

INSIGHT

# CLIMATE RISK RESILIENCE OF THE CITY

September 2021

**Climate risk is now a reality which will impact current and future value of property. When we talk about climate risk, we invariably mean one of two things - the transitional risk of moving towards a low carbon economy or the physical risks associated with climate change (see text box 1).**

Our buildings are at the forefront of these risks. Not only in terms of the stability of their structures but also because they are the foundations to our collective societies. They are valued on this basis; they are valued on the living and working conditions they represent and the areas in which they exist.

As we move into a new reality where we are no longer talking about prospective extreme weather events in ten- or twenty-years' time, but see those events happening in real time, the implications of climate risk on the value of our real estate is becoming front and centre to the industry (see text box 2). However, the methods in place to accurately reflect the current and future potential value of a building in light of climate change arguably fall short of taking climate risk into account.



# 1 TRANSITION AND PHYSICAL RISKS

Transition risks are those associated with moving towards a lower-carbon economy. This includes, policy, legal, technology, market and reputational risks involved in the mitigation and adaptation to climate change.

Physical risks include both the acute (which are event driven e.g. floods, wildfire, landslides) and chronic risks (which are attributed to long-term shift in climate patterns e.g. higher temperatures, change in wind patterns, sea level rise). Physical risks increase with increased global warming due to weather patterns changing.



# 2 HIGH LEVEL OVERVIEW OF IPCC FINDINGS

Key findings from the 6th IPCC Report released in 2021 states that global warming under a very low emissions scenario will see temperature rise of 1.5°C by 2040. If we continue as we are, carbon emissions will triple, therefore warming will reach 1.9°C by 2040.

In terms of the impact of this rise in global warming IPCC have estimated the following increases in the statistical likelihood of an event happening:

- Intensity of an extreme temperature event occurring once in 10 years on average will increase under the following future warming scenarios:
  - o 1.5°C – every 2.4 years
  - o 2°C – every 1.8 years
  - o 4°C – every 1.06 years
- Intensity of an extreme temperature event occurring once in 50 years on average will increase under the following future warming scenarios:
  - o 1.5°C – every 5.8 years
  - o 2°C – every 3.6 years
  - o 4°C – every 15 months
- Frequency and increase of intensity of a heavy 1-day precipitation event occurring once in 10 years on average will increase under the following future warming scenarios:
  - o 1.5°C – every 6.6 years
  - o 2°C – every 5.8 years
  - o 4°C – every 3.7 years

IPCC Working Group, 2021

This Cushman & Wakefield whitepaper will address the impact of climate change to the real estate sector, and answer the following questions: How can the stakeholders involved in owning, managing and operating real estate, pro-actively address climate risk? What investment and business decisions can be taken in advance of events occurring to help protect value and enhance the resilience of our assets?

## CLIMATE CHANGE RISK IN THE CITY

As the climate changes, impacts on real estate are most directly felt in cities. Climate change is already having a devastating impact on our rural and wild environments. Due to the capital locked up in cities, the built environment will feel the economic impacts from climate change the most.

How cities adapt to these increasing risks will be fundamental to the value attributed to them in the next couple of decades. Those cities who can respond proactively and create safe urban environments despite climate change will benefit from their enhanced resilience.

Climate change brings into focus our reliance on an environment in balance. Where natural systems are working in unison with one another and they have not been severely disrupted by an increase in greenhouse gases in the atmosphere. We can often feel removed from the natural world within the confines of our concrete jungles but for these concrete jungles to thrive we need to show more attention, awareness and respect of the externalities on which they rely.

## IMPACTS OF CLIMATE CHANGE ON THE VALUE OF THE CITY

The value attributed to cities and the buildings within them is based on numerous factors. Namely though those who occupy urban spaces attribute value to the benefits provided by urban areas. These benefits are under threat by climate change. Take for example benefits of productivity and accessibility. The impact of a rise in global temperature causes numerous key impacts, such as an increase in heat stress and flooding. Both which are felt intensely in cities. If people's productivity and ability to travel into and out of buildings is affected by these impacts, the value of those buildings will be too. Often this debate is spoken about through the narrative of minimising the impacts of climate change by reducing the amount of greenhouse gases in the atmosphere. Climate change mitigation is a vital part to managing climate risk and forms the basis of transitioning towards a low carbon economy (as part of the commitment to the Paris Agreement to keep global warming well below 2°C but pursuing efforts to limit it to 1.5°C). Legislation,

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such as the introduction of Energy Labels and the attributed minimal standards in certain countries (for example, Energy Label C for offices in the Netherlands by 2023) and the gearing up of the financial market to reward good performing buildings (for example, though reduced interest rates on loans) are examples of encouraging energy efficiency.

