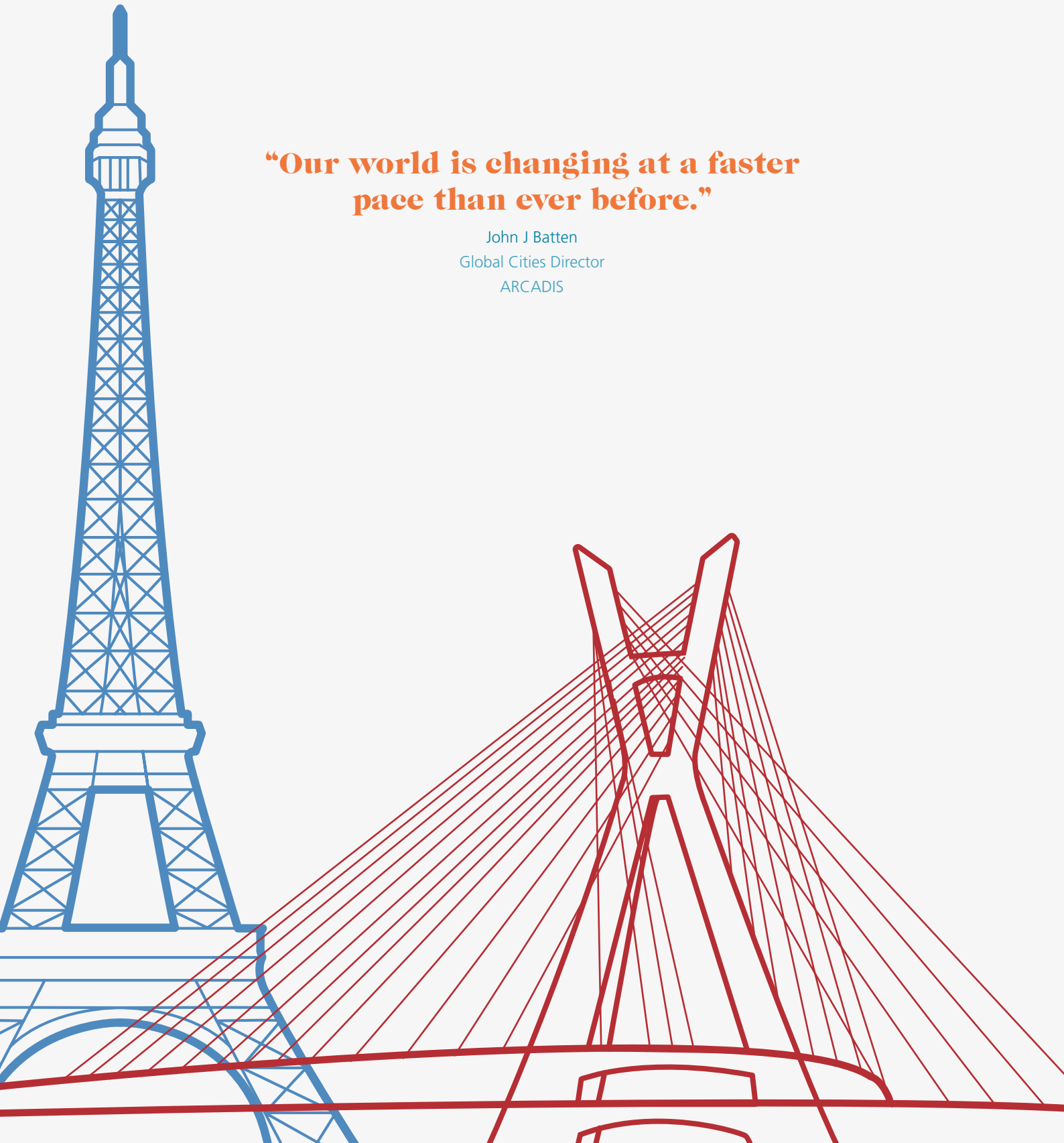**ARCADIS**

SUSTAINABLE CITIES INDEX

2015

Balancing the economic, social and environmental needs of the world's leading cities
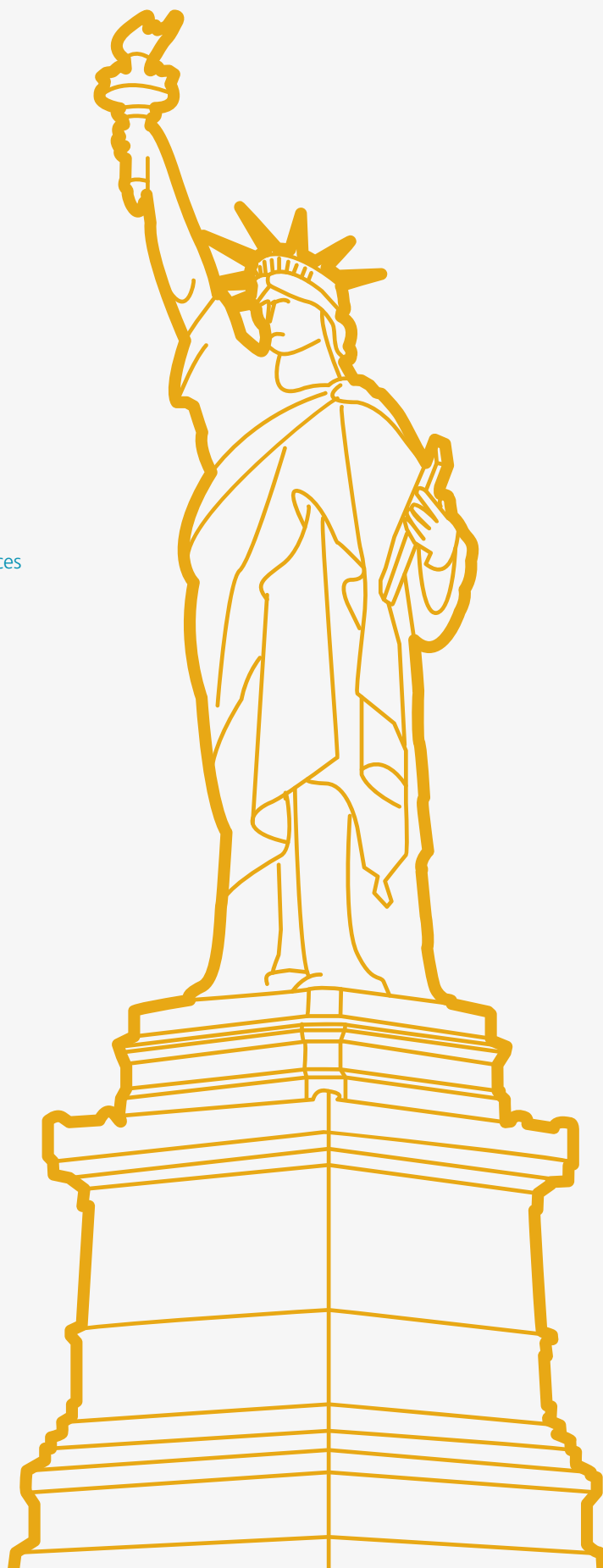
"Our world is changing at a faster
pace than ever before."

