Climate adaptation

How private investors can participate in evolving investment opportunities as cities adapt to climate risks

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Contents

Introduction

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In brief

- With urban areas expected to account for 70% of the world's population and 80% of global GDP by 2050,[1] towns and cities will need to remain resilient to the impacts of climate change, from both a social and economic standpoint.
- To adapt to increased climate risk, investment spending on urban infrastructure, real estate and transport needs to increase significantly, and the particular climate exposures and vulnerabilities of cities need to be better understood to ensure investments are targeted more effectively.
- Private sector investors have a compelling opportunity to reap the benefits of moving early in a space that offers a range of emerging solutions and the potential for long-term, often inflation-linked returns.
- Asset managers with expertise in understanding the adaptive opportunities within urban infrastructure can provide access to attractive potential returns, while helping clients to manage climate risks within their portfolios.
- This is the second piece in our climate adaptation series, looking at cities and urban infrastructure. You can also read our introduction to adaptation and pieces on adaptation in nature and healthcare systems.

The scale and visibility of climate change impacts have accelerated across the world in recent years, leaving few regions untouched. In our previous publication on climate adaptation, we discussed the particular vulnerability of cities and their physical infrastructure to the effects of global warming, due to climate risks such as flooding, storms and extreme heat. Now, we dive deeper into the increasingly severe climate change-related risks facing cities worldwide, focusing on the transport systems, real estate and other critical infrastructure that allow cities and urban societies to function.

There are many reasons why investors can benefit when it comes to adaptation investment in cities – including increasingly supportive policy and regulation, the high benefit-cost ratio of adaptation measures, and the growing opportunity set in this space. The question is how private investors can benefit from these opportunities and, for those investors with specific sustainability goals, direct their capital towards solutions to this pressing global challenge.

[1] "Urban Development at a Glance", World Bank (6 October 2022).

What are the key climate risks facing cities and how can they adapt?

The Intergovernmental Panel on Climate Change (IPCC) warns that failure to limit the global temperature increase to "well below 2°C" will expose the world to increased physical climate risk. Extreme weather events and other climatic hazards are expected to become more frequent and severe with every increment of warming, across all regions of the globe.[2]

In the case of cities, there are two major categories of physical climate risk to consider as global warming takes effect: flooding and extreme heat.

Flooding is a key hazard threatening the physical infrastructure of cities. Flooding can be caused by river overflow, heavy rainfall or increases in storm surges and tropical cyclones, and can quickly overwhelm urban drainage systems, causing widespread disruption and property damage, as well as contributing to the spread of disease. Sea level rise is also a major contributor to flooding risk, with two-thirds of the world's largest cities located on coastlines.[3] Encroaching seas threaten the inundation of coastal infrastructure, salinisation of water supplies and damage to property from coastal erosion, among many other effects.[4]

Extreme heat, meanwhile, is a particular risk to cities because of the urban heat island effect, which can cause temperatures in urban centres to reach 10°C to 15°C above rural surroundings.[5] It also exposes cities to significant drought risk, which impacts everyday activities, citizen health and wellbeing, and heightens risks such as wildfires. In addition, heatwaves can result in melting road surfaces and buckling railway lines, the need for increased cooling in buildings and outdoor spaces, increased water evaporation from reservoirs – exacerbating drought – and reduced output from power generation.[6]

Perception of these risks is widespread. 93% of cities reporting to a 2021 global survey by CDP (a non-profit organisation focused on climate-related disclosures) considered themselves to be facing significant climate hazards.[7] While no region is entirely safe, certain cities are at considerably higher risk than others. Physical climate risks are both difficult to predict (in terms of timing and magnitude) and are systemic – a fact that is highly relevant in the context of cities. The interactions between infrastructure networks in cities means that an impact in one area can be compounded by connections throughout the physical system, quickly undermining day-to-day functionality.[8,9]

Investments that increase the resilience of city infrastructure are therefore crucial to cities from both a social and economic standpoint. City adaptation is not only relevant to governments and policymakers, but also provides important opportunities for private investors in urban infrastructure assets.

Quantifying climate risk in cities

A 2022 report by C40 Cities, a global network of nearly 100 cities focused on taking action against climate change, quantifies the potential costs to member cities from a range of climate hazards by 2050 in a business-as-usual scenario (**Exhibit 1**). The report also highlights other future negative impacts that could be particularly disastrous for densely populated urban areas, such as flooding of energy generation facilities and hospitals, and droughts.

2 "Climate Change 2023: Synthesis Report of the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change", IPPC (2023).

3 C40 Cities, Adaptation and Water.

4 "Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change", IPCC (2022).

5 Mentaschi, L., Duveiller Bogdan, G.H.E., Zulian, G., Corban, C., Pesaresi, M., Maes, J., Stocchino, A. and Feyen, L., "Global Long-Term Mapping of Surface Temperature Shows Intensified Intra-City Urban Heat Island Extremes", Global Environmental Change–Human and Policy Dimensions, Volume 72, 102441 (2022). https://doi.org/10.1016/j.gloenvcha.2021.102441

6 Ibid.

7 "Cities on the Route to 2030: Building a Zero Emissions, Resilient Planet For All", CDP (2021).