We are of course not progressing fast or far enough to stop global warming from occurring. We will now see global temperatures being 1.5°C degrees warmer by 2040. We are already in a 1.1°C warmer climate. Because of the lag effect of impact, it is challenging for people to appreciate the implications of this. Our actions today will reduce the amount our world warms but cannot reverse the warming that is already 'baked in' due to the amount of emissions we have already emitted. Additionally, the likelihood of climate 'tipping points'

occurring increases with increased warming. The impacts of these are not yet known, but might be disastrous (see text box 3).

The impact of an increasingly warmer world will impact our cities in different ways. The underlying issue with any of these impacts is that they will be exacerbated in these urban environments. Because of the materials used to develop our buildings and infrastructure we invite more warming and flooding into urban areas. An obvious example of this is the Urban Heat Island effect which causes urban environments to retain more heat than their neighbouring rural areas. This leads to higher temperatures during the day and, more importantly, higher

## CLIMATE 'TIPPING POINTS'

# 3

There are climate tipping points which would cause long-term irreversible damage. Where they were once considered of low probability, they are now thought to be more likely.

1. Amazon rainforest – shift from rainforest towards savannah which will impact rainfall and contribute to biodiversity loss
2. Arctic sea ice – reduction in the area, amplifying global warming and releasing fresh water into the North Atlantic
3. Atlantic circulation – shutdown caused by an increase of freshwater into the North Atlantic which would disrupt the ocean ecosystem
4. Boreal forest – a shift into tundra in the north and dieback in the south contributing to more global warming
5. Coral reefs – rising temperatures shifting them into alternative states dominated by macroalgae causing losses to fisheries and tourism
6. Greenland ice sheet – irreversible retreat of this ice sheet which could cause a 7m sea level rise
7. Permafrost – abrupt increase in CO<sub>2</sub> and methane emissions through thawing of frozen carbon-rich soils
8. West Antarctic ice sheet – collapse of ice sheet which could cause 3m sea level rise
9. Wilkes Basin – ice loss accelerating into East Antarctic ice sheet which could cause 3-4m sea level rise

(Timothy M. Lenton, 2019)

<https://www.nature.com/articles/d41586-019-03595-0>

temperatures at night causing increased heat stress. A recent example of this is in Canada, where in June 2021 temperatures reached a record breaking 49.6°C - previously predicted as a one in a 1000 year event (McGrath, 2021). Cities are also faced with an increasing risk of pluvial flooding in areas where rainwater is unable to be drained off due to the lack of surface permeability and filled-in canals.

These issues are not going to go away. Our cities will be under more and more stress in the coming years, and our buildings will be challenged to ensure liveable and workable environments for people.



## FINANCIAL IMPLICATIONS OF EXTREME WEATHER EVENTS

The financial impact of an intensive and disruptive climate event is now well documented. Depicted in the diagram is an overview of the financial impact of the top 10 disasters since 1970 which amounted to \$3.6 trillion losses over the past five decades (Bernard & Smith, 2021). Most of these losses happened in developed nations, with three out of the 10 costliest happening in 2017. Although tropical cyclones are associated with 38% of worldwide economic losses, different types of flooding account for 31% (riverine floods 20%, general floods 8% and flash floods 3%).

Note that although cyclones and flooding events could be expected to occur naturally in specific regions, they have been increasing in intensity due to warmer sea surface temperatures (IPCC Working Group, 2021).

