# RESILIENT CITIES
# A GROSVENOR RESEARCH REPORT

GROSVENOR

# Foreword

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For over 300 years, Grosvenor has been investing in and developing real estate, and for the last 60 years, this has been on an international scale. We believe that understanding the cities in which we are active is integral to the success of our business: it is one of the reasons why we have offices in 17 cities around the world. Understanding cities helps us with the careful allocation of capital between our three distinct areas of business and gives us insight into where we may want to have a presence in the future.

At Grosvenor, we realise that a city's long term success cannot be measured on annual volatility and returns alone. We need to evolve our approach and analyse the risks and opportunities of cities holistically, taking into account their geographical location, governance, predicted population growth and resources, amongst other things. We need to know how vulnerable they are, but also understand their ability to adapt and improve. We need to establish their resilience.

This research enables us to do exactly that and is a powerful resource for advising our clients and partners. It advances our way of thinking about long term investment and gives us a robust risk management tool to help us ensure that our business continues to be profitable and can play an active role in the evolution of cities, complementing our 'Living cities' approach.

I hope that you find this research interesting. I was certainly reassured to see that Grosvenor has long been active in some of the world's most resilient cities.

Mark Preston
Group Chief Executive

Typhoon Haiyan, Philippines, 2013

# What are resilient cities?

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Overview

The ability of cities to thrive as centres of human habitation, production and cultural development, despite the challenges posed by climate change, population growth and globalisation, is determined by their resilience. From a real estate investor's perspective, resilience allows cities to preserve capital values and generate sustainable rental income in the long term. In human terms, cities are resilient if they absorb shocks, like Hurricane Sandy, maintain their output of goods and services and continue to provide their inhabitants with a good quality of life according to the standards of the time.

Resilience - the ability of a city to avoid or bounce back from an adverse event - comes from the interplay of vulnerability and adaptive capacity.

Vulnerability is a city's exposure to shocks in terms of both magnitude and frequency. Shocks may be due to changes in the climate, environmental degradation, shortage of resources, failed infrastructure or community strife due to inequality. That most cities have survived for the last several centuries or, in some cases, millennia, indicates a long period of stability in the pattern of urban growth. Recent population growth and industrialisation, despite many benefits, are destabilising planetary systems and making previously safe places more vulnerable than they ever were before.

Yet cities, like societies, are adaptable. Just like societies, they vary enormously in their adaptive capacity due to governance, institutions, technology, wealth and the propensity to plan.

So resilience increases when cities have more adaptive capacity and decreases when they are more vulnerable. Exponential population and economic growth is placing so much pressure on resources that resilience, which has for so long been a free gift of history, urgently needs to be rethought. By quantifying the resilience of 50 of the world's most important cities we, at Grosvenor, hope to contribute to this vital debate.

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The Rise (Grosvenor project), Vancouver, BC, Canada


A street in New Delhi, India
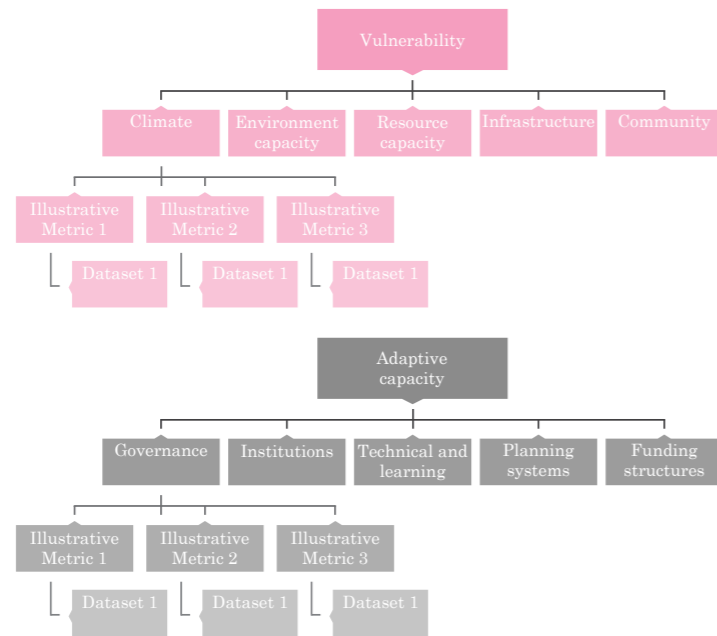
# Resilience:
## the business context

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Creating places

At its best, the real estate industry is concerned with the creation of places in which people can live, work and enjoy life, which in the longer term become part of the national heritage. Grosvenor's 'Living cities' approach recognises that our future success as a business is tied to the sustainable growth of the cities in which we invest. The motivation for this research on city resilience is to enable Grosvenor, its clients and partners to move beyond such classic but limited definitions of property risk, such as standard deviation of returns, projected vacancy rate and forecast rental growth. These have relatively little meaning in the long term, and are particularly unhelpful in a world where the basic patterns of the last millennium are shifting. Successful real estate projects depend on the long term stability and prosperity of cities.