John J Batten
Global Cities Director
ARCADIS

Contents

1.

London

ARCADIS View

The Age of the City

Our world is changing at a faster pace than ever before. Rapidly developing technology, population growth and the emergence of a truly global economy mean that the notion of national borders has become increasingly less relevant while the concept of the 'global city' has swiftly taken hold. As our planet continues to evolve, people will continue to flock to its busy, dynamic and imposing urban centers. Urban migration is now very much the norm. Love them or avoid them, we are now entering the *Age of the City.*

A city is much more than just a place for people to live and do business. Cities are areas of emotional attachment, each with their own distinct personality, traditions and attraction factor. On this note, I am continually reminded of the oft-quoted advice of the anthropologist Margaret Mead,

> **"Always remember that you are absolutely unique… just like everyone else."**

It is precisely this uniqueness that makes the modern day city such a fascinating and important subject for study.

The purpose of this report, our first Sustainable Cities Index, is to take 50 of the world's most prominent cities and look at how viable they are as places to live, their environmental impact, their financial stability, and how these elements complement one another. All 50 of these brilliantly different cities – many of which I have been fortunate enough to visit – are in various stages of evolution – some being further along the sustainability journey than others. Each possesses its own geolocation and cultural distinctions but shares common urban challenges in the areas of job creation, mobility, resiliency and improving the quality of life of its residents.

In light of the global urbanization trend, cities are now subject to frequent assessment with the results often used by city leaders to inform decision-making and to sharpen their competitive edge. There are numerous databases (institutional and corporate) that are measuring cities in a broad cross-section of livability and business climate indicators. At ARCADIS we believe the best way to truly understand the sustainability of a city is to amalgamate these attributes from the perspectives of People, Planet and Profit to form a comprehensive view of each location and its position on the sustainability scale. Only then can we obtain a clearer picture of how sustainable, or not, a city is.

Importantly, the purpose of the ARCADIS Sustainable Cities Index is not to create a hierarchy of elite cities, but to indicate areas of opportunity as they continue to make progress on their missions to become more sustainable economically, environmentally and for the good of their inhabitants. To quote Margaret Mead again,

> **"We are continually faced with great opportunities which are brilliantly disguised as unsolvable problems."**

As our world becomes increasingly more reliant on its urban centers, it is our hope that city leaders find this to be a valuable tool in assessing their priorities and pathways to urban sustainability for the good of all.

John J Batten
Global Cities Director
ARCADIS

Guest Foreword

We are living in the century of the city, but are we living in the century of the sustainable city?

The Sustainable Cities Index endeavors to answer this seemingly simple but actually quite complex question for 50 world cities from 31 countries around the world.

Today, cities dominate in population numbers (54% of the total), economic output (70-80%), energy consumption (80%) and greenhouse gas production (80%). Notably, as this index demonstrates, the more sustainable an urban area is, the higher the quality of life, greater prosperity and lower per capita greenhouse gas production it possesses. With more than a quarter-of-a-million cities worldwide, understanding their successes and failures in terms of sustainability through easily accessible measures may seem to be an insurmountable task. However, this index shows the way.

The Sustainable Cities Index not only benchmarks individual places today but offers a roadmap for future improvements outlining specific areas for attention. Most importantly, this index offers a fundamental truth: cities have unique qualities based on their histories, geographic contexts, and level of development. In highlighting a city's character – its strengths and weaknesses – The Sustainable Cities Index provides a platform for public and private decision-makers. Fundamentally, however, it provides guidance and allows thoughtful decision-makers to "Measure what can be measured and make measurable what cannot be measured," as per Galileo's sage advice.

This report is extraordinarily timely. Global leaders are currently poised to take a closer look at the performance of cities through two major initiatives. The first initiative will occur in September 2015, when the United Nations General Assembly replaces the expiring Millennium Development Goals (MDGs) with a broad set of Sustainable Development Goals (SDG) that, contrary to their predecessors, will apply to nations worldwide not just to developing countries. Among the list recently supported by the UN Secretary General is one that reads: "Make cities and human settlements inclusive, safe, resilient and sustainable," and is accompanied by seven targets. As each nation is required to report annually on their progress in implementing the SDGs, the Sustainable Cities Index will certainly contribute to the reporting on the cities' and human settlements' SDGs.

