



Insurance and  
Risk Finance  
Facility



United Nations Development Programme

# Embedding Risk Finance in Integrated National Financing Frameworks

POLICY NOTE



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## About the Integrated National Financing Frameworks

Integrated national financing frameworks (INFFs) help countries finance their national sustainable development objectives and Sustainable Development Goals (SDGs). INFFs are voluntary and country-led. Through INFFs, countries develop a strategy to mobilise and align financing with all dimensions of sustainability, broaden participation in the design, delivery and monitoring of financing policies, and manage risk. INFFs are embedded within national plans and financing structures, enabling gradual improvements and driving innovation in policies, tools and instruments across domestic and international sources of public and private finance.

## Integrated National Financing Framework (INFF) Facility

The INFF Facility is a joint initiative of the United Nations Development Programme (UNDP), the United Nations Department of Economic and Social Affairs (UN DESA), the Organisation for Economic Co-operation and Development (OECD), the European Union, the United Nations Children's Fund (UNICEF) and the Governments of Canada, Italy, Spain and Sweden. It responds to country requests for support in developing INFFs.

The Facility brokers technical assistance, facilitates knowledge exchange and provides access to technical guidance. It helps governments and their partners at the national level realise the potential of the INFF approach to accelerate progress towards national sustainable development objectives and the SDGs.

## Abbreviations

AfDB	African Development Bank
ARC	African Risk Capacity
BRD	Rwanda Development Bank
CBI	Citizenship-by-Investment
CDRFI	Climate and Disaster Risk Finance and Insurance
CPI	Climate Policy Initiative
DAE	Direct access entities
DFA	Development Finance Assessment
DGE	Dynamic General Equilibrium
DIO	Dynamic Input-Output
EMDC	Emerging markets and developing countries
ESG	Environmental, social and governance
FDI	Foreign direct investment
FONERWA	National Fund for Environment (Rwanda)
GDP	Gross domestic product
GGCRS	Green Growth and Climate Resilience Strategy
GRMA	Global Risk Modelling Alliance
IATF	Inter-agency Task Force on Financing for Development
IHLLEG	Independent High-Level Expert Group on Climate Finance
IIRFD	Inclusive Insurance and Risk Financing Diagnostic
ILO	International Labour Organization
IMF	International Monetary Fund
INFF	Integrated National Financing Framework
IPCC	Intergovernmental Panel on Climate Change
KIFC	Kigali International Financial Centre
MCFH	Maldives Climate Finance Hub
MDB	Multilateral development bank
MRV	Monitoring, reporting and verification
MSMEs	Micro-, small and medium-sized enterprises
NDC	Nationally Determined Contribution
NDRF	National Disaster Risk Fund (Rwanda)
NGFS	Network for Greening the Financial System
NOAA	National Oceanic and Atmospheric Administration (United States)
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
PEFA	Public Expenditure and Financial Accountability
PFM	Public financial management
PPP	Public-private partnership
RCP	Representative Concentration Pathway
RST	Resilience and Sustainability Trust
SDG	Sustainable Development Goal
SFC	Stock-Flow Consistent
SMEs	Small and medium-sized enterprises
TFP	Total factor productivity
TOSSD	Total Official Support for Sustainable Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
WMO	World Meteorological Organization

# Executive summary

Climate change presents a substantial and escalating threat to global economic stability and the achievement of the Sustainable Development Goals (SDGs), particularly in developing and climate-vulnerable nations. Climate-related shocks exacerbate financial burdens and limit countries' capacity to invest in sustainable development and resilience-building. This policy note shows how Integrated National Financing Frameworks (INFFs) can provide a crucial mechanism to address this challenge, through embedding climate risk analytics and risk financing solutions into the financing strategies for national development plans. The key messages and recommendations are summarized below:

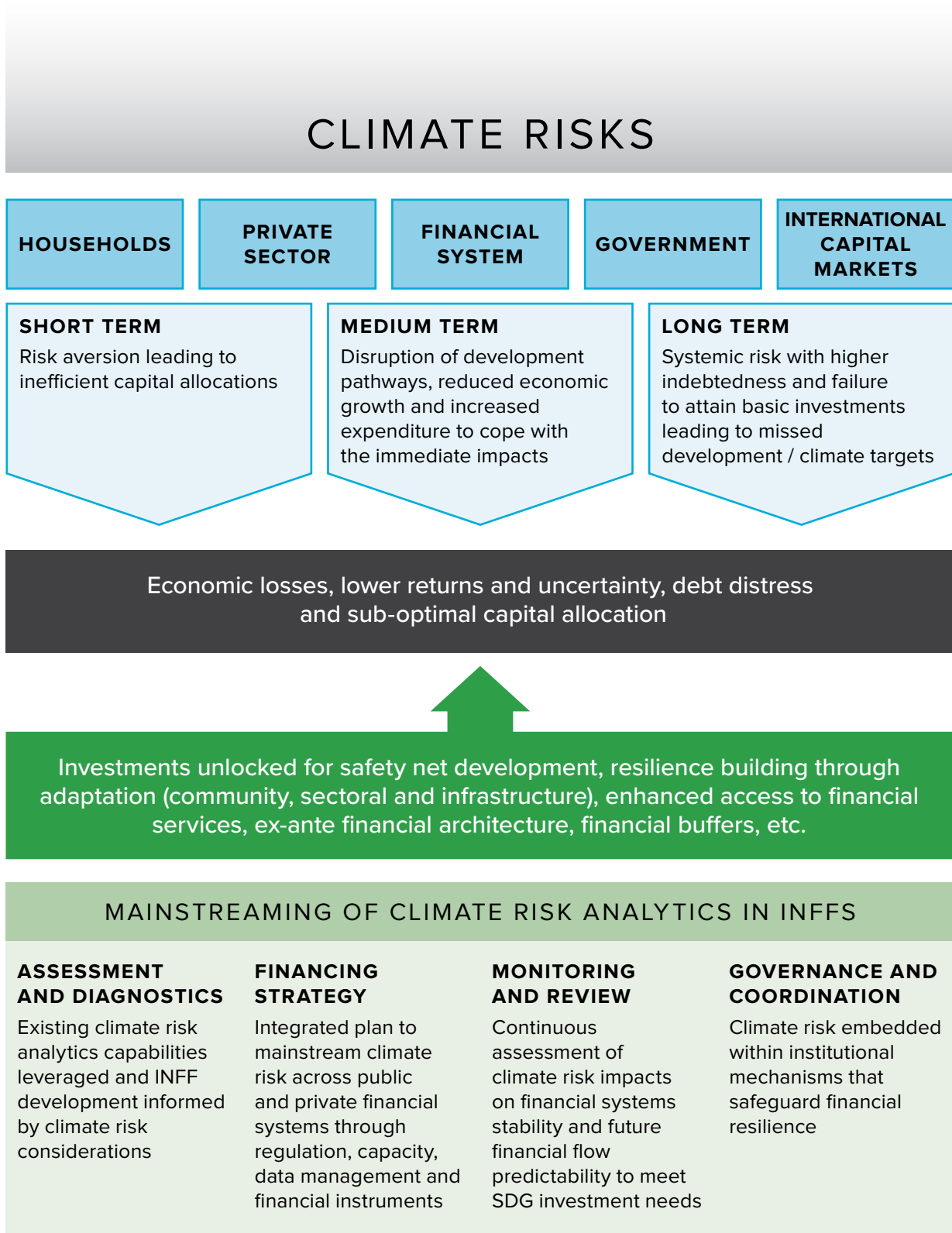
## Key messages:

- **Climate change undermines SDG financing and economic stability:** Climate hazards lead to significant economic losses, increased public debt, reduced tax revenues and decreased private investment. This increases the persistent financing shortfall for SDGs.
- **INFFs are critical for climate risk integration and resilient financing:** INFFs provide a strategic framework for countries to assess financial needs and risks, mobilize diverse funding sources and align investments with sustainable development priorities. Integrating climate risk diagnostics and risk financing mechanisms such as Climate and Disaster Risk Finance and Insurance (CDRFI) into INFFs is essential to manage risks, protect development gains and secure long-term financing for mitigation, adaptation and resilience.
- **Case studies highlight diverse integration approaches:** Country experiences from Maldives, Rwanda and Thailand demonstrate varying and promising approaches to integrating climate risk analytics and finance into INFFs, ranging from operationalizing disaster risk finance instruments to laying institutional and policy foundations for deeper integration.

From an INFF perspective, climate change undermines SDG financing across all four INFF building blocks by weakening diagnostics, constraining financing strategies, complicating monitoring and review and straining governance and coordination. As illustrated in figure 1, this policy note proposes a practical framework in which climate risk analytics act as a foundational enabler, informing diagnostics, guiding financing strategies, strengthening monitoring and review and reinforcing governance, so that INFFs function as an integrated system for managing climate risks and mobilizing finance for resilience.

Figure 1

## Role of risk-informed INFFs in building climate resilience



## Key recommendations for risk-informed INFFs

- **Enhanced diagnostics:** INFFs can propose incorporating climate risk into national investment plans, medium-term fiscal frameworks, fiscal risk statements and debt sustainability analysis to identify vulnerable regions, sectors, populations and assets.
- **Diversified financing instruments:** INFFs can be used to lay the policy, regulatory and institutional groundwork to increase uptake of climate risk-informed instruments for domestic public finance (e.g. catastrophe bonds), international public finance (e.g. contingent credit lines), private finance (e.g. guarantees) and insurance (e.g. parametrics). This ensures robust finance for resilience and recovery.
- **Strengthened monitoring and review:** INFFs can be used as a mechanism to improve existing monitoring, reporting and verification (MRV) systems, invest in local capacities for data development and interpretation and ensure transparent tracking and evaluations of climate and disaster-related data.
- **Robust governance and coordination:** INFFs can foster collaboration among government entities, the private sector and development partners and can establish in-country climate finance structures to streamline climate risk integration and accelerate climate action.



# Introduction

Integrated National Financing Frameworks support countries in strengthening their planning and financing processes and addressing existing barriers to financing sustainable development and achieving the SDGs. INFFs lay out the full range of financing sources – domestic and international sources of public and private finance – and allow countries to develop a strategy to increase investment, manage risks and achieve sustainable development priorities, as identified in countries’ national sustainable development strategies. INFFs are developed and implemented through four building blocks:

1. **Assessment and diagnostics** provide a comprehensive picture of financing, including: i) financing needs; ii) financing landscape assessment; iii) risk factors, constraints and challenges; and iv) opportunities in relation to financing for development.
2. **Financing strategies** set out a set of sequenced actions to finance national development strategies and goals and mobilize and align financing with national priorities.
3. **Monitoring and review** helps governments track progress and draw lessons for policy design and implementation.
4. **Governance and coordination** mechanisms guide the process and enhance coherence and coordination across government and with non-government actors.

