The Adaptation Principles
A Guide for Designing Strategies for Climate Change Adaptation and Resilience

Priority Area 1: Facilitate the adaptation of people and firms

Priority Area 2: Adapt land use plans and protect critical public assets and services

Priority Area 3: Help firms and people manage residual risks and natural disasters

Priority Area 4: Manage financial and macrofiscal issues

Foundations: Rapid, robust, and inclusive development

Application: Prioritization, implementation, and monitoring progress

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The Adaptation Principles

A Guide for Designing Strategies for Climate Change Adaptation and Resilience
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### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>BCP</td>
<td>business continuity plans</td>
</tr>
<tr>
<td>Cat-DDOs</td>
<td>Catastrophe Deferred Drawdown Options</td>
</tr>
<tr>
<td>CGE</td>
<td>computable general equilibrium (model)</td>
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<tr>
<td>CPEIR</td>
<td>climate change public expenditure and institutional review</td>
</tr>
<tr>
<td>CVA</td>
<td>climate vulnerability assessment</td>
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<tr>
<td>DSGE</td>
<td>dynamic stochastic general equilibrium</td>
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<tr>
<td>EIU</td>
<td>Economist Intelligence Unit</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>FONDEN</td>
<td>Fondo de Desastres Naturales / natural disasters fund</td>
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<tr>
<td>GDP</td>
<td>gross domestic product</td>
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<tr>
<td>GFDRR</td>
<td>Global Facility for Disaster Reduction and Recovery</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
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<tr>
<td>IO</td>
<td>input-output</td>
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<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
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<tr>
<td>ISO</td>
<td>International Standards Organisation</td>
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<tr>
<td>LMIC</td>
<td>low- and middle-income countries</td>
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<td>MDB</td>
<td>multilateral development bank</td>
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<tr>
<td>M&amp;E</td>
<td>monitoring and evaluation</td>
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<tr>
<td>NDC</td>
<td>nationally determined contribution</td>
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<tr>
<td>NPV</td>
<td>net present value</td>
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<tr>
<td>PCRAFI</td>
<td>Pacific Catastrophe Risk Assessment and Financing Initiative</td>
</tr>
<tr>
<td>PD-PFM Review</td>
<td>Post-Disaster Financial Management Review and Engagement Framework</td>
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<tr>
<td>PFM</td>
<td>public finance management</td>
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<tr>
<td>PIM</td>
<td>public investment management</td>
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<tr>
<td>PMT</td>
<td>proxy means testing</td>
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<td>PPP</td>
<td>public-private partnership</td>
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<tr>
<td>PPP*</td>
<td>purchasing power parity</td>
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<tr>
<td>R&amp;D</td>
<td>research and development</td>
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<tr>
<td>RDM</td>
<td>robust decision making</td>
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<tr>
<td>SOE</td>
<td>state-owned enterprise</td>
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<tr>
<td>TFP</td>
<td>total factor productivity</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
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</table>

*used in figures only

All dollar amounts are US dollars unless otherwise indicated.
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The Adaptation Principles:

A summary

Climate change is causing risks and pressures that increasingly force societies to rethink their priorities and principles for achieving societal well-being and economic development.

Proactive and robust actions are crucial to safeguard the continued potential of sustainable development. If prioritized according to countries’ objectives, needs, and risks, such actions can help reduce and manage climate risks, accelerating development and poverty reduction.

This guide aims to help ministries of finance or economy—who oversee the wider economic system—approach adaptation challenges. It does not go into detailed adaptation strategies at sector level; rather, it focuses on concrete macroeconomic-level actions. These actions reflect universal principles for effective climate change adaptation, though the relative importance and sequence of these actions will differ by country.
The actions pertain to six principles of climate change adaptation, which correspond to common policy domains (*figure S.1*):

1. Ensure development is rapid and inclusive and offers protection against shocks
2. Facilitate the adaptation of firms and people
3. Adapt land use and protect critical public assets and services
4. Help firms and people cope with and recover from disasters and shocks
5. Anticipate and manage macroeconomic and fiscal risks
6. Prioritize, implement, and monitor interventions
Priority areas and concrete actions for climate change adaptation and resilience policy: an overview

**Application: Prioritization, implementation, and monitoring progress**

**LEAD MINISTRIES:** Finance/economy and agency in charge of climate change

**ACTION A.1 >>**
Create a strong institutional and legal framework, with appropriate stakeholder involvement

**ACTION A.2 >>**
Design an adaptation and resilience strategy with prioritized actions

**ACTION A.3 >>**
Set concrete sector-level targets to guide implementation by line ministries

**ACTION A.4 >>**
Screen all public policies and expenditures for disaster and climate risks, and align them with adaptation targets

**ACTION A.5 >>**
Allocate appropriate funding to the adaptation and resilience strategy

**ACTION A.6 >>**
Track progress over time, and review and revise the strategy

**FIGURE S.1 >>**
Priority areas and concrete actions for climate change adaptation and resilience policy: an overview

**PRIORITY AREA 1**
Facilitate the adaptation of people and firms

**LEAD MINISTRY**
Economy

**ACTION 1.1 >>**
Assess disaster and climate risks, and make the information available

**ACTION 1.2 >>**
Clarify responsibilities and align incentives with resilience and adaptation objectives

**ACTION 1.3 >>**
Facilitate access to technologies through trade policies and investments in research and development

**ACTION 1.4 >>**
Ensure financing is available to all, and provide support to the poorest and most vulnerable people

**ACTION 1.5 >>**
Facilitate structural change in the economic system

**PRIORITY AREA 2**
Adapt land use plans and protect critical public assets and services

**LEAD MINISTRY**
Economy, planning, investment, or infrastructure

**ACTION 2.1 >>**
Identify critical public services and assets

**ACTION 2.2 >>**
Design and implement a government-wide strategy to increase the resilience of infrastructure and public assets