The second initiative is the Habitat III conference to be held in 2016. While this once-in-every-twenty years UN-wide meeting

The Sustainable Cities Index not only benchmarks individual places today but offers a roadmap for future improvements

involves the nations in deciding the contents of an anticipated "new urban agenda" to guide future development policies around the world, a wide variety of stakeholders will contribute to the outcomes. Again, the Sustainable Cities Index will be center stage as an important report to help nations and cities plot their respective courses.

On behalf of the World Urban Campaign members, I offer the appreciation and thanks of the partners for ARCADIS' foresight and wisdom in crafting this report. It will provide a strong basis for helping the world's cities reach their highest potential and ensure that this century will, indeed, be the century of the sustainable city.

Dr. Eugenie L Birch
Nussdorf Professor of Urban Research
Co-Director, Penn Institute for Urban Research
University of Pennsylvania
Chair of Steering Committee, World Urban Campaign

2.
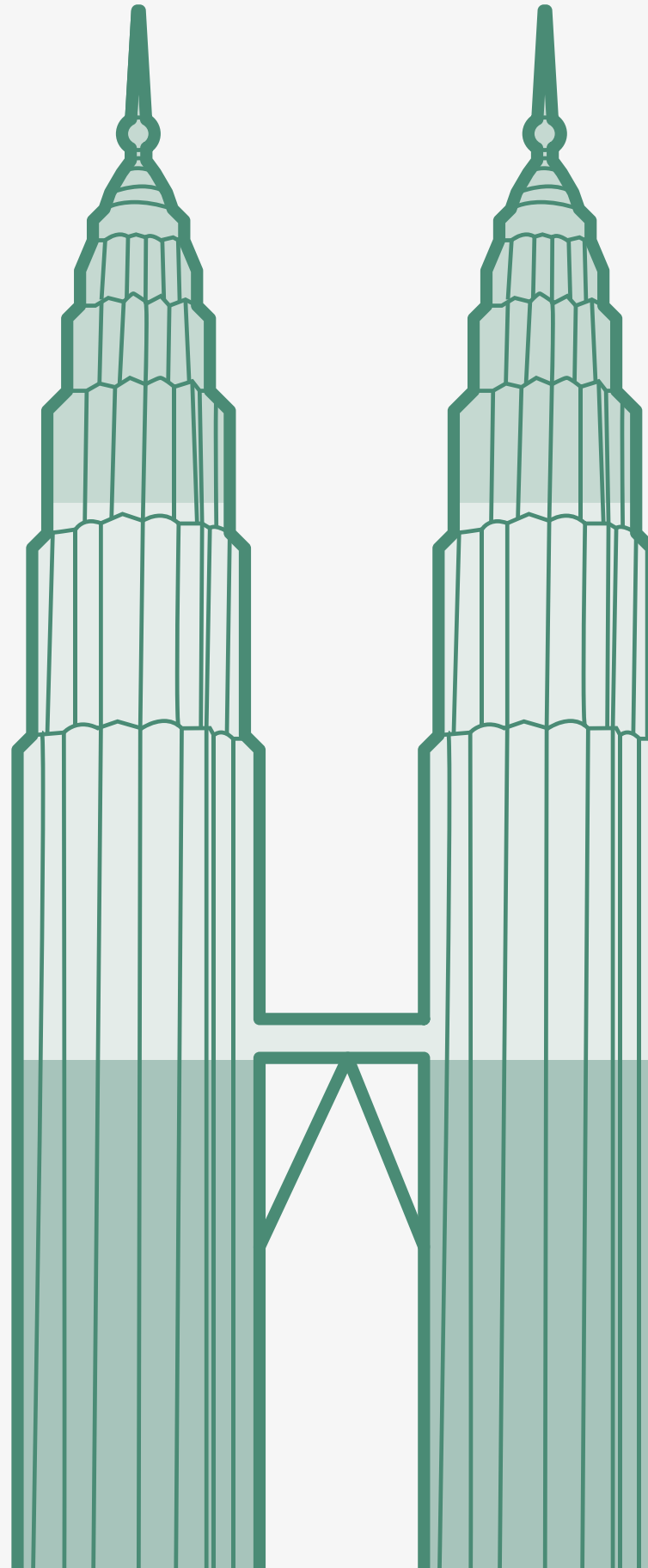
Executive Summary

- In a rapidly urbanizing world, the way in which cities are planned, built, operated and redefined has a huge social, environmental and economic impact

- City leaders need to find ways to balance the demands of generating strong financial returns, being an attractive place for people to live and work in, whilst also limiting their damage to the environment

- The first ARCADIS Sustainable Cities Index explores these three demands of People, Planet and Profit to develop an indicative ranking of 50 of the world's leading cities

- Across the world, cities are performing better for being sustainable for Profit and Planet purposes, but are failing to sufficiently meet the needs of their People

- No utopian city exists, rather, city leaders face a difficult task balancing the three pillars of sustainability

- Well established, European cities come top of the overall rankings, with Frankfurt in first place, followed by London, Copenhagen, Amsterdam and Rotterdam

- Asian cities show the most divergence, with Seoul, Hong Kong and Singapore in the top ten and Manila, Mumbai, Wuhan and New Delhi forming four of the bottom five cites

- No North American city makes it into the top ten. Toronto is the highest ranked at 12th, Boston (15th) and Chicago (19th) are the most sustainable US cities

- The trade-off between Planet and Profit is most starkly seen in the Middle East where Dubai and Doha score much higher in Profit than Planet sustainability where they rank in the bottom four

- In South America, Santiago (30th) and São Paulo (31st) are the two highest ranking cities

- Rotterdam tops the People sub-index. Many of the world's economic powerhouses are becoming less affordable for their citizens, with the cost of property in New York, London, Paris, Tokyo and Hong Kong penalizing their rankings

- The German cities of Frankfurt and Berlin lead the way in the Planet sub-ranking, scoring well for waste management and low levels of air pollution in particular

- Frankfurt also leads the Profit ranking, along with London and Hong Kong. US cities perform significantly better for Profit factors – San Francisco (6th) is the highest ranked, and all the US cities appear in the top half of the table

- Cities in the Middle East have seen the highest real term population growth over the past five years, with Doha, Dubai and Abu Dhabi experiencing a rise of over 30%

- City leaders in all 50 cities must plan for population increases over the coming 15 years, but the pressure on some is immense. Whilst Tokyo's citizens are expected to increase by just 1% by 2030, Nairobi's population will grow by 121% and Shanghai will grow by 54% to over 30 million people

3.

