universal, practical and standardised unit of risk operating across economies and sectors. This is the pure price of risk (quantified potential losses) before adding expenses and profit in the final premium. The annual pure premium is an important contribution to consistent risk evaluation with applicability to transition, physical and liability climate risks.

Ultimately, the performance of the collective insurance pool over time provides a powerful signal on the sustainability of risks across the community. If the risk pool is unable to meet the level of payouts within affordable levels of insurance premium, the level of risk may be unsustainable without some form of additional or external intervention to reduce risks or subsidise premiums.

The total level of premium and claims across a country also provides a national assessment of insured risk and how it is distributed across regions and communities. Parts 4 and 5 will build on this to support greater risk awareness and sharing across economies.

The examples of flood insurance in Australia, the USA and the UK illustrate challenges that are replicated in regions worldwide.

Example: Flood insurance in Australia, the USA and the UK

>> In **Australia**, homeowners' flood insurance is provided solely through commercial markets (private and mutual) without public intervention. Increased losses in high-risk regions, including coastal Queensland, have produced steep and sustained rises of insurance premiums and withdrawal of coverage. Insurance premiums are sending strong and clear risk signals. The speed and impact in hard-hit localities is leading to unacceptable levels of economic risk and social dislocation. While this has prompted some municipalities to undertake flood resilience interventions to help reduce premiums, insurance access and affordability has become a significant political issue and economic challenge.³⁹

>> In the **United States**, homeowners' flood insurance costs in high-risk zones have been subsidised by the federal National Flood Insurance Program (NFIP), under the Federal Emergency Management Agency (FEMA) funded by general taxation. In response to increasing flood claims, the NFIP has required over USD35

>> In the **United Kingdom** homeowners' insurance includes flood cover by default. In the wake of increased flooding events in 2005–10, insurers threatened to withdraw from continued coverage for approximately 500,000 homes in high-risk areas. In response, the industry and government developed Flood Re in 2016, which reinsures the coverage of high-risk homes, subsidised by a levy of approximately £10 on all UK domestic property insurance policies. The programme is not open to new properties built in flood zones and was subject to government commitments to ongoing flood defences. The programme was legislated to have a life of 30 years, by which time it is envisaged that flood risk will have become managed so that premiums for all homes will be affordable without Flood Re.⁴³

billion from the US Treasury to supplement customer premiums since 2005.⁴⁰

While enabling access to affordable insurance to many at-risk homeowners, subsidies raise questions of economic sustainability and social equity, such as should low-income, non-home-owners in low-risk locations subsidise wealthy citizens to insure second homes in high-risk coastal zones? Subsidies for insurance premiums that remain below actuarially based levels dampen risk signalling and incentivise living and investing in high-risk locations.

In response, FEMA is undertaking historic changes to its risk rating methodology "to deliver rates that are actuarially sound, equitable, easier to understand and better reflect a property's flood risk".⁴¹ The private flood insurance market still makes up a small portion of total US flood premiums. The National Association of Insurance Commissioners (NAIC) has published guidance to assist state regulators in developing a larger private insurance market for residential flood insurance.⁴²

Section B: The PCL framework: guiding risk-sharing policy in the climate transition

The flood examples above demonstrate the difficulties in designing and operating socially fair, politically viable and economically sustainable climate-related insurance systems.

These difficulties are addressed in the emerging PCL framework, elaborated to help society, policymakers and wider stakeholders to confront the resilience and adaptation decisions of the Climate Emergency.

2.b.1. What is the PCL framework?

The framework is a complementary policy approach to guide participatory decision-making and choices. The optimum design of risk-sharing systems requires communities and economic actors to decide their priorities for protection, for example: social cohesion, housing, critical infrastructure, education, employment or cultural assets.

The framework starts by societies defining their level of 'loss tolerability', which is "a value-driven consultative assessment by society in which it determines which losses it considers to be tolerable and which ones are intolerable".⁴⁵

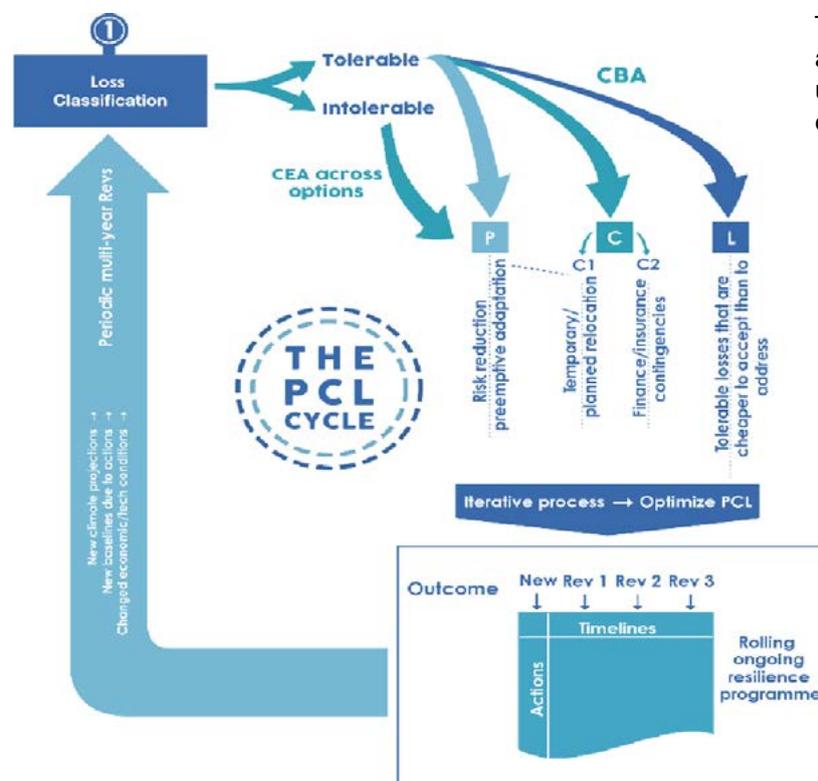
It then guides decision-making on the three overarching approaches in the face of risk:^{44,45}

P – Preventative adaptation or risk reduction, which are undertaken for all potential losses that are deemed to be intolerable, and for those tolerable losses for which preventative measures are the most cost-effective.

C – Contingent arrangements: Excess risk is managed through all risk-sharing and risk transfer available or planned relocation.

L – Loss acceptance: When the loss is smaller than the costs of risk reduction or contingent arrangements.

At the heart of the PCL framework is a system to address the essential resilience choices facing everyone, from families to heads of government: what is the risk; what is valued; what should be protected; what should be insured, how should it be shared, and what should be left to fate? The answer, whether it is a householder protecting lives, livelihoods and shelter or a mayor protecting a city, is usually a blend of these responses.



The PCL cycle⁴⁴

The PCL framework is an iterative process, updated as conditions and circumstances change.

2.b.2 Further integrating the PCL with insurance capabilities

Application of the PCL framework by policymakers can be enhanced with insurance thinking and risk pool capabilities.

a) Insurance-informed quantification to guide loss classification:

The first step in the PCL framework is loss classification, to which insurance expertise can add advanced risk assessment and quantification techniques, as elaborated in the previous section.

The common set of insurance-based metrics, lexicon and data can be used by policymakers, financial institutions, development agencies and public and private sector entities for more effective decision-making and cost-benefit analysis (CBA). This quantification of risk can also inform cultural, social and political priorities in the PCL framework.

b) Using risk-sharing pools to govern, fund and deliver PCL framework outcomes

Risk-sharing pools are the operational platform that enables PCL framework decisions to be implemented by:

1. Establishing contractual relationships and practical mechanisms to administer payments and governance of stakeholders.
2. Revealing in clearer detail the costs and benefits for different stakeholders, using public and private sector contribution. This includes the cost of premiums and wider risk-reduction measures necessary to make the risk pool sustainable and affordable.

c) A common framework for climate policy and financial regulation

PCL outcomes, enabled by risk pools, provide climate policy leaders and financial regulators with a shared, practical means to achieve their respective mandates of climate resilience, financial inclusion and stability. These concepts are translated into actions later in this report.

2.b.3 Supporting highly vulnerable and lower income countries

The PCL framework provides a coherent approach to address structural issues, from local to regional and global scales. However, at national levels, greater risk awareness and transparency could inadvertently hinder investment and risk financing just when it is most needed.

Insurance-informed risk quantification with the PCL approach enables governments to:

- evaluate and articulate where investment is needed to deliver the most significant resilience benefits
- attract donor or concessional finance to be directed towards the most efficient interventions to achieve greater resilience, build economic and social confidence and stimulate sustainable investment
- align the resources of development institutions to match the delivery of their mandates, reduce risks to priority populations and secure development gains and human wellbeing.

Based on these analyses, communities or countries can optimise their participation in risk-sharing pools and configure the use of necessary and available subsidies to achieve collective resilience objectives. Failure to adopt this approach could lead to lack of risk understanding, uncertain prioritisation and inefficient use of scarce resources to achieve desired outcomes.

Part 3 - Insurance regulation and climate

“Far more than in the regulation of other financial services sectors, insurance regulation is the product of normative conceptions of social welfare and economic fairness.”⁴⁶

The contribution that insurance regulation can make to the Climate Emergency is underpinned by its experience of overseeing risk pools that address complex scientific and social challenges.

Part 3 identifies the regulatory mandates and processes that can support the adoption and implementation of the report’s actions and recommendations (parts 4 and 5).

Section A: The architecture of global insurance regulation

This section maps the scope of insurance regulation to provide the logic and foundations of the tripartite relationship among insurance regulation, financial system and climate policy called for in this report.

Insurance regulators do not operate in isolation. They are subject to, empowered and guided by legislation and mandates. This legislation is, in turn, the product of international and national public policy seeking to establish fair and effective ways to understand, manage and share economic and wider risks across societies.¹⁵

3.a.1 The importance of regulatory mandates

Regulators’ activities are bound by their mandates. Insurance regulation is mandated by governments to protect policyholders and ensure wider financial stability. In order to support climate objectives, the role of regulators must be anchored in the interpretation, implementation and evolution of their mandates. They include:

- **Micro-prudential:** Insurance supervisors’ primary duty is to protect the interests of policyholders and to ascertain that risk pools (insurers) have sufficient funds to pay for claims, even in the event of very large and sustained losses.
- **Macro-prudential:** overseeing overall market stability at a national and, more recently, global level. Macro-prudential supervision in the insurance sector addresses two types of risk: the financial stability risks that could impact the insurance sector (and ultimately policyholders) and the risks that are generated or amplified in the insurance sector that could have an impact on other parts of the financial system.
- **Market conduct:** Regulators supervise the performance of institutions and practitioners in the execution of their duties to, and fair treatment of, consumers and other stakeholders.
- **Development:** Some (but not all) regulators have mandates to support the development of the insurance

sector and expand access to protection: “Supervisory objectives could also include promoting insurance market development, financial inclusion, financial consumer education...”⁴⁷

3.a.2 Growing integration of insurance regulation with global financial policymaking

To manage global risks, we need globally co-ordinated systems. Driven by financial shocks and international market co-ordination, the development of international insurance standards has led to increasing harmonisation of insurance supervision around the world. This allows for a more globally co-ordinated response to systemic risks, like climate change.

Since 1994, insurance regulators have convened through the International Association of Insurance Supervisors (IAIS) “to promote effective and globally consistent supervision of the insurance industry”.⁴⁸ It comprises over 200 supervisory authorities, overseeing 97 per cent of global insurance premiums.⁴⁸ It is hosted by the Bank for International Settlements (BIS) in Basel, Switzerland, which is responsible for the banking regulatory framework through the Basel Committee on Banking Supervision. In many countries, integrated regulators and supervisors cover banking, insurance and investment activities.

In the wake of the 2008 financial crisis, the IAIS aligned further with international financial policymakers, becoming

a member of the G20 Financial Stability Board (FSB). Its contribution to policymaking relates to insurance and the supervision of the global financial sector.⁴⁹ As the risks from 2008 were addressed, the FSB also became the vehicle for managing global climate-driven financial risks with the launch of the FSB G20 Task Force on Climate-related Financial Disclosures (TCFD) in 2015.^{50,51}

3.a.3 How insurance supervisors implement their mandates

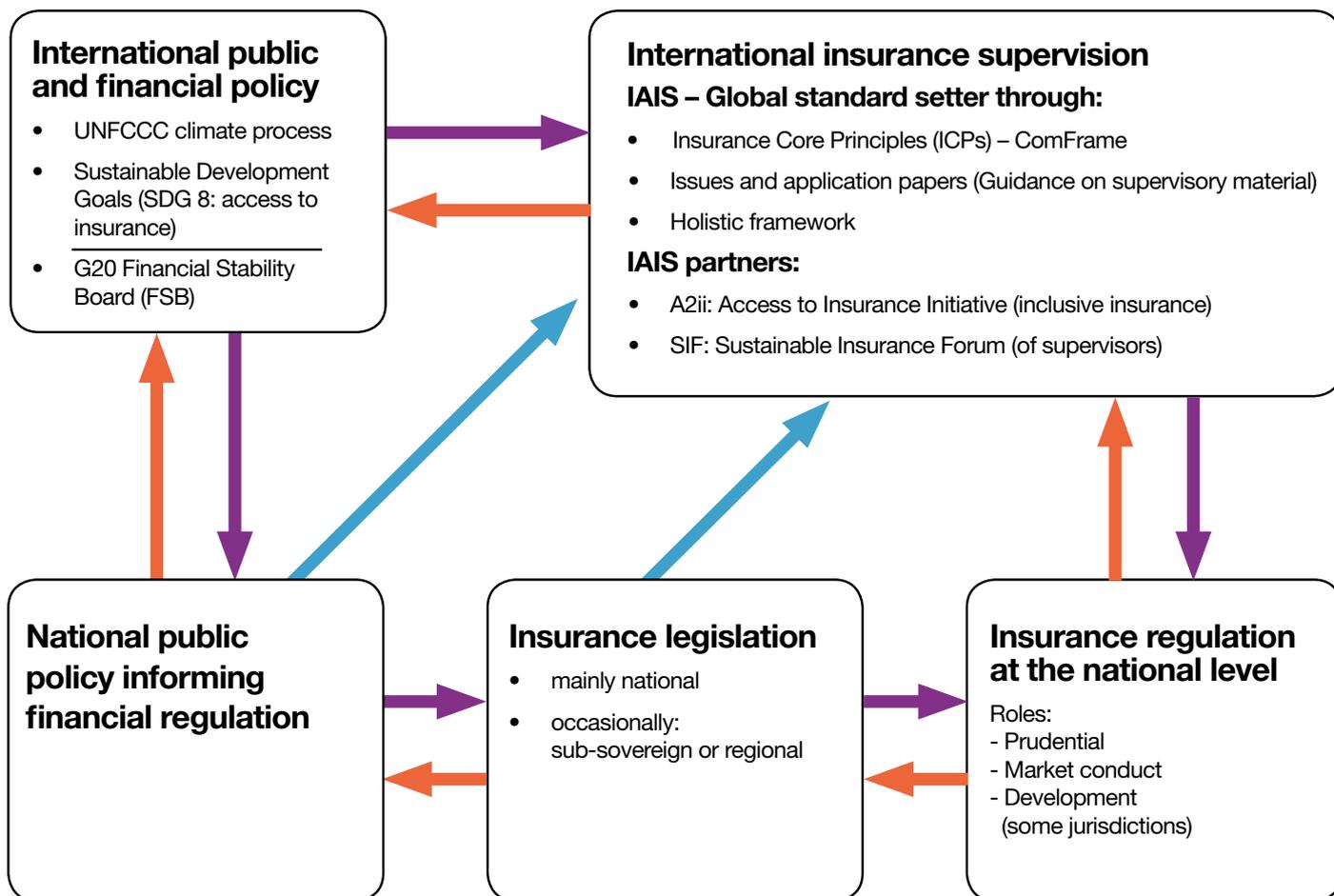
The IAIS sets its standards through 24 Insurance Core Principles (ICPs) updated periodically. Member supervisory authorities apply them in their own jurisdictions through local law, policy and regulation. The ICPs are complemented by Issues or Application Papers, providing advice and examples of good practice on specific areas.