**ACTION 2.3 >>**
Revise land use and urban plans to make them risk-informed

**PRIORITY AREA 3**
Help firms and people manage residual risks and natural disasters

**LEAD MINISTRY**
Interior or environment

**ACTION 3.1 >>**
Save lives (and money) with hydromet, early warning, and emergency management systems

**ACTION 3.2 >>**
Provide all firms and households with risk management instruments

**ACTION 3.3 >>**
Develop the insurance sector, building on public-private partnerships

**ACTION 3.4 >>**
Build a social protection system and make it responsive to shocks

**ACTION 3.5 >>**
Help firms develop business continuity plans and financial preparedness

**ACTION 3.6 >>**
Be prepared to build back better after disasters with contingency plans and financing

**PRIORITY AREA 4**
Manage financial and macrofiscal issues

**LEAD MINISTRY**
Finance

**ACTION 4.1 >>**
Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process

**ACTION 4.2 >>**
Develop a financial strategy to manage contingent liabilities, combining multiple instruments

**ACTION 4.3 >>**
Anticipate and plan for long-term macroeconomic impacts

**ACTION 4.4 >>**
Communicate and mitigate the disaster and climate risk exposure of the financial sector and pension systems

**PRIORITY AREA 5**
Facilitate the adaptation of people and firms

**LEAD MINISTRY**
Economy

**ACTION 5.1 >>**
Assess disaster and climate risks, and make the information available

**ACTION 5.2 >>**
Clarify responsibilities and align incentives with resilience and adaptation objectives

**ACTION 5.3 >>**
Facilitate access to technologies through trade policies and investments in research and development

**ACTION 5.4 >>**
Ensure financing is available to all, and provide support to the poorest and most vulnerable people

**ACTION 5.5 >>**
Facilitate structural change in the economic system

**Connection Points**

**FOUNDATIONS: RAPID, ROBUST, AND INCLUSIVE DEVELOPMENT IS THE FIRST PRIORITY**

**LEAD MINISTRY:** Finance/economy

**ACTION F.1 >>**
Increase economic productivity and growth, while keeping buffers for shocks

**ACTION F.2 >>**
Ensure that economic growth is inclusive

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**SUMMARY 3**
This guide contains practical tools, concrete examples and other information to guide decision makers through the principles of adaptation and help governments formulate effective strategies that enable their societies to thrive in a time of climate change. These include:

- **SCREENING QUESTIONS**
  - to identify the most urgent and effective actions to increase climate resilience and guide the selection of the priorities.

- **TOOLBOXES**
  - offering concrete quantitative examples of how these questions can be answered using commonly available data and methods.

- **INDICATORS AND TARGETS**
  - to monitor and evaluate progress towards the objectives mandated by a national adaptation strategy. 
  - Annex 1 lists proposed indicators or targets, though the list is not exhaustive and other options are available.

- **COVID-19 SPOTLIGHTS**
  - providing information on how the current health and economic crisis changes the priorities and preferred solutions for building resilience and adapting to climate change.

A common theme to each of the policy areas and proposed actions is the large uncertainty on future climate change, especially at the local level, and future vulnerabilities. The direct implication is the need to design adaptation and resilience strategies in a risk management and continuous learning framework. This means avoiding measures that are designed for a precise scenario of the future, instead prioritizing interventions that are robust and flexible, and can be adjusted over time as more information becomes available.
Lay the foundations for adaptation through rapid, robust, and inclusive development

**LEAD MINISTRY: Finance/economy**

Policies to reduce poverty and catalyze robust economic development are most effective for reducing vulnerability to climate change. Poverty and the lack of access to basic services—including critical infrastructure, financial services, health care, and social protection—are strong predictors of vulnerability to climate change. No targeted adaptation strategy can be successful without eradicating extreme poverty and ensuring high-vulnerability populations have the financial, technical, and institutional resources they need to adapt.

**ACTION F.1 >>**

**Increase economic productivity and growth, while keeping buffers for shocks**

Recommendations to improve economic growth and accelerate development have been widely studied and advocated elsewhere, so it is not a focus in this document. But without appropriate economic and social policies, targeted adaptation measures alone cannot reduce vulnerability to climate change in a significant manner. Macroeconomic stability and the usual buffers against shock also improve countries’ ability to deal with unexpected shocks or stresses, including climate-related ones.

**ACTION F.2 >>**

**Ensure that economic growth is inclusive**

It is vital that nobody is left behind. And while rapid development usually reduces poverty and therefore extreme vulnerability to climate change, it can also hide large heterogeneity across regions or socioeconomic groups. Ensuring smallholder farmers have resilient livelihoods and all populations have access to infrastructure services (such as sanitation) and risk management tools (such as savings accounts, health care coverage, and social protection) is the most efficient way of reducing the long-term impact of climate change and natural disasters. **Toolbox A**—in the main text of this guide—offers examples of how to explore these dimensions using commonly available data and specialized indicators, such as the University of Notre Dame Adaptation Initiative’s ND-GAIN Index or the World Bank’s Socioeconomic Resilience Indicator.

