The Adaptation Economy

The case for early action on climate adaptation in emerging markets

Foreword

In recent years, the world has largely galvanised around the need to limit global warming to 1.5°C in line with the goals of the Paris Agreement. The financial sector has rallied in support, providing hundreds of billions of dollars of 'mitigation finance' directed at the energy transition and technologies to reduce carbon emissions.

This is the right ambition and action, and we must continue to do everything in our collective power to materially decarbonise. However, it is increasingly likely, even with the best intention, that we will overshoot the 1.5°C objective by 2050 and that, in any case, we are going to have to incorporate climate-warming effects into our systems and adapt to its reality.

All nations will need to adapt to climate change by building more resilient agriculture, industry and infrastructure, but the need is greatest in emerging and fast-developing economies with a disproportionate risk of exposure to the negative effects of rising temperatures and extreme weather and in many cases, fewer resources or less capacity to respond.

The Adaptation Economy examines the need for adaptation investment in 10 developing markets: Bangladesh, China, Egypt, India, Indonesia, Kenya, Nigeria, Pakistan, the UAE and Vietnam – and explores the current appreciation and appetite for this investment among global banks, asset managers and investors.

Increasingly frequent, unprecedented events – such as the historic floods and droughts in the past year – pose a grave threat. The UNFCCC and signatories to the Paris Agreement have formally recognised that adaptation is a crucial part of the global response to climate change to protect lives, livelihoods and ecosystems.

The case for adaptation is clear: even if the world succeeds against the odds in limiting temperature rises to the Paris goals, the 10 markets in this study could be facing an estimated cost of **USD377 billion** in damages and lost economic growth **by 2030.** This is without adaptation-focused investment of circa **USD30 billion**, the bare minimum needed to withstand projected climate-related damage and degradation within the same period.

Or put differently, the economic pay-off of early action toward adaptation in these 10 markets presents a **twelve-to-one 'return'** this decade. Beyond 2030, the same cost of adapting reaches grim

proportions, rising to a total of **USD1.4 trillion by 2050**, as climate impact worsens and becomes more expensive to respond to, with diminishing returns. This leaves a crucial question: how do we urgently unlock the capital needed for climate adaptation?

At COP27 in Egypt, developed nations reaffirmed their commitment to double their funding for adaptation in developing markets, while agreeing on a long-awaited 'loss and damage' fund. While these steps are positive, they don't go far enough. Too little global finance, particularly from the private sector, is being directed towards adaptation, and emerging markets are not getting their fair share.

Some 150 global investors, asset managers and bankers surveyed as part of this study indicate that their firms have just 0.4 per cent of capital allocated to adaptation projects[1] in emerging markets. While three out of five intend to increase this number, the respondents also highlight multiple barriers to investment, and call for more product innovation and public-private partnership to unlock capital for this purpose.

Banks such as Standard Chartered have a critical role to play in removing these barriers – working with governments and private investors to develop and scale the structures and mechanisms that will facilitate adaptation investment.

We can create a powerful new movement — an 'Adaptation Economy' — if we recognise not only that adaptation is a shared necessity and that inaction creates a shared societal burden of exponentially increasing cost, but also that investing in adaptation is a commercial proposition which can generate market returns for its investors.

Promisingly, the majority of our survey respondents agree. They believe that adaptation finance represents a viable private sector opportunity and almost three quarters point to the recent outperformance of their emerging-markets investments. This suggests there is a willing and ripe investment community to support climate adaptation.

We invite you to delve into the findings in this report and join us on the journey to support the creation of a viable Adaptation Economy that will be as important as mitigation finance to serving society in the collective fight against climate change.

Marisa Drew
Chief Sustainability Officer
Standard Chartered

1. Defined as infrastructure, market reforms, research and education that builds resilience against climate change and limits the adverse effects of global warming

Executive summary

To respond to climate change, we must mitigate its impact by reducing carbon emissions. At the same time, we must adapt to protect communities from increasingly frequent and severe weather events and other climate change effects such as bio-diversity loss.

While the global focus of the financial markets to date has largely been on financing the mitigation of climate change, the urgent need to adapt to our environmental reality has attracted less attention. *The Adaptation Economy* shines a light on this underexplored side of the climate-finance equation.

We have used a bespoke economic model to examine the adaptation investment needed in 10 emerging and fast-developing markets, while attempting to quantify the economic cost of inaction.

The markets (Bangladesh, China, Egypt, India, Indonesia, Kenya, Nigeria, Pakistan, the UAE and Vietnam) are among those where action is critical, either because of their size and contribution to the global or regional economy, or because of their greater risk of exposure to negative climate effects.

To gauge the level of appetite in the global finance community to finance adaptation in these and other markets – and identify any barriers to investment – we have surveyed 150 bankers, investors and asset managers.

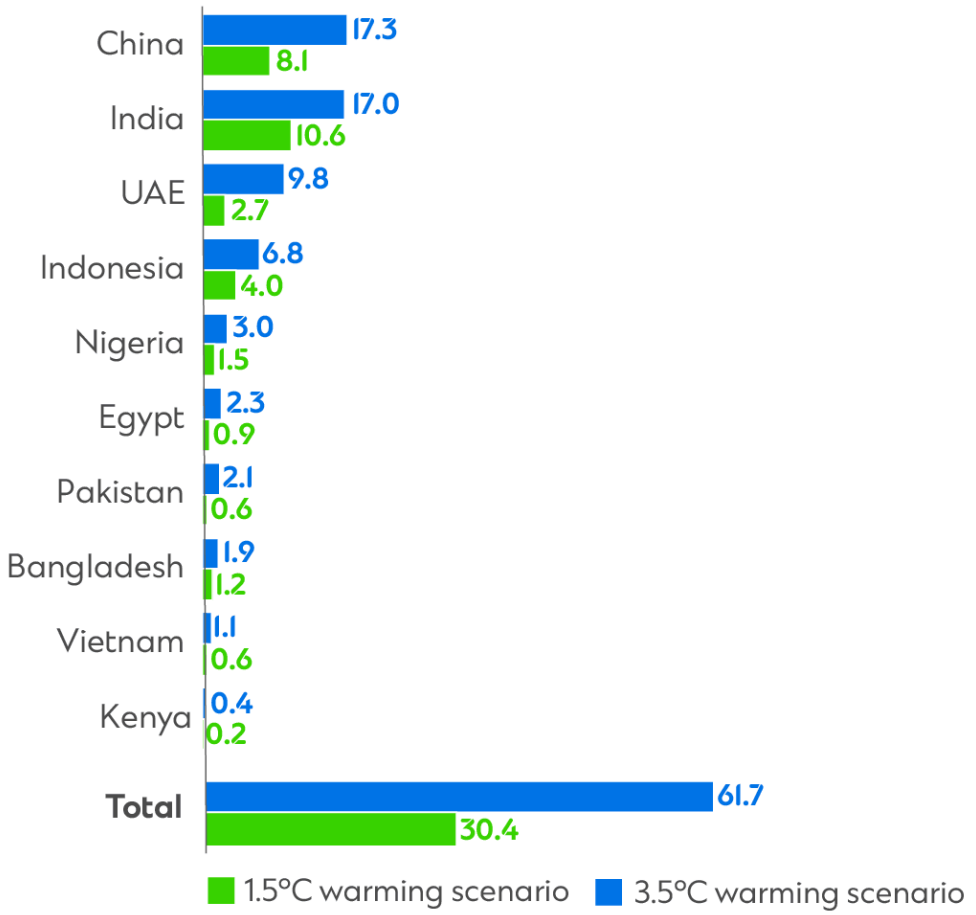
Key findings

- For the 10 markets in this study, failure to invest an estimated **USD30.4 billion** this decade – the minimum projected level to adapt to climate damages as they occur – could lead to a cost of **USD376.6 billion** in damages and lost growth by the end of 2030 (in a 1.5°C warming scenario)