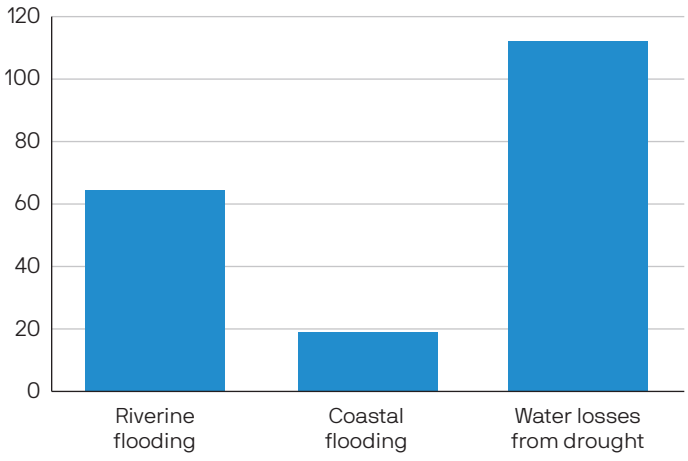
8 Black, D., Pyatt, N., "Transformative Mobility, Adapting Urban Transport to Climate Change", Eichhorst, U., Baskin, A. (eds.), Adapting Urban Transport to Climate Change Module 5f, Sustainable Transport: A Sourcebook for Policymakers in Developing Cities. 2nd Edition (2021).

9 C40 Cities Climate Leadership Group, AECOM, "C40 Infrastructure Interdependencies and Climate Risks Report", C40 Cities (2017).

What are the key climate risks facing cities and how can they adapt? (continued)

Exhibit 1: Projected annual costs to C40 cities by 2050 from climate hazards

USD billions



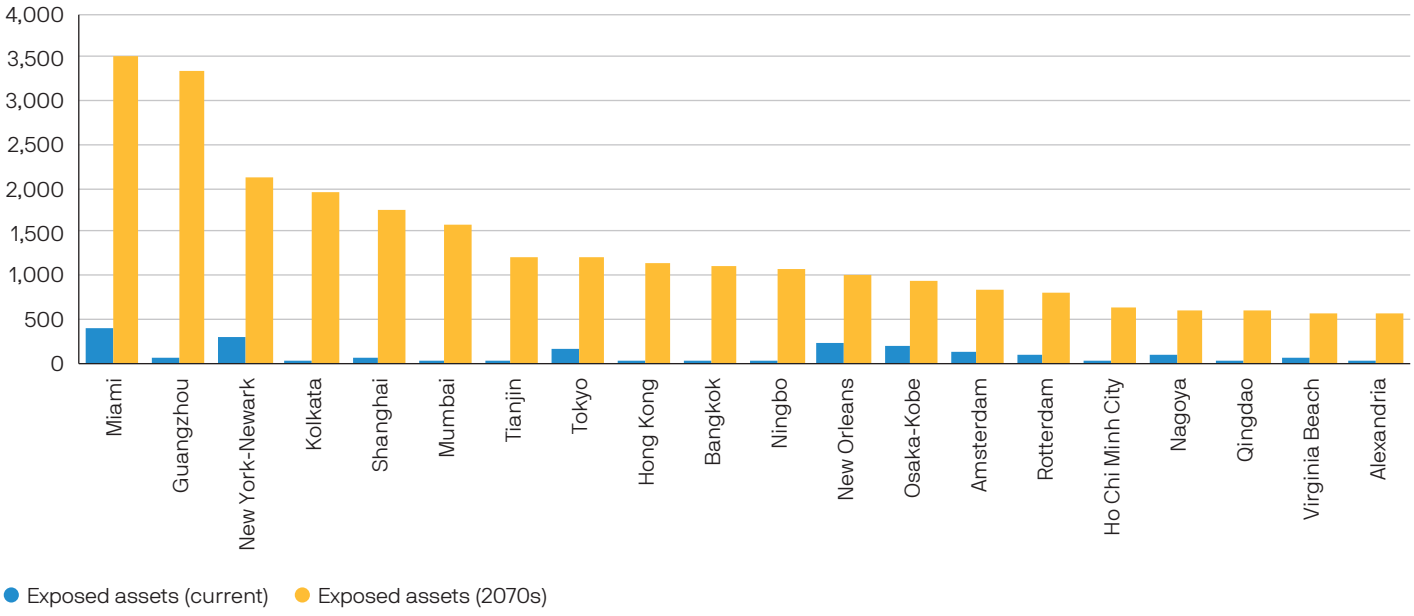
Source: C40 Cities: Water Safe Cities, 2022.

These physical climate risks can lead to secondary impacts that further threaten cities, their inhabitants and the companies that operate in such cities. Disruption to transport networks, for example, obstructs access to education, jobs, markets, and essential services, with negative and far-reaching consequences over extended time periods.

The potential for climate-related damages in the absence of adaptation is also shown by analyses of the financial value of assets at risk from climate change impacts. One study, for example, quantified the value of assets exposed to coastal flooding in 20 major port cities globally, showing a striking increase in potential value at risk by the 2070s, in a scenario where global sea levels rise by an average of 0.5m above 2010 levels. (**Exhibit 2**).

Exhibit 2: Current and future exposure of assets to coastal flooding in global port cities

USD billions



Source: Hanson, S. et al., "A Global Ranking of Port Cities with High Exposure to Climate Extremes" (2010).

What are the key climate risks facing cities and how can they adapt? (continued)

What are cities doing to prepare?

According to a disclosure database maintained by CDP, 583 cities have now undertaken and reported climate risk and vulnerability assessments. These assessments are of varying depth and quality, but nevertheless show that climate change is fast moving up the agenda as a governance and financing concern. Overall, however, understanding of the possible future impacts of climate change is still somewhat scattered and uncertain. This all serves to highlight the importance of investment, in order to build resilience to a range of potential future climate scenarios.