The supervision of almost 50 large insurers is co-ordinated through ComFrame, a comprehensive and outcomes-based framework.⁴⁹ This ensures that large, internationally active, cross-border insurers can operate with internationally consistent regulatory requirements.

To support global financial stability, in 2019 the IAIS adopted the Holistic Framework for the assessment and mitigation of systemic risk in the insurance sector.⁴ Through the Holistic Framework, the IAIS foresees an annual monitoring and assessment of the potential build-up of systemic risks in the insurance sector and supervisory responses. The outcome of this Global Monitoring Exercise is reported to the FSB and the general public.

The interaction between the global and national levels is a two-way flow, where progressive national developments feed into the IAIS to then inform global reforms that are implemented at the national level.

Interaction of policy, law and regulation (Adapted from CISL, 2019¹⁵)



Section B: Climate in insurance regulation

This section highlights the climate-specific instruments upon which the actions and recommendations of this report are built.

Since 2016, the United Nations (UN) convened Sustainable Insurance Forum (SIF) has brought together insurance supervisors on a voluntary basis to facilitate sharing and collaboration, strengthen understanding and address sustainability issues within the insurance sector.⁵² With the input of the SIF, climate-related risks have become steadily more integrated into the work of the IAIS. By 2021, this landscape had become sufficiently developed for climate risks to be channelled into IAIS core activities, as summarised in the following table.

Instruments	Key extracts
IAIS strategy and high-level goals	<p>The 2020–24 IAIS Strategic Plan states:</p> <p>Climate risk: “insurers are exposed to both transition risk as institutional investors and physical risk from natural disasters through their underwriting, but can also be key agents in the mitigation and management of climate risk.”⁴⁹</p> <p>Financial inclusion and sustainable economic development: “insurance supervision has an important role to play in insurance market development and, more broadly, sustainable economic development, in the wider context of achieving the IAIS’ Mission.”⁴⁹</p> <p>Relevance to this report: The actions proposed in parts 4, 5 and Recommendations of this report will invoke these strategic priorities as pressing, interwoven elements of the Climate Emergency requiring urgent action.</p>
Micro-prudential supervision	<p>Application Paper on the Supervision of Climate Related Risks in the Insurance Sector²</p> <ul style="list-style-type: none"> - First of its kind by a global standard-setting body. - Formally embeds climate risk guidance across the supervisory process of insurers: ICP 7 (Corporate Governance), ICP 8 (Risk Management), ICP 9 (Supervisory review and reporting), ICP 15 (Investments), ICP 16 (Own Risk and Solvency Assessment), ICP 20 (Disclosures). - Guidance on disclosure of risks, for instance, in line with the TCFD framework. <p>Relevance to this report: It integrates climate-related risks into the core supervisory requirements applied to insurers (parts 4 and 5).</p>

Continued

Vicky Saporta, Executive Committee Chair, International Association of Insurance Supervisors.⁵³

Instruments	Key extracts
<p>Macro-prudential supervision</p>	<p>Application Paper on Macro-prudential Supervision</p> <ul style="list-style-type: none"> - Provides examples of the various macro-prudential tools that a supervisor may use, many of which are helpful to assess climate-related risks. For example, supervisory macro-prudential stress testing can be used to measure the impact of climate change on the insurance sector as a whole. - Notes that supervisors should develop systems and processes to collect and analyse ad-hoc data to address evolving and emerging risks, such as climate-related risks.⁵⁴ <p>Relevance to this report: It provides the basis for multi-entity data assimilation and market-wide risk assessment at a national level (part 4).</p>
<p>Macro-prudential monitoring</p>	<p>Global Insurance Market Report (GIMAR) Special topic on climate risk⁵⁵</p> <p>Quantitative analysis study of the investment exposures of the insurance sector to climate-related risks, building on data collection from IAIS members. It shows that more than 35 per cent of insurers' holdings of equities, corporate bonds, loans and mortgages, sovereign bonds and real estate could be exposed to climate change.</p> <p>Relevance to this report: a) international, multi-jurisdiction data assimilation; b) quantification of climate-related investment risks (part 4).</p>
<p>Systemic risk</p>	<p>Holistic Framework for Systemic Risk in the Insurance Sector (adopted in 2019)⁴</p> <ul style="list-style-type: none"> - Identifies climate as an emerging systemic risk. - Comprises the following: <ul style="list-style-type: none"> a) Global Monitoring Exercise (GME), as reported on in the annual Global Insurance Market Report (GIMAR): to assess the build-up of systemic risk globally and report to the FSB and wider public. b) Supervisory material: an enhanced set of supervisory policy measures for macro-prudential purposes, as contained in the ICPs and ComFrame. The objectives are: i) to increase the overall resilience of the insurance sector; ii) to enable a prompt response when potential systemic risk is detected. c) Implementation assessment: assessment of the consistent implementation of the supervisory material. <p>Relevance to this report: Provides an existing instrument to incorporate the actions proposed in part 4 on systemic climate risk and the protection gap.</p>

Parts 4 and 5 will build on the mandates and developments identified throughout Part 3 to propose 20 actions required in the Climate Emergency.

“Climate change will have wide-ranging effects on the insurance industry and, if left unchecked, will impact global financial stability; insurers have a central role to play in the transition to net-zero and in building climate resilience. Supervisors should have the expertise to adequately monitor and address these risks.”

Part 4 - Paradigm shift 1: insurance informed risk quantification across public and private financial systems

The scale of the task to integrate climate risk management across finance, regulation and policy requires a shift in various different paradigms. This report focuses exclusively on the contribution of insurance-informed change, but does not imply this is the only desirable paradigm shift in the race to net zero, resilience and a just transition.

Part 4 consists of two sections. Section A advocates further development of the insurance sector's climate risk quantification practices to match the speed and scale of the Climate Emergency.

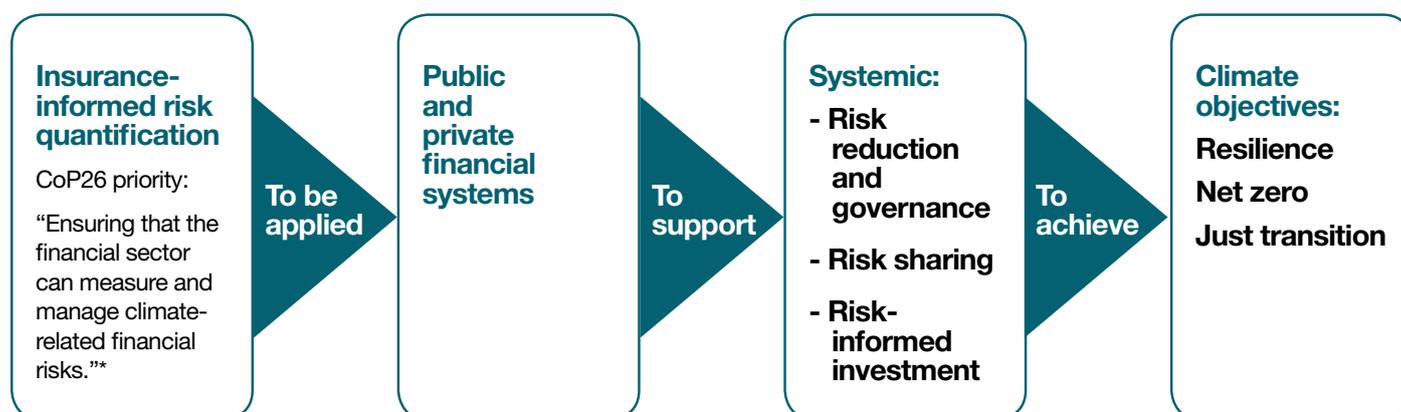
Section B presents a paradigm shift to disseminate insurance-based quantification techniques and capabilities across public and private financial systems.

To guide these actions we have focused on:

- the priorities identified in the *FSB Roadmap for Addressing Climate-related Financial Risks* (July 2021), prepared in consultation with standard-setting bodies and other relevant international bodies.⁵⁶
- two supporting FSB documents: i) *The availability of data with which to monitor and assess climate-related risks to financial stability*⁵⁷ and ii) *Report on promoting climate-related disclosures*.⁵⁸ We refer to sections of these reports as appropriate.

Collectively, the FSB material identifies TCFD as the unifying approach and focuses on how this framework can be operationalised with tractable data and metrics, including the necessity of developing consistent best practice across the financial system.

Paradigm shift



*Source: UKCoP26⁵⁹

Section A: Priorities for the insurance sector

This section focuses on the need for the insurance sector to accelerate the development and implementation of its own climate risk assessment capabilities.

Part 2 identified the spectrum of analytical expertise contained within the insurance sector to assess the wide range of exposures, risks and timescales within institutions and markets. The urgent, comprehensive and complex demands of climate risk assessment invite a more co-ordinated and energetic effort to corral the sector's capabilities.^{60,61} This agenda could support the development of methodologies, metrics and shared reference data and analytical facilities.

Action 1 – Insurance sector improvements

a) Climate risk quantification capabilities and implementation of TCFD

In line with the FSB Roadmap, the IAIS could share among its members: “developments and best practices on metrics, tools and supervisory approaches to encourage and monitor reporting entities’ progress on climate disclosure... [and share] information about relevant public and private initiatives that have been established to increase awareness of climate-related disclosures as well as to support industry in improving the quality, consistency and comparability of disclosures.”⁵⁸

Under the IAIS Climate Risk Steering Group, an opportunity exists to align best practice among supervisors and regulated entities across the insurance sector to improve climate risk quantification, including implementation of TCFD.

b) Reduction of premiums to reflect resilience interventions

At present consumers are not consistently rewarded for their risk-reduction measures. Insurers should pass these benefits transparently to policyholders through reduced premiums and improved conditions.

For example, in the US, multiple states require mitigation credits to be applied to home and business property premiums for risk reduction. Most frequently, premium discounts are applied for enhanced roofing construction as part of the FORTIFIED program developed by the Insurance Institute for Business and Home Safety (IBHS).⁶² On the regulatory side, the National Association of Insurance Commissioners (NAIC) is working with industry and community stakeholders to incentivise risk reduction and encourage policyholders to participate in mitigation action.

c) Macro prudential and systemic risk assessment and monitoring

The Climate Emergency reinforces the sense that risk quantification and systemic risk intelligence are areas

where the distinctive contribution of insurance regulators is valued and anticipated. Plans to incorporate climate-related risks in the IAIS Global Monitoring Exercise output in late 2022 may provide an initial focal point to consider an annual systemic climate risk assessment informing the CoP process.

d) Technology

Advanced technologies and digital platforms are transforming the operations of the insurance sector, including underwriting, product distribution, claim settlement and the affordability of insurance through reduced operational expenses.^{63,64}

Satellite remote sensing, climate modelling, sensors, analytics and continually expanding connectivity are enabling new forms of risk sharing including an expanding range of parametric instruments.

For instance, in India, the ‘Pradhan Mantri Fasal Bima Yojana’ (Prime Minister’s Crop Insurance Scheme) is designed to use technology to serve the 70 per cent of the country’s population dependent on agriculture. It includes smartphones, payment wallets, drones, remote sensing, geo-mapping, geo-fencing and satellite imaging.⁶⁵

Technology creates new areas to be covered by regulation, but also facilitates some of the regulatory tasks, potentially increasing regulatory capacity at a large scale. Big data, machine learning, the internet of things and artificial intelligence help supervisory technology (SupTech) with automated processes for reporting and monitoring. Technology also aids the delivery of regulatory requirements (RegTech).⁶⁶

Many insurance regulators are embracing these new possibilities. For example, in future, if parametric insurance instruments are used to share climate risks, at scale, in sovereign, corporate or municipal bonds markets, technology could be used to help regulators ensure the prudence and effectiveness of such instruments. The adoption of these technologies can require regulatory evolution. For example, Costa Rica, followed by Brazil, adopted index-based insurance through a further interpretation of insurable interest in the governing law of insurance.⁶⁷

As demand for climate-related protection expands across the economy and markets, there are opportunities for further co-ordination between financial regulators to consider how insurance can be operationally integrated and appropriately recognised in other sectors.

e) Natural capital

As natural capital is degraded, the increased risk and impacts on affected assets can be quantified through similar techniques used for physical climate risk modelling.⁶⁸

For example, a degraded mangrove exposes coastal assets to storm damage, as well as reducing carbon sinks, fisheries and habitats. As climate risk reporting is implemented, the value of ecosystems in managing risk and supporting economic and social assets will be further recognised. Material risks and impact of their loss will need to be disclosed, and benefits of maintenance expressed. This imputes specific value on natural assets, even when they provide no income and are part of the shared commons.