- On average, every dollar spent on adaptation this decade would generate **12-dollars** of economic benefit for the 10 markets, highlighting the case for early action

- The need for adaptation will become more urgent after 2030, with a minimum estimated investment of at least **USD317.4 billion** required in the 10 markets between now and 2040, rising to **USD1.4 trillion** between now and 2050
- In a 3.5°C warming scenario, the 10 markets are expected to require twice as much investment this decade; a minimum of **USD61.7 billion**
- Global financial firms currently have very little of their capital invested in climate adaptation projects in emerging markets: just 0.4 per cent in the case of the firms we surveyed
- While almost three in five financial firms say they plan to increase investments in the next year, they also highlight multiple barriers, and call for more product innovation and public-private partnership to unlock capital for adaptation

Estimated minimum investment required by 2030 in a 1.5°C and 3.5°C warming scenario
USD billions, by market



What is climate change adaptation?

As yet, there is no globally agreed definition of climate change adaptation. Standard Chartered's Green and Sustainable Product Framework defines it as:

- Data driven climate monitoring, such as early warning systems, climate observation and systems for monitoring GHG emissions
- The development and/or use of information and communications technology for collecting, transmitting, storing and using data to facilitate reductions in greenhouse-gas emissions
- Design, construction or refurbishment of existing infrastructure and maintenance of eligible infrastructure that features intentional integration of climate-resilient construction and/or soft infrastructure improvement. Examples include heavy rain drainage systems, flood prevention, flood defence systems, sluice gates, drainage systems, tunnels and channels for reinforcement of existing infrastructure. Also, use of climate-resilient crops and drip irrigation for agricultural production systems, stormwater storage, grain storage, soil rehabilitation and climate resilient livestock infrastructure
- Infrastructure that builds resilience as above, while also adding climate resilience to the broader local system. Examples include coastal pumping stations in areas of water stress, water reclamation plants in areas of water stress, wetland protection, stormwater management and flood defences, green roofs and walls, afforestation and reforestation, mangrove conservation, and grid resilience, back-up generation and storage designed for climate-related disruption

Examples of climate mitigation and climate adaptation

Mitigation	Both	Adaptation
Energy Efficiency	Green Infrastructure	Forest Protection / Reforestation
Renewable Energy	Distributed Energy	Infrastructure Resilience
Carbon Capture & Storage	Resilient Urban Transport	Sustainable Agricultural Practices
Combined Heat & Power	Water & Energy Conservation	Sustainable Management of Mangrove Forests
Sustainable Transportation	Biodiversity Conservation	Flood Monitoring
Methane Capture & Use	Low-Input Agriculture	Advanced Disaster Systems
Industrial Process Improvements		Food Supply Protection
Carbon Sinks		Protecting Peatland Systems / Ocean-Based Aquaculture Systems

What is the main barrier to adaptation investment in emerging markets?

- ○ A lack of knowledge
- ○ A lack of innovative financial products
- ○ Uncertainty of where capital is needed
- ○ Uncertainty about the impact of climate change
- ○ Lack of collaboration between the private and public sector

Post answer

Part one: The cost of inaction

Failure to invest in adaptation this decade could lead to significant damages and lost opportunities for growth in emerging markets

The adaptation imperative

All nations will need to make significant adjustments to adapt to climate change – particularly emerging and fast-developing markets, which often have less developed infrastructure and greater exposure to extreme weather events.

This will be the case even if nations succeed in limiting global temperature rises to 1.5°C above pre-industrial levels as outlined in the Paris Agreement. As extreme weather events and other climate effects become more prevalent, climate resilience will need to be integrated into every facet of the economy.

Examples of adaptation measures include flood defences; research and development to improve the drought-tolerance of crops; or the planting and protection of existing nature-based solutions, such as coastal mangrove forests. Without such measures, lives and livelihoods will be at greater risk.

The Paris Agreement

The Paris Agreement is a landmark global pact on climate change, drafted in 2015 and signed by more than 190 nations. Its aim is to keep the global temperature rise this century well below 2°C (above pre-industrial levels) and to try to limit the temperature increase to 1.5°C. Although this temperature rise would still cause disruption, limiting warming to this level should help to mitigate climate change impacts.

Scientists estimate that global greenhouse gas emissions will need to be reduced to net zero by around 2050 to meet the 1.5°C target and minimise climate risk. These risks depend on the magnitude and rate of warming, geographic location, levels of development and vulnerability, and on the choices and implementation of adaptation and mitigation options.[1]

The cost of inaction

Climate adaptation measures are urgently needed to conserve environments, protect populations, and safeguard livelihoods. For the 10 markets in this study, the cost of inaction could amount to an estimated **USD376.6 billion** (in a 1.5°C warming scenario) by the end of 2030.

[1] https://www.ipcc.ch/sr15/chapter/spm/

Without an estimated minimum investment in adaptation of just **USD30.4 billion**, the 10 markets would face projected climate damages of **USD338.8 billion**, while missing out on a potential boost to GDP of **USD37.8 billion**.

In other words, the economic benefits of minimum adaptation in the 10 markets this decade are 12 times greater than the investment required. Reduced risk to life, property destruction, ecosystem degradation and displacement will be additional benefits.

Market variance

Three key factors dictate the varying cost of inaction for the 10 markets in this study:

1. **Projected climate damage:** the projected economic damage to the market from climate change in the years to 2030 under a 1.5°C warming scenario. This considers gradual risks, such as the impact of temperature changes on labour productivity, and immediate risks, such as extreme weather events (including floods, droughts and storms) that can cause damage to infrastructure.

2. **Adaptation investment impact:** the ability of a market to translate adaptation investment into economic benefits. This measures how effectively adaptation investment can translate into more climate-resilient infrastructure, reflecting the specific nature of the adaptation measures required in each market and how well these measures mitigate the climate risk within the market.