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# Resilience:
## the human context

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Population growth

As a profit making company, albeit with a sense of stewardship, our research on resilience is commercially motivated. Our approach helps us to create portfolios of real estate assets which are resilient and operate in emerging markets fully cognisant of the risks. Nevertheless, we are acutely aware of the human context. A large proportion of the world's rapidly growing population is located in cities and other kinds of settlements that are not resilient, either due to high vulnerability, low adaptive capacity or both. By ranking cities we hope that our work contributes to the development of policies, supra-national, national and local, that make places more resilient, particularly those at the bottom of the hierarchy. In our view, pursuing real estate business without an eye to the stability of the underlying communities has little meaning.

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Our data hierarchy



Cleaning up after riots, London, UK

# How do we measure resilience?

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Six stage process

For Grosvenor, measuring resilience is a six stage process. First, we decide on the key components of vulnerability and adaptive capacity. Second, we seek accurate independent data, from as many sources as possible, on each component. Since each data set is different, the third step is to transform them into ordinal ranking systems with the same distribution and units so that we can add the data sets together and average them. The fourth step is to rank the cities in each individual component of vulnerability and adaptive capacity, so we know the relative position of each. The fifth step is, by means of an un-weighted average, to create an overall ranking of cities for vulnerability and adaptive capacity. The sixth step is to average again and create an overall ranking of world cities in terms of their resilience. The final position of each city depends on its resilience level as indicated by over 100 separate, independently verified data sets, covering all aspects of vulnerability and adaptive capacity.

# Resilience: static or dynamic?

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Feedback loops

Cities are not static. Adaptive capacity changes over time in response to economic growth, technological developments, religion, public pressure and lobbying and the nature of government. The level of vulnerability and the way it is perceived stimulates changes in adaptive capacity that are sometimes quite rapid. Normal 'trial and error', which characterises human technological development, creates feedback, which improves adaptive capacity in the long term, sometimes at great cost. In ranking cities we fully recognise that each is on a journey, some moving more rapidly than others, towards prosperity and liveability and each with their own constraints. We need this 'snapshot' of city resilience for our own purposes but we hope it contributes to debate and action.

# Dimensions of vulnerability

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Grosvenor's broad based definition of resilience – that a city be able to maintain itself as a centre of production and culture in the face of adversity while offering its inhabitants a decent standard of living – led us to identify five themes in the area of vulnerability. Some of these are issues at a national and also at a neighbourhood level.

**Climate**

Cities are directly threatened by physical events caused by climate change. Under this theme we analyse vulnerability to sea level change, hurricanes and typhoons, wildfires, floods, droughts and the mass movement of population. We also include, possibly controversially, vulnerability to earthquakes and tsunamis. Population pressures create the need to inhabit risky locations and we think it fair to assess a city's ability to cope with adverse events from such sources.

**Environment**

The enviroment theme measures threats to the city from pollution of all kinds and overconsumption of land resources due to urban sprawl. Our analysis involves some normative judgements.

**Resource**

Cities need access to energy, food and water. To the extent that a city cannot provide for itself in any of these areas at reasonable cost, its population is highly vulnerable.

**Infrastructure**

To function as centres of habitation, production and culture, cities need infrastructure. We rank cities according to their level of housing and transport infrastructure and basic utilities.

**Community**

It is not only physical events that make cities vulnerable, it is also internal tensions due to unfairness. So we assess the performance of cities in the provision of affordable housing, education and health facilities, religious and cultural freedom, reasonably crime-free living conditions, an honest government and a fair business environment.

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Hurricane Sandy aftermath, Jersey Shore, New Jersey, USA