The value of ecosystems can also be transmitted through the impact on insurance premiums. For instance, research in California has demonstrated that forest ecosystem management could reduce the level of wildfire risk on residential insurance premiums by over 40 per cent.⁶⁹

Insurance has unique attributes that make it well suited to protect natural assets. It is not necessary to own an asset to have an insurable interest in its condition. This enables public and private entities to create arrangements to insure and manage their interests in natural assets. These techniques have been pioneered by conservation organisations on territorial and marine ecosystems, such as the Nature Conservancy and the Mesoamerican Reef Fund in Central America and the Caribbean.⁷⁰

The Taskforce on Nature-related Financial Disclosures (TNFD) highlights the critical links between climate risk and nature, and over the next two years will develop a framework for reporting nature-related physical and transition risks. This indicates how natural capital is today perhaps at a similar stage to climate risk half a decade ago.⁷¹

Consideration should be given to how the regulatory impetus to address climate-related risks and sustainable development could be extended to assess and manage the risks and impacts to natural assets.

Action 2 – Evaluating the contingent climate risks of insurers

Risk disclosure alone is insufficient to achieve financial resilience. The insurance sector has achieved relative resilience from natural disasters because regulators and credit rating agencies require companies to maintain sufficient capital to meet stress tests and realistic disaster scenarios. Stress tests can help identify new climate-related contingent liabilities that should be quantified and managed, including whether these are sufficiently provided for in the insurers' own risk and solvency assessments.

This powerful influence means that an evidence-based approach has to be intrinsic in all capital frameworks and supervisory approaches. It must build upon the development of rigorous methods, metrics and data availability identified above. As confidence in the quantification of contingent climate liabilities grows, this will provide a foundation to inform the treatment of regulatory capital.

Some insurance supervisors have developed considerable sophistication in this area and may become the pioneers of this implementation, which can then be refined and adopted by other sectors. For example, plans on the regulatory capital treatment of climate change are already under discussion by the European Insurance and Occupational Pensions Authority (EIOPA).¹²

Building upon existing practice, the insurance sector is in a leading position to pioneer the methodologies to assess contingent liabilities of physical, transition and liability risks. In due course, regulators might apply regulatory capital requirements to these areas in line with determinations of material risks to insurers:

“Risk mitigation in a prudential regulation authority is largely conducted through the lens of firms' capital adequacy... It is therefore possible that the incentives to address climate change risk for both firms and supervisors could be enhanced if it were incorporated explicitly into firms' capital requirements”.⁷²

Action 3 – Integrating risk assessment from short-term to intergenerational timescales

a) Blending short-term and long-term skills

The success of systemic climate risk assessment depends on bringing the skills of the long-term life, pensions and investment sides of the insurance industry together with their property and liability counterparts. At present the insurance sector's sub-disciplines, including life insurance actuaries, natural catastrophe modellers, investment analysts and lawyers have often worked in professional silos.

The building blocks to provide this holistic analysis may already be in place, uniquely in insurance organisations. Chief Risk Officers (CROs) of insurance groups draw these components together under enterprise risk management frameworks using consistent methodologies and metrics. This may form a basis for developing integrated climate risk assessment for institutions across spatial and temporal scales that integrates many channels of risk for financial institutions.

Such work would require approaches to considering extremes, correlations, non-linearities and related techniques for developing and applying scenarios development, data assimilation and stress testing. Managing interdependent climate risks requires expertise to be combined in new ways. Insurance CROs and the insurance supervisors that require these assessments have the experience to contribute leadership in this area.

b) Fiduciary duties

In many jurisdictions insurers operate with a level of implicit government support, which puts high levels of expectation on insurers' social licence to operate. As climate-related events become more frequent and/or severe, these pressures and expectations will also increase.

“Insurers have a fiduciary duty to protect and enhance the value of their ‘policyholders’ assets... The common understanding of this responsibility is that insurers, as fiduciaries, should focus on generating risk-adjusted portfolio returns in order to maximise the financial benefits they can pay out. Prudential standards aim to ensure that they will do so.”⁷³

In 2021, as part of the European Green Deal, the EU amended its rules of the fiduciary duties for the insurance and reinsurance sectors to “encompass sustainability risks such as the impact of climate change and environmental degradation on the value of investments.”⁷⁴

The role of insurers as experts in physical climate risk modelling and influencers on climate resilience through the terms and conditions and design of insurance policies was also highlighted. Under the legislation, insurers will be required to consider the impacts of product design on climate risk and resilience.⁷⁵

These developments are likely to proliferate across other jurisdictions. Prudential regulation and financial conduct supervision will need to align with these evolving duties of care.

c) Climate legal liabilities

Significant parts of the insurance industry have long-dated liabilities. They include the provision of directors and officers (D&O) and professional indemnity cover, which allows company directors and senior executives to act in their roles with confidence and take calculated risks to ensure a return to their shareholders.

Insurance policies issued over 40 years ago are still responding to claims relating to asbestos and other dangerous substances, even though in many cases the detrimental outcomes were known long before the risk materialised. Commercial imperatives and short-term considerations meant they were not acted on, often with tragic human consequences. Courts' approaches to climate-related issues are likely to continue evolving, and liability insurers will need to consider how their policyholders' actions today will be judged in the legal landscape of the future. This should influence their coverage conditions and risk appetite.⁷⁶

Those seeking to identify and redress injustices related to the climate risks and the transition to a resilient and low carbon economy may resort to litigation. Some climate cases relate to responsibility for historic emissions, to the completeness and (in)accuracy of corporate disclosures and to the sufficiency of future plans to meet public or private sector commitments. Insurance coverage will play a significant role in funding the costs of legal outcomes and remedies, and driving behaviours to reduce future risks. Liability insurers will need to consider the legal landscape of the future and how their policyholders acting today will be judged. As a result, coverage conditions will need to be revised accordingly. Within this context, climate liability can be incorporated within the scope of the just transition.^{63,77}

The future impact of climate-related legal liabilities on the insurance sector remains uncertain but potentially significant. Insurance regulators should further develop scenarios and stress tests to understand the scope and scale of the impacts of climate liabilities on insurers.

Action 4 – Serving the uninsured: risk signalling and measuring the protection gaps

Among financial authorities, insurance regulators have developed unique experience in assessing natural hazard risks to national economies: from domestic households and small businesses to infrastructure and public assets. This expertise can be put to wider use in the Climate Emergency. At least three steps are necessary to achieve whole economy risk awareness:

- a) current and future risk signalling to whole society: insured and uninsured
- b) current and projected size of the protection gap
- c) assessment of risk ownership of protection gap exposures.

Insurance regulators' mandates have focused on ensuring the security of coverage for existing policyholders. There have been limited duties to serve the uninsured, and only some regulators have development mandates to support insurance market expansion and wider access to insurance protection.

In the context of the Climate Emergency, this is starting to change. Some regulators and related public agencies already undertake some of these activities. For example:

In 2016, African Risk Capacity (ARC) signed an agreement with the regional insurance oversight body *Conférence Interafricaine des Marchés d'Assurances (CIMA)* to provide access to ARC Risk View data on natural hazard risks in West and Central African countries.⁷⁸

In 2020, the Federal Emergency Management Agency (FEMA) released the online mapping tool, Natural Risk Index, which identifies communities at risk to 18 natural hazards.⁷⁹ Combined with US population data, this tool can be used to identify high-risk, highly vulnerable communities. This information can help inform where grant funding is needed to increase resilience efforts.⁸⁰

Also in 2020, EIOPA published initial assessments of the natural hazard insurance protection gap across Member States.⁸¹

This role and expertise should be built upon to measure and communicate total risk levels and the proportion that is not insured (the protection gap), falling on individuals, companies, banks or governments.

To manage systemic risk, insurance supervisors, working in concert with national authorities including environment agencies, could assimilate this vital information up to regional and global levels. Ultimately, this can provide inputs to systemic FSB financial stability analysis and IPCC climate risk assessments.

Action 5 – Updating risk assessment and asset classes for low carbon and resilient infrastructure investments

Spending of almost USD7 trillion a year is required up to 2030 to achieve net zero by 2050.⁸² Insurers as investors are engaged with programmes to enable investments in low carbon assets and resilient infrastructure, but despite these efforts, less than 2.5 per cent of insurers' assets under management to infrastructure is allocated to infrastructure.⁸³

Insurers' reserves require specific regulation, for example to ensure that sufficient funds are available for catastrophic events even during market downturns. These twin pressures have encouraged regulatory dialogue and innovation to balance the objectives of investment scope while ensuring solvency and liquidity.

Some national regulators are examining the scope to increase the proportion of insurance sector assets that may be allocated to real asset classes and the risk weightings and capital charges these attract. For example in 2017 EIOPA reduced the capital charges on (re)insurers' holdings in infrastructure corporates by 25 per cent.⁸⁴

Investments in emerging and developing market infrastructure where perceived risks are greater create additional challenges. In 2016 the International Finance Corporation (IFC – part of the World Bank Group) launched the USD5 billion Managed Co-Lending Portfolio Program (MCP) to enable private sector institutions to co-invest with the IFC. AXA, Prudential and Allianz participated in this programme.⁸⁵

The IAIS is undertaking risk-based analysis to consider if investments in infrastructure assets should receive a different capital treatment for the purposes of the Insurance Capital Standard. An output of dialogue between insurers and regulators convened by the IAIS is the limited supply of appropriate investment opportunities across developed and developing markets. Initiatives such as the Coalition for Climate Resilient Investment and the Global Infrastructure Hub that include insurers are seeking to address these investment pipeline challenges.^{86,87}

Regulators, industry and governments should build upon this dialogue and focus on practical initiatives to scale up appropriate investment. For example, recommendations by the United Nations Development Programme (UNDP) include “the development of infrastructure as an asset class and a subsection of low-carbon and climate resilient infrastructure, with appropriate risk capital charges for both, in partnership with ministries of finance, insurance supervisors and regulators.”⁸⁸

Section B: Priorities for the financial sector

In line with TCFD implementation across all sectors, the FSB Roadmap encourages consistent, best-practice risk quantification and disclosure requirements across the financial system.

The Institute of International Finance (IIF) has similarly highlighted that the financial industry would welcome a harmonised approach globally to create the right incentives for the transition, specifically in relation to supervision, monitoring, reporting requirements and use of supervisory scenario analysis.⁸⁹

The means for the cross fertilisation of techniques are being enabled by programmes under the FSB, the Network for Greening the Financial System (NGFS), BIS and national regulators working across the financial sectors, including groups such as the Climate Financial Risk Forum, the BIS Green Swan conference or the Superintendencia General de Seguros (SUGESE) round-tables in Costa Rica.^{56,90,91,92,93}

Insurer analytical experience will need to be matched with the data standards and processes of other financial sectors to develop scalable and operational solutions.

Action 6 – Adopting insurance-based physical climate risk quantification across wider financial sector regulation

Each financial sub-sector will bring its own climate quantification best practice and a blended cross-finance approach is likely to have significant insurance contribution. The insurance sector's experience in natural catastrophe risk provides fundamental tools, insights and resources to evaluate and manage physical climate risk. The sector and its regulatory community should take a lead in supporting collective needs in this area and support objectives outlined in the FSB Roadmap and related guidance.

a) Global to local climate hazard data, models and projections

“Financial authorities, in cooperation as appropriate with other official-sector bodies, should work to improve the availability and consistency of data on the underlying drivers of climate-related risks. In doing so, financial authorities should consider, the data needed to understand entities' exposures to physical risks, as well as comparable data on the scale and nature of jurisdictions' climate-change targets and progress in meeting them.”⁵⁷

Insurance regulators can help drive the development and implementation of these analytical improvements to oversee insurers and reinsurers. These efforts and capabilities should be expanded to support physical climate risk assessment in the wider financial sector. This will encourage best practice, avoid wasteful duplication and drive consistency of metrics, standards and interoperability. The Climate Training Alliance (CTA), formed by BIS, IAIS, NGFS and SIF in time for CoP26, is in an optimum position to co-ordinate.

b) Asset level, entity exposure and vulnerability

“Data on entities' exposures to the drivers of physical risks (e.g. severe weather events, policies to reduce emissions) lack consistency and granularity. There is also a lack of data on firms' supply chains, as well as the broader potential impact of the crystallisation of physical and transition risks on such supply chains, the macroeconomy, and how physical and transition risks might transmit across sectors.”⁵⁷

Climate hazard risk assessment requires data on an entity's own assets, their locations and vulnerability factors. These can be difficult to obtain. The insurance sector and its regulators assimilate this information to support insurance transactions and supervisory oversight. Where possible, this information should be used to support climate risk assessment and disclosure by entities and made available to wider financial regulators.

c) Physical climate risk model and disclosure validation

“As disclosure practices continue to evolve and improve over time, in the longer term, authorities can help to improve the reliability of climate-related disclosures if they were to require, as appropriate, some form of third-party verification or assurance on such disclosures made by firms.”⁵⁷

Financial authorities will require access to credible risk models and data sources. Insurance regulators have confronted these challenges with natural catastrophe risk model access and validation. For example, under Solvency II and similar regimes, insurance regulators are required to approve the internal risk-capital models used by insurers for operation and disclosures. This includes non-financial, spatial and temporally heterogeneous risks. The regulatory experience of developing standard risk models, and approving a company's internal models for natural hazard risks, offers value to other financial sectors. Insurance regulators can take the lead in extending these functions into the physical climate risk assessment domain.

Using these models, actuaries, under professional regulatory duties, are required to approve the reserves of insurers and pension providers to meet the long-term uncertainties and short-term extremes to which their contracts are exposed. This enables populations to rely on the security of commitments and on the institutions that provide them for services that may not manifest for 40 or 50 years.

It is possible to imagine similar professional roles and responsibilities to authorise financial entities' climate risk assessments and disclosures.

d) Evaluating and recognising the role of insurance coverage on entities' climate risks

The FSB Roadmap identifies the requirement to assess the level of insurance coverage a financial entity may benefit from (directly and indirectly) to fully assess its residual climate risk. It also highlights the complexity of incorporating this information:

“Climate-related risks may be transferred via the provision of insurance or through financial markets... Financial authorities should work together to widen and harmonise data on the degree to which individual financial institutions' exposures to climate-related risks are mitigated by insurance provision.⁵⁷

Insurance regulators can help define how insured entities can disclose details of their coverage and how this financial protection and risk governance should be recognised. Allowing risk reduction interventions and contingent climate assets (including insurance) to be accounted against corresponding contingent climate liabilities would recognise and incentivise actions.