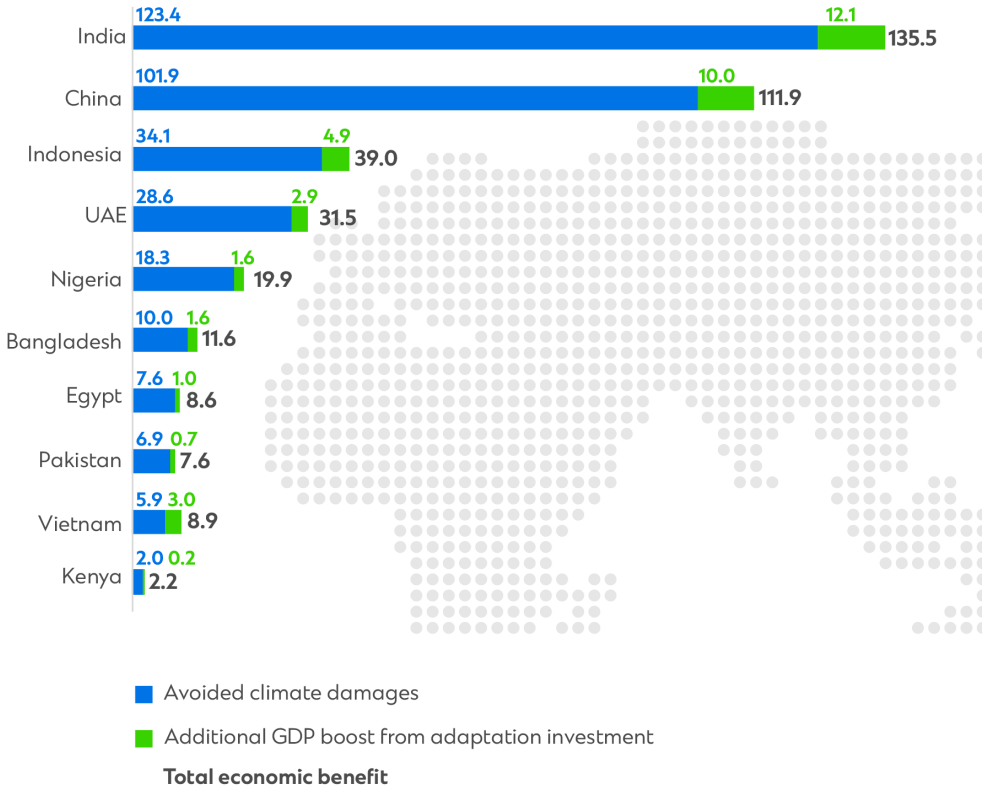
3. **Existing climate resilience:** the existing level of adaptation measures within a market. The more resilient the market is to climate change today – based largely on its existing levels of adaptation measure – the less economic benefit that can be derived from new adaptation investment.

Each of the 10 markets within our study has a unique blend of these three characteristics.[2]

[2] See market spotlights in part four

Estimated economic benefit of adaptation investment in a 1.5°C warming scenario

USD billions, by market



Part two: The adaptation investment gap

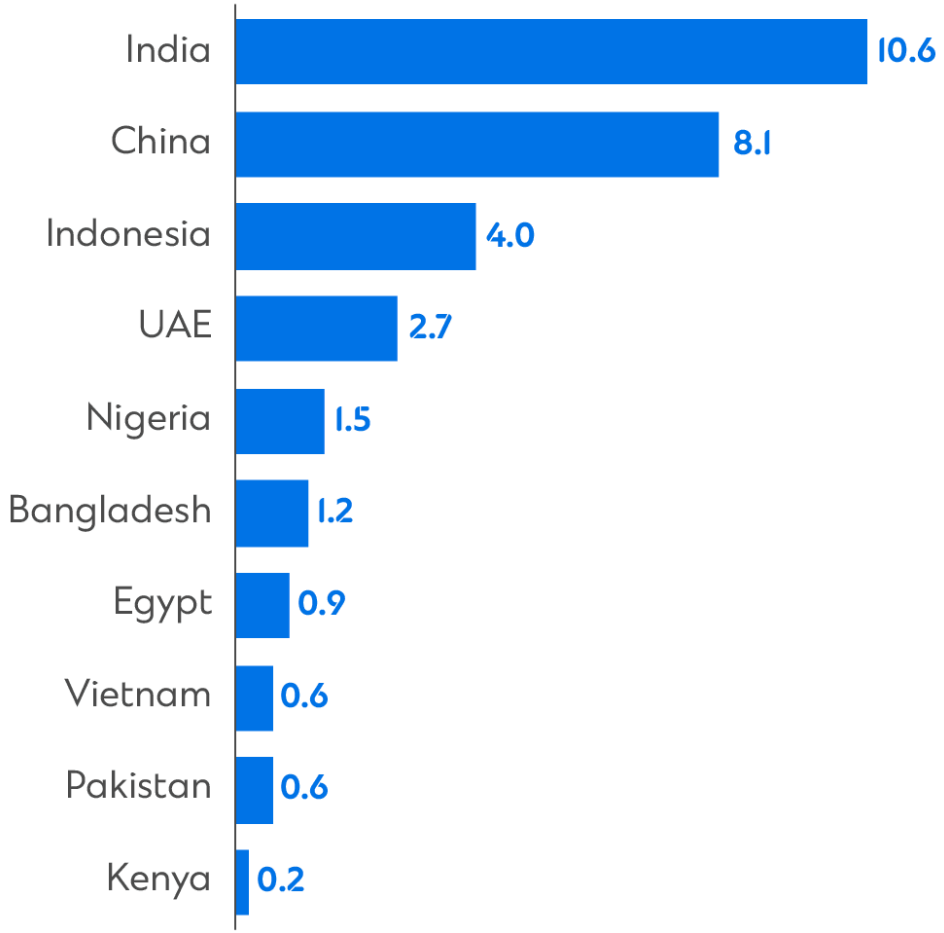
The estimated minimum investment required for adaptation is relatively small this decade, rising dramatically beyond 2030 to 2050

Investment needed in a 1.5°C warming scenario

Between now and 2030, an estimated minimum of USD30.4 billion of adaptation investment is needed in the 10 markets in this study, in a 1.5°C global warming scenario. This minimum assumes that adaptation measures are put in place as they are needed, rather than ahead of time, and only includes adaptation that is feasible to implement – such as flood defences along particularly vulnerable stretches of coast as opposed to a nation's entire coastline.

India accounts for more than a third of this figure, requiring nearly USD11 billion to support infrastructure redevelopment and other adaptation measures to cope with increased drought and flooding. China also needs substantial investment in adaptation measures – over USD8 billion.