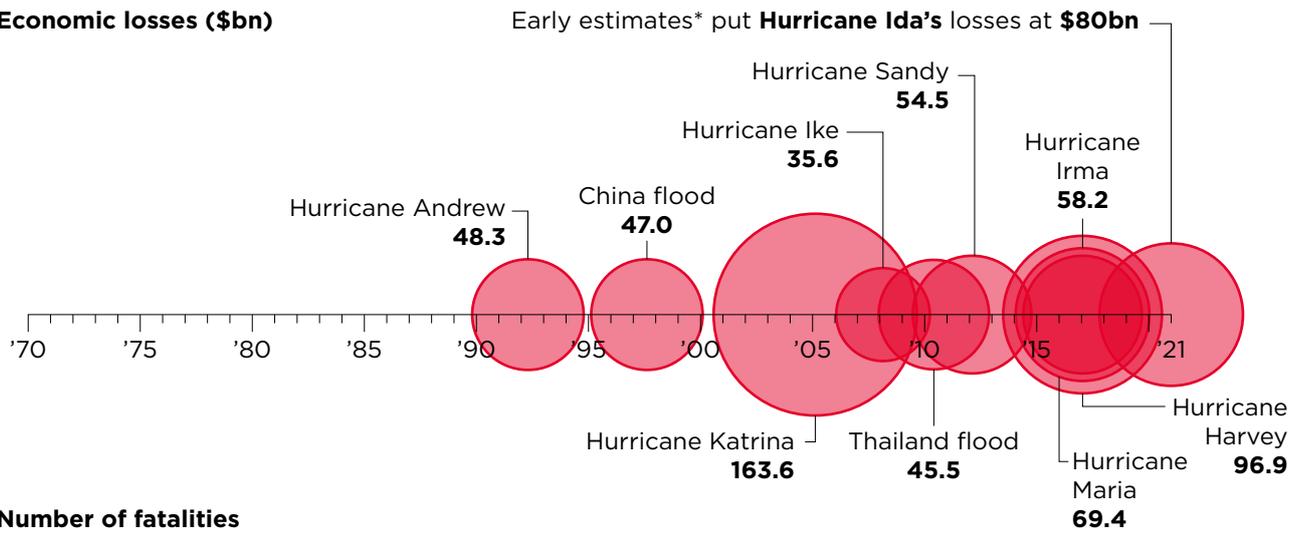
The economic losses attributed to these events demonstrate the estimated damages, the insured losses and the reconstruction costs. Most of these losses are felt in high-income countries (63%) i.e. those which have the most to lose in terms of valuable physical collateral.

## THE REAL ESTATE INDUSTRY'S RESPONSE

The overview of these economic losses is reflective in how we, the real estate industry, manage these risks currently. Until the value of an asset has been permanently eroded due to climate impacts, the industry relies on insurance and pay outs to rebuild or restore (Clayton, 2021). There is also a lot of trust, in some cities, on public investment and strong governance. The expectation that certain climate risks will be dealt with by governments and local municipalities through public infrastructure tends to override any incentive to change an investment strategy (see text box 4).



## Economic losses (\$bn)



## Number of fatalities

Smith, I. (2021, September 6). Climate risks to add \$183bn to property insurance costs by 2040, Swiss Re predicts. Retrieved from Financial Times: <https://www.ft.com/content/5d271251-973d-45e5-8982-2e28bf96f952>



# 4 CLIMATE RESILIENCE IN THE NETHERLANDS - A PRIME EXAMPLE OF OUTSOURCING

Water management has been a governmental responsibility in the Netherlands for centuries. This started with the waterboards, but currently water management is a split responsibility between (mainly) Rijkswaterstaat, water boards and municipalities. Waterboards, charged with water management, are one of the oldest institutions in the Netherlands. This fact is due to the absolute necessity of coordinated water management in this low-lying country. Tasking these specific institutions with responsibilities for water management and water safety has led to a robust system of dykes, pumps and nature-based solutions with the shared goal of water safety.

Water management institutions are funded through taxes. Taxes are used to cover the cost of sea flooding and riverine flooding defences (i.e. Rijkswaterstaat), to provide users with clean water (i.e. the waterboards) and sewage maintenance and rainwater management in public spaces (i.e. the municipalities). The Netherlands are therefore aware of the total costs involved in water management.

More recently though, the responsibilities of these institutions were expanded to include climate resilience. There are debates on how to manage climate resilience in the Netherlands within the current water management budgets. Therefore, responsibility is increasingly being shared with citizens and companies alike to create cooperative climate resilience spaces e.g. Waterklaar which is a campaign to encourage citizens to collect and manage rainwater onsite rather than diverting it to the main sewer systems (i.e. through rainwater tanks) ensuring less overflow in times of heavy rainfall.