While good development and the eradication of extreme poverty can do much to reduce future climate change impacts (and short-term disaster losses), additional adaptation and resilience actions can also be beneficial and highly cost-effective. This guide therefore also covers four priority areas for action.
Facilitate the adaptation of people and firms

The good news is that private actors have an incentive to increase their resilience and adapt to climate change. However, they face a range of obstacles, from the lack of information and behavioral biases to imperfect markets and financial constraints. Governments need to minimize these obstacles to maximize the economy’s adaptive capacity and prevent (as much as possible and desirable) climate change impacts and natural disasters.

ACTION 1.1 >>
Assess disaster and climate risks, and make the information available
Governments must ensure the information people need to adapt to climate change and manage natural risks is widely accessible, free (or cheap enough), and in a simple format that decision makers can use. People and firms need information on many kinds of threat—those from natural hazards, threats to human capital and key sectors, and cross-border threats, including risks linked to food prices. One important consideration relates to uncertainty on future climates and the likelihood of various natural hazards. When deciding how to communicate climate change information to the public, governments must ensure they communicate the large uncertainty around future climate change impacts, and not only one “most likely” scenario.

ACTION 1.2 >>
Clarify responsibilities and align incentives with adaptation and resilience objectives
To ensure that private actors—households and firms—are making the right decisions to manage climate change and natural disasters, governments should clearly establish responsibilities and liabilities in law, and communicate these to all actors. Private actors should be informed about the extent of disaster protection provided by public investments and infrastructure. For example, in the Netherlands, the level of flood protection that the government is required to provide to the population is legally defined, so individuals and firms can decide where to live and invest, and what additional flood management measures they need to invest in. And when private firms provide public services—such as electricity supply—then regulation is needed to define risk management responsibilities in a way that aligns private actors’ incentives with public interest (including in the case of force majeure) (figure S.2).
Creating the right resilience incentives for infrastructure service providers requires a consistent set of regulations and financial incentives.

**FIGURE S.2**

Creating the right resilience incentives for infrastructure service providers requires a consistent set of regulations and financial incentives.

1. Government or regulator defines and enforces an “intolerable” level of risk through a minimum standard in construction codes or procurement.
2. Government or regulator defines an “acceptable” level of risk that can be tolerated (force majeure event).
3. Government or regulator adds incentives to align the interests of service providers with public interest, with penalties and rewards based on social cost.
4. Developer designs project above the minimum standard.

**FIGURE S.3**

Innovation for climate change adaptation as a share of total innovation.

- **Acceptable risks:** For rare events, infrastructure assets are expected to experience damage or disruptions that need to be managed through contingent planning.
- **Risk with the government:**
- **Risk at least partly with the provider:**
- **Risk with the provider:**
  - Force majeure
  - Project-specific design
  - Minimum standard
  - Intolerable risks: Infrastructure should resist frequent hazards.
  - Small, frequent hazard
  - Major, rare event

Source: Glachant et al. 2020, based on PATSTAT data.

**Note:** Pure adaptation refers to technologies for climate change adaptation that are not simultaneously classified as mitigation technologies.
ACTION 1.3 >>

**Facilitate access to technologies through trade policies and investments in research and development**

Effective adaptation will depend on countries being able to draw on the best available technologies for mitigating climate change impacts, especially in the agriculture and health sectors. But there are many obstacles—from traditional knowledge spillover and lack of capacity to trade barriers—that impair access to and adoption of technologies.

International patent registrations show that innovation in adaptation is not growing as a share of total innovation (*figure S.3*) and is concentrated in high-income countries and a handful of middle-income countries. Transfers of this innovation are also insufficient, with almost no transfers to low-income countries, where needs are likely the largest. This suggests the need for countries to support all types of innovation—from high-tech solutions to institutional and process-based innovation—with a focus on local needs, and to facilitate technology transfers with appropriate regulations, trade policies, and capacity-building investments.

ACTION 1.4 >>

**Ensure financing is available to all, and provide direct support to the poorest and most vulnerable people**

High upfront costs or affordability issues may stop private actors from implementing effective solutions. Even if these costs are more than compensated in the long term by avoided impacts and losses, the lack of financing can be a serious obstacle for credit-constrained firms and households. And in the absence of external support, hundreds of millions of people in or close to poverty will be impacted by climate change and have limited ability to respond and adapt. Direct support through social protection or subsidies for resilience-building interventions can play a key role in reducing their vulnerability. *Toolbox B*—in the main text of this guide—reviews methodologies to identify the most at-risk population due to the combination of poverty and vulnerability.
Facilitate structural change in the economic system

Climate change will affect latent comparative advantage. For example, it will make some countries less productive in certain types of agriculture, to the benefit of others; it will also cause the decline of some sectors and the growth of others. Governments need to manage and facilitate economic transition, deal with coordination issues, and ensure social consequences are minimized. In practice, however, the risk is that an important sunset sector (one that is bound to lose competitiveness in coming years and decades) becomes non-profitable exactly when the country needs to be making large investments to boost another sector. Experience from regions where coal mining or heavy industries disappeared in Europe shows how difficult it is to manage a successful transition, especially when a region has a narrow economic base, is isolated geographically, and has a population with limited skills and investment capacity. Governments have various options for addressing this situation:

» Support sunrise sectors and activities to maximize their development potential. Climate change may create new comparative advantages in some countries, and those where key sectors will be negatively affected must prepare to capture the opportunities climate change creates. However, if these comparative advantages face obstacles such as high upfront capital investments, increasing returns to scale, or network effects, then a country may struggle to turn such latent advantages into growth and economic opportunities. Several studies offer guidance on how industrial policies can help transform latent comparative advantages into real economic opportunities, especially if countries face the risk of a low-productivity trap.