This principle could be extended to include the contingent value of resilience and sustainability interventions, including nature-based solutions (NbS). For example, if the owner of a house in a cyclone area upgrades their house to a higher building code, this risk reduction could be rewarded by a lower insurance premium and a lower interest rate. Insurers could also offer policies to pay for a damaged property to be rebuilt to a climate-resilient standard.

Action 7 – Transforming financial system resilience through climate-related contingent liabilities and regulatory capital requirements

To reduce systemic risk efficiently, the wider financial sector will need to account for its contingent climate liabilities, as insurers do.

Building on current developments in stress testing and

disclosure under the NGFS and FSB,⁹⁴ the next step could be for banks and investors to be required to demonstrate they have sufficient capital to meet physical climate risks. This could be expanded to transition and liability risks as assessment methodologies become established. Contingent capital arranged to match these contingent liabilities, including insurance, should be recognised within regulatory capital assessments, in the same way that reinsurance is considered a source of contingent capital in many regulatory regimes.

To optimise systemic risk understanding and risk sharing, consistent metrics and methodologies need to be adopted across the financial system. This can be maintained through active collaboration via shared fora, such as the NGFS and related national cross-sector initiatives (eg the Climate Financial Risk Forum).

Action 8 – Monitoring systemic physical climate risk

The build-up of systemic physical climate risk and its manifestation in long-term trends or short-term extremes has become a growing and urgent concern among policymakers and financial authorities. In the months preceding CoP26 Glasgow, unprecedented heatwaves across Arctic latitudes, Western Canada and the United States, and extreme flooding in Western Europe and China further emphasised the growing risk and vulnerabilities to all economies from systemic physical climate risks. This will grow in type, frequency, extent and duration as average temperatures continue to rise and the fragility of natural and human systems is revealed.

Despite this growing awareness, tractable assessments of systemic physical climate risks that can be used by policy and financial practitioners remain elusive. Without such resources, the largest risks will be, effectively, hidden because they are not measured and communicated. This creates a structural asymmetry between the scope of our risk management systems and the driving threats to financial stability and human wellbeing.

This disconnect has been recognised. The increasing priority of adaptation and resilience within the mainstream climate process, combined with related concerns from financial authorities and markets, is starting to bring a shared focus on this issue. Governments, UN agencies, international institutions and the financial sector are converging towards collective approaches using insurance-aligned methods and metrics.

Financial regulators and standards setters represent important stakeholders in these developments, both as potential users to fulfil financial stability and development mandates and as drivers of wider adoption across the

financial sector. Insurance regulators provide the bridge for this alignment based on the sector's direct exposure to physical climate risks.

Ongoing work by the IAIS on global, systemic, insurance sector climate risk exposures under the Global Monitoring Exercise of the Holistic Framework provides a further opportunity. This is due for publication late 2022, potentially coinciding with CoP27. The opportunity is to consider a) how such an objective could be aligned with and supported by the data and facilities from wider efforts to assess systemic climate risks, and b) how work by the IAIS could be used and adapted by other financial authorities and regulators to develop a comprehensive assessment.

Action 9 – Data trusts for systemic information sharing

The data revolution is at the centre of risk assessment and evaluation. Various stakeholders (such as planners, disaster relief agencies, insurers, investors and banks) could make better-informed and more consistent decisions if they all shared access to each other's data, analysed holistically. But this data is currently in various public and private silos and those holding it may have legitimate concerns about how others, with different interests, might use it. These concerns can be addressed through the creation of data trusts.

Data trusts and similar arrangements can give an independent 'data intermediary' the responsibility to ensure that collection from various contributors, access to the data and use of their data are for specified purposes only and in accordance with their wishes. This arrangement enables the compliant, ethical and secure sharing of proprietary or sensitive data among a network of data providers.

Some examples of the type of data are: data relevant to an assessment of climate-related risk in a given region – topography, demographics, zoning, structure of buildings, locations of businesses and critical infrastructure (including power generation and distribution); historic weather records from local stations and satellites, data about historic flood, drought and heat events and the resulting damage to lives and livelihoods.

Governance challenges have started to be addressed by some existing initiatives. For example, the Standard for Environment, Risk and Insurance (SERI) looking into trusted data ecosystems.⁹⁵

Part 5 - Paradigm shift 2: sharing and managing systemic risk across the public and private financial systems

Insurance-based risk quantification can help ensure that “every financial decision should take climate into account”,⁵⁹ but risk awareness alone is not enough for a just transition to resilience and net zero. A second paradigm shift is necessary to manage and share the risk.

Section A: Resilience

Part 4 identified the role that regulators and the wider sector could play in supporting risk understanding throughout the economy, especially in areas of natural hazard and physical climate risk insurance. Building on this, this section focuses on how regulators can support improved climate resilience through more extensive risk sharing.

Action 10 – Confirming development and financial inclusion mandates to address the climate protection gap

We have a growing insurance emergency as well as a Climate Emergency. Too many communities and assets are unprotected by any form of insurance system, leaving them exposed to economic hardship when events occur and depriving them of ongoing risk pool governance to reduce vulnerabilities.

At present, in many economies, consideration and responsibility for the needs and interests of the uninsured (and under-insured) are unclear. Insurance regulators have a responsibility to protect those who use the insurance sector by ensuring the prudence and conduct of market participants, but this does not currently include those who are uninsured. As set out in Part 2, some insurance regulators also have a *development* mandate to more explicitly consider financial inclusion through the growth and evolution of insurance coverage and related services. A 2018 OECD survey found that 29 out of 50 insurance jurisdictions included market development in the mandates of regulators and supervisors and “less developed market[s] wanting to have their base level penetration being raised.”⁸²

In the context of an insurance protection gap evident from current climate events and projections across developing and industrialised countries, it is appropriate to emphasise the role of insurance regulators to support market development.

Under the IAIS strategic priority themes of financial inclusion and sustainable development, it is appropriate that insurance regulators and supervisory mandates should include responsibilities for the needs of the

uninsured. These include considering how the uninsured can gain access to appropriate coverage and protection via public, private, mutual and hybrid mechanisms.

As policymakers give regulators signals to modify or amplify their mandates, areas requiring policy intervention are:

a) Development mandates and whole economy inclusion:

Policymakers should strengthen insurance regulators’ climate-related mandates, roles and resources to facilitate insurance access for the population and economy, including the currently uninsured. For example, in China the government’s 2021–25 Five Year Plan confirms the objective to develop comprehensive social protection, catastrophe insurance and disaster prevention.⁹⁶ In addition, the State Council established pilot zones for green financial reform, including “green insurance”.⁹⁷

b) Prudential and financial stability objectives:

The political and legislative process to amend mandates can take time, which may not be consistent with the need for an urgent response. Even if some supervisors do not receive clear development mandates, they are not exempt from finding ways to support the insurance sector in playing its critical role as stewards of resilience and transition.

Regardless of these wider dynamics, supervisors already have an important facilitative role to play from a prudential and financial stability perspective. For example, to fulfil stability objectives, urgent and scaled actions are required by supervisors now to reduce the risk of an entire systemic collapse. By supporting insurers to play their critical role in implementing a resilient, net zero, just transition, supervisors will also be fulfilling their (longer-term) financial stability objectives.

c) Insurance protection targets:

Once physical climate risk in exposed communities and sectors is understood (as per part 4), governments can consider how it should be shared, and the roles of different parts of the insurance system: welfare, public, private or mutual. Regulators, working in concert with national authorities, could consider setting and publishing optimum climate insurance protection targets to meet resilience, financial stability and regional economic security objectives.

National climate insurance targets could form part of National Adaptation Plans submitted through UNFCCC processes and assimilated to form a global picture of insurance targets. This could be used by financial authorities to consider how they match global risks and the strength and stability of the insurance architecture and capacity to withstand potential impacts and scenarios.

The overall objective is to expand the scope and scale of risk pools to ensure that populations are widely protected, and that individuals and societies benefit from the risk management governance and disciplines.

d) Integration of the PCL framework:

Insurance developments for climate resilience require the wider context of risks, costs and benefits to be balanced and assessed. Current and future risk signalling to the whole society is an essential component to evaluate the trade-offs in the PCL framework outlined in part 2, as policymakers confront decisions across societies. “Policymakers should address the balance between investing in pre-emptive measures and in reactive or contingent measures, and determine cases where loss acceptance might be even more prudent.”⁴⁵

Risk pools provide the means to design sustainable systems that balance economic viability, resilience outcomes and social equity. Therefore, risk pools refine and operationalise PCL choices and trade-offs, including the optimal use of insurance within the resilience mix. They can then fund, manage and share risk across communities and local to national scales.

Action 11 – Integrating physical climate risk sharing across financial markets

The contingent climate risks of financial institutions are reduced through the net effect of the contingent capital that insurance represents, as well as the risk management governance it demands. For example, the climate risk of home loan providers is significantly influenced by the level of insurance coverage held by mortgage customers in their portfolios. In jurisdictions where insurance is required to enable mortgages, the system acts as a risk management valve to the credit provider through pricing and conditions of coverage.

The 2021 FSB Climate Roadmap and related materials highlight the importance of climate-related insurance protection of transactions, assets and portfolios of the wider financial system. As climate risks are evaluated and disclosed from an asset to portfolio level, climate risk becomes a distinctive input to credit and capital risk management. The scope, scale and demand for insurance protection and risk sharing will increase.

A transformative influence on future societal resilience will be the mainstreaming of sustainable risk pools to protect and manage the climate risk of debt and investment capital. It will be analogous to the resilience impact the integrated credit, investment and insurance market had on urban fire and city landscapes in the late 19th century, but on a far larger scale.⁹⁸

By shaping capital allocation on a risk-informed basis, millions of lives and livelihoods and trillions of dollars in assets can be protected in the years and decades ahead. The integration of physical climate risk insurance markets into the mainstream financial system will also enable a structural expansion of the depth of climate risk pools to support risk sharing that will be needed to confront future risks.

Policymakers and financial regulators should optimise the understanding and recognition of climate-related insurance protection in the wider financial system. This should include all forms of risk sharing, including parametric and indemnity instruments supported by capital markets, insurance entities, public agencies and hybrid solutions.

In future, the FSB or similar authorities should produce an annual global climate financial stability report that assesses the potential risks and resilience of the financial system to climate risks under current and future scenarios. In line with the FSB Roadmap, such an assessment should include the extent, impact and security of climate insurance.

Action 12 – Integrating climate insurance with national social protection systems

This action encapsulates the enormous potential across societies to establish large insurance programmes for communities integrated with national or local social protection programmes.

In 2021, the Moroccan government commenced a ground-breaking initiative as part of its comprehensive Solidarity Fund against Catastrophic Events (FSEC). The initiative consists of a sovereign parametric disaster risk programme, insured via international markets. After catastrophic events, payouts are distributed rapidly to individuals through their national social insurance system.

This programme illustrates the potential of combining public and private systems to deliver efficient, pre-arranged and semi-automatic support to poorer populations using international risk markets.⁹⁹

It is part of a wider policy approach to integrate climate insurance programmes with general social protection systems:

“Given the low coverage of social protection in climate vulnerable regions, there is a need to advocate for social protection systems that are scalable and shock-responsive. On a national level, there is a strong case for integrating social protection instruments into an overall disaster risk financing strategy as part of a layered approach. Increased implementation experience will also help shed light on how to overcome the challenges in linking social protection with climate risk insurance.”¹⁰⁰

In the context of SDG Goal 1.3, referred to in Part 1, countries commit to implement nationally appropriate social protection systems for all. Policymakers, regulators and industry can build upon developments to incorporate climate insurance capabilities in these programmes. Consideration can be given as to appropriate institutions to bring relevant communities and entities together to harness collective experience, and consider how this may become a mainstream policy instrument in the Climate Emergency.

Section B: Net zero

The insurance sector provides a distinctive lens to evaluate the carbon intensity of the financial system, which provides additional channels for policymakers to influence carbon trajectories.

The following actions complement the opportunities identified by ClimateWise members in Policy Opportunities on the Road to Net Zero Underwriting.¹⁰¹

Action 13 – Financial emissions: carbon assessment and disclosure of underwriting portfolios

The following two examples show initial steps to assess, disclose and manage the carbon intensity of underwriting portfolios:

As part of the Glasgow Financial Alliance for Net Zero (GFANZ) and the Net-Zero Insurance Alliance (NZIA), in partnership with the United Nations Environment Programme Principles for Sustainable Insurance (UNEP PSI), eight founding members commit to “individually transition their underwriting portfolios to net-zero greenhouse gas (GHG) emissions by 2050, consistent with a maximum temperature rise of 1.5°C above pre-industrial levels by 2100.”¹⁰²

ClimateWise members have established a group of insurance industry participants who are committed to underwriting portfolios aligned to net zero. Members of this

group are piloting practices and tools aimed at building capacity and enabling the insurance industry to act on the commitment to net zero underwriting. The results will feed into annual reporting by members against the ClimateWise Principles, which were aligned with the TCFD in 2019.

As these standards develop, in parallel with national net zero commitments, it is foreseeable for carbon disclosure to be integrated into insurance regulatory processes. Companies could disclose the carbon load of their underwriting portfolios across different classes of business and geographies, and describe their carbon appetite and strategy in their Own Risk and Solvency Assessment (ORSA). This would complement carbon disclosures of asset portfolios, consistent with emerging practice within the investment sector.

This standardised carbon intensity data could be assimilated nationally by supervisors and aggregated to map global carbon intensities, track trends and assess alignment with Paris and related science-based targets.

Action 14 – Climate stewardship: carbon underwriting budgets

Once effective carbon underwriting metrics and implementation are established, further carbon management actions may be feasible. Governments and central banks are considering how to include the financial sector among the stewards of the net zero transition.¹⁰³

To manage their financial emissions (eg emissions in underwriting portfolios), insurers and regulators may develop a system of annual carbon underwriting budgets. These might set an annual boundary on the emissions that could be contained within an insurance company's portfolio or across the national market as a whole. Retaining information on annual levels will help provide trend data that can be paired with market information to identify performance indicators. Historical data can also be used to provide further refinements to future stress testing and scenario analysis.