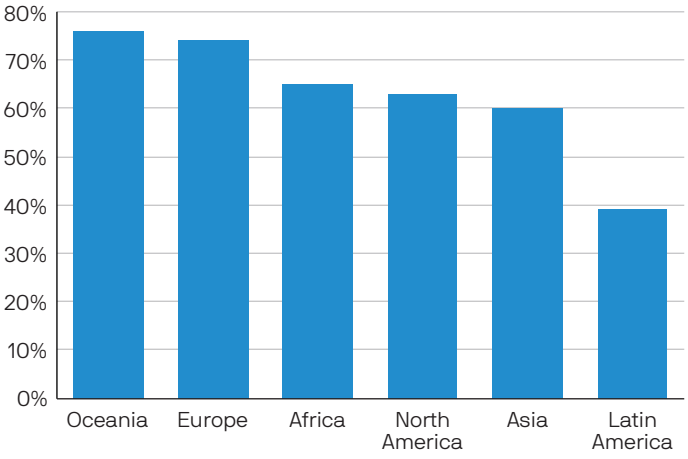
When it comes to urban adaptation, we see three essential elements for cities to act on. First is an initial risk assessment, enabling municipal authorities and investors to understand the risks to which their cities are exposed. Second is the design and implementation of regulations and policies that allow adaptation to be integrated into urban planning and city management, followed by the identification of concrete measures to build resilience against climate risks. Finally, and perhaps most importantly, cities need to attract sufficient investment in order to realise their climate adaptation goals.

1. Plans

Many cities are beginning to build plans of action for assessing climate risks, but this is not universal. The most recent IPCC assessment report found that while many more cities had developed adaptation plans since the previous report, only a limited number of these had been implemented. It also noted that many plans focused narrowly on climate risk reduction, missing opportunities to advance potential co-benefits such as climate mitigation and sustainable development.[10]

This concern is echoed by CDP's 2021 survey, which found that 43% of reporting cities still did not have an adaptation plan to tackle climate risk.[11] Moreover, the proportion of cities reporting climate adaptation plans varied notably by region (Exhibit 3). This variation is significant, because the CDP survey also found that cities with climate action plans identify more than twice as many opportunities from addressing climate change as cities without them. The identification of effective and cost-efficient adaptation opportunities is the first step towards attracting investment and beginning to implement solutions as part of city-wide adaptation strategies.

Exhibit 3: Proportion of cities with a climate adaptation plan by region



Source: CDP, "Cities on the Route to 2030: Building a Zero Emissions, Resilient Planet for All" (2021).

2. Policies

Adaptation policy and planning at both the national and city level is maturing and becoming ever more supportive, but this trend will need to continue, in order to provide an enabling environment for investors, and to highlight areas where private investment is most needed.

Policies outlined in city adaptation plans can be either systemic in nature, or hazard specific. Systemic policies have broadly defined strategies, objectives and proposed lines of action – for example, integrating climate risk assessments into planning and budgeting or enacting regulations and public education programmes to support adaptation. Hazard-specific policies define tangible measures and interventions, such as commissioning climate-resilient infrastructure construction.[12]

Here are just some of the many examples of both systemic and hazard-specific measures that have already been implemented across the world:

[10] "Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change", IPCC (2022).

[11] "Cities on the Route to 2030: Building a Zero Emissions, Resilient Planet For All", CDP (2021).

[12] Olazabal, M. et al., "A Cross-Scale Worldwide Analysis of Coastal Adaptation Planning", Environmental Research Letters, Volume 14, Number 12. 124056 (2019).

What are the key climate risks facing cities and how can they adapt? (continued)

1. Paris's **Oasis Schoolyard Programme** to reduce the impacts of extreme heat in the city[13]
2. New York's **Extreme Weather Response Task Force** and comprehensive plan on combatting storm-related extreme weather[14]
3. The replacement of overhead power lines with underground cables as a weather-proofing measure by a power utility in Finland[15]
4. The United Kingdom's individualised **"City Packs"**, which provide high-level, non-technical summaries of a city's future climate to help local decision makers plan adaptation based on future scenarios[16]
5. Tokyo's varied preparation measures for climate disasters, such as the distribution of virtual reality videos of storms and flooding and enhancement of the **Disaster Preparedness Tokyo** app[17]
6. **Singapore's** digital twin city, Virtual Singapore, which provides a model for experimenting with new strategies for climate resilience (for example, reviewing different responses to the urban heat island effect in each district and adjusting as needed before physical implementation)[18]
7. Nature-based urban adaptation strategies in **Melbourne**, including its "Grey to Green" policy to repurpose asphalt as green open space, its "Urban Forest Strategy", which aims to plant 3,000 trees a year in the central city, and its "Total Watermark – City as a Catchment" strategy, to improve permeability and ground water storage[19]

[13] European Union Climate-ADAPT.
[14] Wolfe, E., Schaeffer, M., Sutton, J., et al., "The New Normal: Combating Storm-Related Extreme Weather in New York City", City of New York (2021).
[15] European Union Climate-ADAPT.
[16] UK Met Office, UK Climate Resilience Outputs <https://www.metoffice.gov.uk/research/approach/collaboration/spf/ukcrp-outputs> [accessed 14 March 2023].
[17] Tokyo Climate Change Adaptation Policy.
[18] "Delivering Climate-Resilient Cities Using a Systems Approach", World Economic Forum (2022).
[19] "Cities on the Route to 2030: Building a Zero Emissions, Resilient Planet For All", CDP (2021).