Rooted in national governance and policy frameworks, INFFs are inherently country-specific. To date, over 20 countries have finalized their integrated financing strategies and over 50 countries are taking forward the implementation of the financing reforms prioritized within the INFF processes. INFF financing strategies often include elements that provide entry points for integrating risk considerations, such as:

- **Policies, strategies and frameworks** that guide and prioritize the mobilization of different types of financing and its alignment with sustainable development priorities, along with the creation of macroeconomic and systemic conditions
- **Financing instruments and regulations** that governments can deploy to implement their policies
- **Processes and systems** for improved coordination and information management, for example, improved budgetary processes and public financial management (PFM) procedures
- **Stakeholders and institutions** involved in the process of designing and implementing financing interventions
- **Methodologies and tools** developed by various agencies, both domestic and international.

Recognizing the potential to enhance INFFs’ responsiveness to climate-related risks, this policy note explores how climate risk and CDRFI can be better integrated into INFF processes. This includes identifying best practices and practical entry points across the four building blocks. This policy note aims to:

1. Understand how climate risk impacts SDG financing
2. Identify how climate risks have been integrated into existing INFF processes
3. Establish a framework for how INFFs can move towards being climate risk-informed.

Ultimately, the conclusions of this note will provide the foundation for future recommendations that support countries implementing INFFs to integrate climate risk management approaches into the four INFF building blocks and provide guidance for government and non-government stakeholders in the development and implementation of INFFs. The note is structured as follows:

1. **Importance of considering climate risk in SDG financing:** Provides an overview on climate risk, how it can lead to financing shortfalls and the existing evidence on SDG and climate finance needs.
2. **Evidence on the impacts of climate risk on the INFF landscape:** Describes the evidence on the effects of climate risk on the relevant sources of SDG finance.
3. **Climate risk integration in INFFs:** Performs an analysis of the INFFs to assess how climate risks have been taken into account in the different stages of development.
4. **Case studies:** Illustrates country experiences in integrating climate risk analytics and integrating risk considerations into financing strategies and INFF processes.
5. **Integrating climate risk analytics and financing into INFFs:** A practical framework: Proposes a practical framework to identify entry points for integrating climate risk analysis and risk finance approaches in the preparation of the INFFs.



# Climate risk impact on SDG financing

There is a massive funding gap for the SDG and climate action agendas. Climate change is already causing significant economic damage, increasing debt and hindering the ability of developing nations to finance the SDGs by eroding domestic resources and increasing the costs of borrowing.

## Why is it important to consider climate risk in SDG financing?

### **Financing the SDGs is already a major challenge.**

The cost of achieving the SDGs by 2030 remains large. Analysis from UNCTAD (2023) covering 48 developing economies suggests that, between now and 2030, each of six key pathways towards sustainable development will require funding of US\$5.4 trillion to \$6.4 trillion.<sup>1</sup> These pathways are:

1. Social protection and decent jobs
2. Transformed education systems
3. Digital transformation
4. Energy access and affordability
5. Food systems
6. Climate change, biodiversity loss and pollution.

### **To meet this requirement, financing must rise significantly.**

The OECD's Global Outlook on Financing for Sustainable Development 2025 projects that without significant reform, the SDG financing gap is set to reach \$6.4 trillion by 2030<sup>2</sup> —

up from the USD 4 trillion estimated in the Financing for Sustainable Development Report 2024 (IATF, 2024). The annual financing needed to achieve the SDGs in developing and emerging countries surged by 36 percent between 2015 and 2022, yet resources grew by only 22 percent over the same period, widening the gap by 60 percent. According to the Organisation for Economic Co-operation and Development (OECD, 2023), COVID-19 has had a detrimental impact on SDG financing: financing for development was reduced by \$774 billion from 2019 to 2020. Despite muted impacts on remittances, and an increase in TOSSD (Total Official Support for Sustainable Development),<sup>3</sup> capital flows and available government revenues, the major components of SDG financing, both contracted by roughly 20 percent. Climate change, localised conflict and geopolitical uncertainty continue to drive financing needs, disproportionately affecting developing countries.

<sup>1</sup> However, the same analysis suggests that as much as \$7.9 trillion could be needed.

<sup>2</sup> OECD (2025), Global Outlook on Financing for Sustainable Development 2025: Towards a More Resilient and Inclusive Architecture, OECD Publishing, Paris, <https://doi.org/10.1787/753d5368-en>.

<sup>3</sup> TOSSD includes "cross-border support to developing countries and global and regional expenditures for sustainable development", which includes aid but not private sector contributions, apart from in official interventions (OECD, 2023).

**In this context of reduced development financing, climate change has become a defining constraint on development outcomes, with profound implications for economic growth, fiscal stability and human prosperity.** Under the climate change scenario of Representative Concentration Pathway 2.6 (RCP 2.6) – which represents a very stringent emissions pathway – average temperatures are expected to increase by 1°C and sea levels are to rise by 0.4m by 2100 when compared to 1986–2005 levels. Under the high emissions scenario, RCP 8.5, the projected temperature and sea level rises are 3.7°C and 0.63m (Coast Adapt, n.d.). The World Meteorological Organization (WMO) in its State of the Global Climate report confirms 2024 was the warmest year to date, with the global average near-surface temperature at 1.55°C (margin of uncertainty of ± 0.13 °C) above the pre-industrial baseline. This record is in line with the ten-year mean (2014–2023) global increase of 1.20±0.12°C above the 1850–1900 average. Moreover, the Intergovernmental Panel on Climate Change (IPCC, 2023) finds that there is a more than 50 percent chance that global temperature rise will reach or surpass a consistent 1.5°C between 2021 and 2040 across studied scenarios. Under a high-emissions pathway, the world may hit this threshold even sooner – between 2018 and 2037. Based on these projections, the incidence of sudden and slow-onset climate hazards will inevitably increase

throughout the 21st century, which poses additional challenges to the development of climate-vulnerable countries. These projections reinforce the importance of embedding climate risk diagnostics into national financial planning, particularly through INFFs.

In terms of the wider economic outlook, table 1 shows projected annual growth rates for 2026 and 2027 from the IMF’s January 2026 World Economic Outlook Update. Global growth is projected to hold steady at 3.3 percent in 2026 and 3.2 percent in 2027 - a slight upward revision of 0.2 percentage points from the October 2025 forecast, driven primarily by stronger-than-expected momentum in the United States and China. Advanced economies are projected to grow at 1.8 percent in 2026, while emerging markets and developing economies are expected to maintain growth just above 4 percent. Risks to the outlook remain tilted to the downside, with trade policy uncertainty, geopolitical tensions, and a potential reassessment of AI-driven investment expectations cited as the main vulnerabilities. Regarding developing countries, moderate to high economic growth rates must be sustained, as they are essential in delivering substantial progress towards the achievement of the SDGs. Climate change, however, increases macroeconomic volatility and downside risks, making these growth paths more difficult to achieve.

Table 1

### Projected economic growth rates (2026 and 2027)

COUNTRY GROUP	2026	2027
World	3.3	3.2
Advanced economies	1.8	1.7
Emerging market and developing countries	4.0	4.0

Source: IMF, World Economic Outlook Update, 2026

**Adaptation can contribute to reducing some of the damages estimated by Kotz et al.**<sup>4</sup> However, climate change simultaneously undermines the economic and financial conditions required to fund such investments. The negative implications for growth and the overall riskier environment that climate change creates reduce fiscal space, weaken domestic revenue mobilization and raise the cost of capital. A growing body of empirical evidence finds that climate shocks depress GDP growth, erode fiscal revenues, and increase public debt burdens and borrowing costs, with disproportionately severe effects in climate-vulnerable economies (IMF, 2023; IMF, 2022; Pintus et al., 2024; da Silva et al., 2025). This indicates a bleak picture for financing the SDGs – and for their achievement. These dynamics underscore the importance of aligning financing frameworks with climate risk realities to avoid undermining development gains.

**The interplay between climate change and debt has formed a suffocating nexus, entangling nations in**

**what can be termed a Climate Debt Trap.** Research from the Financial Protection Forum (2018) shows that climate change risk had already increased debt by \$62 billion between 2007 and 2016 for the V20 countries alone. Additionally, research from Klusak et al. (2023) looking at 109 (mostly developed) countries suggests that interest payments for these countries could increase by \$135–\$203 billion by the end of the century as a result of downgrades in credit ratings. This increase in repayment is also expected to more than double in the following decade. This financial burden is exacerbated by the disproportionate toll of climate vulnerability, with developing countries spending an extra dollar for every 10 dollars paid in interest. The IMF (2019) examined 11 natural disasters in developing nations between 1992 and 2016 (see table 2 for a summary of effects on GDP), and revealed that public debt had increased on average from 68 percent to 75 percent of GDP three years after the event. This reinforces the importance of integrating climate risk analytics into INFF development and implementation.

Table 2

### GDP damage by hazard event

COUNTRY	YEAR	HAZARD	DAMAGE (% OF GDP)
Dominica	2017	Storm	226
Grenada	2004	Storm	184
Maldives	2004	Tsunami	179
Mongolia	1996	Wildfire	158
Samoa	1991	Storm	157
Samoa	1990	Storm	145
Saint Kitts and Nevis	1998	Storm	137
Vanuatu	1985	Storm	131
Haiti	2010	Earthquake	122
Cambodia	1991	Flood	106

Source: IMF (2019), based on EM-DAT data and own estimates.

4 The estimates are derived from past data, and therefore reflect previous adaptive capacity.

**Over-indebted countries face difficulties in responding to emergency needs and enabling future economic recovery due to pre-existing debt and reconstruction costs.** This trend is reflected in the IMF/World Bank's list of countries at high risk of debt distress, which includes 23 of the 50 most climate-vulnerable nations. In fact, two-thirds of World Bank Debt Sustainability Analyses mentioned climate change or natural disasters as relevant to debt stress. This has reflected on sovereign bond spreads, which have a clear link with climate vulnerability even after accounting for controls (GDP, growth, debt and fiscal balance) (Beirne et al., 2020; Cevik and Jalles, 2020).

**The V20 has identified a positive and increasing correlation between climate vulnerabilities and debt servicing.** Furthermore, climate finance, very much needed for mitigation and adaptation investments, has primarily been provided through debt-creating instruments, with evidence from the Climate Policy Initiative (CPI, 2024) suggesting that approximately 60 percent of concessional climate finance is provided through (albeit low cost) debt instruments. This approach reduces countries' ability to achieve fiscal stability and debt sustainability while building climate resilience. INFFs offer a platform for countries to strategically assess and deploy financing instruments to diversify the financing sources to ensure long-term sustainability in the fiscal and financial system.