Estimated minimum adaptation investment required by 2030 in a 1.5 °C warming scenario
USD billions, by market



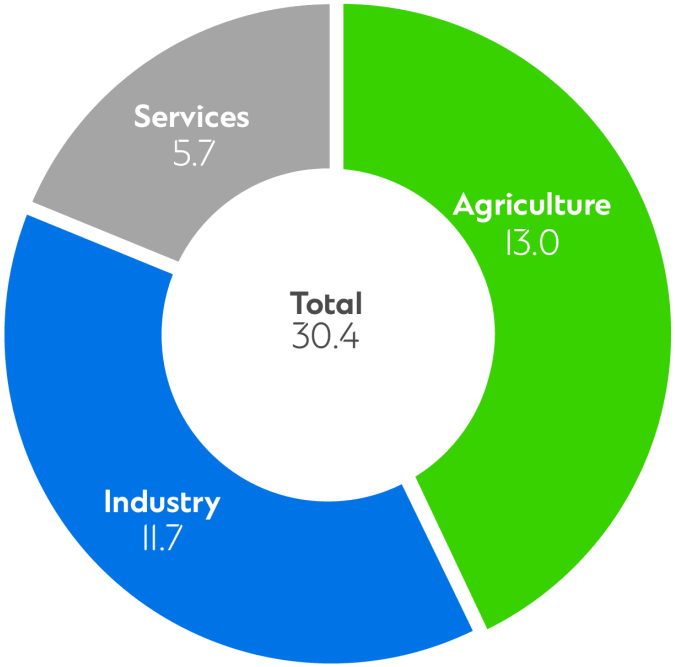
On a sector level, across the 10 markets in this study, the most significant investment is needed in agriculture, which requires USD13 billion of adaptation finance between now and 2030. Agriculture is highly sensitive to temperature changes and extreme weather events, so even a limited temperature rise (1.5°C) will have a big impact.

Agriculture also forms a relatively large part of the 10 economies.

Industry – including sectors such as manufacturing and transport – is close behind with an estimated USD11.7 billion of investment required by the end of 2030. Measures needed include improved air conditioning, heating or energy efficiency measures for properties, and more advanced disaster management systems.

The service sector – which includes businesses in the knowledge economy and tourism – will benefit from adaptation measures which preserve crucial infrastructure and natural capital. Investment in more resilient offices, including air conditioning and weatherproofing, and infrastructure such as telecoms, alongside habit and ecosystem restoration, will require an estimated USD5.7 billion.

Estimated minimum adaptation investment required by 2030 and in a 1.5°C warming scenario
USD billions, by sector



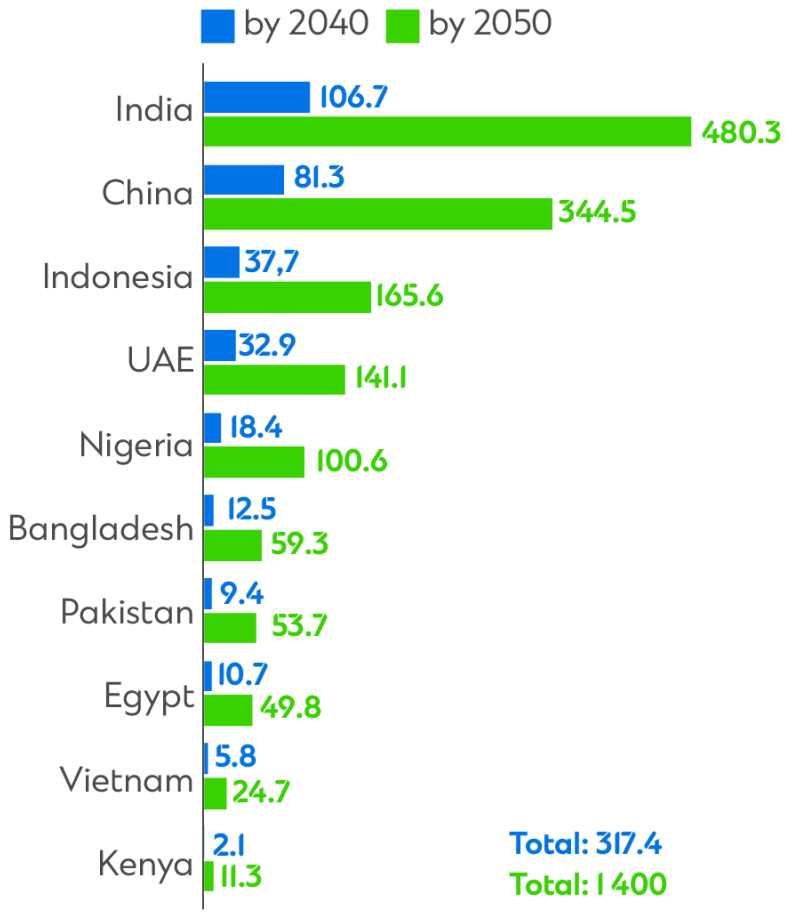
Adaptation beyond 2030

While a minimum estimated USD30.4 billion investment in adaptation measures will be required this decade, the requirement for investment increases dramatically in the years up to 2050.

Across the 10 markets in the study, an estimated minimum of USD317.4 billion will be required between now and 2040, rising to USD1.4 trillion between now and 2050 under a 1.5 °C warming scenario. This huge increase – which assumes successful mitigation efforts in line with the Paris Agreement – underlines that investment in climate adaptation will only become more urgent beyond 2030.

Minimum adaptation investment needed in a 1.5 °C scenario, by 2040 and 2050, respectively

USD billions, by market



Investment needed in a 3.5°C warming scenario

A failure to limit temperature rises to 1.5°C in line with the Paris Agreement would have devastating consequences for societies and ecosystems. Should temperature rises reach 3.5°C, for example, the minimum adaptation investment required by 2030 is projected to double to USD61.7 billion across the 10 markets in this study.

This further underscores the importance of urgent and effective efforts to mitigate climate change.

Estimated minimum investment in adaptation required by 2030 in a 1.5°C and 3.5°C warming scenario

USD billions, by market

Market	1.5°C scenario	3.5°C scenario	Percentage increase
UAE	2.7	9.8	263%
Pakistan	0.6	2.1	250%
Egypt	0.9	2.3	156%
China	8.1	17.3	114%
Nigeria	1.5	3.0	100%
Kenya	0.2	0.4	100%
Vietnam	0.6	1.1	83%
Indonesia	4.0	6.8	70%
India	10.6	17.0	60%
Bangladesh	1.2	1.9	58%

Case study: Water Supply in Angola

According to the World Bank, Angola ranks 138 out of 140 for reliability of water supply. The country has an abundance of water, but its hydraulic infrastructure needs strengthening for reliability, capacity and resilience.

With Angola's Ministry of Finance, Standard Chartered coordinated USD1.1 billion of dual-facility financing backed by the IBRD and Bpifrance, to help transform the capital Luanda's water production, purification, transmission, storage and distribution facilities, through the investment in water treatment plant, a transmission system, water storage facilities, distribution centres and installation of new networks and metered connections.

The Luanda Bita Water Supply Project is expected to improve access for over two million residents to potable water service in selected parts of South Luanda, contributing to the United Nations' Sustainable Development Goal 6, which relates to increasing access to clean drinking water and sanitation for all.

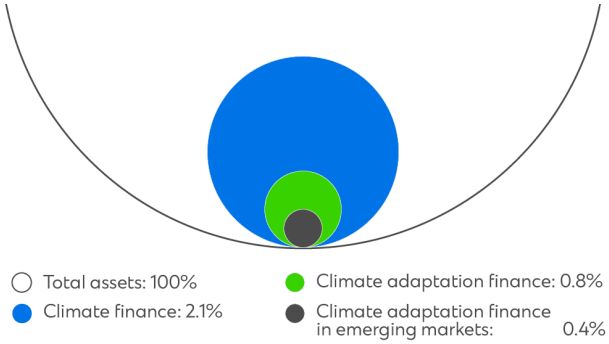
Part three: The view of the global financial sector

Very little capital is currently reaching adaptation projects in emerging markets, but the tide is starting to turn.