There are many details to consider on the desirability and feasibility of carbon underwriting budgets, including: agreed methods to verify the carbon intensity portfolios; how budgets might be allocated (nationally and globally) and whether allowances could be traded. For example, differential weighting could be applied to insurers supporting emitters that implement agreed and robust transition pathways.

Carbon underwriting budgets could provide complementary approaches to public policy to incentivise emissions reduction. The cost and availability of insurance can influence the behaviour of populations, sectors and investors. This risk governance role is driven through two channels: insurance access and coverage conditions.

- *Reducing access to insurance for high carbon risks may accelerate the transition.* Early signs of this have emerged in some high-profile hydrocarbon extraction projects where lack of appetite by selected insurers may have created disincentives for project sponsors.

- *Insurance may change the behaviours of those who are insured.* Within a carbon-constrained environment, it is feasible to imagine insurers influencing emissions management reduction by setting conditions of coverage.

Regulated carbon underwriting budgets may seem bold, yet climate and finance conventions are changing quickly. Five years ago net zero targets in the financial sector were unheard of, now they are conventional commitments among leading financial institutions. The insurance sector provides a global system with additional and complementary modes of influence over the real economy. As the Climate Emergency develops, authorities and markets will examine further ways in which financial regulation can be aligned with the mainstream implementation net zero objectives.

Action 15 – Insuring the green economy

A new global, resilient, low carbon economy will be enabled by unprecedented and accelerated technological innovation. This will, in turn, create new insurance products and classes, just as insurance systems and related governance have supported the development and adoption of new technologies and high-risk industries, such as steam boilers, mass electrification, motor vehicle and air transportation.

The scope and scale of climate transition may even require insurance solutions to be developed before risks manifest to avoid detrimental impacts and delays. Clean energy systems, such as carbon capture and storage, hydrogen power or the decommissioning of brown assets may bring new risks and potential liabilities.

A ClimateWise 2021 report¹⁰⁴ has identified nine key areas in insurance product innovation to support climate mitigation:

- enabling and incentivising low carbon choices
- mainstreaming the encouragement of climate mitigation through effective and resilient reinstatement
- implementing environmentally sustainable claims servicing
- enabling capital flows towards green solutions through risk transfer solutions
- creating removal-based carbon offsets through natural capital protection
- scaling emerging and existing low carbon and net-negative technologies and start-ups
- supporting the sustainable decommissioning of carbon-intensive assets
- developing risk advisory services to support clients' climate mitigation understanding and approach
- developing solutions for reducing climate liability and environmental litigation.

The urgent transition to a green economy will require a pre-emptive, rather than reactive approach to these insurance requirements. These are new areas for governments, regulators and the industry to consider. Building on examples in cyber risk or fintech, insurance supervisors can play a supportive role using their convening power to foster regulatory 'sandpits' to consider opportunities to accelerate innovation or market-wide implementation requirements.

Section C: Just transition to resilience and net zero

As previously defined, just transition in this report refers to the two dimensions of the Climate Emergency: transition to resilience in response to growing physical climate risks and transition to net zero.

Once the protection gap has been measured by regulatory agencies (Action 4), and insurance protection targets established (Action 10), then policymakers can assess what can be covered by market-based systems and what needs to be supported by public intervention, including premium subsidies and international donor support. These types of public interventions are essential for a just transition to climate resilience and net zero.

The nature of insurance pools as local to global, public to private, inter-generational risk sharing and governance systems provides distinctive opportunities to support the just transition across communities, geographies and timescales. There are a wide range of initiatives to expand insurance development, including among donor agencies and development institutions (please see online attachment to this report).

Within a broad landscape of activities, this section identifies a limited number of areas of potential policymaker and regulatory focus.

Action 16 – Integrating disaster risk financing and regulation with NAPs, NDCs and the development sector

Many developed and emerging regions have established public–private insurance systems to manage and share natural hazard risks more equitably, securely and predictably. These have been extensively described in recent surveys on disaster risk financing programmes.²⁷ For example, the Tripartite Agreement between the German Federal Ministry for Economic Cooperation and Development (BMZ), UNDP and the Insurance Development Forum (IDF) implements disaster risk programmes in 20 countries as part of the G20 InsuResilience Vision 2025 programme target to bring insurance-related protection to 500 million people.¹⁰⁵

Public–private disaster risk financing and insurance should become the ‘new normal’ to match the new normal of climate risks and events; the Asian Development Bank has described it as “imperative”.¹⁰⁶

In 2017 the A2ii identified key roles that insurance regulators and supervisors play in enabling disaster resilience programmes including regulatory certainty, deep knowledge of local markets, capacity to help co-ordinate responses, a co-operation role with governments and other supervisors, leveraging progress to enhance penetration and micro with macro objectives.¹⁰⁷

Nevertheless, despite over three decades of policy development, the global pattern of coverage worldwide, even in developed countries, remains patchy and consequently many communities and economies face financial ruin and uncertainty when shocks occur. A new and reinvigorated approach is needed. “Insurance companies, pension funds and their regulators have long solved the key problems of effective disaster risk financing.”¹⁰⁸

Policymakers, regulators and the insurance sector should build upon the recommendations commissioned by the Global Commission on Adaptation, which highlighted that “linking disaster-risk finance and insurance instruments to the nationally determined contributions (NDCs) and national adaptation plans (NAPs) could identify how to best capture resilience dividends. For this to happen, we need joined-up policymaking between treasury, environment and disaster-management divisions within government.”¹⁰⁹

Consideration should be given to incorporating insurance and disaster risk finance within core National Adaptation Planning and related processes, such as readiness funds available from the Green Climate Fund.¹¹⁰

Action 17 – Integrating pre-arranged finance with humanitarian and crisis finance

As described in part 1, only around 2 per cent of crisis financing is pre-arranged despite many disasters, especially natural catastrophes, being foreseeable and predictable. The result is delayed payments, with devastating consequences to exposed populations. The June 2021 G7 meeting in the UK embraced these challenges, which had been identified through the Crisis Lookout campaign that calls for 50 per cent of crisis financing to be pre-arranged by 2030.¹¹¹

These pre-arranged disaster finance systems are based on insurance principles, often using parametric instruments with local risk modelling information and triggers. Governments and international agencies often have challenges in understanding and authorising insurance-based concepts that may be unfamiliar to them.

The reality in recent years means that “while high-income countries have suffered the highest nat-cat losses in absolute terms, climate-vulnerable low-income countries have, however, sustained losses that are three to four times larger when compared to the affected share of the economy or population.”¹¹² This includes members of the Vulnerable Group (V20) of countries, for whom “funding of loss and damage for the victims of human-induced climate change is a major expectation from climate negotiations.”¹¹³

Increasingly, insurance and prearrange finance is being considered as part of adaptation and loss and damage. The V20 and the Insurance Development Forum (IDF) have committed to the Global Risk Modelling Alliance (GRMA), which “provides vulnerable country governments with an open-access risk modelling platform”.¹¹⁴ There is also a growing recognition that premium subsidies or concessional insurance, with support from donor countries, is a necessary component for pre-arranged financing to achieve the protection levels needed with the urgency required.¹¹⁵

Insurance regulators in donor and vulnerable recipient countries may play a significant role in advocating, designing and enabling this transformation with technical, and where necessary, regulatory support.

For example, the ASEAN Disaster Risk Financing and Insurance Program (ADRFI) coordinates efforts to strengthen the region’s overall disaster risk management capabilities by focusing on risk assessment, risk advisory and capacity building, including regulation. In addition, the Southeast Asia Disaster Risk Insurance Facility (SEADRIF), supported by the World Bank and Japan, provides targeted disaster and climate risk resilience solutions to Southeast Asian Countries, such as a flood risk insurance policy to Laos.¹¹⁶

Action 18 – Capacity building for inclusive insurance

Regulatory support for inclusive insurance is an essential element to address the Climate Emergency. The 2021 launch of the UNDP’s Insurance and Risk Finance Facility, and focus on inclusive insurance, illustrates the integration of these capabilities within mainstream development programmes.¹¹⁷

Within the broader ‘inclusive insurance’ term (excluded or underserved markets), microinsurance refers to servicing low-income populations, particularly in emerging markets and developing economies (EMDE).¹¹⁸

Currently, 30 countries have microinsurance frameworks and 23 are working on them.¹¹⁹ These regulatory

frameworks focus on the specific needs of balancing the protection of vulnerable customers with operational needs to create an enabling business environment.¹⁵

A CISL 2019 report documented how supportive insurance regulation is fundamental for financial inclusion and economic resilience. It also identified regulatory vacuums that impede its expansion, particularly in mutual microinsurance (community-owned). In many jurisdictions around the globe, community-owned protection mechanisms operate unrecognised by regulation in what is known as the ‘informal sector’. This is a significant portion of the global risk-sharing domain illustrated in part 1. For example, in Africa, 77 per cent of risk protection providers are community-based organisations.¹⁵

Lack of regulation is usually driven by a shortage of resources and capacity, particularly in EMDEs. For instance, members of an A2ii project steering group in Sub-Saharan Africa highlight, “it is difficult to justify dedicating additional time and resources to climate goals without a clear mandate and therefore roles are largely only restricted to where there are overlaps with prudential oversight and consumer protection, and to a small extent, financial inclusion.”¹²⁰

Investment in regulatory capacity is pivotal in the Climate Emergency.

Action 19 – Integrating climate insurance systems with sovereign debt systems

In its 2021 review of the Financial Sector Assessment Program, Towards a More Stable and Sustainable Financial System, the International Monetary Fund (IMF) announced that it would incorporate physical and transition risks into country financial stability stress tests and assessments. The IMF declared it “will work closely with other bodies, including the UN, the World Bank, the Financial Stability Board, international standard setting bodies, and the Network of Central Banks and Supervisors for Greening the Financial System (NGFS).”¹²¹

Integration of climate risks into sovereign risk transactions would offer a window to improve financial management at times of crisis. When smaller and more vulnerable economies face major financial shocks from natural disasters, the management of on-going sovereign debt payment adds further stress. The move by the IMF to create a sovereign climate risk assessment system provides a basis to improve this and direct concessional support to where it is most needed.

For example, insurance-based arrangements could be made to ensure that debt repayments are serviced for 12,

24 or 36 months after a defined natural disaster or climate event, to provide fiscal space and continuity of credit quality.

Insurance regulators could take up the invitation of the IMF to engage with international standards-setting bodies and support the development and operation of the IMF climate risk assessment facility. National supervisors could review the outputs of national assessment to confirm they reflect the details of local risks and assess risk management strategies and instruments that are put in place.

Some collaboration already exists. For instance, when the IMF reviews country-level financial systems standing in their Financial Sector Assessment Program, they assess insurers' and regulators' compliance with international standards and guidance, such as ICPs and other IAIS guidance. The ICPs are assessed as part of the country's overall review.

Action 20 – Research on insurance for communities affected by the net zero transition

Until now, attention on insurance for the Climate Emergency has tended to focus on protection for communities and assets exposed to growing physical risks and the role of insurance to support the technologies and investment needed for the transition to a low carbon economy.

The support needed for communities connected to the sectors and regions that will be adversely impacted by the net zero transition has not yet received similar focus. To address these complex, long-term issues, regulators, industry and academia will need conducive fora to enable effective collaboration. For example, in 2020 the MAS launched the Global-Asia Insurance Partnership (GAIP), a partnership among the global insurance industry, regulators, policymakers and academia to address the development of the insurance sector in Asia. It comprises a policy think tank to generate research and advice on policy, a living lab to co-create innovative solutions for major risks confronting Asia, including climate risk, and a talent development pillar for insurance training.¹²²

The structural impacts on incomes and ways of life for a significant proportion of the populations of all countries will have profound direct and indirect economic, social and political consequences. Without an appropriate scale of response to dampen and mitigate negative effects of these shocks, the risks could bring overwhelming challenges to fundamental cohesion and stability of states in developed and emerging economies. The scope, complexity and potential magnitude of these risks suggests that they

require advanced planning and early implementation to build up sufficient resources and to shape necessary policies.

These are questions of insurance systems and social solidarity at the broadest level, including welfare and social security with insurance sector expertise, capacity and regulatory consideration. Consideration may now be given to how these systemic risk management issues could begin to be addressed. Within the scope of the just transition and the wider SDG agenda, the relevant climate and financial authorities may stimulate academic and policy research to commence this process by framing the challenge and bring relevant institutions and communities of expertise together.

Conclusions

The Climate Emergency is a systemic risk management challenge. Under the UNFCCC agreements, member states are required to manage the climate risks to almost eight billion people, representing a global economy of USD80 trillion, with a time horizon from today to 2100.

To match this scale and fully manage climate risks, we have to share them by significantly expanding the availability of sustainable risk pools. To do so, the Climate Emergency needs all actors of the risk-sharing domain (tax-based and premium-based, from community programmes to multi-national level) working together in a public–private–mutual risk-sharing continuum.

The Climate Emergency can benefit from a widespread application of risk-sharing pools in two ways:

1. Protecting greater numbers of people straight away from physical and transition-related climate risks.
2. Stewarding the behaviours of individuals, society and capital that are required for the sustainability of the risk pool and a resilient, net zero just transition.

Within the scope of risk-sharing systems, we have unpacked the specific characteristics that enable sustainable premium-based risk pools. We call this the insurance sector and identify the unique skills that it brings to the quantification of risk and to the expansion of public and private risk pools needed in the Climate Emergency.

Insurance regulation is essential to ensure the security and confidence of policyholders. It oversees the sustainability of risk pools, the conduct of insurance providers and the financial stability of the market as a whole. To make pools sustainable, risk and behaviours need to be managed, which insurance supervisors oversee through a variety of mechanisms, including risk quantification and disclosure, capital requirements and governance standards.

We propose that the framework and techniques developed by insurance supervisors spreads across the wider public and private financial system, from microfinance to global financial institutions.

This will do three things:

- a) Apply risk quantification and governance to manage and communicate risk consistently across all sectors of the economy and society.
- b) Increase the size of insurance pools to share risk and manage it at individual and systemic levels.
- c) Align climate and financial policies and implementation. The UNFCCC and FSB share risk-based mandates and growing awareness of structural interdependencies. Through insurance-based thinking and the PCL framework, these communities can combine to create risk pools for systemic risks.