While resilience measures offer some relief, particularly for lower-risk countries, analyses show that for high-risk countries, the impact of vulnerability is larger than that of resilience-building (Beirne et al., 2020). As debt increases, creditors are less likely to lend to countries struggling with payments and climate vulnerabilities, leading to higher interest rates, which hinder productive investments and the provision of essential services for human and socioeconomic development.

**To effectively address the intertwined nature of climate and debt risks, public financial management systems and policies must explicitly integrate**

**climate adaptation commitments, supported by concessional finance, to avoid postponement or underinvestment in resilience measures, and thus to protect both recovery and future stability.** When fiscal pressures arise, there is often a diversion of critical resources and political attention away from investments in climate resilience. As climate-related hazards become increasingly frequent and severe, continued deferral of resilience-building investments leaves countries more vulnerable and with limited fiscal space to respond effectively. Ultimately, public financial management systems must be guided by an integrated fiscal and debt management strategy that accounts for climate risks and clearly maps out resilience investments and their associated financing sources.

**Climate financing needs in emerging markets and developing countries (EMDCs) are also significant.** Research from the Independent High-Level Expert Group (IHLEG) on Climate Finance (Bhattacharya et al., 2024) suggests that an annual \$6.3 trillion–\$6.7 trillion, including \$2.3 trillion–\$2.5 trillion for EMDCs, will be required globally by the year 2030. In 2035, the required annual investment is expected to grow to \$7 trillion–\$8.1 trillion globally and to \$3.1 trillion–\$3.5 trillion in EMDCs. Much of the investment will be required for mitigation and the clean energy transition, including \$1.6 trillion annually by 2030 in EMDCs. Meeting this target will bring significant benefits by reducing future adaptation or loss and damage needs, and by reducing negative economic impacts on productivity and health.

**Compositionally, much of the burden (\$1.4 trillion) will need to be met by public – and increasingly private – domestic resources.** International finance will have a significant role in plugging the remaining climate finance gap, with estimates from the IHLEG (Bhattacharya et al., 2024) suggesting that private international climate finance in particular will need to increase by a factor of 15 over the period to 2030, particularly given its importance in providing investment for clean power generation and other mitigation-related activities.

**According to CPI's 2025 Climate Finance Landscape report, climate finance in 2023 was \$1.9 trillion (CPI, 2025).** This suggests that the annual finance gap to be filled by 2030 is greater than \$5 trillion. However, the growth rate of total climate finance has been exceptionally high, and more than doubled between 2018 and 2022. Importantly, climate finance has also surpassed and diverged from fossil fuel investments across this time period.<sup>5</sup> Private finance now accounts for the majority of mitigation finance, at 54 percent of the total. That said, private capital continues to lag behind in finance for climate adaptation, and in finance to least developed countries (LDCs), accounting for only 10 percent of the total.

**To mobilize finance to meet this gap, developing countries can adopt some key policy changes.** Additional research from IHLEG (Bhattacharya et al., 2024) suggests that across the components of climate finance delivery – multilateral development banks (MDBs), fiscal space, domestic mobilization and private finance, among others – countries are not on track. Developing integrated financing strategies to improve domestic resource mobilization, better aligning existing resources with sustainable development priorities and creating enabling conditions for private finance are critical to spearhead progress in the most important components of current and future climate finance.

## Evidence on the impacts of climate risk on the INFF financing landscape

**This section reviews the documented impacts of climate risk on the financing flows** to assess the impact of climate risk on various sources of SDG finance. It follows the same structure that underpins INFFs:

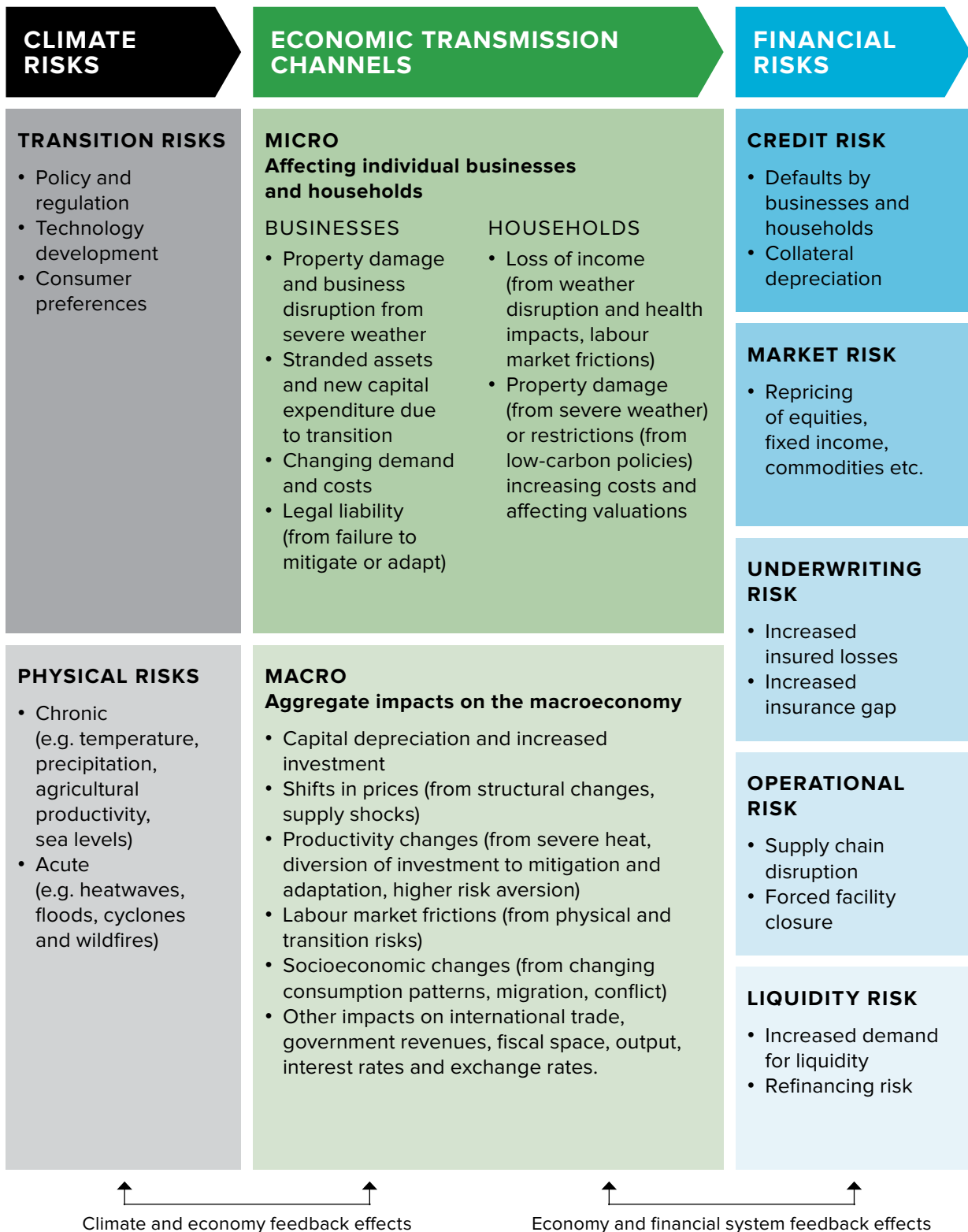
- Domestic private finance
- Domestic public finance
- International public finance
- International private finance.

**The impacts of climate risk on financing, and the financial sector, are vast.** The Network for Greening the Financial Sector (NGFS) summarizes these impacts as shown in figure 2.

<sup>5</sup> This excludes fossil fuel subsidies, which have been shown, worryingly, to have been significantly increasing over the same time period.

Figure 2

## Climate risk transmission channels



Source: NGFS (2023)

**In linking to the sources of SDG financing, this report categorizes impacts as short, medium and long term to define the transmission channels that will determine investment levels in the economy.**

This evidence can support countries to identify climate-sensitive flows and strengthen INFF financing strategies with risk-responsive tools and contingency planning. Figure 3 synthesizes the findings.

Figure 3

### Synthesis of climate risk impacts on economic agents

CLIMATE HAZARD	CLIMATE IMPACTS	INTERNATIONAL PUBLIC FINANCIAL IMPACTS					
Sudden onset events	Crop failure	Short term		Medium term		Long term	
Flooding	Damages to assets and infrastructure	General increase in international flows		Reduced impact of flows	Insufficient flows for learning and development	Combating physical and transition risk crowds out development finance	
Droughts	Loss of livelihoods and business activity	DOMESTIC PUBLIC FINANCIAL IMPACTS					
Heatwaves	Health impacts on people and livestock	Short term		Medium term		Long term	
Wildfires	Reduced productivity	Reduced tax collection	Increased social security obligations	Reconstruction costs	Increased sovereign bond rates	Perpetual debt distress	Stranded assets
Tropical cyclones/storms	Increased agricultural prices	DOMESTIC PRIVATE FINANCIAL IMPACTS					
Slow onset events	Reduction in habitable areas	Short term		Medium term		Long term	
Rainfall variation		Reduced risk appetite/willingness to lend	Reduced opportunities to lend	Lower levels of liquidity	Decreased asset valuation	Increased risk of bank default	Rising insurance premiums
Rising temperatures		INTERNATIONAL PRIVATE FINANCIAL IMPACTS					
Sea level rise		Short term	Medium term		Long term		
Net-zero transition		High-risk companies divest	Reduced FDI inflows	FDI, ODA, remittance impact dampened	Rising climate premia	Pressure on MDB/concessional FIs	Financial reallocation to less risky regions

Source: Authors' elaboration based on literature review.

Climate risks disrupt all sources of finance. Domestically, they reduce private lending and investment, while putting strain on public finances through lower tax revenue and higher reconstruction costs. Internationally, climate risks deter private investment and shift public funds from development to humanitarian aid and debt relief.

## Domestic private finance

**In the short term, financial markets will be categorized by lower levels of lending.** From the demand side, climate risk aversion reduces opportunities to invest. Ahsan (2014) and Cameron and Shah (2015) show that uncertainty over future natural disasters makes people more risk averse, with the implication being that households may be less likely to invest in their business. Additionally, Cevik and Miryugin (2023) and Kling et al (2021) find that nonfinancial businesses in countries that are more vulnerable to climate change tend to be less likely to access debt financing. Meanwhile, for new enterprises, De Blasio et al. (2021) show that natural disaster-induced risk aversion has significant impacts on the likelihood that people will engage in entrepreneurial activity. From the perspective of the lender, exposure to risk also impacts on the supply side, negatively impacting on willingness to lend (Hallegatte et al., 2016). Dal Maso et al. (2024) find that disaster risk leads to an additional loss in bank earnings via an increase in loan loss provisions. Furthermore, Bansal et al. (2019) find a negative impact on asset prices that is likely to compound on national financial institutions.