Sustainable Cities Index

3.1. What do we mean by sustainability?

Sustainability can encompass a wide variety of practices – sustainable development has been defined by the United Nations as: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs," although there are other definitions. In an urban context, this means cities that work well for their citizens in the present without causing problems for themselves and the rest of the world in the future.

Sustainable cities build transport systems that enable people to navigate the city quickly and affordably, have clean and safe water supplies, strong social structures and institutions that work predictably and efficiently, a healthy and well-educated workforce, and an environment conducive to strong economic performance. To take the needs of the future into account, cities must take care of their waste, avoid polluting the atmosphere and protect the surrounding water from contamination. Cities also need to guard against rare and unpredictable events such as disasters that can cost lives and set back their development. Sustainable development means meeting current requirements without jeopardizing the potential for future generations of inhabitants.

The broad definition of the concept means its measurement should reflect a variety of different dimensions. This research develops a composite index of sustainability, created from combining many other input indices that each measure single aspects of urban performance. The ARCADIS Sustainable Cities Index takes into account data on these criteria from reputable sources such as the United Nations, the World Bank, the World Health Organization, the International Labor Organization and many others.

3.2. Methodology

The research examines 50 cities from 31 countries ranking them across a range of indicators to estimate the sustainability of each city. The cities included within this report were selected to provide an overview of the planet's cities, providing not only wide-ranging geographical coverage, but also a variety of levels of economic development, expectations of future growth and an assortment of sustainability challenges.

A detailed, evidence-based metric is derived to quantify each city's performance. The headline ranking can then be divided into three broad subcategories: People, Planet and Profit. These correspond to three dimensions of sustainability – social, environmental and economic and can be described as the triple bottom line.

The 50 cities are ranked in each of the three sub-indices. The breakdown shows us in which respects cities are doing well, and in which respects they are falling behind and need to improve their performance.

A detailed, evidence-based metric is derived to quantify each city's performance. The headline ranking can then be divided into three broad sub-categories

People

Measures social performance including quality of life

Planet

Captures environmental factors like energy emissions and pollution

Profit

Assesses business environment and economic performance

The **People** sub-index rates transport infrastructure, health, education, income inequality, work-life balance, the dependency ratio and green spaces within cities. These indicators can be broadly thought of as capturing 'quality of life' for the populace in the respective cities.

The **Planet** sub-index looks at city energy consumption and renewable energy share, recycling rates, greenhouse gas emissions, natural catastrophe risk, drinking water, sanitation and air pollution.

The **Profit** sub-index examines performance from a business perspective, combining measures of transport infrastructure (rail, air, other public transport and commuting time), ease of doing business, the city's importance in global economic networks, property and living costs, GDP per capita and energy efficiency.

Figure 1:

Frankfurt tops the overall sustainability index

1	Frankfurt	
2	London	
3	Copenhagen	
4	Amsterdam	
5	Rotterdam	
6	Berlin	
7	Seoul	
8	Hong Kong	
9	Madrid	
10	Singapore	
11	Sydney	
12	Toronto	
13	Brussels	
14	Manchester	
15	Boston	
16	Paris	
17	Melbourne	
18	Birmingham	
19	Chicago	
20	New York	
21	Houston	
22	Philadelphia	
23	Tokyo	
24	Rome	
25	Washington	
26	Kuala Lumpur	
27	San Francisco	
28	Los Angeles	
29	Dallas	
30	Santiago	
31	São Paulo	
32	Mexico City	
33	Dubai	
34	Abu Dhabi	
35	Shanghai	
36	Istanbul	
37	Johannesburg	
38	Buenos Aires	
39	Beijing	
40	Rio de Janeiro	
41	Doha	
42	Moscow	
43	Jeddah	
44	Riyadh	
45	Jakarta	
46	Manila	
47	Mumbai	
48	Wuhan	
49	New Delhi	
50	Nairobi	

0%   20%   40%   60%   80%   100%

Key

People   Planet   Profit

Source: Cebr analysis

Hong Kong

3.3. Overall index findings

The top ten cities identified in the ARCADIS Sustainable Cities Index rankings as being more advanced in their sustainability journey are dominated by European cities.

Seven of the top ten performers are located in Europe, with Frankfurt coming top overall and London coming a close second. Frankfurt's high ranking comes as a result of its leading position in both the Planet and Profit sub-indicies, although a slightly unfavorable population dependency ratio (measured as the ratio of non-working age population to working age population) and higher working hours holds Frankfurt back on the People sub-index. London scores highly on both the People and Profit measures, in part due to good health outcomes and excellent higher education facilities, alongside being the best-connected global city, with New York, in terms of its importance to global business networks.

Three advanced Asian cities, Hong Kong, Seoul and Singapore, make the top ten.

Seoul performs particularly well on the People sub-index, where good health and the second highest transport infrastructure across all 50 cities support a high ranking, placing the city seventh on the overall ARCADIS Sustainable Cities Index. In each of these cities, however, long working hours relative to other cities impact on the work-life balance measure – the average working hours in these three cities were 20% higher than those across all 50 cities.

At the other end of the scale fast-growing Asian cities are most prevalent. The least sustainable cities include some of the fastest growing cities on the Asian continent Jakarta (45th), Manila (46th), Mumbai (47th), Wuhan (48th) and New Delhi (49th).