What are the key climate risks facing cities and how can they adapt? (continued)

Overall, these assessments suggest that progress is being made to identify physical climate risks and corresponding solutions. Nevertheless, there is substantial progress to be made: of the cities surveyed by CDP, only 18% were conducting flood mapping, just 14% were developing crisis management plans (including early warning and evacuation systems), and barely 10% were developing hazard-resistant infrastructure design and construction. In addition, more granular and forward-looking asset-level data is still needed to avoid "climate-blind" decision-making. But awareness is only one part of the equation; whether cities have the capacity to fund the solutions they need is another question.

3. Financing

The final piece of the puzzle is access to finance for cities, so that adaptation can become a reality. Although many cities are beginning to recognise the need for climate adaptation, 25% of cities in the CDP survey still cited budgetary capacity issues as an obstacle to taking action.[20] This finding is in line with the growing financing gap analysed every year in the annual Adaptation Gap Report published by the United Nations Environment Programme (UNEP).

While some cities are better equipped to respond to the threat of climate change than others, overall a similar trend is clear for cities across the world. In short, there are substantial and increasing needs for climate adaptation, but also persistent barriers to financing and implementing the necessary measures, which we will explore in more detail later. The result of this financing gap is that effective adaptation is by no means the global norm – a risk that should be a consideration in the strategic asset allocation decisions of private investors in the context of rising climate risk to the companies and assets in which they are invested

[20] "Cities on the Route to 2030: Building a Zero Emissions, Resilient Planet For All", CDP (2021).

Why should investors invest in urban climate adaptation?

The overall impact of climate risk can be seen as the result of a particular climate hazard, combined with a city's level of exposure to that hazard, and a city's level of vulnerability. Exposure and vulnerability will influence both the size of the initial damage from a climate hazard, and the scale of cascading impacts that a city experiences.

Logically, cities in risk-prone locations with ageing infrastructure and few structural provisions for climate change preparedness will suffer longer-lasting damages and greater disruption than those cities that have taken steps to limit the exposure and vulnerability of their infrastructure. As a result, targeted investment in infrastructure adaptation can directly reduce exposure and vulnerability, which in turn can contribute to improved socioeconomic outcomes and better management of climate-related risks for cities, their inhabitants, and companies that operate in such cities.

Thinking of adaptation in this way means it can be viewed not only as a tool for reactive damage reduction by cities, but also as an opportunity for proactive risk management. Overall, a long-term approach to asset resilience and adaptation can offer a novel opportunity set and the potential for positive financial return for investors who seek targeted investments in infrastructure, in addition to providing investment opportunities for investors seeking sustainable outcomes.

Adaptation provides clear benefits relative to its costs

A common misperception is that adaptation investments cost a lot to implement and provide minimal return on investment. As a result, adaptation is frequently relegated to a last-minute solution for when climate impacts become too difficult to cope with.

In reality, the benefit-cost ratio is often a clear advantage when investing in adaptation, which could increase the attractiveness of such investments. For example, while the Global Commission on Adaptation estimates that integrating climate resilience into investments may have an upfront cost of around 3% of the overall project, the Commission also finds that adaptation investments have an average benefit-cost ratio of 4:1, with benefits accruing to the cities where projects are implemented as well as investors in these projects.[21] In other words, even where the initial cost of investment is high, the long-term benefits often outweigh this. We look in more detail at exactly what these benefits represent for investors below. There is a large variation in the ratio of benefits to costs, depending on the project in question, but there is evidence to suggest that some actions, such as water efficiency measures and heatwave planning, may deliver benefits that could be over 10 times greater than their costs.[22]

One report looking at adaptation on a global scale found that every dollar invested in disaster risk reduction could save between USD 4 and USD 11 in losses from events including flooding, wildfires and storm surges.[23] But avoided losses are only one part of the equation. Adaptation also provides a potential "triple dividend" by creating economic opportunities, such as additional jobs, as well as positive environmental and social co-benefits that can support sustainable development (**Exhibit 4**).[24]

These benefits accrue to investors by helping the companies, or the municipal projects, in which they are invested to avoid economic losses related to physical climate risk, thereby making them more competitive in the context of accelerating climate change. Investing in adaptation should also help investee companies to unlock new profit opportunities thanks to improved operational resilience and efficiency, or by offering specific adaptation solutions via their products or services. Indirectly, investors may well enjoy benefits in terms of more robust local economic growth, community resilience, or better long-term management of the natural resources upon which a city relies. Although these co-benefits from adaptation are typically harder to measure and quantify, they contribute to the overall resilience of a sector or region to which an investor has allocated their capital.

[21] "Adapt Now: A Global Call for Leadership on Climate Resilience," Global Commission on Adaptation, 22 December 2022.

[22] "Investment for a Well-Adapted UK", United Kingdom Climate Change Committee (2023).

[23] Dicker, S., Unsworth, S., Byrnes, R., Ward, B., "Saving Lives and Livelihoods: The Benefits of Investments in Climate Change Adaptation and Resilience", Grantham Research Institute on Climate Change and the Environment, and the Environment Centre for Climate Change Economics and Policy. London School of Economics and Political Science (London, 2021).

[24] Tanner, T., Reid, R. C. J., Wilkinson, E., Surminski, S., Maruyama Rentschler, J. E., Rajput, S., "The Triple Dividend of Resilience: Realising Development Goals Through the Multiple Benefits of Disaster Risk Management", Overseas Development Institute (ODI), World Bank, Global Facility for Disaster Reduction and Recovery (Washington DC, 2015).