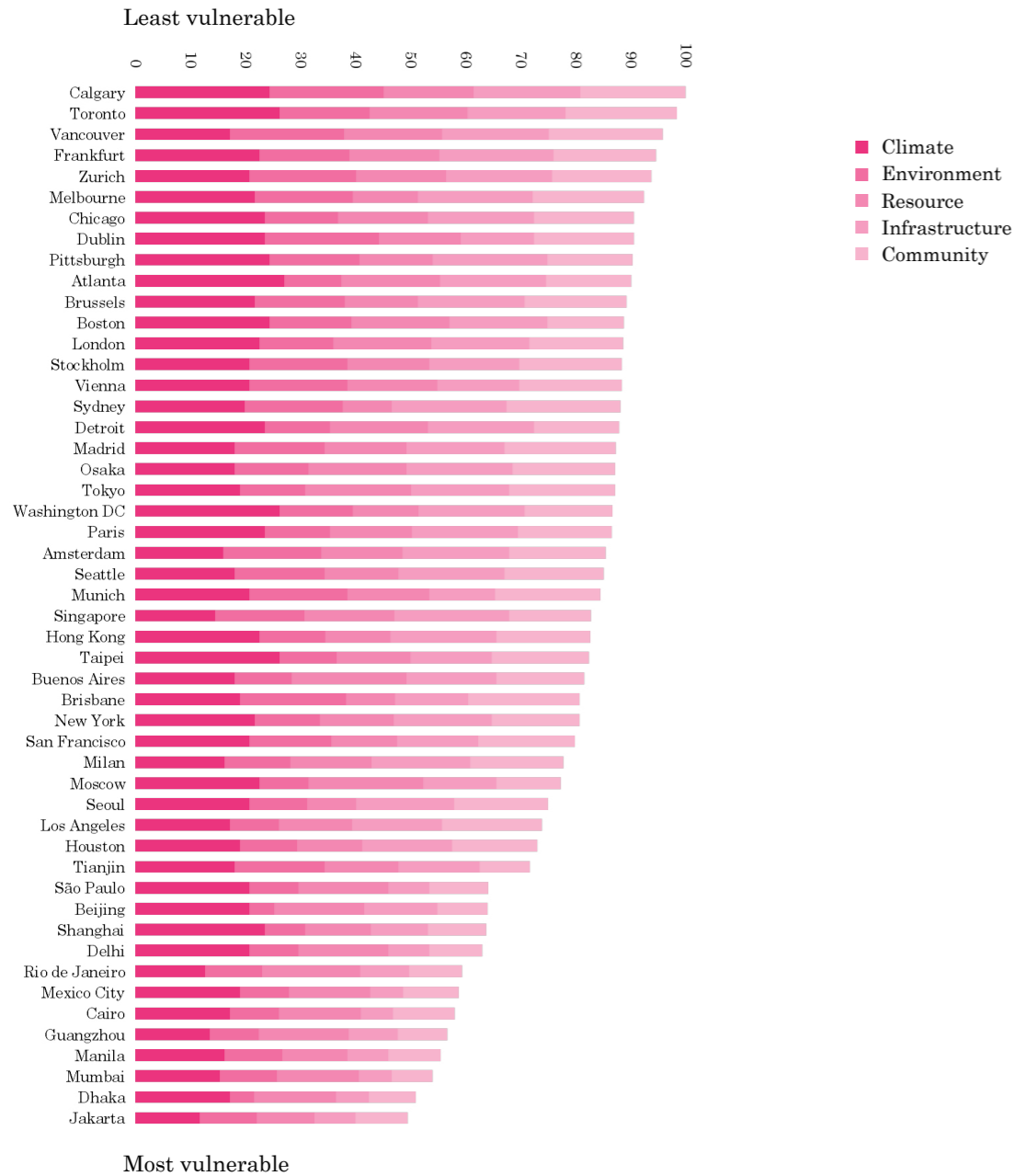# Adaptive capacity:
# five key themes

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Cities are all too aware of the rapid changes taking place at a global level, from changes in the climate and the relocation of production from the developed world to emerging markets. Many are putting in place the hard and soft infrastructure needed to cope with change. Sometimes, where cities are very large, the infrastructure investments constitute national projects. Here large cities, with leverage over national resources, may have an advantage. Our adaptive capacity rankings are based on city performance in five areas. Political judgements cannot be avoided in undertaking this type of analysis. However, our motivation is practical and commercial, not ideological. Which cities offer the best prospects of preserving capital values in the long term? After all, the best determinant of a long term real estate return is a city with a thriving economy and community.

**Governance**

Precise institutions vary but a city should have democracy, freedom of speech and community participation in investment decisions. Alongside transparency and accountability there should be leadership that looks to the long term as well as being concerned with short term issues.

**Institutions**

There should be a capacity to deliver within government bodies at all levels and associated groups such as non-governmental and community organisations. Institutions should have a good track record of delivering long term projects.

**Technical and learning**

Cities should be in partnership with national and international monitoring organisations, technology should be available and good technical universities should be present where technological expertise is fostered.

**Planning systems**

A good disaster management plan should be in place, emergency procedures should be rehearsed and, with the long term in mind, risk based land use planning should be practised.