**In the medium term, financial institutions will suffer from decreasing liquidity and asset values, leading to default risks.** In the aftermath of a natural hazard, Brei et al. (2019) find that the channel of impact affecting financial market effectiveness is an increase in deposit withdrawal and a decrease in new credit supply as a direct consequence. That said, there appears to be no significant impact on loan defaults (Brei et al., 2019). Nonetheless,

the effect is that, unless regional banks remain sufficiently liquid, a decline in the supply of credit is inevitable. Klomp (2014) finds that this solvency issue in the aftermath of a natural disaster leads to an increased risk of commercial bank default. Furthermore, if transport or power infrastructure is affected by the hazard, then this can have significant impacts on companies' productivity (Fiorini et al., 2021; Geginat and Ramalho, 2018). The findings of Hallegatte et al. (2022) that post-disaster capacity constraints may lead to significant delays in the reconstruction of high return infrastructure would deepen the impacts of such damages. Households, who serve as key contributors to private health and education financing, may be forced to substitute away from these important investments to smooth consumption as climate hazards impact negatively on key assets such as property and livestock. As a result, many children may receive poorer nutrition (Dercon and Porter, 2014), be less likely to receive medical attention, or even be taken out of formal education (Jensen, 2000; Dercon and Porter, 2014), and this may even induce child-based participation in the labour force (Baez and Santos, 2007).

**In the long term, financial products will be drastically underprovided and default risk may become severe.** Increasing climate risks and uncertainty will lead to a systemic underprovision of market insurance (due to fears of massive losses in the instance of underpricing). This lack of financial insulation will reduce the willingness of loan-providing financial institutions to supply credit (Battiston et al., 2021). Eventually, the impact of climate hazards, through the

simultaneous negative impact on asset values and on deposit holdings, will create persistent solvency issues for national financial institutions. For firms and enterprises, the impacts of climate risk may result in a permanently higher prevalence of micro-, small and medium-sized enterprises (MSMEs) due to an unwillingness and inability to invest. Household and firm-level impacts from the climate transition will affect the balance sheets of domestic financial institutions. Asset-level revaluation in the context

of transition risks will increase the probabilities of non-performing loans and default, leading to credit risk. As households are subjected to the dynamics of labour market shifts, liquidity risks, especially among regional banks, may become more present. Finally, combined with physical risks, the cost of insurance for financial institutions – either directly or indirectly through their debtors – will increase, affecting the viability and profitability of certain investments (Dunz and Power, 2021).

Box 1

### Enterprise-level impacts of extreme heat in Mexico

Using financial and climate data from 2010 to 2018, Aguilar-Gomez et al. (2024) look at the impacts of extreme heat on enterprise-level loan defaults in Mexico. They find that small and medium-sized enterprises (SMEs) are significantly more likely to default as a result of these extreme events. The results are also found in the non-agricultural sector, suggesting that reducing economic reliance on agriculture does not fully mitigate these effects.

This has strong implications for domestic investment, as both credit institutions and businesses face higher risks and therefore lower adjusted returns. This stymies firm-level investment and hinders the progress of the SDGs.

## Domestic public finance

**In the short term, tax collection will suffer, while social security obligations and sovereign bond rates will begin to rise.** The negative impacts on household prosperity have the potential to crowd out public investment expenditure from productive investments in favour of widespread social protection and insurance aimed at mitigating climate risks. For businesses, the combination of low demand for and low supply of access to financial markets results in low levels of business formality – both the International Labour Organization (ILO, 2016; ILO, 2024) and the World Bank (2014) cite access to finance as a major determinant of formalization. As a result, businesses will suffer from lower productivity and profitability (Cevik and Miryugin, 2023). The implication of low formalization from a public financing perspective is the inability to tax unregistered firms, leading to a

decrease in tax revenues (ILO, 2016; Ulysea, 2020). Tsopmo et al. (2022) confirm that climate vulnerability leads to reduced revenue mobilization, finding that a 1 percent increase in climate vulnerability coincides with a 0.63-point reduction in government revenues. Through quantile regression, the impacts are shown to be particularly pronounced for the most vulnerable countries. Finally, vulnerability to the impacts of climate change has significant implications for sovereign bond rates. Cevik and Jalles (2020) and the Beirne et al. (2020) both find that after controlling for other determinants of bond rates (including GDP per capita, where climate change also has an impact), climate vulnerability has a significant positive impact on rates, and therefore on willingness to borrow. INFF diagnostics and financing strategies must account for how climate

risk weakens tax bases and raises borrowing costs, and must identify fiscal buffers, pre-arranged finance (e.g. contingent credit) and insurance mechanisms to maintain macrofiscal stability.

**In the medium term, governments will suffer from increased expenditure on reconstruction, continued lower tax revenues and an imbalanced current account.** Hallegatte et al. (2022) find negative impacts on GDP and the current account as a result of natural disasters. This evidence is supported by Cavallo et al. (2022), who find that countries suffer from a loss of 2.1–3.7 percent of GDP in the wake

of a natural disaster. Research from the IMF (2016) identifies as the transmission mechanism for the current account deficit the fact that many of the reconstruction costs are constituted as imports, while the supply of exports is hampered by infrastructural damages. In terms of government revenues, Panwar et al. (2024) show that from 2000 to 2022, climate-attributable indirect economic losses from severe weather events amounted to approximately 2.9% of government revenue across all SIDS, rising to around 4.8% for SIDS within low- and lower-middle-income country groups, on an average annual basis. (ibid).

Box 2

## Household impacts of the 2011 floods in Thailand

In 2011, Thailand suffered from an incredibly severe flooding event, which took the lives of 800 people and damaged 1.2 million homes. In terms of financial impacts, the floods were the costliest of their kind on record at the time, with total damages reaching \$46.5 billion, of which a considerable amount were lost in worker wages (Noy et al., 2021).

The consequences of this were debilitating for households. Poaponsakorn and Meethom (2013) find that household expenditure after the floods decreased by between 5.7 and 14 percent. Noy et al. (2021) also find that there were significant impact spillovers, with households who had not even reported being directly affected by the flood suffering similarly to households who had.

Educational attainment suffered as well. Thamtanajit (2020) finds that the floods had significant negative impact on test scores for pupils in grades 6 and 9 in a vast majority of tested subjects.

**In the long term, as countries suffer from the impacts of climate risk on growth and the cost of borrowing, debt distress will become a greater issue.** The long-term impacts of household consumption smoothing on human development in health and education will result in lower growth and, as a consequence, reduced public revenue as well. This will crowd out investments in adaptation, as vulnerable countries will no longer have the fiscal space available to make adaptation and resilience investments (Alayza et al., 2023; Neunuebel, 2023). In a cyclical manner, this will lead to a perpetual increase in sovereign bond rates: Klusak et al. (2023) show that countries are set to suffer from significant credit rating downgrades

in the absence of adaptation interventions. This is supported by evidence from both Cevik and Jalles (2020) and Beirne et al. (2020), who show that resilience can mitigate these impacts. However, with higher rates, borrowing will only be sustainable for fewer projects of very high return. Finally, increasingly frequent and important debt resolution episodes will take resources away from other productive activities (Alayza et al., 2023). Transition risks are expected to have significant impact on domestic finances. Labour market frictions from sectoral reallocations may increase the needs for unemployment benefits and insurance. Additionally, these risks are likely to affect specific communities and geographies,

making revenue generation essential to compensate transition “losers” from the gains of “winners”. Impacts on businesses, including state-owned enterprises, are likely to lead to significant carbon-linked stranded assets, with implications for revenue collection (Dunz and Power, 2021). The outcomes for public debt from transition risks alone could be substantial, with the IMF suggesting debt-to-GDP could rise by

25 to 40 percentage points by 2050. Well-designed carbon pricing and policy will be crucial to reduce these costs (Garcia-Macia et al., 2024). INFFs offer a vehicle to integrate these reforms – identifying priority adaptation investments, fiscal policy shifts and debt-sustainability measures that reflect climate risks and enable long-term resilience.

Box 3

## Public debt in Dominica after Hurricane Maria

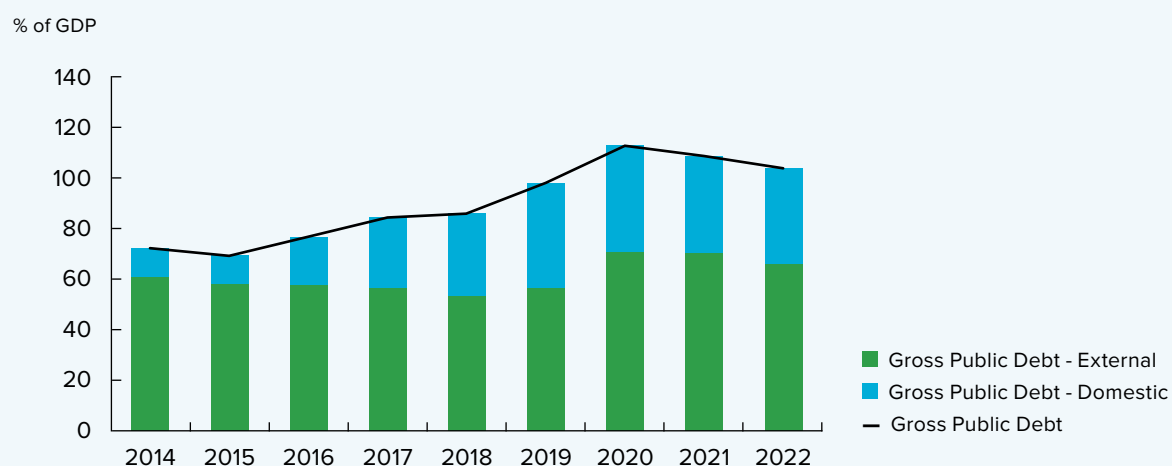
In 2017, Dominica was hit by Hurricane Maria, which in that year was the most severe storm in the world. As a consequence, the country’s GDP declined by 10 percent. This put a large strain on public revenues, which fell by 23 percent, and generated a necessity for greater central expenditure, which rose by 18 percent, mainly due to reconstruction and investment. Furthermore, as many of these expenditures were made on imports, the country was forced to run a larger current account deficit, which was only offset by a robust Citizenship-by-Investment (CBI) programme.