Why should investors invest in urban climate adaptation? (continued)

Exhibit 4: The triple dividend of adaptation

Source: Global Commission on Adaptation (2019)

As an example, adaptation measures, such as mangrove forests for flood protection, not only provide USD 80 billion per annum of avoided economic losses, but also might generate between USD 40 billion and USD 50 billion in co-benefits in terms of ecosystem services, improved community wellbeing and consumer goodwill. And these co-benefits will materialise regardless of whether the disaster they are protecting against occurs or not.[25] The financial benefits of adaptation investments, coupled with the additional co-benefits they provide, could make this an attractive area for investors, particularly for those targeting specific sustainability outcomes.

The perception has been that the adaptation space is by default the responsibility of the public sector and governments. Although adaptation investments are sometimes for the public good – large-scale urban infrastructure being an obvious example – it is important to note that these projects also concern private investors in several ways. Real assets may be directly owned or managed by private investors, for example, making the relevance of proactive adaptation investment very clear. Even in the case where such assets are publicly owned, private investors should have an interest in bolstering public spending to increase asset resilience and promote adaptation more broadly. This need for private sector involvement is particularly true in the context of cities, where the cascading impacts of physical climate risk could endanger privately held assets and businesses. As such, private investment in adaptation should be seen as a key tool of risk management.

Furthermore, the association of adaptation with large-scale public investment is weakening, with the recognition that adaptation encompasses a varied and accessible opportunity set across multiple sectors. Increasingly, adaptation provides an attractive thematic play for individual investors that offers the chance to diversify away from the focus on traditional climate mitigation finance.

In other papers in our adaptation series, we look at the range of strategies and financial instruments that can allow investors to access financial returns from adaptation opportunities - including mechanisms for public-private collaboration. We discuss the complexities of identifying beneficiaries from adaptation actions, while emphasising the importance of private investment in adaptation to mitigate portfolio risks and participate in evolving opportunities.

Closing the urban adaptation financing gap

While the rationale for adaptation has been firmly established, financing for adaptation solutions is lagging. The Organisation for Economic Co-operation and Development (OECD) estimates that infrastructure investment globally stands at around USD 2.7 trillion each year. This amount is almost 60 times larger than the total climate finance earmarked specifically for adaptation. The small size of allocated adaptation finance to date in relation to finance for infrastructure in general shows a lack of concern for adaptation needs within infrastructure planning.[26]

[25] "Adapt Now: A Global Call for Leadership on Climate Resilience," Global Commission on Adaptation, 22 December 2022.

[26] Mullan, M. and Ranger, N., "Climate-Resilient Finance and Investment: Framing Paper", OECD Environment Working Papers. No. 196 (Paris, 2022). https://doi.org/10.1787/223ad3b9-en.

Why should investors invest in urban climate adaptation? (continued)

The International Finance Corporation (IFC), meanwhile, notes that in the 15 years to 2018, less than 20% of private investment in infrastructure had been directed to urban infrastructure, for either resilience building or general purposes, and that there was a declining trend in the number of projects backed by private investment. These figures are borne out by analysis from the Climate Policy Initiative, which found that finance for urban adaptation projects amounted to USD 7 billion in 2017-2018, representing just 9% of investments tracked at the project level, against the 91% (USD 69 billion) for mitigation and dual uses. In addition, only 22% of flows for adaptation came from the private sector.

Investments in adaptation provide opportunities for long-term returns for investors while closing the financing gap for projects. The World Bank suggests that an annual investment in adaptation of USD 11 billion – USD 20 billion will be needed by 2050 to protect urban infrastructure alone, and the estimated costs of adaptation in many sectors are only increasing.[27] According to World Bank analysis, coastal protection is the sector with the biggest adaptation financing gap, with an annual shortfall of around USD 26 billion until 2050.[28] Coastal protection was followed by the infrastructure, energy and other built environment sector, and then by water and wastewater management – all of which are vital for the effective functioning of cities. CDP's recent survey of the adaptation needs of cities, meanwhile, identified over 1,000 climate adaptation projects seeking finance in the areas of transport, energy efficiency, and water and waste management, among others.[29]

There is also a strong case for cities to act imminently on climate adaptation. The long-lived nature of city infrastructure means that decisions made now will lock in vulnerabilities if they fail to consider future climate impacts. The longer the delay in integrating adaptation into investments, the less prepared infrastructure will be for those impacts. Retrospective adaptation is ultimately more costly and labour-intensive than pre-emptive resilience-building – integrating adaptation from the outset makes good financial sense, especially if adaptation is being built into urban infrastructure investments that need to be made anyway.

Ultimately, effective adaptation solutions need to be underpinned by adequate and targeted finance, but financing to date has been far from sufficient. City governments are unlikely to be able to fill the gap alone, which is where we believe private investors could have a key role to play.

City-level climate risk assessments and strategic plans for climate adaptation are key for the public sector as well as private investors, since large proportions of city infrastructure can be owned by private investors. These assets can be impacted by cascading effects from a lack of resilience in public infrastructure, given the high interdependency of built environments.[30] Consequently, private investor awareness of city climate adaptation plans, budgets, and the trajectory of municipal policy and regulation is key.

Crucially, investment in adaptation does not have to mean rejecting or divesting from projects assessed to be at high risk from climate change. Adaptation investments can – and arguably should – be intentional, proactive and systematic, supporting projects that build in resilience from the start.[31] Investors should consider both what can be done about their assets already at risk, as well as how investing in new projects can be done differently, with the goal of minimising asset exposure and vulnerability.

In the table in **Exhibit 5**, we lay out a number of specific adaptation solutions in the three key areas of transport, real estate and other infrastructure. These solutions encompass hazard-specific and more systemic actions that aim to improve city resilience to climate change. Opportunities vary in terms of scale and feasibility, so it remains up to the individual investor to assess which urban adaptation actions might be accessible with the financial instruments available, and given their capital constraints and risk/return objectives.