This massive upscaling of risk sharing and managing across populations, generations and economies requires urgent reforms. We have identified 20 concrete actions that will drive meaningful change.

In the Climate Emergency, everything and everybody should be a member of risk-sharing pools. We must ensure this happens on a large scale, across both public and private sectors.

Call to Action Summary

Risk Quantification: Priorities For The Insurance Sector

Action 1 – Insurance sector improvements [page 28](#)

With acute exposure to natural catastrophes, insurers and regulators are leaders in assessing *current* underwriting risks from many climate related hazards.

Climate risk quantification and adoption of TCFD: Under the IAIS Climate Steering Group, industry and supervisors should lead best practice physical climate risk disclosure, by incorporating: future scenarios and stress tests; slow-onset perils; asset and investment portfolios. The sector should also integrate best practices in climate transition and liability risk assessment and disclosure.

Reduction of premiums to reflect resilience interventions, including the protection of natural capital.

Macro prudential and systemic risk assessment and monitoring: Under the IAIS Global Monitoring Exercise, information should be assimilated to provide regular macro and systemic-level climate risk assessments.

Action 2 – Evaluating the contingent climate risks of insurers [page 29](#)

The financial resilience of insurers to increasing natural disaster risks over the last three decades has been significantly influenced by the use of risk modelling and stress testing to inform the assessment of contingent liabilities, prudent solvency thresholds and regulatory capital requirements. In essence, insurers need enough capital to manage extreme losses that could happen, even if they are unprecedented.

Insurers and regulators should develop best practice for evaluating **current** contingent climate related liabilities for additional physical, transition and liability risks and consider appropriate treatment of future contingent liabilities across underwriting and investment portfolios.

Action 3 – Integrating risk assessment from short-term to intergenerational timescales [page 30](#)

Non-life insurers have short-term horizons due to one-year underwriting policies. However, insurers, actuaries and regulators also undertake long-term risk assessment to manage life and health insurance, pensions, investment portfolios and long tail legal liabilities.

The sector should blend its analytical expertise in short-term extremes and long-term projections to develop integrated climate risk assessments across their underwriting, assets and operations.

Insurers also identify emerging risks that may impact future legal, fiduciary and financial liabilities. Insurers and regulators should highlight the potential impact of physical, transition and liability risks on the sector, wider economy and society.

Action 4 – Serving the uninsured: risk signalling and measuring the protection gaps [page 31](#)

Many stakeholders remain unaware of the physical climate risks to their homes, businesses and infrastructure. Uninsured risk, or the protection gap, falls upon someone, including householders, business owners, creditors, public authorities and governments. Insurance regulators, with partner organisations, are well-placed authorities to highlight these financial exposures and assess how much of this risk is uninsured.

Policymakers should enable insurance regulators to assess and communicate the scale and dynamics of the physical climate risk protection gap by region, sector and community. Information can be assimilated across jurisdictions for regional and global monitoring of climate protection gaps for IAIS, FSB and IPCC inputs.

Action 5 – Updating risk assessment and asset classes for low carbon and resilient infrastructure investments [page 31](#)

Less than 2.5 per cent of insurers' assets are allocated to infrastructure, meanwhile there is an urgent need for sustained financial sector allocation in resilient, low carbon investments. Insurers have specific requirements to maintain solvency and liquidity to meet the underwriting demands in response to market downturns and catastrophic losses. Building on extensive dialogue and to stimulate investment opportunities, policymakers and the insurance sector should develop a defined low carbon resilient infrastructure asset class. Qualifying investments would receive proportionate treatment by supervisors, including capital charges, to balance risk and liquidity requirements.

Risk Quantification: Priorities For The Financial Sector

Action 6 – Adopting insurance-based physical climate risk quantification across wider financial sector regulation [page 32](#)

Insurers and regulators should share their best practice in physical climate risk assessment and disclosure with regulators and practitioners across the financial system, working through national programmes, the FSB, NGFS and regulators' Climate Training Alliance.

The insurance sector has asset-level exposure and vulnerability information on entities that could be multi-purposed for wider use under appropriate arrangements. Insurance regulators and actuaries also have specific expertise in assessing and validating internal physical risk models to underpin insurers' capital management. This expertise should be shared to validate the physical climate risk models to be used by banks and investors.

Action 7 – Transforming financial system resilience through climate-related contingent liabilities and regulatory capital requirements [page 33](#)

The wider financial system should emulate insurers by disclosing and managing their contingent liabilities to natural hazards and other climate related risks to ensure capital adequacy – directly or through insurance coverage – to cope with shocks and stresses. As techniques, data and protocols develop, financial institutions should disclose these contingent liabilities and manage them within their mainstream regulatory frameworks.

Based on their experience, insurance regulators should support this necessary reform by policymakers and advise on the appropriate recognition of contingent capital instruments to address climate risks, such as parametric insurance and catastrophe bonds.

Action 8 – Monitoring systemic physical climate risk [page 33](#)

High-impact, high-profile disasters since 2017, including extensive wildfires, flooding and tropical cyclones, across developed and emerging regions, have alerted financial authorities and markets to the potential near-term impact of physical risks on solvency and financial stability.

Insurance regulators provide a bridge for this understanding within jurisdictions and at regional and global levels. Building on the IAIS Holistic Framework, in particular the Global Monitoring Exercise, systemic physical risk assessments should be developed across the financial regulatory system and shared with the IPCC and climate policymakers.

Action 9 – Data trusts for systemic information sharing [page 34](#)

Effective climate risk assessment, management and regulation requires integration of private, public and academic information across jurisdictions and timescales. Navigating these administrative and technical complexities may contribute to the quality, comprehensiveness and speed of local to global analysis.

Financial regulators and supervisors, with their distinctive roles and authority, should explore their potential roles to enable such data assimilation to occur using legal facilities, such as data trusts.

Risk Quantification: Priorities For Resilience

Action 10 – Confirming sustainable development and financial inclusion mandates to address the climate protection gap [page 35](#)

Policymakers should strengthen insurance regulators' climate-related mandates. In addition to prudential and financial stability mandates, under the IAIS strategic priority themes of financial inclusion and sustainable development, it is appropriate that insurance regulators and supervisory mandates should incorporate responsibilities for the needs of the uninsured. These include insurance protection targets and considering how the uninsured can gain access to appropriate coverage and protection via public, private, mutual and hybrid mechanisms.

National climate insurance targets should form part of National Adaptation Plans submitted through UNFCCC processes and be assimilated to form a global picture of insurance targets. The overall objective is to: a) expand the scope and scale of risk pools to ensure that populations are widely protected, and b) provide the means for individuals and societies to benefit from the risk management governance of risk pools, enhanced by the PCL framework.

Action 11 – Integrating physical climate risk sharing across financial markets [page 36](#)

The 2021 FSB Climate Roadmap and related materials highlight the importance of climate-related insurance protection of transactions, assets and portfolios of the wider financial system. Policymakers and financial regulators should optimise the understanding and mainstreaming of all forms of climate risk sharing across the financial system to protect millions of lives and trillions of dollars, including: parametric and indemnity instruments supported by capital markets, insurance entities, public agencies and hybrid solutions.

In future, the FSB or similar authorities should produce an annual global climate financial stability report that assesses the potential risks and resilience of the financial system to climate risks under current and future scenarios. In line with the FSB Roadmap, such an assessment should include the extent, impact and security of climate insurance.

Action 12 – Integrating climate insurance with national social protection systems [page 37](#)

In SDG Goal 1.3, countries commit to implement nationally appropriate social protection systems for all. In addition, the potential exists to establish large climate insurance programmes integrated with national or local social protection systems.

Policymakers, regulators and industry should build upon emerging examples to combine public and private systems to deliver efficient, pre-arranged and automatic support to poorer populations using international risk markets. Consideration should be given to how appropriate institutions can bring relevant communities and entities together to implement this as a mainstream policy instrument in the Climate Emergency.

Risk Quantification: Priorities For Net Zero

Action 13 – Financial emissions: carbon assessment and disclosure of underwriting portfolios [page 37](#)

In parallel with national net zero commitments, and once metrics are agreed, it is foreseeable for carbon disclosure to be integrated into insurance regulatory processes. Companies could disclose the carbon load of their underwriting portfolios across different classes of business and geographies, and describe their carbon appetite and strategy in their Own Risk and Solvency Assessment (ORSA). This would complement carbon disclosures of asset portfolios, consistent with emerging practice within the investment sector.

This standardised carbon intensity data could be assimilated nationally by supervisors and aggregated to map global carbon intensities, track trends and assess alignment with Paris and related science-based targets.

Action 14 – Climate stewardship: carbon underwriting budgets page 38

Once effective carbon underwriting metrics and implementation are established, further carbon management actions may be feasible. Insurers and regulators may develop a system of annual carbon underwriting budgets to manage their financial emissions in underwriting portfolios.

Carbon underwriting budgets would set an annual boundary on the emissions that could be contained within an insurance company's portfolio, providing a complementary approach to public policy to incentivise emissions reduction by: a) reducing access to insurance for high carbon emitters, and b) changing the behaviours of those who are insured by setting conditions of coverage.

Action 15 – Insuring the green economy page 38

Insurance has enabled previous industrial revolutions. The scope and scale of the climate transition will require insurance products and related risk management governance to support clean energy systems, new technologies, the safe decommissioning of brown assets and decarbonisation across industries and agriculture.

Insurance supervisors should play a supportive role, using their convening power, to foster regulatory 'sandpits' to consider opportunities for accelerating innovation, including public-private collaboration and market-wide implementation requirements.

Risk Sharing: Priorities For Just Transition To Resilience And Net Zero

Action 16 – Integrating disaster risk financing and regulation with NAPs, NDCs and the development sector page 39

The benefits of pre-arranged disaster risk financing have been well established with targets and programmes established by the G20, G7 governments and international institutions. Despite this, disaster insurance protection, even in many developed countries, remains patchy. To accelerate and mainstream this process, climate and disaster risk finance should be integrated within UNFCCC National Adaptation Plans and Nationally Determined Contributions.

Insurance supervisors can use their convening power across governments and industry to enhance inclusion and coverage objectives. Where available, readiness funds should be obtained from the Green Climate Fund to support this work.

Action 17 – Integrating pre-arranged finance with humanitarian and crisis finance page 39

Less than 2 per cent of humanitarian and crisis finance is pre-arranged, despite extensive evidence that the speed and certainty of interventions saves lives and livelihoods, and accelerates recovery and reconstruction before traditional responses and appeals have time to take effect. Regulators have coordinated the development of pre-arranged crisis finance facilities in South East Asia and elsewhere.

Insurance supervisors can play a significant role in recipient and donor countries in advocating, designing and enabling the implementation of pre-arranged protection of communities, agriculture and critical national infrastructure from climate disasters.

Action 18 – Capacity building for inclusive insurance page 40

Inclusive insurance has become an established part of development policies, including protection from climate related risks. Regulatory support for inclusive insurance is an essential element to address the Climate Emergency. Adequate insurance regulation is also necessary to enable mutual and community-owned facilities to operate and expand securely. Currently, 30 countries have microinsurance frameworks and a further 23 are working on them.

Insurance regulators require clear mandates to establish these responsibilities, as well as the allocation of resources from governments and donors to enable the capacity necessary to establish regulations and build supervisory functions.

Action 19 – Integrating climate insurance with sovereign debt systems page 40

The IMF and other institutions have announced plans to incorporate climate risks into country financial stability stress tests, and to work closely with the FSB and international standard-setting bodies, such as the IAIS. This allows disaster risk finance and insurance to be harnessed to cover debt repayments in times of crisis, which ensures resources are directed to recovery while credit ratings are protected.

Insurance regulators should accept the invitation of the IMF to engage with international standard-setting bodies and support the development of the IMF climate risk assessment facility.

Action 20 – Research on insurance for communities affected by the net zero transition page 41

Support will be required for communities connected to sectors and regions that will be adversely affected by the net zero transition. The social and economic impacts across developed and emerging economies are likely to be immense. This area has not received a similar policy interest as the insurance requirements of physical risks and clean energy technologies. To address these complex, structural and long-term issues, national policymakers and international institutions should establish programmes with regulators, industry and academia to enable preliminary research and collaboration.

Recommendations

Policymakers:

Reinforce financial inclusion and sustainable development priorities within insurance regulators' mandates to meet the climate objectives.

Increase the capacity and resources of insurance regulators worldwide as a key strategic policy decision for the Climate Emergency.

Reinforce IAIS Strategic Plan priorities on climate risk, financial inclusion and sustainable economic development.

Confirm mandates for insurance regulators and supervisors to support financial inclusion and sustainable market development in order to close the protection gaps faced by communities and economies in the Climate Emergency.

Actions:
4, 10, 16, 17, 18, 19, 20

Financial markets:

Accelerate consistent physical climate risk quantification through insurance experience, methods, metrics and resources.

In line with the FSB Climate Roadmap, the CoP26 Private Finance Agenda and the regulators' Climate Training Alliance, evaluate and manage exposures to physical climate risks.

Actions:
1, 3, 5, 6, 7, 8, 9

Public and private financial authorities:

Massively expand risk-sharing pools across financial systems to manage global-to-local and intergenerational climate risks.

Consider how climate risk insurance can be used to manage climate risks across public and private financial systems.

Deepen and diversify sustainable risk pools and apply climate risk management and governance disciplines, including the PCL framework.

Work with development and humanitarian sectors to support expansion of risk pools.

Actions:
11, 12, 15, 16, 17, 18, 19

Insurance regulators and climate authorities:

Explore ways for UNFCCC and IAIS members to co-operate on shared climate risk objectives.

Building upon this report, consider how the IAIS, SIF and UNFCCC may explore dialogue and co-operation on shared climate objectives. For example, the IAIS could present climate outputs from the annual Global Insurance Market Report (GIMAR) at CoP meetings.

Actions:
7, 16, 18, 20

Insurance sector:

Become pioneers of climate-related disclosures, prudential supervision and climate stewardship.

In conjunction with the SIF and IAIS, the insurance sector must develop comprehensive and consistent climate risk assessment capabilities, to enable TCFD implementation, supervision and management.

Insurance supervisors must act now, from their prudential and financial stability mandates, to reduce the risk of a systemic collapse.