**Funding structures**

Access to funding is a key part of adaptive capacity, although in our scheme it is weighted equally with other factors. We rank cities according to their own budget resources, their ability to borrow and their access to national and international funding.
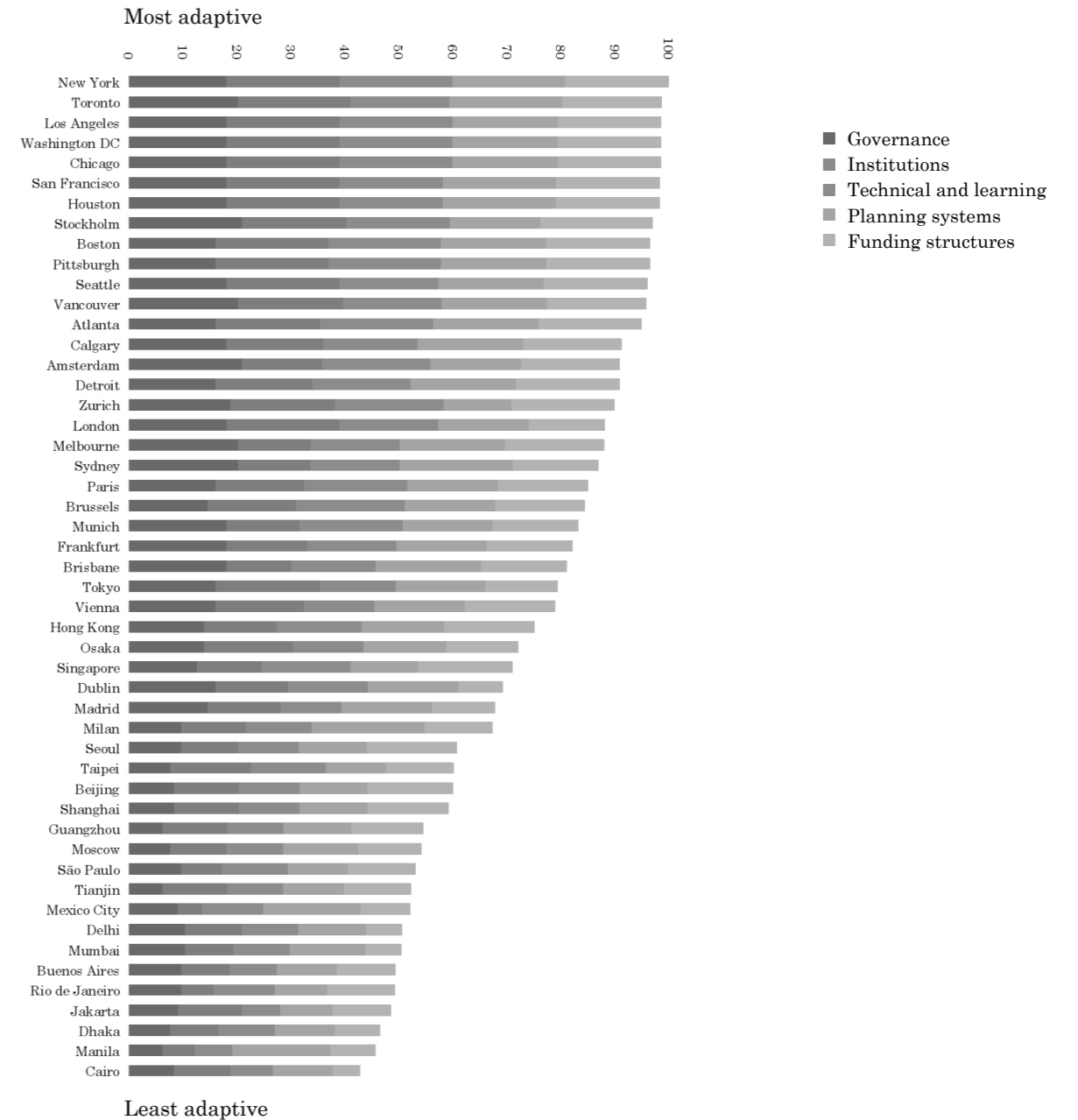
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The Thames Barrier, London, UK

# Vulnerability: world city ranking

Least vulnerable

0 10 20 30 40 50 60 70 80 90 100

Calgary
Toronto
Vancouver
Frankfurt
Zurich
Melbourne
Chicago
Dublin
Pittsburgh
Atlanta
Brussels
Boston
London
Stockholm
Vienna
Sydney
Detroit
Madrid
Osaka
Tokyo
Washington DC
Paris
Amsterdam
Seattle
Munich
Singapore
Hong Kong
Taipei
Buenos Aires
Brisbane
New York
San Francisco
Milan
Moscow
Seoul
Los Angeles
Houston
Tianjin
São Paulo
Beijing
Shanghai
Delhi
Rio de Janeiro
Mexico City
Cairo
Guangzhou
Manila
Mumbai
Dhaka
Jakarta