These are joined by three Middle Eastern cities, Doha, Jeddah and Riyadh at 41st, 43rd and 44th respectively, as well as Moscow and Nairobi to form the bottom ten. The prevalence of such rapidly growing cities amongst the bottom ten highlights the ground that many of these emerging cities still have to cover. Greater income may help these cities to improve their rankings, however, as highlighted by the positioning of some more advanced cities, such as San Francisco and Los Angeles, higher economic development does not guarantee greater sustainability.

Furthermore, there are a number of cities where sustainability appears to be particularly unbalanced across the indices. Doha, for example scores much higher on the Profit sub-index than on People and Planet. Meanwhile the Brazilian cities of Rio de Janeiro and São Paulo score highly on the Planet sub-index, but are impacted by weak People and Profit scores. In these cities, the areas of potential improvement are clearer, but this also suggests that sustainability could prove more sensitive to changing economic circumstances or shifts in environmental policy.

To understand drivers of the composition of the overall sustainability ranking better, each dimension – People, Planet and Profit – is presented in the sections which follow.
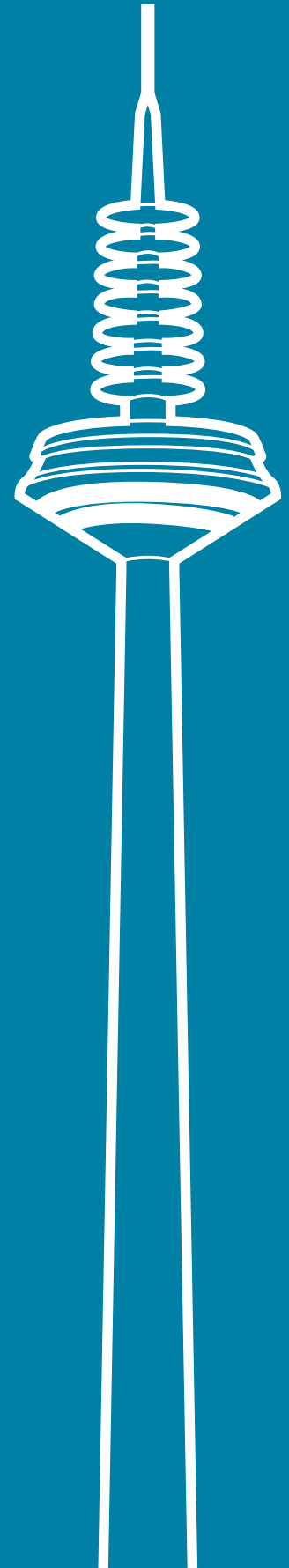
The least sustainable cities include some of the fastest growing cities on the Asian continent Jakarta (45th), Manila (46th), Mumbai (47th), Wuhan (48th) and New Delhi (49th)

1

Frankfurt
Germany

People 9
Planet 1
Profit 1

Frankfurt is widely recognized as a major international financial and trade center as well as transportation hub. Frankfurt's high ranking in the Sustainable Cities Index may come as a surprise, however, the self-proclaimed "Green City Frankfurt" has a long track record of proactively taking action to improve its sustainability. 25 years ago the city created its own energy agency and is a founding member of the Climate Alliance of European Cities in 1990, pledging to continuously reduce its CO_2 emissions by 10% every five years, resulting in a 50% cut by 2030. Since 1990 Frankfurt has already decreased its CO_2 emissions per capita by 15% while increasing its economic power by 50% and office space by 80%.

Frankfurt's new master plan "100% Climate Protection" goes even further. By 2050, 100% of Frankfurt's energy will originate from renewable (and mainly local) sources causing a 95% decrease in greenhouse gas emissions. Frankfurt plans to achieve this by increasing energy efficiency and decreasing the demand side by half in residential and office buildings, the transportation sector, and in communications.

Frankfurt was one of three finalists to be awarded European Green Capital 2014. Furthermore, the city has been recognized as the European City of Trees 2014 – not only is every tree registered and monitored; the information is also publicly available online. Frankfurters can also enjoy Germany's largest city forest with more than 8,000 hectares or one third of the city. The adjacent green belt that spans around the city from the Main river bank, is not only a close recreational area but also the reason why Frankfurt is such a compact city of short distances. The pleasant and compactness of the city explains why 15% of all commutes are already done by bicycle.

London
United Kingdom
2

People 3
Planet 12
Profit 2

Chicago
USA
19

People 18
Planet 29
Profit 12

London is a city with a great international profile, widely regarded as one of the top cities in the world as evidenced in the Sustainable Cities Index, yet it is starting to become a victim of its own success. For years London has suffered from under-investment in its infrastructure and is struggling to meet the demands of the existing population, let alone the impact of growth.

Congestion and aging infrastructure are at the heart of current issues, but so too are a chronic shortage of affordable housing, air quality, and the more visible impact of climate change and resilience against the elements.

The current Mayor of London has recognized this and launched his 2020 Vision to make London 'The Greatest City on Earth'. The aim is to make London the best place in which to work, live, play, study, invest and do business. World-class infrastructure provision that meets the city's needs is a critical element of the vision. The Mayor's vision identifies the shortage of housing as the gravest crisis London currently faces. Although housing delivery is increasing, it is still far short of the 49,000 net new homes that are needed every year to house the growing population and meet the backlog of need. London will also need to change its behaviors towards consumption, whether in energy, waste, modes of transport. All this requires political will, more devolved accountability to the city authorities, and funding on a scale never before achieved.

Chicago is the second highest ranked US city in the Sustainable Cities Index after Boston. It is the third largest city in the US and is a national transportation, industrial, telecommunications, and financial leader as well as a city of great architectural significance, ethnic diversity, and cultural wealth. The only inland urban area to rank with major East and West Coast cities, Chicago has achieved international status through the quality of its cultural institutions and its position as a world financial center.