Capital flows in the adaptation economy

To gauge the global financial community's appetite to finance climate adaptation projects – and to identify any barriers to investment – we surveyed 150 prominent bankers, investors and asset managers.[1] We found that currently just **0.4 per cent of their capital is allocated to adaptation projects in emerging markets**. Just 0.19 per cent of their capital is in adaptation projects in Asia, with 0.07 per cent invested in adaptation in the Middle East, and 0.03 per cent in Africa.

Global capital allocation to adaptation in emerging markets



Global capital allocation to adaptation by region

Region	Percentage share of total assets
North America	0.19%
Europe	0.22%
Asia (not ME)	0.19%
Middle East	0.07%
Africa	0.03%
South America	0.04%
Australia/ Oceania	0.07%

[1] 150 interviews with senior leaders from global asset management firms, institutional investors and banks conducted in November 2022.

Increasing focus on the adaptation economy

Although investment flows are currently small, our study shows that adaptation is rising up the agenda. Three quarters of banks, asset managers and investors believe climate adaptation finance will hit the mainstream in 2023 (73 per cent) and that adaptation is 'the next big thing' in ESG (74 per cent).

The world's top finance firms are also waking up to the opportunity that climate adaptation presents, with nearly four in five surveyed (77 per cent) stating that it is a strategic focus and 68 per cent actively working on strategies for adaptation finance and investment.

Most firms (68 per cent) believe that adaptation finance and investment is a promising commercial opportunity. And emerging market investment performance is exceeding or matching the performance of similar developed market investments: 74 per cent of surveyed firms say that their climate

adaptation investments or lending in emerging markets over the last 12 months have had an average or above-average performance compared to equivalent investments or lending in developed markets.

Most firms intend to increase their adaptation investments imminently: 59 per cent of our respondents plan to put more money into adaptation over the next 12 months. Over this decade, the adaptation economy should continue to grow, with global adaptation financing expected to rise from 0.8 per cent of assets in 2022 to 1.4 per cent by 2030.

Unlocking the adaptation economy

For this growth to happen, however, collaboration between the public and private sector will be critical. Almost seven in 10 of the firms surveyed say that government intervention is needed to translate the economy-wide benefits of adaptation into commercial returns for investors (69 per cent), and that public-private partnerships will be critical for unlocking adaptation investment in emerging markets (67 per cent).

Banks, investors and asset managers also call for innovation in the financial sector: three-quarters believe entirely new products such as adaptation bonds will need to be created for climate adaptation to attract the capital required. Financial firms also cite a lack of knowledge and uncertainty as key barriers to allocating more capital to climate adaptation projects, both generally and in emerging markets specifically.

Top three barriers to allocating more capital to adaptation projects

Ranking	Climate adaptation projects generally	Climate adaptation projects in emerging markets
1	Lack of knowledge in my organisation	Uncertainty about where private capital is needed
2	Uncertainty about the impact of climate change	
3	Uncertainty about where private capital is needed	Lack of knowledge in my organisation

Q&A with Alex Kennedy, Head of Sustainable Finance Solutions

Alex Kennedy
Head of Sustainable Finance Solutions
Standard Chartered

What does adaptation mean to you? What impact does it have on the world?

I guess, unfortunately, it means that to a certain extent we have to live with some of the effects of climate change. Adaptation is about how we ensure we can continue to live in a way that protects our fragile communities, helps them to reduce and avoid the effects of our changing climate.

Adaptation also helps shield these communities from the future effects of severe climate events like droughts or storms or severe heatwaves, making populations more resilient

Why is adaptation so important? Shouldn't we focus on mitigation?

We really need to do both. While it's easier to define and measure mitigation finance by looking at emissions, adaptation covers a far broader array of activities and could be very location specific.

Investing in renewable energy, for example, is massively important, as is decarbonising hard to abate sectors, but the effects of these investments may not be felt for years. Rising temperatures and sea levels require more immediate solutions – improved building methods in coastal areas will mean that houses can withstand the storms that climate change is making happen more often.

What adaptation projects is the Bank financing?

One of the biggest updates in our fourth version of the Green and Sustainable Product Framework is the inclusion of the climate change adaptation category. This will enable us to define and raise finance for adaptation. It contains critical activities such as climate resilient construction, water reclamation, mangrove conservation, climate resilient crops and data driven climate monitoring solutions.

Unfortunately, adaptation finance is not getting to the areas where it matters the most. A recent OECD report shows that 70 per cent of climate finance went to middle income countries, rather than least developed markets.

As evidenced in our latest impact report, 90 per cent of our Sustainable Finance assets are in Asia, Africa and the Middle East, which is where sustainable finance is really needed.

I am excited that adaptation is one of our key priorities for 2023 and beyond.

What can companies do to adapt to climate change?

The changing climate will alter the conditions that all companies and economies operate in.

This will affect global supply chains and food systems and floods and storms will cause billions of dollars' worth of losses.

Companies of all sizes will need to climate proof themselves; they may need to invest in new technologies to protect themselves from future threats that might stop them from being able to deliver goods and services in the future.

What opportunities does adaptation present for investors?

Adaptation is a hard concept to fathom for an investor. Mitigation is far easier, we know what a solar array costs, we know what returns we will get from financing it, we even know how much CO2 it might save. It is immediate and impactful.

Adaptation is the opposite, it is spending money to protect ourselves from a threat that may come unannounced, it is amorphous and intangible. What adaptation does that mitigation does not is that it builds resilience – and in the changing fortunes of time, as the negative effects of climate change become more and more real, resilience feels incredibly important to me.

While we don't have all the answers, we are working hard to understand the problem. For me personally, 2023 will be a year of focus on adaptation (alongside biodiversity and social finance), and I look forward to finding some innovative ways of channelling capital towards adaptation finance in emerging markets – where it is needed the most.

[1] 150 interviews with senior leaders from global asset management firms, institutional investors and banks conducted in November 2022.

Part four: Market spotlights

While all 10 markets in this study need to adapt, the cost of inaction differs depending on level of development and resilience

Bangladesh

Estimated economic benefit from every dollar invested	**10x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD1.2bn (0.29% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD11.6bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD1.9bn (+58% compared to 1.5 °C)**

Bangladesh only accounts for a tiny proportion of global emissions, yet among our 10 focus markets, it is one of the markets most at risk from climate change. In 2022 the country suffered its worst floods in more than a century, in which millions of people were displaced.

Even under a 1.5 °C warming scenario, Bangladesh is highly susceptible to damages such as river, flash and coastal flooding – incidents which will be exacerbated by higher temperatures leading to more concentrated rainfall and rising sea levels. However, protection from heavy rainfall and flooding requires high levels of funding to be effective.

Areas identified as a focus for adaptation in Bangladesh include the adoption of sustainable agriculture practices and improved water resource infrastructure. The government – with help from the World Bank – has been working on flood protection barriers and upgrading drainage facilities, as well as crop cultivation to combat climate-related food scarcity, and improved data management and use.