Actions:
1, 2, 3, 8, 9, 10, 13, 14

Academia and NGOs.

Research the role of the insurance system in managing the social risks of the net zero transition.

Academic institutions, science funding agencies, regulators and industry partners to co-ordinate research on social protection and insurance systems to support a just transition to resilience and net zero for exposed and vulnerable communities.

Actions:
11, 20

Annex 1

Contribution of the insurance sector to the four priorities of CoP26

CoP26 priorities	Insurance sector
Priority 1: Reporting	Climate risk assessment and quantification Disclosure, solvency and capital management Systemic climate risk intelligence
Priority 2: Risk management	Climate risk reduction Climate risk governance Climate risk sharing and transfer
Priority 3: Returns	Defining climate risk market boundaries Underwriting for the climate transition
Priority 4: Mobilisation	Insurers as investors

Insurance can offer a contribution to the four CoP26 priorities for the finance sector. By reporting and managing risk, uncertainties are reduced and predictable returns increase, which helps to mobilise larger scale investment, production and use of new technologies. The insurance sector may also enable classification standards and collect risk performance data that may be shared and analysed for systemic risk patterns.

All the areas indicated in the table above need to be supported by adequate levels of regulation to function. Regulation is also fundamental to match the evolving needs of climate risks affecting the sector and governmental policy commitments to net zero.

References

- 1 Bank of England Prudential Regulation Authority. (2015). The impact of climate change on the UK insurance sector: A climate change adaptation report by the Prudential Regulation Authority. London: Bank of England.
- 2 International Association of Insurance Supervisors (IAIS), & Sustainable Insurance Forum (SIF). (2021). Application paper on the supervision of climate related risks in the insurance sector. Basel: International Association of Insurance Supervisors.
- 3 Geneva Association, & Clyde & Co. (2021). Climate change litigation: insights into the evolving global landscape. Zurich: The Geneva Association.
- 4 International Association of Insurance Supervisors (IAIS). (2019). Holistic Framework for systemic risk in the insurance sector. Basel: International Association of Insurance Supervisors.
- 5 United Nations Framework Convention on Climate Change (UNFCCC). (2021). About the Secretariat. Retrieved September 2, 2021, from UNFCCC website, <https://unfccc.int/about-us/about-the-secretariat>
- 6 Financial Stability Board (FSB). (2021). Mandate of the FSB. Retrieved September 2, 2021, from FSB website, <https://www.fsb.org/about/>
- 7 Bank for International Settlements (BIS). (2021). The universe of supervisory mandates – total eclipse of the core? Basel: Financial Stability Institute.
- 8 Intergovernmental Panel on Climate Change (IPCC). (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- 9 United Nations Framework Convention on Climate Change (UNFCCC). (2015). The Paris Agreement. Retrieved September 14, 2021, from UNFCCC website, <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>
- 10 Banque de France. (2019). Financial stability review: greening the financial system. Paris: Banque de France.
- 11 Bank of England Prudential Regulation Authority. (2018). A transition in thinking: The impact of climate change on the UK banking sector. London: Bank of England.
- 12 European Insurance and Occupational Pensions Authority (EIOPA). (2021). Opinion: on the supervision of the use of climate change risk scenarios in ORSA. Frankfurt: European Insurance and Occupational Pensions Authority.
- 13 United Nations Framework Convention on Climate Change (UNFCCC). (2021). Action on climate and SDGs. Retrieved September 2, 2021, from UNFCCC website, <https://unfccc.int/topics/action-on-climate-and-sdgs/action-on-climate-and-sdgs>
- 14 University of Cambridge Institute for Sustainability Leadership (CISL). (2015). Insurance regulation for sustainable development. Cambridge: University of Cambridge Institute for Sustainability Leadership.
- 15 University of Cambridge Institute for Sustainability Leadership (CISL). (2019). Mutual microinsurance and the Sustainable Development Goals. Cambridge: University of Cambridge Institute for Sustainability Leadership.
- 16 World Bank. (2021). Gross Domestic Product 2020. Retrieved September 26, 2021, from World Bank Data website, <https://databank.worldbank.org/data/download/GDP.pdf>
- 17 International Labour Organization (ILO). (2021). Social protection: building social protection floors and comprehensive social security systems. Retrieved September 2, 2021, from ILO website, <https://www.social-protection.org/gimi/WSPDB.action?id=19>
- 18 International Labour Organization (ILO). (2017). World social protection report 2017-2019: universal social protection to achieve the Sustainable Development Goals. Geneva: International Labour Organization.
- 19 Organisation for Economic Co-operation and Development (OECD). (2020). Social expenditure (SOCX) update 2020: social spending makes up 20% of OECD GDP. Paris: Organisation for Economic Co-operation and Development.
- 20 United Nations Statistics Division (UNstats). (2021). End poverty in all its forms everywhere: social protection systems fall short of reaching the world's most vulnerable people, including children. Retrieved September 29, 2021, from UNstats website, <https://unstats.un.org/sdgs/report/2019/goal-01/>
- 21 World Bank. (2020, October 7). Covid-19 to add as many as 150 million extreme poor by 2021 [Press release]. Retrieved from: <https://www.worldbank.org/en/news/press-release/2020/10/07/covid-19-to-add-as-many-as-150-million-extreme-poor-by-2021>
- 22 Swiss Re. (2020). Sigma 2020: world insurance riding out the pandemic storm. Switzerland: Swiss Re.
- 23 Swiss Re. (2021). Map retrieved July 14, 2021, from Sigma Explorer website, www.sigma-explorer.com/index.html
- 24 International Cooperative and Mutual Insurance Federation (ICMIF). (2019). Global mutual market share 10: the global insurance market share held by mutual and cooperative insurers. Cheshire: International Cooperative and Mutual Insurance Federation.
- 25 Strebel, B. (2019, August 26). Africa must become more resilient to climate risk: here is how. World Economic Forum. Retrieved from: <https://www.weforum.org/agenda/2019/08/africa-resilient-climate-change-insurance-reinsurance/>
- 26 World Bank. (2010). Government support to agricultural insurance: challenges and options for developing countries. Washington: The World Bank.
- 27 Organisation for Economic Co-operation and Development (OECD). (2015). Disaster risk financing: a global survey of practices and challenges. Paris: Organisation for Economic Co-operation and Development.
- 28 Centre for Disaster Protection (CDP). (2021). Funding disasters: tracking global humanitarian and development funding for response to natural hazards. Oxford: Centre for Disaster Protection.
- 29 Development Initiatives. (2021). Global humanitarian assistance 2021: humanitarian and wider crisis financing. Retrieved September 25, 2021 from Development Initiatives website, <https://devinit.org/resources/global-humanitarian-assistance-report-2021/chapter-two-humanitarian-and-wider-crisis-financing/#fa4b4026>
- 30 Lloyd's. (2014). Catastrophe modelling and climate change. London: Lloyd's.
- 31 European Insurance and Occupational Pensions Authority (EIOPA). (2021). Discussion paper on methodology on potential inclusion of climate change in the Nat Cat standard formula. Frankfurt: European Insurance and Occupational Pensions Authority.
- 32 National Centre for Atmospheric Research (NCAR). (2008). Hurricanes and climate change: NCAR launches intensive study into future hurricane risk. Colorado: National Centre for Atmospheric Research.
- 33 Strachan, J. (2007). Climate, risk and insurance. Retrieved September 26, 2021, from Natural Environment Research Council website: <https://nerc.ukri.org/planetearth/stories/143/>
- 34 G. Hadzilacos, personal communication, May 21, 2021.
- 35 Duverne, D. (2017). How the Insurance Industry Manages Risk. In F. Hufeld, R. Kojien & C. Thimann (Eds.). *The Economics, Regulation and Systemic Risks of Insurance Markets* (pp 55–76). Oxford: Oxford University Press.
- 36 Oasis. (2021). What is a catastrophe model. Retrieved May 30, 2021, from Oasis website, https://oasislmf.github.io/modelling_methodology/what_is_a_catastrophe_model.html
- 37 Bank of England Prudential Regulatory Authority. (2021). Biennial Exploratory Scenario on the Financial Risks from Climate Change (CBES). London: Bank of England.
- 38 Swiss Re. (2021). Annual report 2020: transforming tomorrow together. Switzerland: Swiss Re.
- 39 Summerhayes, G. (2020). A burning platform. Speech delivered at Australian Business Roundtable webinar. Retrieved September 13, 2021, from Australian Business Roundtable website, <http://australianbusinessroundtable.com.au/a-burning-platform>

- 40 Congressional Research Service (CRS). (2020). A brief introduction to the national flood insurance program. Washington: Congressional Research Service.
- 41 Federal Emergency Management Agency (FEMA). (2021). Risk rating 2: Equity in action. Retrieved September 26, 2021, from FEMA website, <https://www.fema.gov/flood-insurance/risk-rating>
- 42 Swiss Re. (2021). Annual report 2020: transforming tomorrow together. Switzerland: Swiss Re.
- 43 Association of British Insurers (ABI). (2021). Flood Re explained. Retrieved September 29, 2021, from ABI website, <https://www.abi.org.uk/products-and-issues/topics-and-issues/flood-re/flood-re-explained/>
- 44 Detlefsen, R. (2009). Dual Insurance Chartering: Potential Consequences. In M. Grace & R. Klein (Eds.), *The Future of Insurance Regulation in the United States* (pp. 97–116), Washington DC: Brookings Institution Press.
- 45 Detlefsen, R. (2009). Dual Insurance Chartering: Potential Consequences. In M. Grace & R. Klein (Eds.), *The Future of Insurance Regulation in the United States* (pp. 97–116), Washington DC: Brookings Institution Press.
- 46 Detlefsen, R. (2009). Dual Insurance Chartering: Potential Consequences. In M. Grace & R. Klein (Eds.), *The Future of Insurance Regulation in the United States* (pp. 97–116), Washington DC: Brookings Institution Press.
- 47 International Association of Insurance Supervisors (IAIS). (2021). Insurance Core Principle 1.2.1. Basel: International Association of Insurance Supervisors.
- 48 International Association of Insurance Supervisors (IAIS). (2021). Welcome to the website of the International Association of Insurance Supervisors (IAIS). Retrieved June 25, 2021, from IAIS website, <https://www.iaisweb.org/home>
- 49 International Association of Insurance Supervisors (IAIS). (2019). *The IAIS Strategic Plan 2020–2024*. Basel: International Association of Insurance Supervisors.
- 50 Task Force on Climate-related Financial Disclosures (TCFD). (2015). *Recommendations of the Task Force on Climate-related Financial Disclosures*. Basel: Financial Stability Board, Bank for International Settlements.
- 51 International Association of Insurance Supervisors (IAIS), & Sustainable Insurance Forum (SIF). (2020). *Issues paper on the implementation of the recommendations of the Task Force on Climate-related Financial Disclosures*. Basel: International Association of Insurance Supervisors.
- 52 W. Harding, personal communication, September 27, 2021.
- 53 Bank for International Settlements (BIS). (2021, July 9). International financial organisations unite with the central bank and financial supervisory community to launch the Central Banks' and Supervisors' Climate Training Alliance (CTA) ahead of COP26 [Press release]. Retrieved from: <https://www.bis.org/press/p210709a.htm>
- 54 International Association of Insurance Supervisors (IAIS). (2021). *Application paper on macro-prudential supervision*. Basel: International Association of Insurance Supervisors.
- 55 International Association of Insurance Supervisors (IAIS). (2021). *Global insurance market report (GIMAR): the impact of climate change on the financial stability of the insurance sector*. Basel: International Association of Insurance Supervisors.
- 56 Financial Stability Board (FSB). (2021). *FSB roadmap for addressing climate-related financial risks*. Basel: Financial Stability Board.
- 57 Financial Stability Board (FSB). (2021). *The availability of data with which to monitor and assess climate-related risks to financial stability*. Basel: Financial Stability Board.
- 58 Financial Stability Board (FSB). (2021). *Report on promoting climate-related disclosures*. Basel: Financial Stability Board.
- 59 UKCoP26. (2020). *Building a private finance system for net zero: priorities for private finance for CoP26*. Retrieved December 18, 2020, from UK CoP26 presidency website, https://ukcop26.org/wp-content/uploads/2020/11/COP26-Private-Finance-Hub-Strategy_Nov-2020v4.1.pdf
- 60 Association of British Insurers (ABI). (2021) *Climate Change Roadmap*. London: Association of British Insurers.
- 61 Australian Prudential Regulation Authority (APRA). (2021). *Information paper: climate vulnerability assessment*. Sydney: Australian Prudential Regulation Authority.
- 62 Insurance Institute for Business & Home Safety (IBHS). (2021). *Risk research*. Retrieved September 26, 2021, from IBHS website, <https://ibhs.org/about-ibhs/ibhs-research-center/>
- 63 Clyde & Co. (2021). *Climate tech investment report: Innovating to Net Zero: Funding climate tech from concept to commercialisation to critical mass*. London: Clyde & Co.
- 64 Insurance Development Forum (IDF). (2020). *Technology and innovation: tools to help close the protection gap in microinsurance markets*. London: Insurance Development Forum.
- 65 G. Thomas, personal communication, September 26, 2021.
- 66 Access to Insurance Initiative (A2ii). (2019, March). *RegTech and SupTech: implications for supervisions*. A2ii-IAIS Consultation Call. Freiberg: Access to Insurance Initiative.
- 67 T. Soley Perez & ASSAL team, personal communication, July 2021 and September 2021.
- 68 United Nations Environment Program Finance Initiative. (2019). *Integrating natural capital in risk assessments*. Geneva: United Nations Development Programme.
- 69 The Nature Conservancy, & Willis Towers Watson. (2021). *Wildfire resilience insurance: quantifying the risk reduction of ecological forestry with insurance*. Virginia: The Nature Conservancy.
- 70 Christiansen, J. (2021). *Securing the sea: ecosystem-based adaptation and the biopolitics of insuring nature's rents*. *Journal of Political Ecology*, 28(1), 337–357. Retrieved from: <https://journals.librarypublishing.arizona.edu/jpe/article/id/2899/>
- 71 Summerhayes, G., & Waterford, L. (2021, July 3). *Biodiversity loss is a risk to the global financial system*. *The Guardian*. Retrieved from: <https://www.theguardian.com/commentisfree/2021/jul/04/biodiversity-loss-could-wreck-the-global-financial-system-and-its-only-a-matter-of-time>
- 72 Sweeney, A. (2020). *Paving the way forward: managing climate risk in the insurance sector*. Speech delivered at the Moody's Insurance Summit webinar. Retrieved May 3, 2021, from Bank of England website, <https://www.bankofengland.co.uk/speech/2020/anna-sweeney-moodys-the-resilience-of-insurers-in-a-changing-climate>
- 73 Geneva Association. (2018). *Climate change and the insurance industry, taking action as risk managers and investors*. Zurich: The Geneva Association.
- 74 European Commission. (2021). *European Union taxonomy, corporate sustainability preferences and fiduciary duties: directing finance towards the European Green Deal*. Brussels: European Commission.
- 75 European Commission. (2021). *Amending Delegated Regulation 2015/35 as regards the integration of sustainability risks in the governance of insurance and reinsurance undertakings*. Brussels: European Commission.
- 76 London School of Economics (LSE). (2021). *Global trends in climate change litigation: 2021 snapshot*. London: London School of Economics.
- 77 Clyde & Co. (2021). *Climate change risk and liability report 2021*. London: Clyde & Co.
- 78 African Risk Capacity (ARC). (2016, May 25). *Signing of Memorandum of Understanding between ARC and CIMA*. Retrieved from: <https://www.arc.int/en/news/memorandum-understanding-institutions>
- 79 Federal Emergency Management Agency (FEMA). (2021). *Flood maps*. Retrieved June 12, 2021, from FEMA website, <https://www.fema.gov/flood-maps>
- 80 Federal Emergency Management Agency (FEMA). (2021b). *National risk index for natural hazards*. Retrieved September 26, 2021, from FEMA website, <https://www.fema.gov/flood-maps/products-tools/national-risk-index>
- 81 European Insurance and Occupational Pensions Authority (EIOPA). (2020). *Pilot dashboard addresses natural catastrophe protection gap*. Frankfurt: European Insurance and Pensions Occupational Authority.
- 82 Organisation for Economic Co-operation and Development (OECD). (2018). *The institutional structure of insurance regulation and supervision*. Paris: Organisation for Economic Co-operation and Development.