■ Climate
■ Environment
■ Resource
■ Infrastructure
■ Community

Most vulnerable

# Adaptive capacity: world city ranking

Most adaptive

0 10 20 30 40 50 60 70 80 90 100

New York
Toronto
Los Angeles
Washington DC
Chicago
San Francisco
Houston
Stockholm
Boston
Pittsburgh
Seattle
Vancouver
Atlanta
Calgary
Amsterdam
Detroit
Zurich
London
Melbourne
Sydney
Paris
Brussels
Munich
Frankfurt
Brisbane
Tokyo
Vienna
Hong Kong
Osaka
Singapore
Dublin
Madrid
Milan
Seoul
Taipei
Beijing
Shanghai
Guangzhou
Moscow
São Paulo
Tianjin
Mexico City
Delhi
Mumbai
Buenos Aires
Rio de Janeiro
Jakarta
Dhaka
Manila
Cairo

■ Governance
■ Institutions
■ Technical and learning
■ Planning systems
■ Funding structures

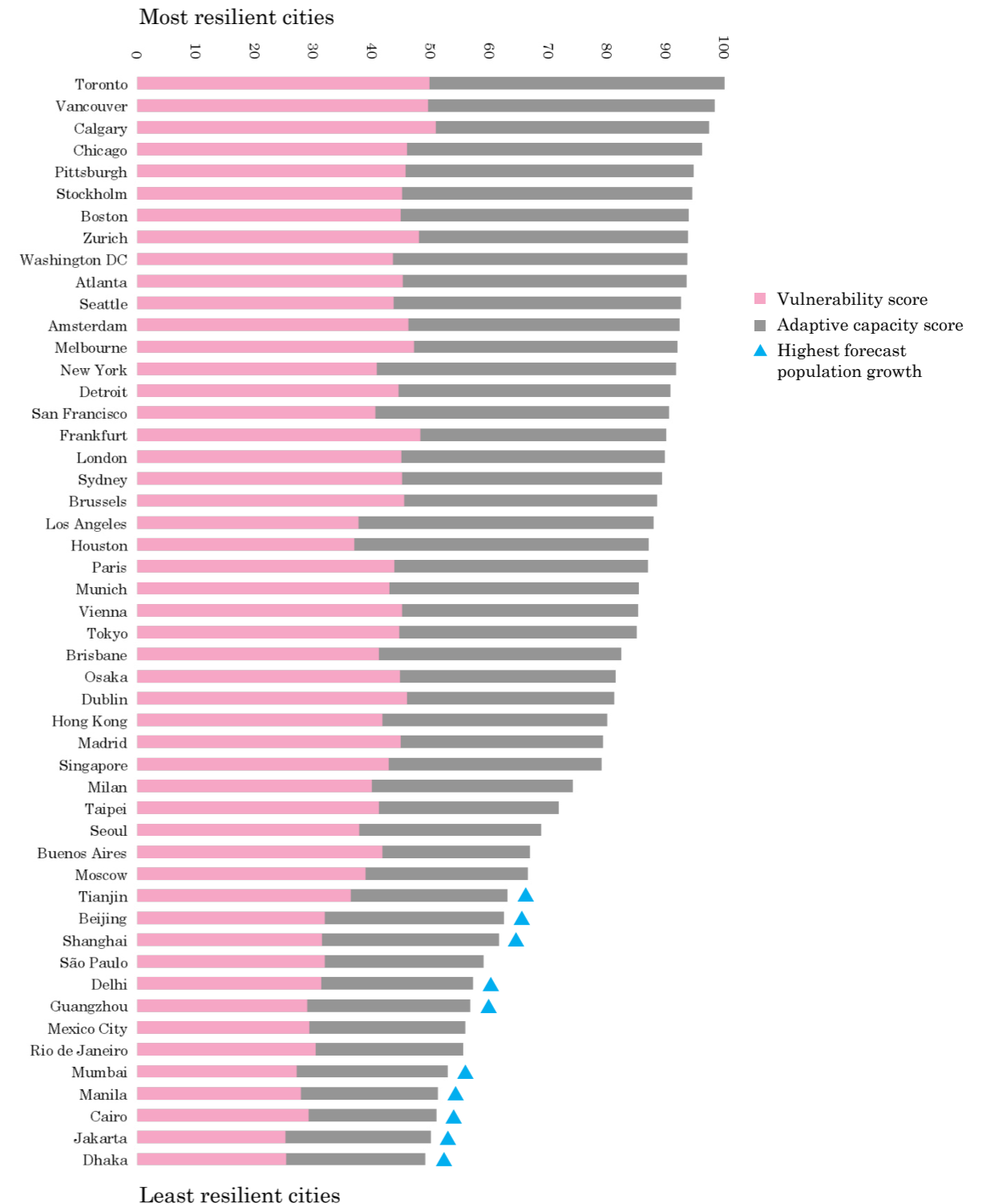Least adaptive

# Resilience: overall world city ranking

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**Canadian and US cities top the ranking**