Of course, it is not in the interest of a city to have its value permanently eroded so it is also incentivised to invest heavily where needed in public infrastructure. The real estate industry must be conscious though that there is a limit. For example, take the floods in the Netherlands in June 2021. Here, public infrastructure was insufficient to protect numerous homes which is estimated to have caused 400 million euros worth of damage. This was only partially covered by insurance. Luckily enough, the Dutch government declared the region a disaster area. Which meant that non-insured damage compensation would be paid out by from government funds (AP NEWS, 2021).

This type of disaster shows that as real estate stakeholders we must be mindful that the severity of climate risks is starting and will continue to erode the investment quality of a place. Not only in terms of immediate economic losses through acute physical events i.e. flooding events but also in terms of chronic impacts too. An example of this relates to heat stress and the impact on people's productivity. It is predicted that the

inevitable increase in heat stress will lead to global productivity losses of of 80 million full-time jobs globally by 2030 (ILO News, 2019). If the real estate industry is to cope and the protect the value of its assets and the livelihoods of people that depend on it, a more strategic approach is needed to cope with these financial impacts of climate change.

#### **PRICING IN PHYSICAL CLIMATE RISK**

Setting up the business case to invest upfront in protecting our assets in addition to relying on insurance and public infrastructure is challenging. Although we are starting to see transition risk being priced into assets (i.e. through the Energy Labels, and with some institutional investors carbon stranded dates) physical risks are notoriously harder to price in. Especially since the resilience of a building is currently showing no significant impact on its value (Remie, 2021) despite the build-up of evidence that investment upfront does pay pay off. Take for example The Global Center on Adaptation which estimated that yields from investing in resilience range from 2:1 to 10:1 (benefit to cost ratio) (see text box 5).

**WATER MANAGEMENT HAS BEEN A  
GOVERNMENTAL RESPONSIBILITY IN THE  
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# 5 EXAMPLE OF COST BENEFIT

The costs of climate adaptation precede its benefits as the returns of investing in climate resilience is made through avoided damages. This makes investing in climate resilience harder to quantify than covering the costs of damages incurred, making it challenging for asset owners to invest upfront. For instance, if there was a flood in the area and an asset had no damages, was it prepared or was it lucky? Either way the avoided damage would not be perceived as a profit.

Globally, it is estimated that the benefits of investing in adaptation will be about four times the costs (Hof, 2014). There have been studies to show the benefits of adapting to climate change. An example of which is in Florida that showed new buildings adhering to a stricter building code suffered less damage from hurricanes. The benefits were estimated at \$3.50 for every dollar spent in extra compliance costs (the Economist, 2021).

The Economist, 2021

<https://www.economist.com/finance-and-economics/2021/07/24/the-private-sector-starts-to-invest-in-climate-adaptation>



From an insurance perspective Swiss Re recently (6th September 2021) estimated that climate risks will add \$183bn to property insurance costs by 2040 (Smith, 2021). This is a staggering statistic, especially since 2021 alone has already been the most costly for the insurance industry, having to cover €34 billion of damages directly resulting from extreme climate change events (Financieel Dagblad, 2021). The impact of this will be seen in the affordability and availability of insurance. The expectation being that property insurance costs will be up to 29 percent of the total property and casualty premiums (from 25%) by 2040 (Smith, 2021).

There appears to be, even with statistics such as this, a lagging response from the real estate industry. No longer are we speculating about potential physical hazards, we are talking about the scale and the frequency of damage. The systemic impacts of climate change mean that the industry will not only face highly disruptive acute, one-off

events but will need to plan and prepare for the permanent, chronic changes happening now too.

Those benefiting from real estate are missing a trick if they do not act proactively on climate risk now. Currently, there is no discernible evidence that climate risk is being accounted for in market prices, capital or operational expenditure. However, the anticipated effects of increased exposure to climate risk will influence cash flow, risk premiums, expected growth potential, cost and availability of financing (Clayton, 2021). Despite anticipating these impacts, the impact on the value of a building is still hard to model since appraisers' base value on past losses and the systems in place are not geared up to be predictive. As a valuer you need evidence to be able to price in changes and unfortunately this is lacking currently.

If financial real estate models continue to limit themselves to predicting the future using data from the past, they are missing a vital part of the picture (see text box 6). This results in an underappreciation of the potential severity of future impacts and a lack of preparedness for the impacts of climate change. This will make the real estate sector more vulnerable to climate change, and will negatively impact real estate investors, owners and managers.