» Manage sunset sectors and activities to facilitate a smooth transition. Some economic sectors may be strongly affected by climate change, with significant implications for jobs and tax revenues. For example, some agricultural production may become non-competitive or unsustainable, snow-based tourism may disappear from low-altitude mountains and summer destinations may become too hot to attract tourists. Targeted policies can help declining industries better manage the drop in activity (for example, by ensuring the least productive firms close first). This may be costly, but it can be justified by distributional considerations or the desire to smooth a transition.

» Support economic diversification to hedge against climate risks. Diversifying away from narrow economic bases is key to reducing vulnerability to climate change and other technological or preference shocks, including those caused by decarbonizing the world economy. But it is also desirable for governments to diversify their economy to accelerate economic growth.
ADAPTATION PRINCIPLES

PRIORITY AREA 2 >> Adapt land use plans and protect critical public assets and services

LEAD MINISTRY: Economy, planning, investment, or infrastructure

Beyond direct support to households and businesses, governments have a transformative role to play in ensuring their country, their economy and their citizens can adapt to climate change. This is particularly the case to ensure the adaptation of important public assets and infrastructure systems such as power systems, roads, water and sanitation, and essential services such as health care, education, safety and security. Urban and land use plans also influence massive private investments in housing and productive assets, so it is vital these adapt to evolving long-term climate risks to avoid locking people into high-risk areas.

ACTION 2.1 >> Identify critical public services and assets

Critical public services such as energy, water, health care, civil protection, and education need to take a thorough approach to assessing and managing climate risks. Not only can their reconstruction be costly; they also provide critical services which people’s well-being depends on. For a systematic risk and vulnerability assessment, governments must develop inventories of key public assets, including primary health care facilities, hospitals, and schools. Assessing the resilience of service delivery in critical sectors can also be a useful exercise. In networked systems, such as transport or power systems, the criticality analysis described in toolbox C—in the main text of this guide—can help governments identify the most important assets or system components, to invest more resources in their resilience (figure S.4).

ACTION 2.2 >> Design and implement a government-wide strategy to increase the resilience of infrastructure and public assets

There is a consensus among experts that governments have a key role to play in ensuring the resilience of critical infrastructure and that they should adopt a whole-of-government approach. Infrastructure disruptions in developing countries are estimated to cost firms more than $300 billion and households over $90 billion each year. But if countries have the right data, risk models, and decision-making methods available, the incremental cost of building the resilience of infrastructure assets is small—only around 3 percent of investment needs.
The main challenge to making infrastructure more resilient is thus not primarily a financing one. Rather, it is a question of governance and the ability to make and enforce good decisions, designs, operations, and maintenance. One priority is focusing on the early stages of infrastructure system development: designing regulations, producing hazards data and master plans, or the initial stages of asset design (toolbox D in the main text of this guide). This is when small, low-cost investments can significantly improve the overall resilience of infrastructure systems, generating huge benefits. The other priority is improving maintenance. As well as increasing the vulnerability of infrastructure assets, poor maintenance also increases infrastructure investment needs by 50 percent in the transport sector and more than 60 percent in the water sector. Using an infrastructure asset management system to ensure proper maintenance, utility companies can better manage their operations, reduce operational costs, and boost resilience.

**Figure S.4**  
The criticality of a road depends on how it is used

a. Critical roads for household consumption

<table>
<thead>
<tr>
<th>Location</th>
<th>Household loss (% of daily consumption)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>0.7</td>
</tr>
<tr>
<td>Arusha</td>
<td>0.4</td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>0.1</td>
</tr>
<tr>
<td>Dodoma</td>
<td></td>
</tr>
<tr>
<td>Morogoro</td>
<td></td>
</tr>
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<td>Mwanza</td>
<td></td>
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<tr>
<td>Dem. Rep. of Congo</td>
<td></td>
</tr>
</tbody>
</table>

b. Critical roads for international clients

<table>
<thead>
<tr>
<th>Location</th>
<th>Importer loss (% of daily consumption)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>3</td>
</tr>
<tr>
<td>Arusha</td>
<td>1.7</td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>0.5</td>
</tr>
<tr>
<td>Dodoma</td>
<td></td>
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<tr>
<td>Morogoro</td>
<td></td>
</tr>
<tr>
<td>Mwanza</td>
<td></td>
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<tr>
<td>Mbeya</td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
</tr>
<tr>
<td>Dem. Rep. of Congo</td>
<td></td>
</tr>
</tbody>
</table>

**ACTION 2.3 >>**

**Revise land use and urban plans to make them risk-informed**

Land markets are powerful tools for driving new construction in a way that efficiently meets population needs. However, they are also imperfect, and often fail to fully internalize climate change and natural hazards. In some countries, land markets are even dysfunctional, with most of the population living in dwellings that have informal arrangements and no land use or urban planning. As a result, developments often occur in risky areas, especially when developers do not carry the cost of future climate change impacts. Land use regulations can help by ensuring that new development takes place in safe areas or those that can be easily and cheaply protected. They can also avoid unchecked urban development that leaves too little porous green space, further increasing runoff and flood risk.