According to Grosvenor's research, the three most resilient cities in the world are in Canada. Canadian cities have a strong combination of low vulnerability and high adaptive capacity. There is a high level of resource availability, and Canadian cities are well governed and well planned.

Six of the other top ten cities are in the US. US cities do not score particularly well in our vulnerability rankings. Inequality in US cities leads to social tension, utilities lack investment, and urban sprawl leads to the over consumption of land resource. US cities are currently weak on access to energy but that situation is changing fast due to shale gas exploitation. The strong US ranking is due to adaptive capacity, where resources, public accountability of elected officials and the technology of the US are dominating factors. This suggests that US cities will continue to see a pattern of effective public intervention, but often only after a major shock has occurred.

The middle group of cities, ranked 11 to 30, are fairly close to the top ten in their scores so should be considered resilient. Most European cities fall into this group. London is 18th in the ranking. It suffers increasingly from social tensions due to lack of affordable housing. However, it has relatively strong institutional capacity and the ability to track progress of goverment policies. In the sample, the weakest European cities are Moscow, Milan and Madrid; the strongest are Zurich, Amsterdam and Frankfurt. The latter are in highly developed societies, with a strong tradition of social equality and collective provision.

The weakest 20 cities are in emerging markets. Eight of these are in the 'BRIC' countries. So far, blistering economic growth has not fed through into the quality and long term resilience of these cities. The bottom 20 cities are considerably weaker than the top 30. Their vulnerability derives from inequality, poor infrastructure provision and environmental degradation, and, to a lesser extent, climate vulnerability. At the same time, these cities are weak in all of the dimensions of adaptive capacity. Our view is that the lack of democracy that exists in some of these cities, though effective in some respects, is a long term hindrance.



Most resilient cities

0  10  20  30  40  50  60  70  80  90  100

Toronto
Vancouver
Calgary
Chicago
Pittsburgh
Stockholm
Boston
Zurich
Washington DC
Atlanta
Seattle
Amsterdam
Melbourne
New York
Detroit
San Francisco
Frankfurt
London
Sydney
Brussels
Los Angeles
Houston
Paris
Munich
Vienna
Tokyo
Brisbane
Osaka
Dublin
Hong Kong
Madrid
Singapore
Milan
Taipei
Seoul
Buenos Aires
Moscow
Tianjin
Beijing
Shanghai
São Paulo
Delhi
Guangzhou
Mexico City
Rio de Janeiro
Mumbai
Manila
Cairo
Jakarta
Dhaka

Least resilient cities

■ Vulnerability score
■ Adaptive capacity score
▲ Highest forecast population growth

# Meaning and implications

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Population growth in low ranked cities

If we look at those cities with the highest forecast population growth within the overall resilience rankings (see cities marked with a ▲ on page 15), a disturbing picture emerges. The least resilient cities are the ones facing the greatest pressure to grow. High rates of population growth, while beneficial to production and culture in the long term, are likely to challenge improved adaptive capacity in the short term. The analysis reminds us that a large proportion of the world's population live in settlements that are much less resilient than the ones for which we have data. Intelligent transfer of financial, technological and intellectual resources is an urgent continuing priority. Those in the real estate world, with their necessary long term perspective and their experience of city building, would seem most able to contribute.

Impact on property pricing

Although this work is primarily a risk analysis, there are some interesting property relationships. Those cities with the least resilience have the highest ten year average yields. At the other end of the scale, where on average, yields are lower, there is a marked positive correlation between yields and resilience. The cities which are currently the most popular with investors are not necessarily those that will protect capital in the long term. Low yielding London is a case in point. Investors would be better off deploying capital in those cities which are above the line, namely resilient and high yielding. In the commercial world we do not always have the luxury of time: in the same way perhaps, given the magnitude of the challenges, cities also do not have the luxury of time. We hope that this work will add to the urgency of the debate.

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Busy crossing, Tokyo, Japan

# Using the information
# in this report

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**Modifying the analysis**

Although we present our findings in the form of a ranking, our purpose is to develop a tool as well as a hierarchy. If clients, or other public bodies were interested primarily in the influence of technology on adaptive capacity, the indicators could be re-weighted and a new analysis produced. Similarly, cities can easily benchmark themselves against their peers to determine areas for development. Apart from that, this work has numerous implications and uses in the areas of real estate strategy, corporate strategy and public policy.