As the figure shows, the storm has had a demonstrable impact on public finances. The average debt-to-GDP ratio across 2012 to 2015 was measured at 72 percent. But by 2019, this number had reached 98 percent. This was largely due to increased borrowing from the national bank, as the country also has poor connectivity to international financial markets

Source: IMF (2023); UNCTAD (2020).

Figure 4

### Gross public debt in Dominica, by creditor type (% of GDP)



Sources: IMF (2024).

## International private finance

**In the short term, capital is allocated to countries with more attractive risk profiles.** Gu and Hale (2023) find that, in companies with high climate risk exposure, investments in countries with greater levels of climate risks are significantly deterred. Moreover, Ait Soussane et al. (2023) find that many climate hazard risks lead to reductions in inward foreign direct investment (FDI). This result is particularly large when recipient countries are more dependent on agricultural activity and have not made investments in structural change away from this economic dependence. The result is, therefore, that poorer countries suffer more greatly from this phenomenon.

**In the medium term, the impact of capital inflows is dampened and FDI inflows fall.** Drabo (2021) shows that climate shocks dampen the impact of FDI and remittances on economic growth. This is particularly important since remittances have been found to increase after climate disasters (Becerra et al., 2014; Bettin and Zazzaro, 2018), although not to a size equivalent to the cost of the disaster itself. FDI, on the other hand, has an ambiguous (but mainly negative) response to climate hazards (Doytch, 2020). Finally, Klomp (2015) finds that climate hazards increase the sovereign default premium in the long run (for meteorological disasters at least), impacting negatively on portfolio investments and the perceptions of portfolio managers. This

indication of this finding is that, when new debt is issued, vulnerable developing countries will pay a higher premium.

**In the long term, climate risk premiums will continue to rise and pressure will increase on concessional lenders.** As countries suffer from greater debt distress and credit rating downgrades, international financial markets will see greater losses and will demand higher repayments to compensate for the risks of non-repayment. An increasing need to create alternative financing solutions will put pressure on MDBs and other concessional lenders, unless universal buy-in can be achieved (Centre for Disaster Protection, 2023). Furthermore, evidence from sub-Saharan Africa by Arogundade et al. (2022) suggests that credit rating downgrades will also have a significant negative impact on the inflow of other investment flows such as FDI. International private finance is likely to be affected by credit risk and rising insurance premiums, similarly to domestic financial institutions. Given these risks, international institutions may choose to shift financing away from countries and regions with greater transition needs, significantly affecting the total available level of finance. By integrating climate risk assessments into national investment plans, INFFs can help countries make decisions on CDRFI-backed investments in high-risk settings.

## International public finance

**In the short term, there is mixed evidence on the response of official development assistance (ODA) to a country's climate vulnerability and on its relationship with social development.** At an aggregate level, greater climate vulnerability has been shown to positively influence ODA flows (Jain and Bardhan, 2022; Lee and Lim, 2024). However, there is less consensus on whether climate vulnerability increases ODA flows specifically targeted at reducing climate vulnerability. Liu et al. (2024) find that climate adaptation and mitigation flows are

increasing for countries with climate vulnerability, with adaptation being particularly robust to a number of additional controls. However, this may be due to how the data is coded. Jain and Bardhan (2022) instead show that vulnerability to climate change is linked specifically to increases in humanitarian, debt assistance and social infrastructure and not to economic infrastructure or production. Finally, evidence from the agricultural sector finds that adaptation aid is most impactful on total factor productivity (TFP) in countries that are more climate-

ready, whereas vulnerable or agriculture-dependent nations are less able to leverage the development benefits of such assistance.

**In the medium term, international ODA flows are likely to rise in response to the pressing demands of climate disasters.** However, as is the case with remittances, although ODA does increase depending on the intensity of a climate disaster, it does not tend to rise to the equivalent level of loss and damages faced by the affected country (Becerra et al., 2014; Bettin and Zazzaro, 2018). And, similar to FDI and remittances, Drabo (2021) finds that climate shocks reduce the effectiveness of ODA flows in promoting economic growth.

**In the long term, the evidence of systemic climate risk on development assistance is less clear.** However, unless the climate-debt nexus is broken, it is likely that the relationship between climate vulnerability and debt assistance relief found in the literature will persist and that other development-enhancing flows will be crowded out. This is likely to be exacerbated by transition risk. The increasing need for climate action, combined with constrained economic growth as a result of changes in environmental conditions and risks, is expected to lead to substitution away from certain ODA sectors towards climate action (Koch and Aleksandrova, 2023). Countries will rely on development finance institutions to provide transition finance, but these institutions are likely to suffer losses from stranded assets in carbon-intensive sectors (Monasterolo et al., 2018).





# Climate risk integration in INFFs

Most INFFs acknowledge climate change as a key risk, but a better quantification of the financial impact of climate change, as well as explicitly linking climate change to public and private finance risks, could help make national financing systems more resilient. For instance, Maldives and Rwanda offer excellent examples of including climate risk diagnostics in INFF Financing Strategies, while Thailand is making progress on deploying CDRFI solutions and integrating risk finance into its INFF.

This section looks at patterns and trends across existing INFFs. The analysis also assesses the degree to which countries have integrated climate risk diagnostics and risk financing mechanisms, including CDRFI, into their INFFs, and identifies opportunities to strengthen future strategies.

**General characteristics:** The strategies analysed are linked to national strategic development frameworks whose implementation horizons range from short five-year cycles to medium cycles (tending to coincide with the end of the 2030 Agenda for Sustainable Development). All strategies are motivated by the underlying need to maximize investment flows to the SDGs. Other motivations include: ensuring policy and programmatic coherence; promoting improved governance; enhancing collaboration; mobilizing and aligning climate finance; improving climate risk management; strengthening private sector action and protection mechanisms against climate shocks, including through disaster risk finance and insurance instruments; promoting socioeconomic and sectoral development; and building fiscal resilience. Most of the strategies are oriented towards financing sources (internal/external; public/private) with varying degrees of climate risk integration. While not a clear causal relationship, this could suggest that aligning

INFF structure to expected development outcomes – including climate resilience – can incentivize more integrated treatment of both climate risk analytics and financing solutions, including CDRFI.

**Risk integration in INFFs:** All strategies refer to economic and financial risks such as debt distress, exchange rate fluctuations, interest rates or the erosion of the tax base. Climate risks are clearly mentioned in most strategies (10 out of 12) in a generic way, mainly to outline their negative effects on development processes. Only Maldives's strategy makes an estimate of the long-term economic cost of climate risks, although Comoros provides evidence of a past episode. Rwanda's strategy provides a more detailed study of the country's climate risk profile. Very few strategies establish a clear link between climate risks and risks to public and private finance.

**Risk-informed financing for INFFs:** One measure that is common across INFFs is the inclusion of climate tagging in national budget processes, which enables the identification and tracking of climate-related expenditures, improving fiscal transparency and supporting better prioritization of resources towards risk reduction and resilience. Regulatory improvements to introduce climate considerations in local financial and private sectors can and are

being promoted, albeit to a lesser extent. These initial steps open up opportunities for future INFFs to go further. For example, to stimulate CDRFI markets, countries could consider adopting blended policy and regulatory reforms such as premium subsidies, public-private co-insurance models or integrating risk financing indicators in public investment management frameworks.

Maldives and Rwanda have established clear road maps for the financial instruments that can be used for disaster management and climate adaptation. Other countries creating INFFs can learn from these examples and build on interventions from their own INFFs that serve as a foundation for more elaborate policies.

Box 4

## Insights from Maldives's INFF Finance Strategy

Maldives's INFF was designed under the overarching principle that “all finance is climate finance”. The INFF systematically integrates climate risk across its full architecture, from diagnostics and investment planning to governance and financing instruments. The document establishes three clear pillars for its financing strategy:

1. Better aligning finance flows towards a sustainable agenda
2. Mainstreaming sustainability into risk management and transparency
3. Mobilizing new sources of sustainable finance.

These pillars are supported by 16 financing objectives, with 100+ total actions to be achieved across these objectives.

The INFF clearly reflects Maldives's awareness of its extreme vulnerability to both chronic and acute climate hazards. The strategy recognizes that climate change poses an existential threat, especially via sea level rise, coastal erosion and coral reef bleaching, all of which imperil Maldives's two economic lifelines: tourism and fisheries. Climate risk is thus framed not only in environmental terms but also as a foundational macroeconomic threat, capable of undermining livelihoods, state revenues and social stability. The INFF breaks down **climate impacts across key economic sectors**:

- Tourism: Coral reef degradation and coastal flooding threaten asset bases and tourist arrivals, and average annual losses are estimated to the tune of \$75 million. The strategy underscores the need for resilience-based investments and sustainable infrastructure in the sector.
- Fisheries: Warming oceans and acidification impact fish stock productivity.
- Energy and transport: Maldives remains entirely dependent on fossil fuel imports, exposing the economy to price volatility and supply disruptions.
- Subnational systems: Local councils now hold mandates for climate action but lack capacity.

With this diagnostic, the INFF is able to link climate risk to **financial stability**. It notes that failing to integrate climate considerations into governance and financial market oversight could lead, among other things, to:

- Asset mispricing and destruction, particularly from unaccounted physical risks
- Budgetary stress from escalating adaptation costs and fossil fuel subsidies
- Market signal distortions due to misaligned public procurement practices.

**Quantitative assessments** estimate that coastal protection alone requires \$250 million annually – exceeding current fiscal capacities. Future investments needed to mitigate tourism losses and protect infrastructure are similarly substantial, highlighting the scale and urgency of climate adaptation.

The INFF strategy offers a detailed investment road map, setting out lower and upper bound needs across mitigation and adaptation sectors (e.g. energy, transport, water, waste and coastal protection). These needs are **tied to national climate targets**, integrated into the Third Nationally Determined Contribution (NDC) framework published in February 2025, which includes 15 percent renewable energy share, 26 percent greenhouse gas emissions reduction and achieving net zero by 2030 (conditional on external support).

Most importantly, Maldives's financing strategy considers a full range of climate-related policies and financing instruments.

#### **Public finance and budgeting reforms**

- Green and gender-sensitive public procurement regulations
- Programme-based budgeting linked to SDG and climate targets
- Fossil fuel subsidy reforms to reduce fiscal burden and redirect funds
- Deployment of thematic public funds
- Empowerment of local councils to plan and manage revenues for climate related investments.

#### **Market-based instruments**

- Development of a Sustainable Finance Taxonomy to classify green investments
- Green bonds, sustainability-linked loans and thematic debt instruments
- Carbon pricing and polluter-pay levies to internalize environmental costs.