[27] Chu, E., Brown, A., Michael, K., Du, J., Lwasa, S., Anjali, M., "Unlocking the Potential for Transformative Climate Adaptation in Cities", Background paper prepared for the Global Commission on Adaptation, World Resources Institute (Washington DC and Rotterdam, 2019).

[28] Tall, A., Lynagh, S., Blanco Vecchi, C., Bardouille, P., Montoyo Pino, F., Shabahat, E., Stenek, V., Stewart, F., Power, S., Paladines, C., Neves, P., Kerr, L., "Enabling Private Sector Investment in Climate Adaptation and Resilience: Current Status, Barriers to Investment and Blueprint for Action", World Bank, Global Facility for Disaster Reduction and Recovery (Washington DC, 2021).

[29] "Cities on the Route to 2030: Building a Zero Emissions, Resilient Planet For All", CDP (2021).

[30] C40 Cities Climate Leadership Group, AXA, "Understanding Infrastructure Interdependencies in Cities", C40 Cities (2019).

[31] Mullan, M., Ranger, N., "Climate-Resilient Finance and Investment: Framing Paper", OECD Environment Working Papers, No. 196, OECD Publishing (Paris, 2022) https://doi.org/10.1787/223ad3b9-en.

How private investment can support urban climate adaptation

Exhibit 5: Potential adaptation solutions

Sector	Adaptation solution
Transport	Make road surfaces concave for improved drainage and reduced surface water flood risk
	Install emergency pumping capacity to evacuate water from underground transit systems
	Increase provisions for active transport, such as improved walking and cycling routes and shaded access routes for pedestrians
	Expand the range of transit options and improve connectivity to provide alternative options during disruption
	Stabilise slopes using physical support structures
	Implement erosion control measures
	Remodel train tracks to be more aerodynamic to reduce debris accumulation
	Use smart technology to aid monitoring and maintenance of transport networks
	Adapt design and location of roads, railways, bridges and other key infrastructure to reduce exposure
	Adapt vehicles for altered climatic conditions
Infrastructure	Design pavements to resist melting in high temperatures
	Increase transmission tower height
	Upgrade water storage and supply; desalination and sanitation
	Install remote sensing, drone technologies and monitoring software to combat risks, such as wildfires, and conduct targeted power shutdowns
	Upgrade flood defences, such as sea walls, dikes, levees and fortified coastal infrastructure
	Develop added redundancy for key infrastructure links
	Increase cooling system capacity for energy generation facilities
	Build emergency response teams for quick repair and restoration actions
	Put distribution lines and electricity cables underground
	Use climate-resilient construction materials, such as stainless steel, to reduce corrosion from water damage
	Install porous pavements, sustainable urban drainage systems (SuDS) or lattice grids for storm run-off control and improved drainage
	Expand constructed wetlands
	Use nature-based infrastructure such as street trees to combat the urban heat island effect, and flood retention lakes

How private investment can support urban climate adaptation (continued)

Sector	Adaptation solution
Real estate	Invest in frangible architecture
	Use triage design for rapid reconstruction
	Design for deconstruction
	Install rainwater collection and harvesting systems – stormwater attenuation
	Install green roofs and other urban greening factors
	Orientate property for improved ventilation or solar access
	Ensure appropriate insulation and/or reflective cool surfaces, such as white walls and roofs
	Install UPVC windows
	Use water walls or Trombe walls
	Build raised or amphibious homes
	Design for storm resilience, such as geodesic domes
	Implement behavioural change programmes at the user level
	Design for physical risk scenarios
Cross-cutting	Install early warning systems
	Install control, monitoring or forecasting systems to provide tailored or localised climate and weather information
	Enhance inspection and maintenance regimes
	Inform urban planning with climate risk and vulnerability assessments
	Develop pre-emptive disaster mitigation plans
	Mandate climate-resilient design via policy and regulation to encourage climate-aware buildings and raise construction standards

How private investment can support urban climate adaptation (continued)

Real estate: A case study in climate change preparedness

Real estate assets are potentially among those with the greatest exposure to physical climate risks as global temperatures continue to rise. J.P. Morgan Asset Management's Resilience programme was developed to assist in the evaluation of climate change risk to existing and prospective property investments. The programme is aligned to the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and provides a process for identifying physical risks to real assets at both the portfolio and individual asset level. The programme is subject to continuous refinement in order to make it more structured and responsive to evolving climate risks. It also aims to take advantage of improving tools for modelling climate risks and quantifying asset exposure to risks.

J.P. Morgan Asset Management's real estate investment teams use specialist software to identify potential future location-based, climate-related physical risk perils. Properties are aggregated at the portfolio level to calculate the risk by percentage of gross added value (GAV) for perils including earthquakes, wildfires, floods, hurricanes and typhoons, heat stress, water stress, and sea level rise. Additionally, an initial assessment of the potential risk of a location is performed as part of due diligence for the underwriting of new acquisitions.

For individual assets at high or extremely high risk for any physical risk peril, deeper analysis is performed, beginning with the largest assets by GAV. Our external consultant uses another tool from a reinsurer to compare the results, as each software product offering has a different model for projecting its potential future risk. These discrepancies are likely due to the scales used by underlying models and differences in how they consider underlying environmental factors. In addition, the reinsurance tool demonstrates greater levels of detail, in that it offers multiple projection periods up to 2100 and multiple climate scenarios.

If the two tools yield similar results, the consultant and property team will assess the asset's existing physical improvements to see if the risk has already been mitigated. If not, the investment team will be given recommendations or guidance on how to improve the asset's resilience. They are then responsible for evaluating strategies and ensuring that appropriate adaptation measures are considered.