**Resilient portfolios**

The research does not suggest there are no profitable real estate investments outside cities with high resilience scores. Short and medium term opportunities can be found anywhere. However, there are many organisations, for instance pension funds, insurance companies, sovereign wealth funds and trusts, with a long term fiduciary duty to safeguard the capital of their members, contributors or beneficiaries. For these organisations, the best approach to creating an internationally diversified real estate portfolio is to select resilient locations and invest in assets for the long term.

**Making a contribution**

Using this research it is possible to create portfolios that optimise returns or value growth subject to minimum vulnerability scores or maximum adaptive capacity. Existing portfolios can be assessed for overall vulnerability as well as susceptibility to individual risks, such as climate change. Our analysis of vulnerability and adaptive capacity provides insights into the strengths and weaknesses of individual cities. Companies, not only from the real estate sector, can use these insights to make a contribution to improved resilience. For instance, where housing affordability is an issue of community sustainability, companies could make a special effort in the area of social or key worker housing. This level of corporate social responsibility is complex and time consuming but yields real benefits in the long term.

Our research can be used by city authorities to judge their own performance or the likelihood that they will face major economic dislocation due to an adverse event. Multinational aid agencies can use the findings for forward planning and effective targeting of limited funds. Highly resilient cities could easily partner with those further down the rankings to share technology and know-how.

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Ambleside public consultation (Grosvenor project), Vancouver, BC, Canada

## The team

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# CASE STUDY [NEW YORK]

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Vulnerability score: 80
Adaptive capacity score: 100
Resilience score: 92
Overall rank: 14/50

New York is faced with pervasive long term issues like increased severity of heat waves, extreme winter weather and social exclusion.

To counteract these adverse trends, New York has had an ambitious city plan, PlaNYC, since 2007. The plan covers multiple aspects of the city, from energy to housing, to investment in green infrastructure and economic opportunity, up to 2030. Within a year of its release, over 97% of the 127 initiatives in the plan had been launched. Perhaps one of the most interesting elements of the plan is the way in which many of the strategies deliver multiple benefits. For example, the investment in green space is helping to address overheating and flood mitigation, whilst also creating new cycle routes and high quality amenity space. An example of this is the ring of green space that has been created around the southern edge of Manhattan.

In our study, the city ranks the highest for adaptive capacity and scores full marks for three of the five areas-institutional capacity, technological and learning capacity and planning systems. Within these themes, New York scored strongly in the Government Effectiveness Indicator of the Inter American Development Bank; this is exemplified by the policies and leadership of the local government after Hurricane Sandy. For example, a Special Initiative for Rebuilding and Resiliency, "A Stronger, More Resilient New York", was instigated in order to improve the ability of key infrastructures to withstand strong winds and flooding (Coleman, 2013).

The financial tools and flexibility of New York's city government give it many potential resources to draw on to make investments in key monitoring systems and infrastructure to protect property against future disasters. The city has a large network of Business Improvement Districts (BIDs), a type of private/public partnership that can accelerate economic development, and social impact bonds have been used to tackle social problems.

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# CASE STUDY [SHANGHAI]

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Vulnerability score: 62

Adaptive capacity score: 59

Resilience score: 62

Overall rank: 40/50

Shanghai ranks in the lowest quintile in this study in terms of vulnerability and its score is particularly low for environmental degradation.

Rapid population growth is putting huge strain on Shanghai infrastructure and transportation systems are congested. Environmental resources, such as rivers, are affected and providing clean water and treatment of sewage is problematic. High levels of air pollution are released from the activities of heavy industry and coal-burning power stations, which meet 95% of the city's electricity needs (Siemens, 2008).

Shanghai's adaptive capacity is low. It comes in 40th in the overall ranking, but it has a good score for funding structures due to relatively high borrowing capacity and good budget resources. It is an economic powerhouse, recording double digit gross domestic product growth for the past eleven years. Recently, Shanghai has been investing heavily in new infrastructure. The metro system opened in 1993 and is now the second largest system in the world but infrastructure investment still struggles to keep pace with the city's rapid growth.

China bans access to many Western social media and news websites and Shanghai has been the location of pro-democracy protests. It has poor scores for governance across the board, including in the Inter-American Development Bank's national press freedom index and Economist Intelligence Unit's democracy index. This political situation may mean that it is easier for changes to be made in the city than in other nations due to a lack of consultation obligations. Shanghai is also weak in its learning capacity since, according to UN data, the city does not partner with international risk monitoring systems and therefore cannot learn from other cities.