Where possible, governments should mandate local authorities to revise their land use and urbanization plans, using hazard maps that consider climate change (toolbox E in the main text of this guide). Choices around the localization of power, water, sanitation, and transit infrastructure guide spatial development and influence land use, land use intensity, land values, and employment and population densities (figure S.5). Planners can use infrastructure master plans and new investments to guide urban growth towards safe zones. Risk-sensitive land use and urbanization plans must also abide by construction norms and building regulations. The quality of construction and the role played by building regulations are key determinants of climate resilience. In places with little capacity to create and enforce risk-sensitive land use and urban plans, alternative approaches include allocating the riskiest land such as flood zones to non-residential use—for example, by creating urban parks to minimize the risk of encroachment.

---

**FIGURE S.5 >>**

Urbanization in Addis Ababa, Ethiopia, closely follows the major public transport lines.

Source: NASA, MODIS Imagery 2002–2013 for built-up area and OpenStreetMap for road infrastructure.
Help firms and people manage residual risks and natural disasters

LEAD MINISTRY: Interior or environment

While effective risk mitigation can go a long way in reducing losses and damages, some natural shocks are too extreme and intense to be prevented. Governments must develop strategies to ensure that when disasters do occur, people and firms can cope without devastating long-term consequences, and can recover quickly.

ACTION 3.1 >>

Save lives (and money) with hydromet, early warning, and emergency management systems

Weather forecasts enable the anticipation of and preparation for extreme events, and timely evacuation can save thousands of lives. Preparation reduces physical damage and economic losses—for example, shuttering windows ahead of a hurricane can reduce damage by up to 50 percent. The benefits of providing universal access to early warning systems globally have been repeatedly found to largely exceed costs, by factors of at least 4 to 10. There is also a set of good practices to ensure that early warnings are communicated properly so that people can act upon them and that shelters meet communities’ needs. This includes considering gender issues, access for people with disabilities, and how to organize shelters in times of epidemics and pandemics like COVID-19.

ACTION 3.2 >>

Provide all firms and households with risk management instruments

Helping households cope with and recover from shocks requires a holistic and flexible risk management strategy with a range of policy instruments appropriate for different disasters and affected populations. Poorer and richer households have different needs and can be supported with different instruments (figure S.6).
ACTION 3.3 >>

Develop the insurance sector, building on public-private partnerships

Domestic disaster insurance markets can be an effective channel for developing the resilience of disaster-exposed households and businesses. Governments can use their own resources to support domestic insurance markets and reach households and businesses with insurance products, realizing their policy goals of expanding the population’s financial resilience to disasters. The Turkish Catastrophe Insurance Pool and the Mongolian Livestock Insurance Pool are good examples of public–private partnerships that have substantially increased insurance penetration at the local level.

But developing insurance markets is challenging, particularly in low-income environments. Where insurance is not compulsory, pick-up rates remain low. This includes high-income countries, even where insurance is heavily subsidized.
ACTION 3.4 >>

Build a social protection system and make it responsive to shocks

For the poorest households, savings are often not an option, and high transaction costs and affordability issues make access to private insurance challenging. These households need well-targeted and easily scalable social safety nets.

Adaptive social protection systems have proven to be critical for channeling resources to those who are most in need due to climate stresses. Based on existing social protection systems, adaptive systems can respond quickly to disasters or slow-onset climate crises by:

» Scaling up or providing additional resources to regular beneficiaries—for example, in Fiji, all beneficiaries of the Poverty Benefit Scheme received exceptional transfers after Tropical Cyclone Winston in 2016

» Scaling out or providing support to additional beneficiaries during bad times or years—for example, the number of beneficiaries of Ethiopia’s Productive Safety Net Program depends on rainfall.

Toolbox F—in the main text of this guide—discusses methodologies to estimate the benefits (and benefit–cost ratios) of investing in adaptive social protection systems, taking beneficiary vulnerability into account.

It is important to design post-shock or postdisaster support in a way that does not disincentivize adaptation to long-term trends. For example, support to areas that are increasingly affected by drought should not lock people in place, especially if the trend is expected to worsen over time. Instead, postdisaster support should help people change activity or migrate if that will improve their prospects.

SPOTLIGHT S.1 >>

COVID-19

Exiting the COVID-19 crisis more resilient than before?

A few months into the COVID-19 crisis, almost all countries have boosted their social protection systems to help their populations manage the pandemic and the consequences of needed containment measures. If designed and implemented sustainably, and if efforts are maintained over the long term, any improvements made during the current crisis could improve all social protection systems’ capacity to scale up quickly and efficiently next time countries are affected by a major shock, including climate-related shock. This includes, for example, creating and maintaining household registries and electronic payment mechanisms.
Help firms develop business continuity plans and financial preparedness

Individual firms’ ability to cope with a shock and continue to produce in the aftermath of a disaster depends on many factors, but they can do a lot to become more resilient. The usual recommendation is to identify threats, assess risks, and consider mitigation options. This allows firms to invest in prevention—for example, by adding a generator in case of power outage, investing in movable flood protection, or even elevating critical equipment. It also helps them prepare for residual risk. Preparing business continuity plans (BCPs) can ensure a firm’s management and workers know what to do in case of disaster, to maintain or restore production as fast as possible. BCPs should consider a firm’s full supply chain and include issues that may affect suppliers (or suppliers’ suppliers) and clients. Other things to consider include financial issues, such as how to manage a drop in sales, increased supply prices, or the urgent need to replace expensive pieces of equipment. Access to contingent credit lines and appropriate insurance are among the many tools that firms can include in their BCP.