## TIGHTENING OF THE REGULATION LANDSCAPE - IMPACTS OF TCFD AND THE EU TAXONOMY ON VALUE

The introduction of the TCFD (Taskforce on Climate-related Financial Disclosures) in June 2017 looks to address this lack of evidence. The G7 agreed to introduce mandatory climate-related disclosures via the TCFD recommendations. This gives the capital markets in general more insight into exposure to climate-related risks and to build the evidence base for investing and managing resilience. In addition, the introduction of the EU Taxonomy gives guidance into what constitutes as sustainable. As financial participants will be required to report against this taxonomy more evidence will be created.

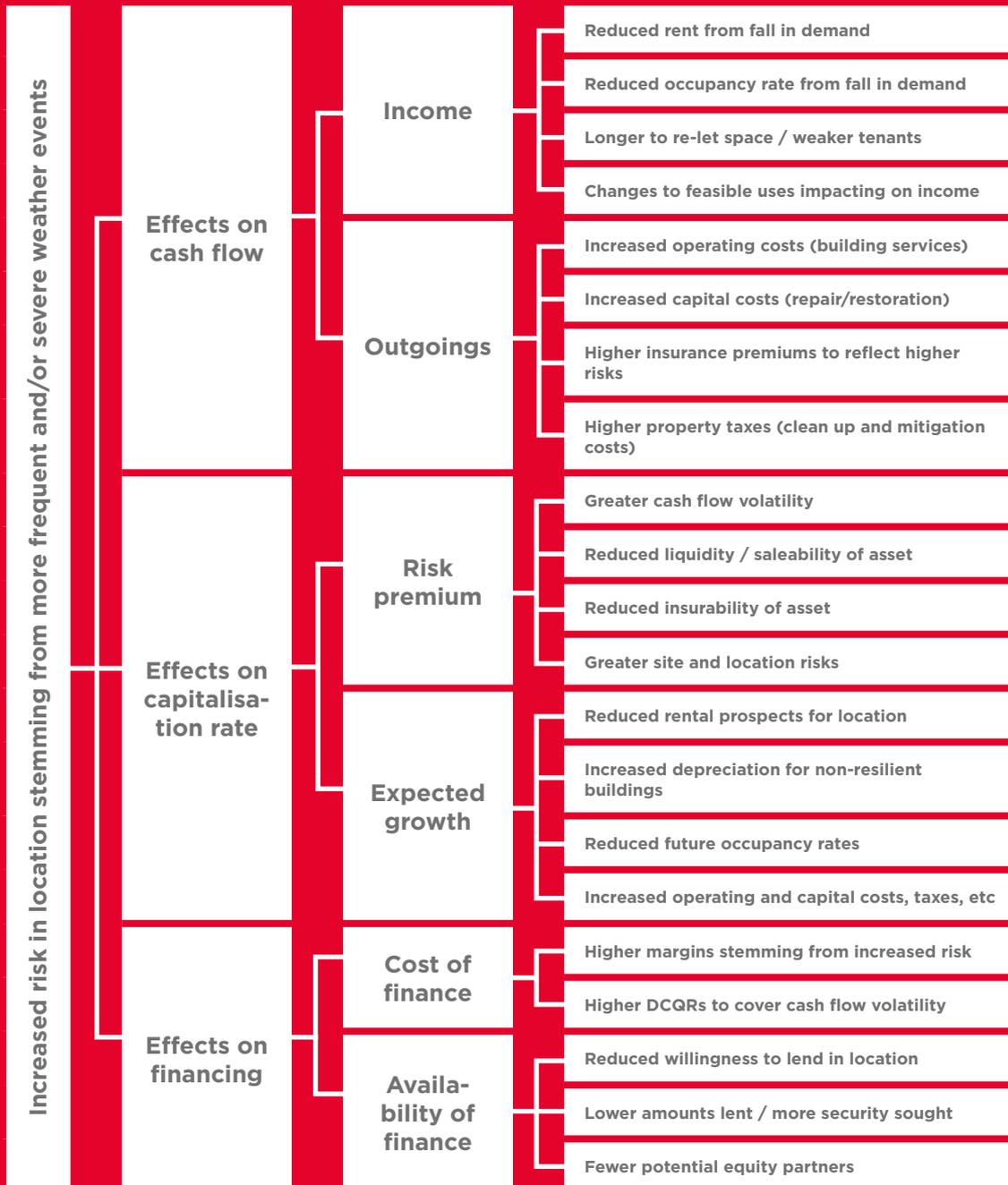
These top down measures will trickle down into the real estate industry as investors, creditors and insurance bodies will use this insight to review how real estate is governed. Reporting against the TCFD requirements will show how climate related risks are managed and monitored, whereas the EU Taxonomy could show what percentage of a portfolio has undergone a climate risk analysis. Those organisations who respond positively to the TCFD recommendations or have undertaken a climate risk assessment on a high percentage of their portfolio will have a clearer oversight of their risk exposure. This information will affect capital flows and reward those assets that are intrinsically less risky due to resilience planning.