#### **Insurance**

- Promotion of climate risk insurance products, both at individual and systemic levels
- Institutional incentives for insurance markets to develop products tailored for tourism, fisheries and agriculture.

#### **Blended finance and PPPs**

- Use of blended finance models to de-risk private sector entry into renewable energy, transport and coastal protection
- Active development of public-private partnerships (PPPs) to leverage investment.

#### **International climate finance**

- Improved readiness for climate vertical funds (e.g. Green Climate Fund or Adaptation Fund)
- Institutional support for direct access entities (DAEs) to access international funds more efficiently
- Ability to tap into new funding instruments like carbon markets, Loss and Damage Fund or biodiversity financing.

The strategy is grounded on a clear Theory of Change and uses its targets to anchor the financing objectives and the actions that fall within them. Each objective outlines short-, medium- and long-term policy interventions, backed by responsible agencies, indicators and measurable targets. The Maldives Climate Finance Hub (MCFH) is proposed as the centre for financial sector coordination and policy coherence, directly reporting to an Advisory Board and tasked with aligning domestic and international financing streams with climate resilience goals. At the same time, discussions are ongoing to realign elements of the strategy with evolving policy priorities and immediate fiscal constraints, ensuring that implementation remains responsive to the country's current macrofiscal context while preserving long-term resilience objectives.

## Insights from Rwanda's INFF Finance Strategy

The Government of Rwanda's INFF represents a strategic and forward-looking approach to mobilizing, aligning and optimizing financing flows to achieve national development goals and the SDGs.

Rwanda's INFF acknowledges climate change as a systemic threat that compounds socioeconomic vulnerabilities and undermines long-term sustainability. The strategy references the **impacts of climate risks** such as extreme weather events as a factor that can exacerbate poverty, reduce productivity and strain public resources. The agriculture sector, which employs the majority of Rwandans and contributes significantly to GDP, is highlighted as particularly climate-sensitive. Similarly, energy, water, transport and urban infrastructure are seen as highly vulnerable to climate shocks.

The **INFF builds on Rwanda's NDCs and Green Growth and Climate Resilience Strategy (GGCRS)**, recognizing the need for enhanced investment in climate-resilient infrastructure, disaster response systems and low-carbon technologies. These sectors, particularly in the post-COVID recovery landscape, are seen as priority targets for both public and private financing. The INFF identifies adaptation and mitigation as critical to achieving Rwanda's national development strategy, Vision 2050. Rwanda's climate-related financing needs are embedded in the estimated 84 percent of GDP annual financing requirement to meet the SDGs and transformation goals, and are estimated at \$11 billion for the NDC.

The strategy acknowledges that Rwanda's **macroeconomic framework is increasingly susceptible to climate-induced volatility**. Climate-related shocks such as floods and droughts can destabilize agriculture, lower exports, reduce tax revenue and increase public spending – thereby worsening the fiscal deficit and public debt ratios. The INFF estimates that Rwanda loses about 200 billion Rwandan francs (c. \$137 million) every year because of climate change effects, and emphasizes the importance of integrating climate risk into debt sustainability analyses and public investment frameworks.

Rwanda's INFF expands the financing toolbox with a **diverse set of instruments designed to match climate-related financing needs**. A central pillar of the financing strategy is the integration of climate tagging into the national budget and the Integrated Financial Management Information System, ensuring that public investment programmes directly contribute to climate adaptation and mitigation goals. The domestic landscape is further reinforced by fiscal measures including green taxes. The strategy recognizes the strategic role of ODA in promoting blended finance approaches and de-risking private investments. A major breakthrough in Rwanda's climate finance readiness is its early access to the IMF's Resilience and Sustainability Trust (RST), which injects concessional resources while also necessitating reforms to enhance absorptive capacity and long-term climate resilience. The INFF also anchors its climate finance strategy in the capitalization and coordination of three flagship funds: the Ireme Invest Fund, designed to accelerate green private sector investment; the National Fund for Environment (FONERWA), Rwanda's vehicle for climate adaptation and community-based resilience; and the National Disaster Risk Fund (NDRF), aimed at pre-empting and responding to climate-induced shocks. These funds will be capitalized through a mix of public budget allocations, concessional loans, green bond proceeds and targeted ODA contributions.

Finally, the INFF lays out a **coherent institutional architecture** to anchor Rwanda's climate finance ecosystem in robust governance and long-term effectiveness. Central to this architecture is the proposal for a dedicated Climate Finance Strategy and the development of a green finance taxonomy to organize, guide and regulate the growing number of actors and instruments operating in the climate finance space. The strategy reinforces the mandate of institutions such as FONERWA and the Rwanda Development Bank (BRD), positioning them as critical engines for mobilizing and deploying green finance at both national and subnational levels. The Kigali International Financial Centre (KIFC) has the role of promoting private investment flows related to environmental, social and governance (ESG) sectors. The Public-Private Partnership Unit is to be empowered to curate and manage an investment-ready pipeline aligned with national development priorities. Another relevant aspect is the provision to develop an integrated financing dashboard that will serve as an MRV tool, enabling climate-related financial flows to be tracked.

Rwanda's focus on climate risk and resilient financing in its INFF is complemented by further national policies: the **Climate and Nature Finance Strategy** (Rwanda, Ministry of Finance and Economic Planning (2024), the **Local Disaster Risk Finance Action Plan** (Rwanda, Ministry in Charge of Emergency Management, 2024) and the **Disaster Risk Finance Strategy**. The Local Disaster Risk Finance Action Plan in particular places a significant priority on enhancing local climate risk analytic information and capabilities. This investment will support the financial instruments proposed in the Climate and Nature Finance Strategy – including insurance products, PPPs and thematic bonds, among others – to maximize resilience both at the level of the investment and across the wider economy.

Box 6

## Insights from Thailand's INFF Process

To date, Thailand has published **three major INFF related documents**: the Inclusive Insurance and Risk Financing Diagnostic (IIRFD; UNDP, 2023a), the Development Finance Assessment (DFA; UNDP, 2023b) and the Roadmap on Insurance and Risk Finance for Thailand. All documents are explicit in highlighting the risks to SDG financing in Thailand.

The DFA undertakes a comprehensive **mapping of Thailand's SDG financing landscape** to understand potential finance gaps – estimated to be 15.783 trillion Thai baht between 2021 and 2030 – and recommend policies to ensure robust flows to finance the SDGs. The priorities of SDG financing in Thailand are founded on indicators that are off-track. Priorities are spread across SDG 2 (Zero hunger), SDG 3 (Good health and well-being), SDG 10 (Reduced inequalities) and SDG 14 (Life below water). Climate change has an impact on many of these priorities, both at a local and global level. As a result, suggested policies related to climate have been included in the DFA.

The DFA lists **high-level risks that may impact on Thailand's ability to finance the SDGs**. Among these risks are geopolitical tensions, the lacklustre economic growth trajectory, a demographic shift and the impacts of climate change. Compounding risks – specifically, the global geopolitical landscape and climate change --are analysed through a simple scenario analysis to create a range of potential SDG financing pathways until 2030, with the worst-case scenario necessitating an additional THB 1.698 billion (c. \$51.8 million) over this period. The assessment also includes a landscape survey of climate risk management financial instruments in the form of insurance, risk finance and adaptation finance.

The IIRFD focuses on the **role of insurance and risk finance** as an instrument to support such flows. The analysis includes a hazard profile of the country, bringing in data on flood-affected areas and the number of villages declared as “disaster areas” year-on-year by type of hazard. With regard to insurance, the change in coverage, premiums, penetration and overall insurer profitability is also analysed for rice and maize crop insurance. The analysis shows the success of Thailand’s crop insurance scheme: in 2021, 72.3 percent of plantation areas were insured, compared to only 1.7 percent 10 years earlier. Central disaster relief expenditure is tracked and analysed, both for crops (including the hazard that caused relief to be necessary) and from a wider economic perspective by looking at withdrawals from the national contingency fund. Finally, the document maps out the disaster risk finance landscape in Thailand, including potential future instruments.

Building on the IIRFD, the Roadmap on Insurance and Risk Finance for Thailand underlines the importance of integrating insurance products, risk financing mechanisms and disaster management into one cohesive framework. This can be linked to the country’s INFF Financing Strategy, which already contains an insurance and risk finance component, making Thailand one of the countries pioneering risk-informed INFFs.

The collective financial instruments and policies proposed for Thailand are summarized below:

#### **Public finance and budgeting reforms**

- Complement existing ex-post risk finance mechanisms, such as the public budget, with ex-ante risk finance mechanisms
- Introduce tax and incentive mechanisms to promote climate action
- Introduce climate budget tagging as an entry point for wider SDG tagging.

#### **Market-based instruments**

- Issue thematic bonds, such as sustainability-linked bonds and blue bonds to address finance gaps for SDG 13 (Climate action) and SDG 14 or resilience bonds to use for risk-reducing activities
- Ensure catastrophe bonds incorporate risk-layering into hazard response
- Issue municipal bonds for climate-resilient infrastructure.

#### **Insurance**

- Expand the coverage of crop insurance and microinsurance to ensure access for vulnerable groups and for more crop types
- Develop parametric insurance schemes for rapid payouts from climate hazards, particularly for supporting vulnerable populations
- Expand public asset insurance to ensure public service continuity.

**Lessons can be learned** from the process of developing the DFA and IIRFD. Firstly, the two documents were produced at the same time, allowing for the integration of climate risk and exposure insights and supporting the promotion of CDRFI instruments as part of the financing strategy from its inception. Additionally, the IIRFD uncovered a detailed picture of the bottlenecks to insurance adoption (e.g. the absence of a legal mandate for government agencies to purchase insurance, and political reluctance to pay premiums for low-frequency disasters), which informed policy and regulatory actions to support the financing strategy. The development of a multi-stakeholder Working Group on Insurance and Risk Finance for Thailand was crucial in providing an institutional home for the risk-informed financing agenda. Finally, the momentum generated by the documents was used to leverage a pilot project on insurance and risk analysis for the benefit of vulnerable populations, which has been useful in raising political and public awareness of their importance.

Moving towards the development of Thailand's INFF, **climate risk analytics** can continue to be used to inform the design of the proposed financial instruments. For example, climate risk analytics could guide the allocation of proceeds for thematic bonds and ODA, in addition to improving the targeting of insurance and other risk transfer products. It can also help optimize allocations to national disaster relief funds.