Chicago ranks number one in LEED certified buildings, has 26 miles of public lakefront and is home to multiple clean energy companies. The City of Chicago is also leading the way in implementing some innovative environmental initiatives, and sustainability is a key focus of Chicago's policies. 'Sustainable Chicago 2015' is a plan to advance Chicago's goal of becoming the most sustainable city in the country; from improving citywide energy efficiency and promoting diversified transit options, to launching citywide recycling.

The plan aims to establish Chicago as a hub for the growing sustainable economy and accelerate it by assisting people and companies in adopting sustainable practices. More than $8 billion in public/private investments will be made over the next decade.

3.4. People

The People sub-index, presented in Figure 2, measures the social performance of the city, that is, the interaction between a city and its community. To investigate this, The Sustainable Cities Index uses nine separate indicators, all of which influence the quality of life enjoyed within the city. The top 10 is dominated by European cities, with seven of the top ten coming from this continent. In these cities, transportation infrastructure is typically quite good – the average commuting time amongst the top ten, for example, is around ten per cent lower than amongst the 50 cities overall. London, Berlin and Manchester are slight exceptions here, however, and have the lowest transport indicator scores amongst the top ten.

Rotterdam rises to the top of the People sub-index, supported by relatively strong performance across most indicators. The exception to this is on higher education, since the city has relatively few high ranking universities compared to other cities. However, this is more than compensated for by both the affordability of property within the city and the work-life balance enjoyed by citizens. Compared to other countries within the top ten, property is estimated to be around 60% cheaper in Rotterdam, while relatively low hours worked support a more favorable work-life balance.

Only two Asian cities, Hong Kong and Seoul, make it into the top ten on the People sub-index. Accessible green spaces, high quality education and long life expectancies all exert a strong positive influence. However, as with many of the Asian cities included within our Index, long working hours hold the cities back from scoring even higher.

The highest performing US city is Boston, ranking 13th overall. The city does particularly well on the two education indicators, assisted by the presence of first class international educational institutions. By contrast, Boston was impacted by a relatively low score for transport infrastructure – the provision of public transport infrastructure in particular ranked poorly in comparison to many other cities included within the study. Similarly, in Los Angeles, high commuting times – the fifth highest of all 50 cities – contributed to a low transport indicator score. Meanwhile in New York, while transport fared better, the city was penalized for its soaring property costs, which were the highest recorded across all the cities studied and contributed to New York ranking just 33rd. Further down the rankings, the relative prices of property tend to support each city's scores. But this was usually more than offset by poor transport infrastructure, education provisions and health outcomes. For these cities, such as

Nairobi, Rio de Janeiro and Wuhan, investment is needed in a wide array of areas to improve the cities sustainability from a social perspective.

New York's soaring property costs contributed to the city ranking just 33rd.

Rotterdam
Netherlands
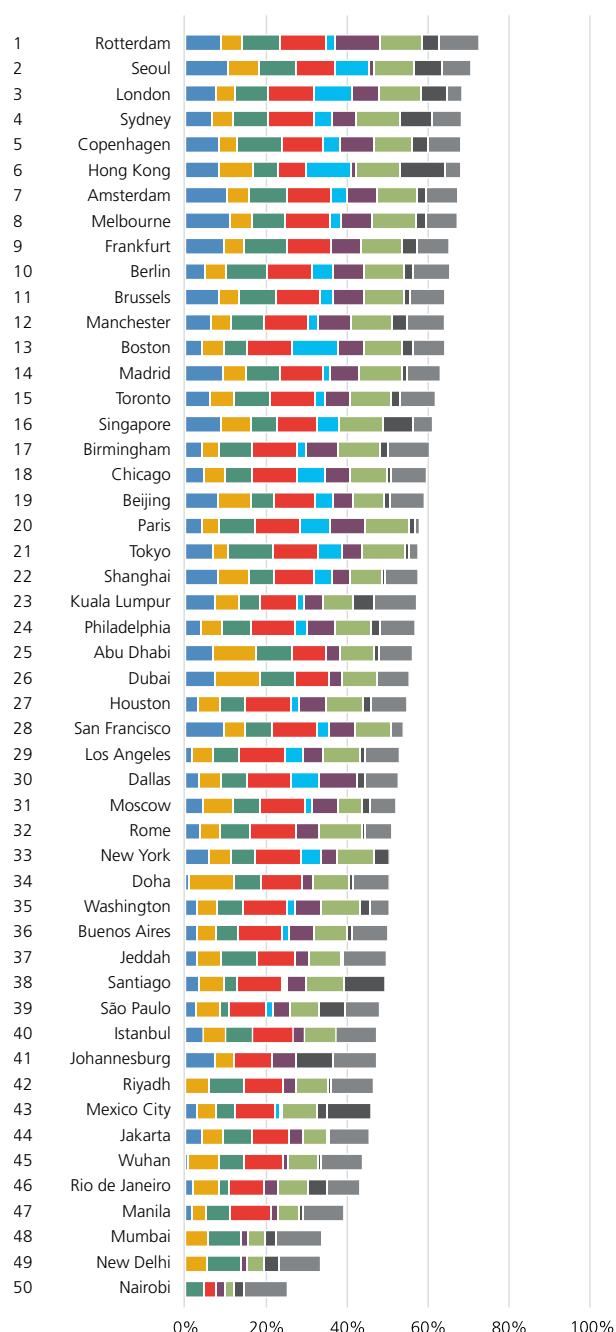
5

People 1
Planet 5
Profit 19

Rotterdam attaches great importance to sustainability, and achieves a high ranking in the ARCADIS Sustainable Cities Index.