Better risk-return models will be developed as more evidence comes into focus. Decisions can be made by real estate owners based on potential climate scenarios playing out in the future. The insurance industry can use this information to reset premiums and make informed decisions on whether to cover assets. As this evidence base grows, stronger business management decisions can be made. We know (IPCC 6th Report) that we will reach 1.5°C degree warming even under a low emission scenario warming by 2040. The impact of this fact is crucial to how we consider and value climate risk. As investors increasingly base their decisions on their portfolio's exposure to risk, this turn in the market will inevitably impact prices. By focusing in on protecting the future value at risk, investors will have a key role in setting the tone for pricing in climate change.



# 6

## ANTICIPATED EFFECTS ON COMMERCIAL REAL ESTATE ASSET PERFORMANCE OF INCREASED EXPOSURE TO CLIMATE RISK



## **INEQUALITY IN SOCIETY AND WORKING TOGETHER TO BENEFIT URBAN RESILIENCE**

A risk for the real estate sector working in isolation is that once the hurdle rate has been compromised due to climate risk, many investors will choose to dispose of assets. By factoring in the capital expenditure required to build up the resilience of an asset, coupled with the potential impact of future revenue, many will choose to remove rather than resolve the issue. There will inevitably be a limit to how much impact an owner can take.

There is a real danger here, that coupled with higher insurance premiums, this approach could contribute to further inequality in society. As an industry what we must be mindful of as we price in climate-related risks more, is to not create good and bad assets particularly within the city context. We must work collectively to protect the value of the city which not only benefits the value of our assets but mitigates the benefit of resilience being a luxury of just a few and not the majority.

As city stakeholders it is in our collective best interest to work together. As mentioned previously the reliance on strong governance and good infrastructure is paramount to how cities are protected from climate change impacts currently. That coupled with property insurance, is the predominant way value at risk is currently protected from the physical impacts of climate change.

A building has little to no value if people are unable to use it. A key risk of climate change is the disruption to the accessibility and the infrastructure which form the foundations to urban places. Addressing resilience at the asset level is a vital but an incomplete part of the picture as the strength of resilience is in the ability of an area as a whole to absorb these hazards.

Relying on the pay-outs of insurance to cover the costs of damages is also an unsustainable model. Like the public infrastructure, there is a limit to how far this model will go, and it will become



increasingly more challenging for the insurance industry to cover the costs of climate change. It will be in the best interest of the insurance industry and those who own and rely on real estate to prevent the severity of the risk upfront. Building up climate risk adaptation strategies at scale which focus on preventing and protecting assets and areas will be key. Forming strong private-public partnerships will be fundamental to these climate risk adaptation strategies in practice.

Working collectively to avoid risk is a commercial opportunity. However, like the problem of pricing in physical climate risk, it requires the industry to be forward looking. We now know the direction of global warming in the next ten years. That alone should be a good platform in which conversations between city stakeholders should take place. As city stakeholders we have a responsibility to bridge these connections in order to protect the value at risk (see text box 7).

## 7 THE BIG U

In collaboration with New York City, The BIG U proposal was developed by numerous architects, engineers and designers who came together to design 10 continuous miles of protection for Lower Manhattan. This area is home to 220,000 residents and is the core of a \$500 billion business sector that influences the world's economy. After the impacts of Hurricane Sandy which caused \$19 billion worth of damage, a decision was made to create flood protection zones (The East Side Coastal Resilience Project, sd). The project is split into two zones, with 2.4 miles being created as part of the East Side Coastal Resiliency project. It is a great example of private and public funding, with \$338 million coming from public funds and the remainder of the project's \$1.45 billion total cost funded privately by the City of New York (The East Side Coastal Resilience Project, sd).

The other part, overseen by the Lower Manhattan Coast Resiliency project has identified a set of strategies to build resilience in Lower Manhattan. The city has agreed to advance \$500 million for four climate resilience projects.