Bangladesh has also been focusing on developing early warning systems to mitigate the impacts of flooding, such as the Community Flood Information System, which can help communities to prepare and protect their crops and livestock.

China

Estimated economic benefit from every dollar invested	**14x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD8.1bn (0.05% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD111.9bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD17.3bn (+114% compared to 1.5 °C)**

In the summer of 2022, China suffered its worst drought on record, caused by weeks of extreme temperatures and record low rainfall. The IPCC has predicted increased drought risks for western China over the coming decades, hitting the agriculture sector hardest, although parts of China have also been dealing with heavy rainfall and flooding.

Despite these vulnerabilities, China is one of the markets in our study less at risk of climate damage under a 1.5 °C warming scenario, explaining its relatively low requirement for adaptation investment as a proportion of GDP. At the same time, China's economic strength and historically strong investment in climate adaptation drives an economic benefit of USD14 for every one dollar invested – one of the highest in our study in our study.

In its National Climate Change Adaptation Strategy, published in June 2022, the Chinese government has committed to addressing rising flood risk (from rising coastal sea levels). This includes strengthening monitoring at rivers and lakes to boost flood control and improve water supply security, and reforming water prices and imposing binding consumption targets in selected regions over the next decade.

Egypt

Estimated economic benefit from every dollar invested	**10x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD900mn (0.22% of annual GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD8.6bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD2.3bn (+156% compared to 1.5 °C)**

Egypt is very vulnerable to climate change, with projected increases in extreme weather events such as heat waves, flash flooding, and sand and dust storms. With 95 per cent of Egypt's population[1] living on the banks of the Nile and in the Nile Delta, the Egyptian economy is vulnerable to sea level rise leading to the destruction of property and disruption of infrastructure. The increase in storms, flooding and heat waves is also predicted to contribute to a reduction in agricultural productivity.

Egypt would need to invest a minimum of USD900 million by 2030 to adapt to climate damages as they occur. However, this would prevent economic damages and loss of growth of almost ten times that amount – or USD8.6 billion.

According to the World Bank, Egypt's climate adaptation response needs to focus on closing data and information gaps, and strengthening environmental monitoring capabilities. The country also needs to protect its coastline, investing in risk assessments and exploring adaptation options. In addition, climate-smart agriculture and risk management in the agricultural sector have been identified as key areas, alongside more effective land use, resource management and early warning systems to improve water management techniques.

[1] Anatomy of the Nile | National Geographic Society

India

Estimated economic benefit from every dollar invested	**13x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD10.6bn (0.33% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD135.5bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD17.0bn (+60% compared to 1.5 °C)**

India is exposed to an array of extreme weather events such as heat waves, cold waves, cyclones, flooding and landslides. About 80 per cent[1] of India's population live in regions highly vulnerable to at least one climate-related hazard.

Along with Bangladesh, the Indian economy is the market in our study most exposed to climate risk in the years to 2030 under a 1.5 °C warming scenario. This is because India is at risk from climate damages that are likely to happen regardless of global emission reductions such as extended periods of drought and increased rainfall. It therefore needs the highest level of adaptation investment in the study. This investment could generate USD13 of economic benefit for every dollar invested, partly as India's current level of adaptation measures and historic levels of adaptation investment are lower than many other large economies, so big gains are still there to be made.

In terms of areas of adaptation focus, India will be looking at infrastructure resilience and strengthening early warning systems, while also protecting land from droughts and flooding through water resource management and dryland agriculture crop production. Mangroves – shrubs found in tidal and coastal areas with complex root systems – can play an important role, providing protection against natural disasters such as cyclones and tsunamis on the east and west coasts of India.

[1] Climate Change in the Indian Mind, 2022 - Yale Program on Climate Change Communication

Indonesia

Estimated economic benefit from every dollar invested	**10x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD4.0bn (0.34% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD39.0bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD6.8bn (+70% compared to 1.5 °C)**

As a nation made up of thousands of islands and with 81,000km of coastline, Indonesia is highly vulnerable to the impacts of climate change. According to the IPCC, the impacts of global warming on Indonesia include long-term changes such as temperature increases, rising sea levels and changing rainfall patterns as well as extreme events such as flooding and droughts.

Indonesia is one of the markets in our study at most risk. Without higher investment in adaptation, it can expect to take a significant hit to GDP over the next decade under a 1.5 °C warming scenario.

Priority areas for adaptation in Indonesia include protecting peatland systems and ocean-based and inland aquaculture systems. Financial measures are needed to address increasing flood-related risks to agricultural production. Indonesia will also need to invest in structural and non-structural measures for flood management to improve drainage systems and flood warning systems.

Kenya

Estimated economic benefit from every dollar invested	**11x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD200mn (0.18% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD2.2bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD400mn (+100% compared to 1.5 °C)**

Kenya has suffered devastating droughts in the past few years, destroying crops and causing mass displacement. An investment of just USD200 million dollars in adaptation by 2030 – the lowest amount in our study – would prevent climate damages and lost GDP growth of USD2.2 billion by the end of this decade.

Adaptation efforts in Kenya will need to be wide-ranging, encompassing the country's energy, infrastructure, land use and environment, health system, water and irrigation, agriculture and tourism sectors. Reforestation is needed, as well as clean energy development, climate-smart agriculture and drought management. Data and information gaps must be closed to enable better environmental management, and continuing investment is needed in weather stations and monitoring systems. Improved monitoring, data and research should help improve risk assessments and agriculture and urban water-use management.

Nigeria

Estimated economic benefit from every dollar invested	**13x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD1.5bn (0.34% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD19.9bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD3bn (+100% compared to 1.5 °C)**

Nigeria is classified as one of the 10 most vulnerable countries in the world to the impacts of climate change and natural hazards. In 2022, widespread flooding impacted hundreds of thousands of people across more than 30 Nigerian states.

Nigeria faces severe damages even under a 1.5 °C warming scenario, as the country is prone to floods, storms, ocean surges, droughts and wildfires. Nigeria could see a USD13 return for every dollar invested in adaptation this decade, partly as its existing level of adaptation measures is low, which means that significant gains remain to be made.

The World Bank's 2021 Climate Risk Country Profile suggests that Nigeria needs to focus on promoting and facilitating ways of managing exposure to extreme heat and associated health risks, while also establishing an early warning system to deal with human diseases associated with climate change. Nigeria also needs improved water and waste management facilities to maximise both agricultural and urban water-use efficiency. The World Bank highlights the need for Nigeria to improve information and forecasting surrounding extreme weather events, including strengthening flood monitoring and modelling to inform disaster risk planning.

Pakistan

Estimated economic benefit from every dollar invested	**13x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD600mn (0.17% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD7.6bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD2.1bn (+250% compared to 1.5 °C)**

Pakistan faces some of the highest disaster-risk levels in the world. Heavy monsoon rains and melting glaciers caused devastating floods in Pakistan in 2022, leading to loss of life, displacement of people and food and clean drinking water shortages.