Through the Rotterdam Sustainability Programme, the Rotterdam Municipal Executive has set out its ambition to make the city a clean, green and healthy city where sustainability contributes to a strong economy. Reducing carbon emissions by half, preparing for the consequences of climate change, improving air quality and reducing noise are the main topics of the programme, which the Municipal Executive has committed to spending 31 million euros on in order to achieve their green ambitions.

This programme is complemented by the Rotterdam Climate Initiative (RCI). The RCI is a public-private partnership consisting of the City of Rotterdam, the Port of Rotterdam, the DCMR Environmental Protection Agency Rijnmond, and Deltalinqs. Together these partners aim to ensure that Rotterdam is the most sustainable port city in the world. In order to achieve this, the ambition is to realise a 50% reduction in CO_2 by 2025 compared to 1990 and to be 100% climate proof.

Figure 2:

Rotterdam tops the People sub-index, demonstrating strong social sustainability

1	Rotterdam
2	Seoul
3	London
4	Sydney
5	Copenhagen
6	Hong Kong
7	Amsterdam
8	Melbourne
9	Frankfurt
10	Berlin
11	Brussels
12	Manchester
13	Boston
14	Madrid
15	Toronto
16	Singapore
17	Birmingham
18	Chicago
19	Beijing
20	Paris
21	Tokyo
22	Shanghai
23	Kuala Lumpur
24	Philadelphia
25	Abu Dhabi
26	Dubai
27	Houston
28	San Francisco
29	Los Angeles
30	Dallas
31	Moscow
32	Rome
33	New York
34	Doha
35	Washington
36	Buenos Aires
37	Jeddah
38	Santiago
39	São Paulo
40	Istanbul
41	Johannesburg
42	Riyadh
43	Mexico City
44	Jakarta
45	Wuhan
46	Rio de Janeiro
47	Manila
48	Mumbai
49	New Delhi
50	Nairobi

0%   20%   40%   60%   80%   100%

Key

Transport infrastructure **Dependency Ratio**
Inequality **Literacy** **Education** **Work-life balance**
Health **Green spaces** **Property Prices**

Source: Cebr analysis

Kuala Lumpur
Malaysia

26

People 23
Planet 24
Profit 22

Kuala Lumpur achieves a mid-table placing across all of the Sustainable Cities Index rankings, but has high ambitions. Within Malaysia's current Economic Transformation Program (ETP), improving Kuala Lumpur and the wider Klang Valley around the capital, has been identified as a key growth engine in delivering the national vision and driving continued economic growth across the country. The government has set a goal to transform Kuala Lumpur into a world-class city by 2020 that appeals to both residents and tourists alike.

To help make Kuala Lumpur a cleaner, more efficient and vibrant place to live and work, a number of important initiatives are currently underway. Firstly, significant investment is going in to improving mobility. The expansion of the MRT system will help to ease congestion and provide commuters to the city center with an efficient and environmentally sustainable mode of public transportation. Similarly, the high-speed rail link between Kuala Lumpur and Singapore will offer a faster and more reliable commute strengthening business links between the two cities.

In an attempt to make Kuala Lumpur even more attractive to people in the world, there is also a program in place to increase green space and sustainability within the capital. A target has been set to plant 100,000 trees within the city by 2020 whilst steps are also underway to transform Kuala Lumpur into a more pedestrian-friendly city with a greater amount of safe and accessible walkways.

Transforming the Greater Kuala Lumpur / Klang Valley region into a vibrant, world-class hub requires a framework and comprehensive plan that has the support of government, the private sector and citizens. Since the ETP was launched in 2010, more than 40 government agencies and private sector firms have been involved and significant progress has been made in this period. By 2020 Kuala Lumpur will rightly stand amongst the world's top cities in terms of economic growth and livability whilst retaining its diverse mix and cultural heritage.

3.5. Planet

The sub-index measuring environmental performance, which focuses on resource consumption, resource disposal and risk of exposure to natural catastrophes, is the second component of the overall measure. The top ten features many European cities, with only Singapore and Toronto coming from outside the continent. The two German entrants are at the top of the list.

Generally, the US cities fare worse on this metric than on the others. For example, Chicago, Philadelphia and especially Los Angeles are all energy-hungry cities which use a low proportion of renewable energy. The energy use and renewables indicator measures consumption per person and the proportion of energy in the country's mix that comes from sources other than fossil fuels. Certain Latin American cities do very well on this indicator, with the mix in Brazil estimated to be 37% renewable fuels.

Cities in the Middle East, the United States and some European countries are let down by their lack of renewable energy solutions.

All the Middle Eastern entrants use virtually no renewable energy, unsurprisingly given their abundance of hydrocarbon fuels, even if in recent years

moves towards renewables have started to progress. The UK, the Netherlands and Russia lag European leaders such as Denmark and Spain in renewable energy generation.

Natural catastrophe exposure measures each city's vulnerability to eight kinds of natural disaster. This is determined by whether such a disaster has occurred there before (in records dating back to 1900). San Francisco and Los Angeles score the lowest on this measure, having experienced several disasters. At the top are various European and Middle Eastern cities, including London, Amsterdam, Rotterdam, Abu Dhabi, Dubai and Doha, which have no record of experiencing any of these disasters on a sufficiently damaging scale.

Many cities score above 90% for air pollution, which the World Health Organization measures in terms of particulate matter.

Losing out on this metric are some Middle Eastern cities (Abu Dhabi, Dubai, Doha) and Nairobi, although for the Middle East cities, the prevalence of sandstorms does play a part. New Delhi comes last, with its concentration of the particles in question 60% higher than the next-worst performer, Doha.

The Chinese cities, especially Wuhan, are penalized due to having larger, polluting manufacturing industries.