Key to the development of actionable INFFs is to develop a tailored analysis at sectoral and regional levels – such as the work conducted in the tourism industry – to inform stakeholders on how they can incorporate risk into financial and general planning. For this, **private sector engagement** to access disaster risk financing will be key. The IIRFD represents a strong step in this direction. Disaster impacts are still primarily funded through the government's budget and borrowings – a system which leaves the country increasingly vulnerable to the growing magnitude of climate risks.

Thailand's INFF poses a great opportunity to build economic resilience through a risk-informed financing strategy. Government financing can be recalibrated to proactively address climate risks and protection gaps. Risk management frameworks can be bolstered by adopting a sectoral lens to enhance private sector investment and local funding. Finally, a granular understanding of climate risks will allow national and subnational governments to coordinate and redistribute heterogeneous impacts.

These case studies illustrate the diverse and evolving ways in which countries are integrating climate risk analytics into their national financing frameworks. While some have already begun to operationalize disaster risk finance and insurance instruments as part of their broader climate finance strategies, others are laying important institutional and policy foundations that can enable deeper integration over time. Across all contexts, the experiences highlight

promising entry points for aligning INFF processes with climate risk management – particularly by enhancing diagnostics, improving coordination and progressively incorporating risk-layered financing instruments such as insurance, contingent credit and fiscal buffers. These lessons provide valuable guidance for strengthening INFFs as tools to safeguard development investments and build long-term resilience.





# Integrating climate risk analytics and financing into INFFs: A practical framework

INFFs provide a structured process to build financial resilience in the age of climate change. This requires investing in data and technical skills, strengthening risk monitoring and governance and deploying climate-informed financial instruments (like thematic bonds or insurance) across public and private finance systems to protect against the effects of climate change.

The rapidly evolving risk landscape described in this report reinforces the need for comprehensive, risk-informed financial planning. INFFs can play a pivotal role in that effort by enabling countries to integrate climate risk analytics, adaptation planning and risk financing strategies into national development finance systems.

The evidence review and critical appraisal conducted in this paper have shown the tangled nature of the climate-debt nexus and demonstrated that climate risks impact negatively on the ability of developing and vulnerable countries to sustain SDG investments in the long term. The shrinking fiscal space – driven by the intersection of debt distress, climate vulnerability and uneven ODA allocation to developing countries – underscores the urgent need for strategic financial planning. In this context, approaches like INFFs are more essential than ever to align resources, manage risks and mobilize investment to address the climate emergency.

This section presents a practical framework for integrating climate risk analytics and financing into INFFs, structured according to the four INFF building blocks: (i) assessment and diagnostics; (ii)

financing strategy; (iii) monitoring and review; and (iv) governance and coordination.

## **Assessments and diagnostics: Integrating climate risk analytics**

This paper has already discussed the pervasive effects of climate risks on development processes, bringing economies to a low equilibrium for investments through various transmission channels in the economy. Climate risk management approaches in the form of climate risk analytics, adaptation measures and climate finance and CDRF instruments can be leveraged in INFF formulation and implementation to minimize climate change's negative impacts, acting as firewalls in the financial system (both public and private).

## **Financing strategy: Climate risk-informed instruments and processes**

Table 3 presents a structured, non-exhaustive set of climate risk-informed processes and instruments across key sources of SDG finance. While not comprehensive, it reflects the main categories of interventions observed across INFFs and related climate and disaster risk financing practice.

Table 3

## Examples of climate risk-informed approaches by financial strategy area

FINANCING SOURCE	ACTIONS TO MAKE FINANCE TYPE CLIMATE RISK-INFORMED
Public finance	<p><b>Processes</b></p> <ul style="list-style-type: none"> <li>• <b>Incorporate climate risk in budget documents including Fiscal Risk statements:</b> Indicate risks and funding requirements for resilience-building and strengthen fiscal risk assessment and disclosures.</li> <li>• <b>Public Expenditure and Financial Accountability (PEFA) climate assessments:</b> Identify weaknesses in climate-responsive PFM.</li> <li>• <b>Sectoral assessments:</b> List vulnerable investments and assets.</li> <li>• <b>Climate budget tagging:</b> Align public budgets with climate risk mitigation and adaptation priorities.</li> <li>• <b>Public investment alignment:</b> Align public investment with priorities for resilience-building.</li> <li>• <b>Budget execution rules:</b> Establish trigger points for budget reallocation.</li> <li>• <b>Audits:</b> Establish systems for climate budget audit.</li> <li>• <b>Expenditure reviews:</b> Evaluate efficiency and effectiveness of climate expenditures.</li> <li>• <b>Taxation:</b> Align tax policies with climate action, including review of tax expenditures. Determine how tax policies can be reformed to generate additional finances for climate action.</li> <li>• <b>Contingent expenditure provisions:</b> Create flexible budget rules that allow repurposing of expenditures during emergencies.</li> <li>• <b>Shock responsive social protection systems:</b> Enable timely and scalable support to vulnerable populations in response to shocks, leveraging pre-arranged financing and delivery mechanisms.</li> </ul> <p><b>Financing instruments</b></p> <ul style="list-style-type: none"> <li>• <b>Thematic bonds:</b> Raise public finance for resilience-building interventions.</li> <li>• <b>Carbon taxation:</b> Collect revenue from emissions that increase climate risks.</li> <li>• <b>Catastrophe bonds:</b> Layer risk finance in the event of a high-severity hazard.</li> <li>• <b>Budget contingencies:</b> Earmark specific funds for risk management and reduction.</li> <li>• <b>Public asset insurance:</b> Insure critical and vulnerable assets to rebuild quickly.</li> <li>• <b>Sovereign insurance and reinsurance:</b> Transfer disaster risk to insurance and reinsurance markets to secure timely liquidity following shocks.</li> <li>• <b>National risk pools</b></li> <li>• <b>Debt pause clauses:</b> Maintain fiscal sustainability in hazard recovery.</li> <li>• <b>Debt for Nature swaps:</b> Restructure sovereign debt in exchange for commitments to finance conservation and resilience investments.</li> </ul>

FINANCING SOURCE	ACTIONS TO MAKE FINANCE TYPE CLIMATE RISK-INFORMED
International climate finance	<p><b>Processes</b></p> <p><b>Loss and damage assessment:</b> Highlight historical shortfalls from climate-linked hazards.</p> <p><b>Flexible processes for humanitarian relief:</b> Make use of tools like Automated System for Relief Consignments to prevent friction in receiving relief.</p> <p><b>Instruments</b></p> <p><b>Pre-arranged finance:</b> Set up contingent credit lines to reduce overreliance on domestic, non-concessional and humanitarian disaster finance.</p> <p><b>Humanitarian aid:</b> Agree on residual risk appetite to be filled by non-arranged relief.</p>
Private commercial finance	<p><b>Processes</b></p> <p><b>Stress-testing:</b> Assess institutional and sectoral systemic risks.</p> <p><b>Sector exclusion regulation:</b> Limit exposure to sectors that are vulnerable to hazards and sectors that increase vulnerability.</p> <p><b>Green taxonomies:</b> Define resilience-building investments.</p> <p><b>Instruments</b></p> <p><b>Reserve requirements:</b> Secure liquidity for appropriate hazard responses.</p> <p><b>Thematic bonds:</b> Raise private finance for resilience-building interventions.</p> <p><b>Blended finance and green credit guarantees:</b> De-risk the entry of private capital into investments for resilience.</p>
Insurance sector	<p><b>Processes</b></p> <p><b>Protection gap assessments:</b> Analyse shortfalls in existing insurance coverage.</p> <p><b>Instruments</b></p> <p><b>Parametric insurance:</b> Distribute payouts to policyholders in anticipation of the hazard.</p> <p><b>Microinsurance schemes:</b> Expand coverage to vulnerable households and businesses.</p> <p><b>Public-private insurance pools:</b> Increase the affordability of coverage for high-risk events.</p> <p><b>Reinsurance:</b> Offset risks from covariate shocks.</p>

The examples of Maldives, Rwanda and Thailand illustrate how some of these elements can be prioritized and used in the formulation of INFFs to enhance risk management tools that act as enablers for the other pillars in the strategy. Many of the

processes and instruments identified above will need to be supported by data-driven and probabilistic climate risk analysis. Box 7 explores the concept of climate risk analytics, its implications and the inputs required.

## Unpacking climate risk analytics

Climate risk analytics (CRA) is a technically demanding process that combines climate science, risk modelling and economic analysis to assess the impacts of climate hazards on populations, infrastructure and economies. It forms the backbone of evidence-based climate-informed financial planning and can be an essential element in developing actionable strategies within INFFs.

At the core of CRA lies three fundamental and integrated data layers: **hazard, exposure** and **vulnerability**. Hazard data includes information on the frequency, intensity and duration of climate events such as droughts, floods and storms. Exposure data captures the physical and economic assets – like infrastructure, populations or productive sectors – likely to be affected. Vulnerability data provides insight into the sensitivity and adaptive capacity of different communities, ecosystems and systems. Together, these data sets form the foundation for assessing risk and determining its financial and development implications.

The implementation of CRA requires a diverse range of **data inputs**, including historical and projected climate variables, national accounts and macroeconomic indicators (e.g. GDP, public capital stock), geographic and spatial data sets, sectoral investment plans and social development indicators (such as poverty or human development indices). These can be sourced from global platforms – such as **Copernicus, IMF, IPCC, NGFS**, the **US National Oceanic and Atmospheric Administration (NOAA)**, the **United Nations Office for Disaster Risk Reduction (UNDRR)** and the **World Bank Climate Change Knowledge Portal** – as well as national institutions including meteorological services, disaster risk management authorities and planning ministries. Several open-source tools and portals also support the risk mapping process, including **CLIMADA** and **OS-Climate**.

On the **technical skills side**, CRA requires a fusion of capabilities in climate modelling, macroeconomic analysis, risk assessment and geospatial analysis. Climate modellers must be able to interpret downscaled climate projections and apply scenario-based assessments using IPCC reference scenarios (e.g. “Orderly Transition” or “Hot House World”). Economists and risk modellers can translate climate and hazard data into monetary and sectoral impacts using techniques like Dynamic General Equilibrium (DGE) models, Dynamic Input-Output (DIO) models or Stock-Flow Consistent (SFC) frameworks. These are used to estimate changes in productivity, capital depreciation, consumption, trade and fiscal sustainability in light of climate shocks.

CRA also involves **probabilistic modelling** to assess the likelihood and severity of low-frequency, high-impact events (e.g. 1-in-50-year floods), which is critical for the design of financial protection instruments such as insurance, contingent financing or catastrophe bonds. Spatial analysis platforms (like **QGIS** or **Google Earth Engine**) and climate dashboards are often used for visualizing hotspot areas and assessing the economic value at risk.