From a purely economic perspective, Shanghai represents one of the best investment opportunities today, offering high returns, but it has some major vulnerability and adaptive capacity issues that may threaten the value of investments in the long term.

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# CASE STUDY
# [LONDON]

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**Vulnerability score: 88**

**Adaptive capacity score: 88**

**Resilience score: 90**

**Overall rank: 18/50**

London's key vulnerabilities arise not from natural issues, but rather human-induced issues.

Crime levels, particularly relating to petty crime, were rated as 'uncomfortable' by the Economist Intelligence Unit. Affordability of housing also emerged as an issue due to the high rental prices and recent news suggests this trend is unlikely to change – there was an 8.1% increase in house prices in London over the year leading up to June 2013 (ONS, 2013). Other areas which may become cause for concern are an aging population, represented by the UN old age dependency ratio and high levels of energy consumption paired with high prices, based on the National Geographic and International Energy Agency data and average scores for pollution based on the Mercer Eco City ranking and WHO Air Pollution data.

The 2011 London Plan, published by the Mayor of London, sets out the environmental, economic, transport and social development plans for the city. Individual borough plans must be in accordance with The London Plan. London performs above average for adaptive capacity and ranks at the top for institutional capacity. Data gathered for this study shows that there is a high concentration of think-tanks and non-governmental organisations in the city, as well as a strong ability to deliver and track progress of government policies. London also performs well in terms of technological and learning capacity, partly due to the high availability of technology and density of world class learning institutions.

Prior to 1982, London was at threat from flooding by the Thames, but investment in the Thames Barrier, the second largest moveable barrier in the world, means that the centre of London is relatively protected. However, areas downstream of the barrier are increasingly vulnerable and it is likely that in the second half of the century a second barrier will be needed to protect London from the growing risk of flooding. London was the first city to invest in sewage works, the underground system and other major infrastructure. Because much of the system is old, management and maintenance costs are relatively high and upgrades complex.

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# CASE STUDY [VANCOUVER]

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Vulnerability score: 97
Adaptive capacity score: 96
Resilience score: 98
Overall rank: 2/50

In terms of vulnerability, Vancouver ranks in the top five in each category except climate vulnerability, where it is in the bottom ten. Its low-lying coastal location makes it relatively vulnerable to sea level rise.

In response to these vulnerabilities, British Columbia's Ministry of Environment has undertaken research into sea level rise predictions for planning purposes. Vancouver has the 'Greenest City 2020 Action Plan', which contains ten goal areas around carbon, waste and ecosystems, with the objective of making Vancouver the greenest city in the world.

The Canadian government has been working to enhance transparency through proactive disclosure, contributing to high levels of accountability, in governance. Over 35,000 people participated in the development of the Greenest City 2020 Action Plan through a variety of communication channels.

Vancouver has excellent adaptive capacity scores, especially in governance and planning systems. Vancouver also scores well in terms of funding structures, with a favourable country credit rating and good access to financial services within the city.

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# CASE STUDY
# [MEXICO CITY]
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Vulnerability score: 58

Adaptive capacity score: 52

Resilience score: 56

Overall rank: 44/50

One key area of weakness is community vulnerability. The city has very poor scores based on Economist Intelligence Unit (EIU) data for violent and petty crime, public healthcare availability and quality, inequality and corruption.

The city also has particularly low scores for infrastructure vulnerability; there are challenges around providing transport for the burgeoning population and the quality of road networks was rated by the EIU as 'uncomfortable'.

There is also seismic hazard in Mexico City, which poses a significant risk in central parts of the city, where older buildings designed without building codes are typically located. Central areas face a threat of subsidence due to overdrainage of groundwater. This is a result of the draining of the former lake Texcoco to accommodate housing for the large population. According to an urban risk assessment by the World Bank (2012), western areas of the city will be subject to increased risk of landslides and flooding due to increased likelihood of extreme rainfall events resulting from climate change.

In 2007, Mexico launched 'Plan Verde' which covers seven key areas: land conservation, housing and public spaces, water supply and sanitation, transportation and mobility, air pollution, waste management and recycling and climate. The plan describes a route for the city to become sustainable within 15 years with US $1bn investment per year. Progress has been made in the transport sector, significantly reducing greenhouse gas emissions from vehicles.

This has not yet resulted in high levels of adaptive capacity for the city-Mexico City's adaptive capacity ranking puts it in the bottom ten cities for every theme for planning systems. Institutional capacity is a particular weakness, with a low score for government effectiveness (defined by the Inter American Development Bank according to several indicators including quality of bureaucracy, stability of government officials' power, and wastefulness of spending).

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