Be prepared to build back better after a disaster with contingency plans and financing

When a disaster hits and old or low-quality assets are destroyed, countries can build back better, under improved building norms, thereby improving both productivity and resilience. But this does not always happen, often because the urgency to reconstruct leaves little time and few resources to rethink the design or spatial footprint of cities and infrastructure. Building back better depends on the ability to plan and implement the reconstruction process efficiently, or on the existence of plans prepared before the crisis occurs.
The impact of climate change on the economy will affect activity and tax revenues, and strong impacts on major sectors (especially exporting ones) can affect a country’s trade balance and capital flows. The combination of these factors may result in new risks for macroeconomic stability, public finances and debt sustainability, and the broader financial sector. Governments will need to manage these risks, considering the many channels involved (figure S.7). However, the macro-level impacts of climate change are extremely uncertain, and all quantified assessments should be considered as a partial approximation and used in a way that considers both this uncertainty and the possibility of surprises.

**Figure S.7**
Climate change affects macrofiscal and financial aggregates

- **Physical/health/crop models**
  - Climate scenarios
  - Physical impacts (reduction in yield, disaster damages, labor productivity, etc.)

- **Real economy**
  - Impact on firms' operations and investment choices (e.g., using supply chain models)
  - Impact on economic sectors (e.g., partial equilibrium sector model such as agriculture sector model)
  - Impact on public asset (infrastructure, schools, etc.), government spending needs (e.g., social protection), and total public expenditures
  - Impact on households' welfare and behaviors (home maintenance and operations, health expenditure, labor productivity and skills, etc.)

- **Macro, fiscal, financial**
  - Macroeconomic impacts (e.g., GDP, trade balance, inflation) with various models (computable general equilibrium and macrostructural models, input-output models for post-disaster, empirical approaches, etc.)
  - Asset values (e.g., land and housing, equity, bonds, loans) and financial system stability (urban economy models, stress test methodologies, financial modeling, etc.)
  - Fiscal implication and public finances (e.g., deficit debt) using macrostructural models
ACTION 4.1 >>

Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process

Contingent liabilities only materialize if a certain event occurs—for example, if a flood damages roads, the government is responsible for repairing them. Including contingent liabilities in the budget planning process and making them part of the deliberation will ensure that authorities cannot ignore climate and disaster risks.

Assessing risks for public finance should include:

- **Explicit contingent liabilities**, which are relatively easy to estimate and based on public asset and infrastructure inventories (toolbox G in the main text of this guide). For example, if the state owns the public roads, it is responsible for fixing them.

- **Implicit contingent liabilities**, which are linked to other forms of commitment. For example, governments will provide humanitarian and financial resources to support populations that are affected by a disaster or small and medium enterprises that cannot cope with the shock without going bankrupt. This expectation or political commitment creates an implicit liability that is more difficult to estimate (toolbox F in the main text of this guide).

- **Tax revenues**, which also fall during a disaster, increasing the funding gap. For example, in 2018, Argentina lost an estimated $1.5 billion in tax revenue, mostly due to reduced export tax revenues after a severe drought in 2017. Tax revenue estimates are even more uncertain, as they depend on GDP impacts that are difficult to measure and anticipate with models (toolbox H in the main text of this guide).
ACTION 4.2 >>

**Develop a financial strategy to manage contingent liabilities, combining multiple instruments**

When a disaster or another environmental shock hits, there are urgent financial needs related to emergency response and humanitarian support to affected populations (Priority Area 3) and longer-term recovery and reconstruction costs, which can have a strong impact on public finance. In parallel, tax revenues often drop during the crisis and recovery phase. As a result, governments and local authorities can struggle to finance postdisaster response and reconstruction, while liquidity constraints can also affect their short-term response.

Regardless of their origin, the most robust way to manage unexpected shocks is maintaining fiscal space in normal conditions, with manageable structural deficit and debt levels. It is also preferable to have a reasonably diversified and resilient tax collection system.

Various instruments—such as contingent credit lines, insurance and catastrophe bonds, regional risk-sharing facilities, state contingent debt instruments and international aid—are available to cover the contingent liabilities created by natural hazards and other environmental risks. None of these instruments can meet all the needs, so a combination of tools is preferable (figure S.8). Some can cover short-term liquidity needs, while others are better for larger, longer-term reconstruction needs. Some are better placed for frequent, low-intensity events, while others can better manage massive shocks. It is also important to consider that instruments differ in terms of cost, timeliness, transparency, and predictability.