An important application of climate risk analytics is the estimation of the “cost of inaction” – that is, the projected economic and fiscal losses associated with delaying or foregoing investments in climate adaptation and resilience. By comparing expected damages under a no-action scenario with the costs and benefits of resilience investments, cost-of-inaction analyses can help inform financing strategies within INFFs, including the prioritization of investments, the choice between risk retention and risk transfer and the justification for concessional finance and risk financing instruments.

Recognizing the complexity of this work, countries are encouraged to adopt a **progressive and modular approach** that builds on existing institutional capabilities and leverages partnerships. Several multilateral development banks and technical institutions provide support in this space, including the **African Development Bank (AfDB), African Risk Capacity (ARC), IMF, UNDP** and the **World Bank**. Private sector leaders, for example members of the **Global Risk Modelling Alliance (GRMA)**, offer advanced analytics.

Ultimately, CRA is not just a technical necessity – it is a **strategic enabler** for financial resilience, allowing risk layering and the deployment of cost-effective financial instruments. By investing in foundational data systems, developing interdisciplinary expertise and building collaborative relationships with knowledge providers, governments can generate the robust evidence base required to unlock climate finance and build robust fiscal systems that can withstand climate shocks.

Since climate risk analytics capacities may not be readily available within national institutions, a concerted effort is needed to build these capacities, particularly among finance ministries, national insurers and financial institutions. Embedding climate risk analysis into these institutions will enable them to systematically assess the resilience of national

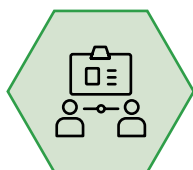
accounts, balance sheets and financial operations. This, in turn, will support more effective risk management, such as tailoring financial instruments to levels of vulnerability, and will ultimately facilitate a more stable and proactive flow of investment into national economies.

## Monitoring and review: Tracking climate risk impacts on SDG financing

A number of policies can be implemented to improve monitoring and review of quantified impacts of climate risks on SDG financing at the national level. Key recommendations include:



Strengthening existing MRV systems – Align national climate finance reporting with government expenditure and investment databases, while also enhancing coordination among relevant ministries, including for activities such as climate budget tagging.



Investing in local capacities to develop and interpret data – Improve basic infrastructure like weather stations, develop early warning systems, provide training on geospatial analysis, determine cost of inaction and carry out comprehensive economic loss assessments after disasters to quantify impacts on public finance and the broader economy.



Transparent tracking and evaluations of post-disaster expenditure – Improve the effectiveness of public spending in climate emergencies and inform future resilience investments without impeding disaster response efforts.

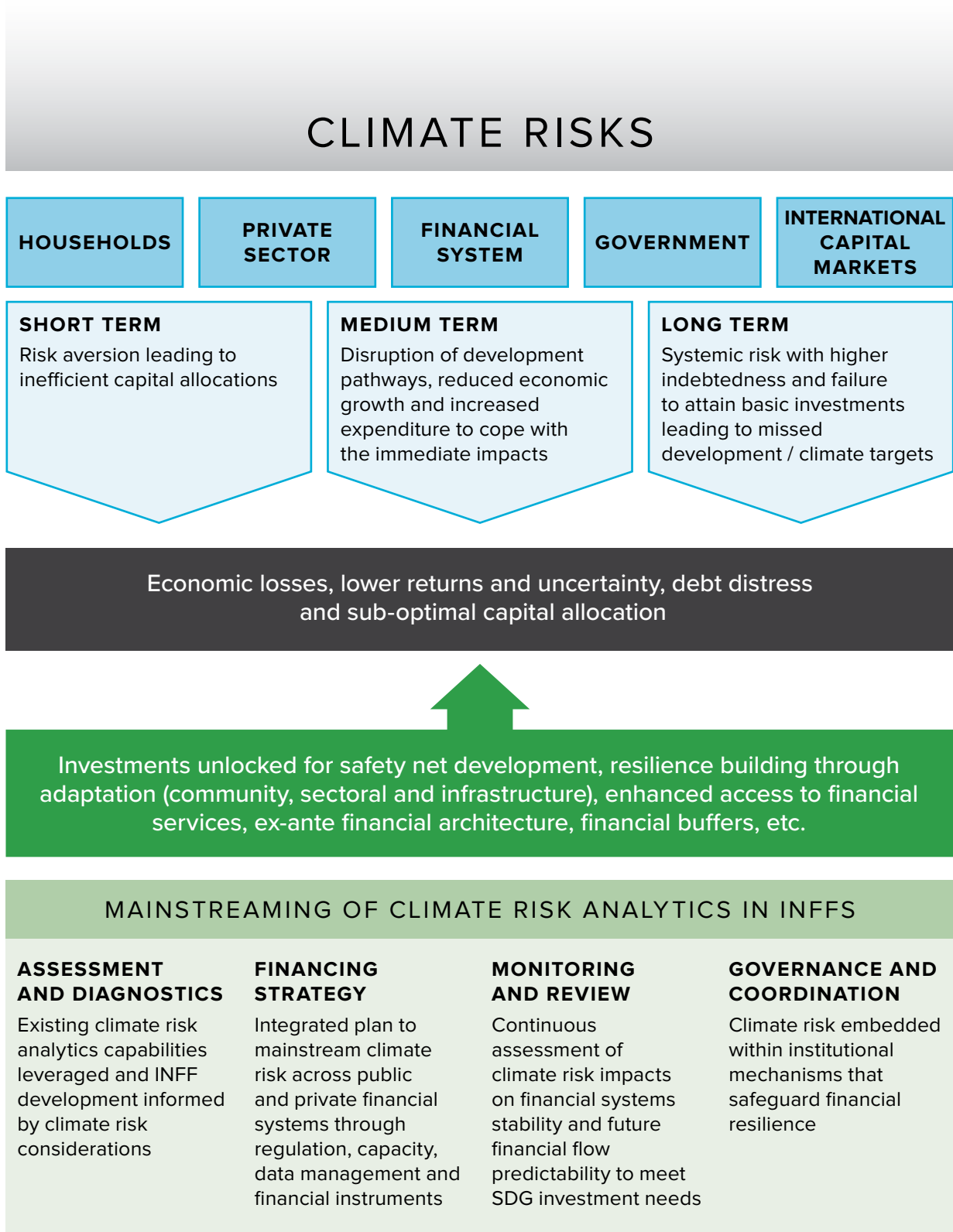
## Governance and coordination: Institutional arrangements for risk-informed INFFs

Likewise, governance and co-ordination structures established through the INFF process can be enhanced to become risk-informed. Firstly, processes should align with and reinforce existing national climate policy frameworks by actively engaging climate focal point entities, disaster risk management authorities, parliamentary select committees and relevant members of academia alongside finance ministries. This collaborative approach ensures that INFFs benefit from established expertise and mandates, streamlining climate risk integration and avoiding stakeholder fatigue. Secondly, it is crucial to create or strengthen in-country climate finance structures, such as dedicated technical units within ministries or broader country-led climate finance platforms. These platforms foster collaboration among governments, the private sector and development finance institutions to develop investment plans, co-create project pipelines and address policy bottlenecks, thereby accelerating climate action and mobilizing the significant financing required for climate goals.

Figure 5 summarizes these entry points for risk mainstreaming in INFFs.

Figure 5

## Role of risk-informed INFFs in building climate resilience



(Source: Own elaboration)



# Conclusion

This policy note addresses the mitigation of climate risks to SDG financing within the nationally led INFF processes.

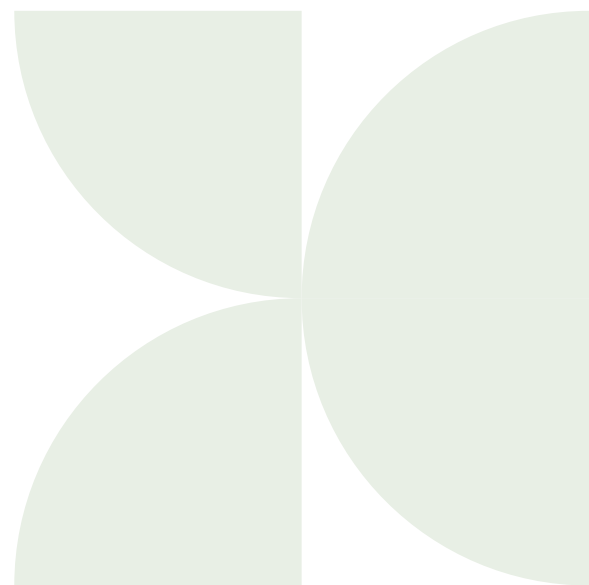
Firstly, the paper examined the impacts of climate change on SDG financing. There remain **significant gaps in the resources required** to achieve the SDGs and reach global climate objectives. The fight to close this gap – and to prevent it from widening – is hindered by climate risks that are growing in severity. In particular, **impacts on tax collection, reconstruction costs and sovereign borrowing rates demonstrate that domestic public finance could be curtailed by concerns over debt sustainability**. With regard to domestic private finance, volatile climate impacts could lead to dramatic underprovision of both credit and insurance products, which could stymie firm- and household-level investments. At the international level, private finance will be affected likewise. Climate change will compound already high perceived risk levels, leading to a **reallocation of finance away from the countries that need it most**. Finally, while climate risk is unlikely to causally affect international public financial flows, increased demands for assistance with debt sustainability and humanitarian relief will **capture resources that – in the absence of risk – could have been used to drive development progress**.

Next, the policy note looks at existing INFFs. Overall, **there is considerable integration of risks into INFFs**. Climate change as a risk is often mentioned, albeit at a surface level. However, few documents seek to quantify the impacts of climate change, or explicitly make a link to public and private financial flows. The case studies on the INFF process in Maldives, Rwanda and Thailand demonstrate real-world examples of climate risk integration into the development financing processes and give rise to policy recommendations on the basis of these experiences.

Finally, the policy note considers **a framework for the wider adoption of climate risk-informed INFFs**. It presents recommendations **across the INFF building blocks**:

1. assessments and diagnostics;
2. financing strategy;
3. monitoring and review; and
4. governance and coordination. The framework focuses on the role of climate risk analytical tools as an enabler for processes and financial instruments within the INFF processes.

To foster sustainable and climate-resilient development, **national financial systems must become intrinsically resilient to climate shocks and adept at mobilizing diverse resources**. INFFs can significantly contribute to this objective. By conducting comprehensive climate risk assessments, implementing innovative financing instruments, enhancing monitoring for transparent resource allocation and strengthening multi-stakeholder governance and coordination, INFFs can safeguard continued progress toward the SDGs in an increasingly risky world.



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