- 83 Levy, J. (2017, December 22). Feature story: Risk and capital requirements for infrastructure investment in emerging market and developing economies. The World Bank. Retrieved from: <https://www.worldbank.org/en/news/feature/2017/12/22/risk-and-capital-requirements-for-infrastructure-investment-in-emerging-market-and-developing-economies>
- 84 European Insurance and Occupational Pensions Authority (EIO-PA). (2017). Amending delegated regulation 2015/35 concerning the calculation of regulatory capital requirements for certain categories of assets held by insurance and reinsurance undertakings (infrastructure corporates). Brussels: European Commission.
- 85 International Finance Corporation (IFC). (2021). Managed Co-Lending Portfolio Program (MCPP). Retrieved September 5, 2021, from IFC website, https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/solutions/products+and+services/syndications/mcpp
- 86 Coalition for Climate Resilient Investment (CCRI). (2021). Vision & mission. Retrieved September 5, 2021, from Climate Resilient Investment website, <https://resilientinvestment.org/vision-mission/>
- 87 Global Infrastructure Hub. (2021). About Global Infrastructure Hub. Retrieved September 5, 2021, from Global Infrastructure Hub website, <https://www.gihub.org/about/about/>
- 88 United Nations Development Programme (UNDP). (2020). Mobilizing insurance investment in sustainable infrastructure: the role of the United Nations. New York: United Nations Development Programme.
- 89 Institute of International Finance (IIF). (2021). Prudential pathways: industry perspectives on supervisory and regulatory approaches to climate-related and environmental risks. Washington: Institute of International Finance.
- 90 Bank of England. (2021). Climate Financial Risk Forum. Retrieved June 15, 2021, from Bank of England website, <https://www.bankofengland.co.uk/climate-change/climate-financial-risk-forum>
- 91 Network for Greening the Financial System (NGFS). (2020). Guide to climate scenario analysis for central banks and supervisors. Paris: Network for Greening the Financial System.
- 92 Bank for International Settlements (BIS). (2021). The Green Swan Conference – Coordinating finance on climate. Retrieved September 4, 2021, from Bank for International Settlements website, https://www.bis.org/events/green_swan_2021/overview.htm#:~:text=The%20BIS's%20mission%20is%20to,a%20bank%20for%20central%20banks
- 93 Superintendencia General de Seguros (SUGESE). (2019). Mesas de diálogo climático en el sector financiero. Superintendencia General de Seguros de Costa Rica.
- 94 Banque de France. (2021). A first assessment of financial risks stemming from climate change. Paris: Banque de France.
- 95 Icebreaker One. (2021). Standard for Environment, Risk and Insurance (SERI): the principles and practices of a trusted data ecosystem. UK: Icebreaker One.
- 96 Xinhua News Agency. (2021, March 12). Outline of the People's Republic of China 14th Five-Year Plan for national economic and social development and long-range objectives for 2035. Beijing: Xinhua News Agency. Translation downloaded from the Center for Security and Emerging Technology website, <https://cset.georgetown.edu/publication/china-14th-five-year-plan/>
- 97 L. Wang & Y. Yi, personal communication, July 26, 2021.
- 98 Wermiel, S. (2012). Did the fire insurance industry help reduce urban fires in the United States in the nineteenth century? In G. Bankoff, U. Lubken & J. Sand (Eds.), *Flammable Cities: Urban Conflagration and the Making of the Modern World* (pp. 235–253). USA: The University of Wisconsin Press.
- 99 Bavandi, A., & El Hafre, A. (2021, June 23). Developing disaster risk finance in Morocco: leveraging private markets for sovereign risk transfer [Web log post]. Retrieved from: <https://blogs.worldbank.org/arabvoices/developing-disaster-risk-finance-morocco-leveraging-private-markets-sovereign-risk>
- 100 InsuResilience Global Partnership. (2019). Linking climate risk insurance with shock-responsive social protection. Bonn: InsuResilience Secretariat.
- 101 University of Cambridge Institute for Sustainability Leadership (CISL). (2021). Policy opportunities on the road to net zero underwriting: highlighting three key areas of influence by the insurance industry. Cambridge: University of Cambridge Institute for Sustainability Leadership.
- 102 United Nations Environment Programme Finance Initiative, Principles for Sustainable Insurance (UNEP FI PSI). (2021). Net-zero Insurance Alliance. Retrieved September 4, 2021, from UNEP FI PSI website, <https://www.unepfi.org/net-zero-insurance/>
- 103 Breeden, S. (2021). Climate change – plotting our course to net zero. Speech delivered at the University of Edinburgh and Environmental Association for Universities and Colleges Webinar. Retrieved from: <https://www.bis.org/review/r210519b.htm>
- 104 University of Cambridge Institute for Sustainability Leadership (CISL). (2021). Climate product innovation within the insurance sector. Cambridge: University of Cambridge Institute for Sustainability Leadership.
- 105 InsuResilience Global Partnership. (2019). Vision 2025. Bonn: InsuResilience Secretariat.
- 106 Asia Development Bank (ADB). (2017). Promoting disaster risk financing in Asia and the Pacific. Policy brief, number 2017-1. Manila: Asia Development Bank.
- 107 Access to Insurance Initiative (A2ii). (2017). The importance of insurance regulation in disaster resilience. A2iii-IAIS Consultation Call. Freiberg: Access to Insurance Initiative.
- 108 Clarke, D., & Dercon, S. (2016). *Dull disasters? How planning ahead will make a difference*. Oxford: Oxford University Press.
- 109 Jarzabkowski, P., Chalkias, K., Clarke, D., Iyehen, E., Stadtmueller, D., & Zwick, A. (2019). Insurance for climate adaptation: opportunities and limitations. CASS Business School, City University of London. Retrieved from: <https://gca.org/reports/insurance-for-climate-adaptation-opportunities-and-limitations/>
- 110 Green Climate Fund. (2021). Country readiness. Retrieved September 29, 2021, from Green Climate Fund website, <https://www.greenclimate.fund/readiness>
- 111 Centre for Disaster Protection (CDP). (2021). Crisis Lookout. Retrieved September 5, 2021, from Centre for Disaster Protection website, <https://www.disasterprotection.org/>
- 112 Munich Climate Insurance Initiative (MCII). (2021). Premium support: background paper for the internal use of V20. Bonn: United Nations University Institute for Environment and Human Security.
- 113 Huq, S. (2021, July 20). The era of loss and damage from climate change is upon us. Retrieved from Thomson Reuters Foundation website, <https://news.trust.org/item/20210720193604-ubg6h>
- 114 Vulnerable Twenty Group (V20). (2021, September 29). V20 calls on IMF and developed countries to develop practical steps to deliver climate finance commitment [Press release]. Retrieved from Vulnerable Twenty Group website, <https://www.v-20.org/our-voice/news/press-releases/v20-calls-on-imf-and-developed-countries-to-develop-practical-steps-to-deliver-climate-finance-commitment>
- 115 World Bank, & Department for International Development (DfID). (2017). Technical discussion paper on concessional insurance. Washington: The World Bank.
- 116 H. S. Ho, J. Pan and W. S. Fong, personal communication, July 27, 2021.
- 117 United Nations Development Programme (UNDP). (2021). Insurance & risk finance facility: building resilience, protecting lives and driving inclusive economic growth. Geneva: United Nations Development Programme.
- 118 International Association of Insurance Supervisors (IAIS). (2012). Application paper on regulation and supervision supporting inclusive insurance markets. Basel: International Association of Insurance Supervisors.
- 119 Access to Insurance Initiative (A2ii). (2021). State of inclusive insurance. A2ii Fact Sheet. Freiberg: Access to Insurance Initiative.
- 120 H. L. Chiew, personal communication, September 26, 2021.
- 121 International Monetary Fund (IMF). (2021). 2021 Financial Sector Assessment Program Review—Towards A More Stable And Sustainable Financial System. Retrieved September 29, 2021 from IMF website, <https://www.imf.org/en/Publications/Policy-Papers/Issues/2021/05/28/2021-Financial-Sector-Assessment-Program-Review-Towards-A-More-Stable-And-Sustainable-460517>
- 122 Monetary Authority of Singapore (MAS). (2021). Global-Asia Insurance Partnership (GAIP). Retrieved June 8, 2021, from Monetary Authority of Singapore website, <https://www.mas.gov.sg/schemes-and-initiatives/global-asia-insurance-partnership-gaip-beta>

Acronyms

A2ii: Access to Insurance Initiative	IDF: Insurance Development Forum
ADRFI: ASEAN Disaster Risk Financing and Insurance Program ARC: African Risk Capacity	IFC : International Finance Corporation
ASEAN: Association of Southeast Asian Nations	IIF : Institute of International Finance
ASSAL - Latin American Association of Insurance Supervisors	ILO: International Labour Organization
BIS: Bank for International Settlements	IMF: International Monetary Fund
BoE - Bank of England	IPCC: Intergovernmental Panel on Climate Change
BSIA - Balsillie School of International Affairs	MCPP: Managed Co-lending Portfolio Program
CBA: Cost Benefit Analysis	NAIC: National Association of Insurance Commissioners
CCRI: Coalition for Climate Resilient Investment CCRIF: Caribbean Catastrophe Risk Insurance Facility	NAPs: National Adaptation Plans
CIMA: Conférence Interafricaine des Marchés d'Assurances	NbS: Nature-based Solutions
CoP: Conference of Parties	NDCs: Nationally Determined Contributions
CROs: Chief Risk Officers	NFIP: National Flood Insurance Program
CTA: Climate Training Alliance	NGFS: Network of central banks and supervisors for Greening the Financial System
EIOPA: European Insurance and Occupational Pensions Authority	NZIA: Net Zero Insurance Alliance
EMDE: Emerging Markets and Developing Economies	OECD: Organisation for Economic Cooperation and Development
EU: European Union	ORSA: Own Risk and Solvency Assessment
FEMA: Federal Emergency Management Agency	PCL: Preventative adaptation, Contingent arrangements, Loss acceptance
FSB: Financial Stability Board	PCRAFI : Pacific Risk Information System
GAIP: Global Asia Insurance Partnership	SDGs: Sustainable Development Goals
GDP: Gross Domestic Product	SEADRIF: Southeast Asia Disaster Risk Insurance Facility
GFANZ: Glasgow Financial Alliance for Net Zero	SERI: Standard for Environment, Risk and Insurance
GHG: Greenhouse Gas	SIF: Sustainable Insurance Forum
GIMAR: Global Insurance Market Report	SUGESE: Superintendencia General de Seguros
GME: Global Monitoring Exercise	TCFD: Task Force on Climate-related Financial Disclosures
GRMA: Global Risk Modelling Alliance	TNFD: Taskforce on Nature-related Financial Disclosures
Hainan Green Finance Research Institute	UNDP: United Nations Development Program
IAIS: International Association of Insurance Supervisors	UNEP PSI: United Nations Environment Program Principles for Sustainable Insurance
IBHS : Insurance Institute for Business and Home Safety	UNFCCC: United Nations Convention on Climate Change
ICPs: Insurance Core Principles	

Cambridge insight, policy influence, business impact

The University of Cambridge Institute for Sustainability Leadership (CISL) brings together business, government and academia to find solutions to critical sustainability challenges. Capitalising on the world-class, multidisciplinary strengths of the University of Cambridge, CISL deepens leaders' insight and understanding through its executive programmes; builds deep, strategic engagement with leadership companies; and creates opportunities for collaborative enquiry and action through its leadership groups. Over the past 30 years we have built up a leadership network of over 16,000 senior leaders and practitioners from business, government and civil society, who have an impact in every sector and on every continent. Their experience and insights shape our work, which is further underpinned by multidisciplinary academic research. HRH The Prince of Wales is the Royal Founding Patron of CISL and has inspired and supported many of our initiatives.

Head office

1 Trumpington Street
Cambridge
CB2 1QA, UK

T: +44 (0)1223 768850
info@cisl.cam.ac.uk

Brussels

The Periclès Building
Rue de la Science 23
B-1040 Brussels, Belgium

T: +32 (0) 2 894 93 19
info.eu@cisl.cam.ac.uk

Cape Town

PO Box 313
Cape Town 8000
South Africa

T: +44 (0)1223 768850
info@cisl.cam.ac.uk