As well as needing specific tools to address resource mobilization in postdisaster situations, the urgency and chaos of the situation creates specific challenges on the expenditure side. These need to be considered through a disaster-sensitive public finance management system.
**FIGURE S.8 >>**

Financing instruments to cover contingent liabilities from natural disasters

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Sovereign risk transfer</th>
<th>Insurance of public assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low frequency High intensity</td>
<td>• Insurance (including risk pools)</td>
<td></td>
</tr>
<tr>
<td>Contingent financing</td>
<td>• Derivatives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Catastrophe bonds</td>
<td></td>
</tr>
<tr>
<td>High frequency Low intensity</td>
<td>Post-crisis financing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• World Bank, IDB, JICA: Deferred Draw-Down Option (DDO)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contingent Emergency Response Components (CERC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• IDA Crisis Response Window (CRW)</td>
<td></td>
</tr>
<tr>
<td>Budgetary instruments</td>
<td>• Emergency lending</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bi- or multilateral financing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sovereign reserve funds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contingent budget</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Government reserves</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Budget reallocation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-term liquidity</td>
<td>Time</td>
</tr>
</tbody>
</table>


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**ACTION 4.3 >>**

Anticipate and plan for long-term macroeconomic impacts

Climate change will provoke other long-term changes in tax revenues and spending needs, with additional implications for economic growth and public finances. It is important for governments to understand these risks and construct an appropriate response strategy. They can use macrofiscal risk assessments as a standalone analysis, such as with the World Bank and International Monetary Fund’s (IMF) Climate Change Policy Assessments, or embed them into other long-term, macro-level assessments. Two joint World Bank-IMF diagnostics can include disaster and climate risk: the Debt Sustainability Analysis, which can include macrofiscal risks of climate change impacts, mitigation and adaptation plans; and the Financial Sector Assessment Program, which can include climate and disaster risks in the financial sector assessment, especially in stress testing exercises.

Whichever approach governments use, looking at long-term effects will mean exploring long-term growth impacts, their consequences on public finances, and the uncertainty of possible assessments. Here, again, it is important to consider both revenue and spending. If, for example, a large part of a country’s tax revenues come from export duty on a small set of vulnerable commodities, the country is highly exposed. Likewise, if sea level rise will require large investments in coastal defenses, the cost could threaten the position of public finances. *Toolbox 1* — in the main text of this guide — reviews the methodologies available for such assessments. It also stresses their limitations, which need to be considered in decision making.
Communicate and mitigate the disaster and climate risk exposure of the financial sector and pension systems

One role of the financial system is to help the economy manage risks. But a history of financial crises has shown that it can also magnify the impact of a shock, if this shock exceeds the financial sector’s capacity. Governments must therefore assess their financial system’s ability to absorb climate shocks, to ensure it can play the role of adaptation facilitator and not create a crisis (see toolbox J in the main text of this guide, for example, on stress testing approaches).

Climate change and natural disasters can impact the financial sector balance sheets through four overlapping channels:

» **Operational risk**, such as damages to financial infrastructure

» **Market and liquidity risk**, such as brutal changes in asset valuations

» **Credit risk**, including shocks that adversely affect borrower repayment capacity or lower collateral prices

» **Underwriting risk**, including errors in pricing of (re)insurance liabilities.

Transparency alone could help reduce future losses. Information on firms’ exposure to disaster and climate risks can help investors and decision makers adjust investments and portfolios to reduce exposure and future losses. Transparency on disaster and climate risks, as advocated by the Task Force for Climate-related Financial Disclosures, would also send a strong signal to firms’ management that this is a topic of concern for investors, creating an incentive for all firms to manage their long-term risks better.

Regulators could also consider imposing appropriate requirements to ensure firms’ risk management approaches adequately capture investment risk profiles regarding natural hazards and other adaptation-relevant climate risks. Authorities can set out regulatory guidance or supervisory expectations to enhance firms’ responses to these risks and actively monitor their implementation by integrating climate risk into existing regulatory frameworks. They should aim to address all aspects of firms’ governance, risk management, and disclosure practices.
Prioritization, implementation, and monitoring progress

LEAD MINISTRIES: Finance/economy and ministry or agency in charge of climate change (often environment)

To effectively implement and assess these actions, governments must not only prioritize actions to make them compatible with available resources and capacity; they must also establish a robust institutional and legal framework, and a consistent system for monitoring progress. The objective is to ensure that all government departments and public agencies adopt and mainstream the adaptation strategy in all their decisions, and that governments continuously monitor and evaluate the impact of their decisions and actions, so they can address any challenges and adjust their actions accordingly.

ACTION A.1 >>
Create a strong institutional and legal framework, with appropriate stakeholder involvement

The policy actions discussed in this report require an appropriate institutional and legal framework. Indeed, climate change framework laws can be crucial for formulating short- and long-term climate change targets—for example, most climate change framework laws have a “knowledge” or “data” component, which can help ensure that climate change-related information is available to public and private decision makers (Action 1.1). To ensure that climate change is properly addressed, a strong institutional framework is also needed, that:

- Adapts the mandates of existing ministries, agencies, or institutions
- Creates new agencies or committees when necessary (for example, water management agencies at the watershed level)
- Establishes an overarching coordination body to ensure stakeholder involvement at each stage of the adaptation and resilience process, from strategy design to implementation and monitoring.
ACTION A.2 >>

**Design an adaptation and resilience strategy with prioritized actions**

Once they have established the appropriate institutional and legal framework, governments can design their adaptation and resilience strategy, with precise interventions, investments, and policies. No country has the capacity and resources to implement all possible measures and interventions for increasing resilience. So, prioritizing interventions is one of the adaptation strategy's (and the finance ministry's) main roles, as this will ensure the efficient use of limited resources. Multiple tools are available for prioritization, from traditional methods for appraising investments to more holistic approaches that account for societal benefits and uncertainty (see toolbox K in the main text of this guide and an illustration in figure S.9). The latter are crucial, as some interventions that may not be justified on the basis of pure economics are essential to protect communities from catastrophic risks. Overall, prioritization methodologies enable decision makers to identify a concrete subset of interventions that are most likely to deliver large net benefits. While some of these will target short-term priorities, they should also align with long-term plans and objectives—for example, governments should ensure COVID-19 recovery programs align with long-term growth objectives (spotlight S.2).