Our study shows that Pakistan would need significantly higher levels of adaptation investment under a 3.5°C scenario, emphasising the importance of global mitigation efforts; rising temperatures would trigger changes to rainfall and run-off regimes and increase flood risks.

Pakistan currently has a moderate level of adaptation measures in place but could expect to see a USD13 return per dollar of adaptation investment. In a 1.5°C warming scenario, the minimum investment required to keep pace with damages as they occur this decade is USD600 million, whereas inaction could cost the Pakistan economy USD7.6 billion.

Without adaptation, millions of people will face flooding annually. Pakistan is also likely to suffer increased drought, affecting key crops like cotton and wheat. Agriculture alone employs nearly 40 per cent of Pakistan's workforce and contributes over 22 per cent to its GDP, making potential climate impacts and adaptation needs in the sector a high priority.

The country will need to focus on improving management of water resources and strengthening flood risk management in vulnerable areas. Sustainable management of watersheds and mangrove forests is highlighted as a key focus by the World Bank, alongside upgrades to waste management, safe water in urban areas and enhanced disaster resilience.

UAE

Estimated economic benefit from every dollar invested	**12x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD2.7bn (0.75% of 2020 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD31.5bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD9.8bn (+263% compared to 1.5 °C)**

The vast majority of the UAE's population and infrastructure is on the coast, making it particularly vulnerable to the impact of rising sea levels. And – as the nation is already dealing with extreme temperatures and water scarcity – temperature rises will have a significant impact.

Even if global warming is limited to 1.5°C, the UAE will need to invest a minimum of USD2.7 billion to adapt to climate damages as the occur this decade. However, the cost of inaction would be twelve times higher – USD31.5 billion by 2030 – providing a strong incentive for action.

In terms of areas of adaptation focus, the UAE's National Climate Change Adaptation Program has identified the importance of improving seawater quality, as it has been impacted by increased water temperature and acidity. The government also indicated that future adaptation efforts must target the increased demand for water and electricity which will accompany rising temperatures and humidity levels. Food supply and production has also been identified as a focus area.

Vietnam

Estimated economic benefit from every dollar invested	**15x**
Estimated minimum investment required between now and 2030, in a 1.5°C scenario	**USD600mn (0.17% of 2021 GDP)**
Estimated cost of inaction between now and 2030 (avoided climate damages and missed GDP growth)	**USD8.9bn**
Estimated minimum investment required between now and 2030, in a 3.5°C scenario	**USD1.1bn (+83% compared to 1.5 °C)**

As a country with low-lying coastal and river delta regions, Vietnam is prioritising coastal flooding risk when it comes to adaptation to climate change.

According to our study, Vietnam will need to invest a minimum of USD600 million this decade to keep up with climate damages as they occur. However, the economic benefits will be 15 times greater than that, or USD8.9 billion, as damages are avoided, and GDP is able to grow more strongly.

According to the World Bank, Vietnam needs to focus its adaptation efforts on building disaster risk management capacity, for example, by improving water resource planning and water-use efficiency in drought-affected provinces, as well as biodiversity conservation and increased uptake of sustainable agricultural practices. The Vietnamese government has also emphasised the country's need for adapted infrastructure and changes to agricultural approaches to deal with the impacts of climate change. Indirect economic benefits of adaptation investment are the highest in Vietnam – adaptation investment results in substantial economic growth in the country.

About The Adaptation Economy

The Adaptation Economy examines climate change adaptation in key emerging and fast developing markets.

Economic modelling

The study uses a three-stage economic model to estimate the minimum investment required in climate adaptation measures, along with the economic benefits.

The study focuses on 10 markets across Standard Chartered's footprint – Bangladesh, China, Egypt, India, Indonesia, Kenya, Nigeria, Pakistan, the UAE and Vietnam – and assumes adequate climate mitigation measures are put in place to limit global heating to 1.5 °C above pre-industrial levels (unless otherwise stated).

For the purposes of this study, climate adaptation is investment in infrastructure, market reforms, research and education to build resilience against climate change and limit the adverse effects of global warming on economic activity.

This could include measures such as the building of flood walls, the restoration of mangrove forests, early warning systems or raising up streets to protect cities from rising sea levels.

Stage 1: Estimating expected future climate damages

Expected future climate damages are estimated by combining the gradual damage (i.e. impact on labour productivity) and immediate damage (i.e. impact from extreme weather events) at a GDP level. The gradual impacts are calculated using the work of Burke et al (2015),[1] which captures labour productivity losses due to temperature change, and data from UN population projections[2] to estimate the economic impact at a market level. Immediate damage was estimated using a blend of the EM-DAT[3] database of historical extreme weather events and IPCC estimates on increases in frequency of those events due to global warming.[4] Further analysis was conducted to estimate how these combined damages would impact at a broad sector level (agriculture, industry and services).

Stage 2: Calculating the investment required to abate those damages

The investment required to abate expected future climate damages in stage 1 is calculated based on estimates by the OECD.[5] In its modelling the OECD estimates optimal adaptation investment needed for given levels of climate damages. An investment-to-damage ratio is calculated from the identified 'cost optimal' pathway. This ratio is then used with expected damages to determine adaptation investments.

Stage 3: Calculating the economic benefit

The economic benefit figures are calculated using a combination of the future damages avoided by the adaptation measures and the indirect economic impact of the investment of the activity on GDP.

Avoided Damages

Avoided damages are calculated as a share of total expected future climate damages. The ratio of damages that can be avoided through adaptation is calculated using investment figures computed in stage 2 and parameters of adaptation capacity obtained from OECD research.[6] In line with the OECD methodology, the modelling assumes that adaptation investments contribute to overall resilience, which is built over time, and that this resilience needs to be maintained (as investments have a rate of deprecation).

GDP impact

The adaptation investment figures from Stage 1 were added to the macro-econometric model E3ME[7] as 'shocks' to ascertain the impact the investment would have on GDP (in addition to the avoided climate damages). These impacts were calculated country-by-country and are sensitive to local economic structures. It is assumed that these adaptation investments are financed from 'new' money, loans or grants that otherwise would not be available in the economy, therefore spending on adaptation does not mean that investment in other areas would need to decrease.

The economic benefit figures, which are a combination of avoided damages and indirect GDP impact, are reported in USD and a GDP (market) level.

Global figures

All global figures reported in the report are a sum of the 10 focus markets for the study.

Opinion research

Interviews were conducted with 150 senior leaders in global asset managers, institutional investors and banks. The research was conducted in November 2022 under the ethical research guidelines set by both the MRS (Market Research Society) and ESOMAR (European Society for Opinion and Market Research).

[1] Burke, M., Hsiang, S.M. and Miguel, E., 2015. Global non-linear effect of temperature on economic production. *Nature*, *527*(7577), pp.235-239.

[2] https://population.un.org/wpp/

[3] D. Guha-Sapir, R. Below, Ph. Hoyois - EM-DAT: The CRED/OFDA International Disaster Database – www.emdat.be - Université Catholique de Louvain – Brussels – Belgium.[4] IPCC, 2021. Summary for Policymakers

[5] Agrawala, S., et al. (2010), "Plan or React? Analysis of Adaptation Costs and Benefits Using Integrated Assessment Models", OECD Environment Working Papers, No. 23, OECD Publishing, Paris, https://doi.org/10.1787/5km975m3d5hb-en.