If the two software tools do not yield the same result, our external consultant reviews flood maps, the location of water sources and other information about the location, the city and any future improvements, to make a determination about the potential risk level. An early understanding of the climate risk profile of real estate assets allows for time to consider a range of adaptation measures and implement them as appropriate, with the goal of protecting an asset's long-term returns.

Transport: A case study in climate adaptation

In recent years, climate change has led to extreme weather conditions across western Europe, including heatwaves and droughts. The impact has disrupted the livelihoods of many people, including those living in the Rhine basin. The Rhine is a critical European transportation artery for commercial and industrial activity in Germany, the Netherlands, France and Switzerland. Each year, more than 300 million tonnes of cargo are transported via the Rhine, providing job opportunities for over 58 million people who reside within the Rhine basin.

In the summer of 2022, the water level at Kaub in Germany, which is the usual shallow water bottleneck spot on the Rhine, dropped to as low as 34 centimetres. In comparison, the preferred river barge navigation water level is above two metres. Overall, water levels from June to September 2022 were up to 75% below the historical average over the previous five years, which was already well below 20th century averages. These recent droughts and low water levels led to heavy congestion at ports, delayed deliveries of essential raw materials, and higher inflation due to increasing transportation costs.[32]

[32] J.P. Morgan Asset Management

How private investment can support urban climate adaptation (continued)

Figure 1: River Rhine low water level in 2022

Source: Shutterstock, April 2023.

To combat this climate challenge, environmentally friendly hybrid river barges can be introduced with ultra-shallow draft designs that enable navigation during droughts, thereby helping to ensure the smooth flow of essential cargo and the continuation of commercial activities along the river. Environmental impacts are reduced due to hybrid technologies that enable the barges to utilise more environmentally friendly fuels than traditional marine diesel. The intention behind the introduction of these environmentally friendly barges is to coordinate efforts with local traders and help inspire traditional river barge participants to join the efforts to preserve the Rhine's ever-important trade lanes.

How private investment can support urban climate adaptation (continued)

Figure 2: Eco-friendly hybrid barge

Source: J.P. Morgan Asset Management.

How could the private sector investment landscape evolve from here?

As the Climate Policy Initiative's analysis of investment flows to adaptation suggests, the concept of aligning investment portfolios and private financial flows with adaptation and resilience goals is still in its early stages. We see three barriers to increased private sector participation in adaptation financing as particularly relevant.

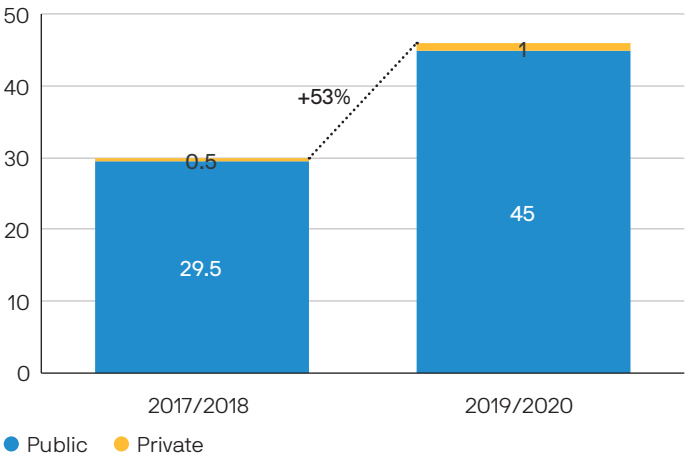
First, the need for adaptation is persistently associated with developing countries and emerging markets, while in reality physical climate risk should be a consideration for cities and industries in all regions, as evidenced by extreme weather across Europe, America and Australia in recent years.

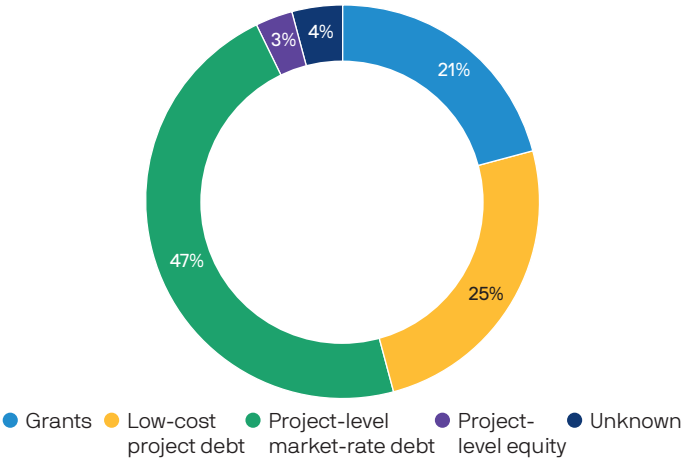
Second, as we've discussed, adaptation is widely seen as the preserve of governments and public actors, partly due to a perceived low return on investment that does not match the associated climate risk reduction benefits. There is a need to promote the material benefits of investments in climate resilience – including increased asset life and protected asset returns, investments that help insulate private investment portfolios from financially material physical climate risks, and other benefits that are attractive for investors seeking sustainable outcomes.

Third, there is still insufficient decision-useful data and information around physical climate risks and the benefits of adaptation actions to cities and investors. This lack of data is compounded by the lack of a single comparable metric for adaptation projects. Whereas mitigation solutions deliver a tangible output and can be viewed via a standardised metric of carbon emissions reduction, adaptation solutions are highly context-specific; they can take many forms and are not always well defined. A good starting point is to utilise measurements such as avoided losses and benefit-cost ratios. Over time, better data and quantified assessments of the benefits of adaptation would help private investors to integrate these solutions into their decision-making.