**SPOTLIGHT S.2 >> COVID-19**

**A stimulus and recovery package that builds resilience**

To accelerate recovery once the COVID-19 health emergency is under control, many governments are planning to introduce massive stimulus packages. These can be improved by considering not only the short-term needs for jobs and economic activity, but also actions to boost the resilience and sustainability of future development paths.

Governments can use a sustainability checklist, for example, to screen potential projects, policies, and measures for inclusion in a stimulus package. Checklists should include:

- Short-term questions, such as: How many jobs will be created? Over which timeline?
- Long-term questions, such as: Does the intervention enhance the long-term growth potential (for example, by improving the population skillset)? Does it make the economy and population more resilient? Does it facilitate the transition to a zero carbon economy and contribute to protecting and building natural capital?

The key objective is to maximize short- and long-term gains through a careful selection of interventions.
FIGURE S.9

Using different metrics to measure risk can lead to different priorities for action

A: Annual asset risk

B: Number of people falling into poverty each year

C: Annual well-being risk

D: Socioeconomic resilience

ACTION A.3 >>
Set concrete sector-level targets to guide implementation by line ministries
Transport, energy, water, environment, social protection, and other ministries will implement and fund most adaptation and risk reduction interventions, and local authorities will also be important players. To allocate responsibilities, an adaptation and resilience strategy can set sector-level targets for 2025 or 2030, leaving detailed policy implementation for achieving the targets to the relevant ministries. The main text of this guide provides a list of potential indicators that can be used to set these goals. Having a representative body such as parliament approve a list of targets could significantly improve ownership and accountability and strengthen the strategy’s authority. It could also help institutionalize a formal and regular reporting process (Action A.6).

ACTION A.4 >>
Screen all public policies and expenditures for disaster and climate risks, and align them with adaptation targets
Adaptation measures can only be cost-effective if all investments and planning decisions consider climate-related risks in their design. To mainstream adaptation measures in this way, governments must systematically screen relevant policies and expenditures—even those without an explicit adaptation or climate rationale—to avoid any negative effects on adaptation objectives. One priority is improving public investment management (PIM) to include specific actions and controls that will ensure public investments are consistent with adaptation strategy objectives and consider disaster and climate risks. The ultimate goal is mainstreaming climate change considerations in PIM across all institutions and all projects. Multiple tools are readily available to help governments conduct such a screening process. These include the World Bank Group’s climate risk screening tools, which help project development teams assess possible climate change or disaster risks to their project and identify interventions for reducing risks and increasing resilience.
ACTION A.5 >>

**Allocate appropriate funding to the adaptation strategy**

Once an adaptation and resilience strategy has been prepared, it needs to be appropriately funded. A small dedicated adaptation budget may be needed, especially for monitoring and evaluating progress. However, most of the funding needs are for sectoral interventions—for example, more resilient roads, investments in irrigation, financial protection instruments, and so on. To fund such interventions, governments can create dedicated funds with the mandate of funding investment in resilience or climate change measures (adaptation and/or mitigation). But it may be preferable to integrate adaptation and resilience funding into sectoral budgets, rather than create dedicated budgets. For example, funding investments to increase resilience in the transport system through the transport infrastructure budget would ensure investments in the transport system and in transport resilience are consistent and synergetic. Budget tagging and expenditure reviews (toolbox L in the main text of this guide) can help track resources spent on adaptation and resilience, even when they are integrated in general budgets.

ACTION A.6 >>

**Track progress over time, and review and revise the strategy**

Adaptation and resilience strategy can be further strengthened as new challenges and insights become apparent over time. Continuous tracking of progress indicators can highlight specific sectors in which implementation lags behind. If milestones are missed, implementation challenges—such as capacity or resource constraints, or coordination failures between implementing bodies—may become apparent that were not accounted for in the initial strategy design. Flexibility in the adaptation strategy would allow course corrections and adjustments to be programmed as integral elements of the strategy, rather than being regarded as admissions of failure. Such strategy revisions are also likely to become necessary as new challenges and risks arise—for example, the COVID-19 pandemic forced governments to reevaluate their approach to emergency management. Scientific advances and technologies are also likely to become available, enabling actors to implement actions in more targeted, cost-effective ways.
Effective action on resilience and climate change adaptation can be a complex task—requiring coordinated efforts from the highest levels of government to individual households and firms. The *Adaptation Principles* offer a guide to effective climate change adaptation, containing hands-on guidance to the design, implementation and monitoring of national adaptation strategies. It specifies six guiding principles, which correspond to common policy domains:

» Ensuring resilient foundations through rapid and inclusive development;

» Facilitating the adaptation of firms and people;

» Adapting land use and protecting critical public assets and services;

» Increasing people’s capacity to cope with and recover from shocks;

» Anticipating and managing macroeconomic and fiscal risks;

» Ensuring effective implementation through prioritization and continuous monitoring.

While outlining these universal *Adaptation Principles*, this guide shows that each country needs to tailor these actions to its specific needs and priorities. To guide this process, *Adaptation Principles* offers concrete and practical tools: Screening questions to identify the most urgent and effective actions, toolboxes illustrating common datasets and methodologies to support decisions, indicators to monitor and evaluate progress, and case studies on how the COVID-19 pandemic influences priorities in taking effective adaptation action.