[6] Agrawala, S., et al. (2010), "Plan or React? Analysis of Adaptation Costs and Benefits Using Integrated Assessment Models", OECD Environment Working Papers, No. 23, OECD Publishing, Paris, https://doi.org/10.1787/5km975m3d5hb-en.

[7] The E3ME model is a dynamic computer-based macroeconomic model of the world's economic and energy systems and the environment, www.e3me.com

Standard Chartered

We are a leading international banking group, with a presence in 59 of the world's most dynamic markets and serving clients in a further 85. Our purpose is to drive commerce and prosperity through our unique diversity, and our heritage and values are expressed in our brand promise, Here for good.

Standard Chartered PLC is listed on the London and Hong Kong Stock Exchanges.

For more stories and expert opinions please visit Insights at sc.com.

Follow Standard Chartered on Twitter, LinkedIn and Facebook.

Credits and Disclaimer

Credits

The Adaptation Economy is based on in-depth research commissioned by Standard Chartered. The research was designed by Standard Chartered and Man Bites Dog.

Disclaimer

Forward-looking statements

This study may contain 'forward-looking statements' that are based on current expectations or beliefs, as well as assumptions about future events. These forward-looking statements can be identified by the fact that they do not relate only to historical or current facts. Forward-looking statements often use words such as 'may', 'could', 'will', 'expect', 'intend', 'estimate', 'anticipate', 'believe', 'plan', 'seek', 'continue' or other words of similar meaning.

Any forward-looking statements contained in this study are included to assist our stakeholders in understanding the ways we intend to address climate-related risks and opportunities. This information may not be appropriate for other purposes.

By their very nature, forward-looking statements are subject to known and unknown risks and uncertainties and can be affected by other factors that could cause actual results, and the Group's plans and objectives, to differ materially from those expressed or implied in the forward-looking statements. Recipients should not place reliance on, and are cautioned about relying on, any forward-looking statements. There are several factors which could cause actual results to differ materially from those expressed or implied in forward-looking statements. The factors that could cause actual results to differ materially from those described in the forward-looking statements include (but are not limited to): changes in global, political, economic, business, competitive and market forces or conditions; future exchange and interest rates; changes in environmental, social or physical risks; legislative, regulatory and policy developments, including regulatory measures addressing climate change; the development of standards and interpretations, including evolving practices in Environmental, Social and Governance reporting; the ability of the Group to mitigate the impacts of climate change effectively; risks arising out of health crises and pandemics; changes in tax rates, future business combinations or dispositions; and other factors specific to the Group. Any forward-looking statement contained in this study is based on past or current trends and/or activities of the Group and should not be taken as a representation that such trends or activities will continue in the future.

No statement in this study is intended to be a profit forecast or to imply that the earnings of the Group for the current year or future years will

necessarily match or exceed the historical or published earnings of the Group. Each forward-looking statement speaks only as of the date of the particular statement. Except as required by any applicable laws or regulations, the Group expressly disclaims any obligation to revise or update any forward-looking statement contained within this study, regardless of whether those statements are affected as a result of new information, future events or otherwise.

Please refer to the Group's latest Annual Report for a discussion of certain of the risks and factors that could cause actual results, and the Group's plans and objectives, to differ materially from those expressed or implied in any forward-looking statements.

Important Notice – Basis of Preparation and Caution Regarding Data Limitations

This study has been prepared by Standard Chartered Bank (SCB), a firm authorised by the United Kingdom's Prudential Regulation Authority and regulated by the United Kingdom's Financial Conduct Authority and Prudential Regulation Authority.

The reader should be aware that this study and the information contained within it have been prepared on the following basis:

1. This study and its contents are unaudited;
2. All material, positions and statements set out and cross-referred to in this study are subject to change without notice;
3. The material in this study does not constitute any investment, accounting, legal, regulatory or tax advice or an invitation or recommendation to enter into any transaction;
4. This study may have been prepared using models, methodologies and data which are subject to certain limitations. These limitations include: a lack of reliable data (due, amongst other things, to developing measurement technologies and analytical methodologies); a lack of standardisation of data (given, amongst other things, the lack of international coordination on data and methodology standards); and future uncertainty (due, amongst other things, to changing projections relating to technological development and global and regional laws, regulations and policies, and the inability to make use of strong historical data);
5. Some of the models, external data and methodologies used in this study are subject to adjustment which is beyond our control;
6. Any opinions and estimates should be regarded as indicative, preliminary and for illustrative purposes only. Expected and actual outcomes may differ from those set out in the study (as explained in the "Forward-looking statements" section);
7. Some of the information appearing in this study may have been obtained from public and other sources and, while the Group believes such information to be reliable, it has not been independently verified by the Group and no representation or warranty is made by the Group as to its quality, completeness, accuracy, fitness for a particular purpose or non-infringement of

such information;

8. For the purposes of this study, a number of key judgements and assumptions have been made. It is possible that the assumptions drawn, and the judgement exercised may subsequently turn out to be inaccurate. The judgements and data presented in this study are not a substitute for judgements and analysis made independently by the reader;
9. Any opinions or views of third parties expressed in this study are those of the third parties identified, and not of the Group, its affiliates, directors, officers, employees or agents. By incorporating or referring to opinions and views of third parties, the Group is not, in any way, endorsing or supporting such opinions or views;
10. Whilst the Group bears primary responsibility for this study, it does not accept responsibility for the external input provided by any third parties for the purposes of developing the study;
11. The data contained or cross-referred to in this study reflects best available information and estimates at the relevant time;
12. Where the Group has used any methodology and tools developed by a third party, the application of the methodology (or consequences of its application) shall not be interpreted as conflicting with any legal or contractual obligations and such legal or contractual obligations shall take precedence over the application of the methodology;
13. Where the Group has used any underlying data provided or sourced by a third party, the use of the data shall not be interpreted as conflicting with any legal or contractual obligations and such legal or contractual obligations shall take precedence over the use of the data;
14. This Important Notice is not limited in applicability to those sections of the study where limitations to data, metrics and methodologies are identified and where this Important Notice is referenced. This Important Notice applies to the whole study;
15. Further development of reporting, standards or other principles could impact this study or any metrics, data and targets included in this study (it being noted that Environmental, Social and Governance reporting and standards are subject to rapid change and development); and
16. While all reasonable care has been taken in preparing this study, neither the Group nor any of its affiliates, directors, officers, employees or agents make any representation or warranty as to its quality, accuracy or completeness, and they accept no responsibility or liability for the contents of this material, including any errors of fact, omission or opinion expressed.

You are advised to exercise your own independent judgement (with the advice of your professional advisers as necessary) with respect to the risks and consequences of any matter contained in this study.

The Group, its affiliates, directors, officers, employees or agents expressly disclaim any liability and responsibility for any decisions or actions which you may take and for any damage or losses you may suffer from your use of or reliance on this material. Copyright in all

standard chartered

Thank you for reading

The Adaptation Economy