The East Side Coastal Resilience Project, sd,  
<https://www1.nyc.gov/site/escr/index.page>

## WHAT CAN THE REAL ESTATE SECTOR DO?

Creating a business case for climate adaptation and increasing resilience, can be done using a three-pronged approach.

The first step is to make an inventory of climate risks and opportunities. This step can be undertaken using TCFD's and/or the EU Taxonomy's approach to climate risks. To make a full inventory of risks, real estate owners and managers should consider three different data points which together indicate the value at risk. These data points should focus on revealing exposure, vulnerability and probability:

- Exposure on whether a climate risk is present in the vicinity of a building.
- Vulnerability on how susceptible a certain building is to the impact of climate change.
- Probability of the likelihood that the event might occur.

Together, these three data points indicate the level of risk and will be instrumental for driving business decisions.

It is important to undertake this climate risk management exercise in relation to different global warming scenarios. By using stress testing, the real estate sector can consider the resilience of an asset under increasing frequency and severity of climate events against a default scenario.

The second step is to translate climate risk into value at risk. The outputs of the first step are used to estimate the value at risk. Value could be expressed as monetary value but could also be measured in different ways. For instance, projected loss of productivity due to increased heat stress is such a value.

The third step is implementing risk management strategies. This is where currently there is a focus on weighing up retrofits and insurance costs and when to dispose of an asset. However, in order to increase building resilience further the strategy can focus on how to advance the resilience of the area around the building (see text box 8). This aspect will be crucial if we are to protect our cities at scale from the impacts of climate change.



# 8

## ECOSYSTEM SERVICES

Nature-based or ecosystem-based approaches are cost effective climate change adaptation and resilience tools. They simultaneously conserve, restore and improve areas of natural habitat, while also increasing carbon storage and avoiding greenhouse gas emissions. For example, mangroves act as natural barriers against cyclones, hurricanes, tsunamis, and waves which generates an estimated \$82 billion of annual value globally (which will increase as over time as coastal communities face more extreme weather events). A review showed that a hectare of mangrove created around \$3,600 in coast protection (McKinsey & Company, 2020). Munich Re have also shown that a reduction in insurance premiums and a six fold return on investment is possible over a 25 year period through restoring coral reefs to reduce the damage by storms.

The Economist, 2021

<https://www.economist.com/finance-and-economics/2021/07/24/the-private-sector-starts-to-invest-in-climate-adaptation>

### CONCLUSION

Stakeholders involved in owning, managing and operating real estate can and should play a central role in addressing climate risk. How the real estate market addresses the impacts of climate change will determine the value of their portfolios in the future. We know climate risk is increasing. Improving climate resilience is vital if we are to protect value now and in the future.

As transitional risks are progressively priced in, we cannot ignore the increase in physical risks. The pricing in of the physical impacts of climate change requires a different way of thinking; one that is future looking, predictive, and not based entirely on historic evidence alone. We can make solid predictions on how the insurance industry will react, when capital and operating expenditures will become financially unviable and when areas are likely to become no longer investable without sufficient climate adaptation strategies.

The real estate market should not do this in isolation. No man is an island, and real estate is nothing without the urban fabric surrounding it. Most of the world population lives in cities, and cities represent central hubs of economic activity. Consequently, the stability of our global economy is dependent on how cities will respond to climate change. Therefore, city stakeholders should be increasing the resilience of urban areas as well as the buildings themselves by working together. Building constructive public-private partnerships and working collectively to increase resilience will be fundamental in the future of real estate. We need to be bold, decisive and ready to work differently if we are to protect the value of our cities.



This insight is part of the series entitled 'the value of the city' ('de waarde van de stad') and is the result of internal research and dialogue with internal and external stakeholders, in close cooperation with consultants and analysts from our Real Estate Strategy & Innovation team. This insight accompanies the column by Elsbeth Quispel in which she gives her vision of the social relevance of towns and cities and urban development, including real estate, of course.

Real Estate Strategy & Innovation is the service line within Cushman & Wakefield that plays a leading role in data-driven strategic consultancy assignments in the real estate market (which includes climate risk management support). Through this service line, as a professional real estate services company we connect strategy and execution and provide ongoing added value for our clients. The following insight ties in with the series on 'smart cities' (slimme steden') which discusses Artificial Intelligence and Machine Learning.



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