Exhibit 6, based on Climate Policy Initiative data, shows the notable increase in global adaptation finance in 2019-2020 compared to the previous year, but also the negligible proportion of this investment that came from private sources, which was split evenly between corporations and institutional investors. Although a range of instruments was used to provide adaptation finance from both public and private sources, there is room for further expansion. And considering that adaptation finance made up only 7% of overall climate finance in 2019-2020, the scope for an increase is also clear.

Exhibit 6: Sources of adaptation finance and instruments used (USD billions)





Source: Climate Policy Initiative as at 2021.

How could the private sector investment landscape evolve from here? (continued)

Assessing the financing options for private sector investors

Scaling up private adaptation finance requires a full pipeline of urban adaptation project options, combined with supportive policy and regulation, and streamlined processes for attracting private sector expertise and to help crowd in private capital. Expanding the range of financing options available to access adaptation solutions may also encourage more adaptation investment.

Fortunately, the possibilities for allocating capital to adaptation through a range of channels is expanding. Opportunities to invest in adaptation exist at the level of companies, financial instruments and individual assets. At the company level, investors can allocate capital to the public or private equity, or debt, of companies developing adaptation solutions, or companies that are working to effectively climate-proof their own operations.

Investors also have access to an increasing array of mechanisms and financial instruments that can advance private investment in adaptation. These instruments include: green, social and sustainability bonds; emerging fixed income instruments, such as resilience and catastrophe bonds; municipal bonds based on project cash flows; and sovereign bonds designed to help issuing countries with adaptation efforts. Financing options can extend to public-private partnerships that use de-risking or guarantee mechanisms provided by development finance institutions (DFIs) or other public institutions, or vehicles that pool portfolios of adaptation investments to spread risk and lower investment entry points. They can also include alternative financing structures, such as blended or project finance vehicles with enhancements to increase project creditworthiness, reduce risk and catalyse private investment.

Furthermore, investors can think in terms of individual assets and asset classes for adaptation financing. They might look to invest directly or via fund managers in alternative assets, such as transport, real estate and other infrastructure crucial to urban development. They might also consider investing in insurance as an effective measure to support climate adaptation, targeting appropriately priced and widely available climate risk insurance. Investing in insurance solutions includes engagement with insurers during planning processes so that measures that would reduce insurance risk can be highlighted, thereby making insurance more readily available as a risk backstop.

Finally, investment opportunities can be supported by adaptation-focused policy instruments, incentives and standards, including the incorporation of climate-resilient standards into procurement requirements, and the setting of climate-resilience mandates for regulated infrastructure.[33] For example, New York's Climate Design Guidelines apply scientific climate projections to design interventions for buildings and infrastructure. The city can use sea level rise projections from the guidelines to adjust a design according to an asset's expected useful life. New York has also implemented a "mitigation banking programme" to encourage systematic wetland restoration and resiliency improvements across the city.[34]

In another example, Copenhagen has used a public-private finance scheme to fund its Cloudburst Management Plan for storm water management. The city worked with private sector partners, including insurance companies, to monetise losses and projected losses, and create cost-benefit analyses of measures to provide a strong case for municipal budget allocation.[35]

Private sector involvement

This all goes to show that as well as providing direct financing, the private sector can help urban adaptation in a range of other ways, as investors look for further opportunities for long-term returns from infrastructure investment or to support sustainability outcomes. Where cities lack the technical capacity to develop and implement adaptation projects, the private sector can step in to provide hard-to-access data and modelling expertise, among other services. Private finance with a long investment horizon, such as direct infrastructure investment, could also help to overcome the inherent conflict between city budgeting cycles and the need for long-term, adaptation-focused development.

Ultimately, for the urban adaptation financing gap to be closed, expanding and combining the range of investment sources that are able and willing to invest in climate resilience will be key. Increasing the amount of private investor capital flowing to urban adaptation, via increased awareness of the opportunity set and the ways to access it, should be a clear priority for climate-focused investors and asset managers.

[33] Tall, A., Lynagh, S., Blanco Vecchi, C., Bardouille, P., Montoyo Pino, F., Shabahat, E., Stenek, V., Stewart, F., Power, S., Paladines, C., Neves, P., Kerr, L., "Enabling Private Sector Investment in Climate Adaptation and Resilience: Current Status, Barriers to Investment and Blueprint for Action", World Bank, Global Facility for Disaster Reduction and Recovery (Washington DC, 2021).

[34] C40 Cities Climate Leadership Group, "Water Safe Cities", C40 Cities (2022).

[35] C40 Cities Climate Leadership Group, "Climate Change Adaptation in Delta Cities: Good Practice Guide", C40 Cities (2016).

Conclusion

Cities across the world are hotspots of exposure and vulnerability to the increasingly severe impacts of climate change. At the same time, cities also face multiple challenges in responding to the climate-related threats that they face. These issues are, however, precisely the reason why cities should be of interest to private investors looking to better understand risks and allocate capital towards proactive, pragmatic opportunities in the climate adaptation space.

The characteristics that make cities vulnerable to climate change, including rapidly growing populations and dense concentrations of infrastructure, also offer possibilities for transformative change. Building awareness of both risks and effective adaptation solutions can allow private investors to benefit from the long-term opportunity in climate adaptation investing, while also helping those investors with specific sustainability goals contribute to a more resilient urban environment for all.

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For more information on our approach to Sustainable investing, contact your J.P. Morgan Asset Management representative.

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