Greenhouse gas emissions are lowest in some developing cities, including Nairobi, Manila and São Paulo, and highest in various Middle Eastern and US cities. A higher proportion of journeys made by private car drive this trend in the US.
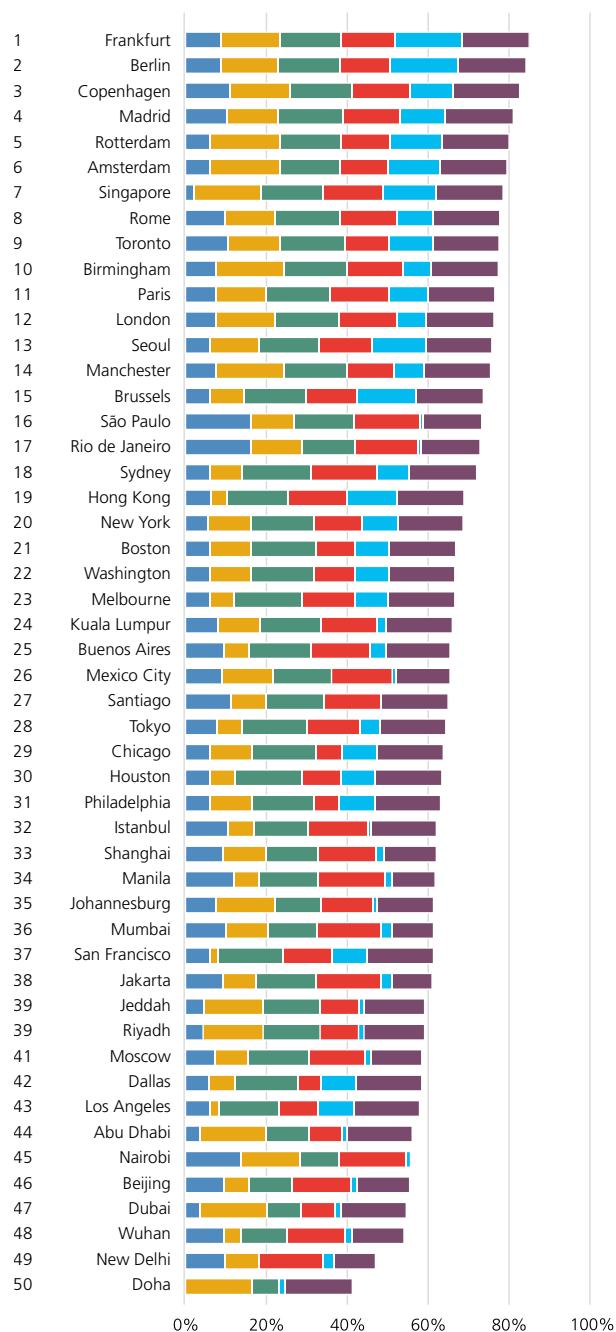
Waste management refers to the proportion of waste disposed of in more environmentally friendly

ways, such as through composting and waste to energy conversion. The alternatives are landfill and incineration. At the top are Berlin and Frankfurt, which have subsidies encouraging waste-to-energy conversion, and Brussels is close behind. Some Latin American cities, such as Santiago and São Paulo, receive some of the lowest scores on this indicator due to recycling, composting or converting into energy very little of their waste.

The final indicator, drinking water and sanitation, measures the percentage of citizens with access to these, however it does not take into account areas of cities with 'informal settlements'. Coverage is universal in many cities thus their score does not differ, but it does penalize cities which have slightly less than 100% coverage including Wuhan and Shanghai, also New Delhi, Jakarta and Nairobi.

Figure 3:

Two German cities score highest on environmental stability, with Europe performing strongly

1	Frankfurt	
2	Berlin	
3	Copenhagen	
4	Madrid	
5	Rotterdam	
6	Amsterdam	
7	Singapore	
8	Rome	
9	Toronto	
10	Birmingham	
11	Paris	
12	London	
13	Seoul	
14	Manchester	
15	Brussels	
16	São Paulo	
17	Rio de Janeiro	
18	Sydney	
19	Hong Kong	
20	New York	
21	Boston	
22	Washington	
23	Melbourne	
24	Kuala Lumpur	
25	Buenos Aires	
26	Mexico City	
27	Santiago	
28	Tokyo	
29	Chicago	
30	Houston	
31	Philadelphia	
32	Istanbul	
33	Shanghai	
34	Manila	
35	Johannesburg	
36	Mumbai	
37	San Francisco	
38	Jakarta	
39	Jeddah	
39	Riyadh	
41	Moscow	
42	Dallas	
43	Los Angeles	
44	Abu Dhabi	
45	Nairobi	
46	Beijing	
47	Dubai	
48	Wuhan	
49	New Delhi	
50	Doha	

0%   20%   40%   60%   80%   100%

Key

Energy use and renewables mix
Natural catastrophe exposure **Air pollution**
Greenhouse gas emissions **Solid waste management**
Drinking water and sanitation
Source: Cebr analysis

20

New York
USA

People 33
Planet 20
Profit 13

New York City is the largest city in the United States and is a global hub of international business and commerce. The city has a comprehensive plan, PlaNYC, to help improve the quality of life for generations to come.

The plan sets out targets to have the cleanest air in the nation, fortify waterfronts and waterways, clean contaminated land, and ensure all New Yorkers live within a 10-minute walk of a park. Originally launched in 2007, the plan is overseen by the Mayor's Office of Long-Term Planning and Sustainability and the Mayor's Office of Recovery and Resiliency.

In 2014 a progress report on PlaNYC was published which highlighted some major successes including:

- New York City air being the cleanest it's been for 50 years

- 865,000 trees and five million square feet of reflective rooftops being added to urban landscape. The latter is thanks to a Tax Abatement Program which helps property owners offset the cost of photovoltaic and green-roof installations

- Building codes being upgraded to prepare for floods, wind, and extreme weather

- Over past 10 years carbon emissions being reduced by 19% – well ahead of the goal to reach 30% reduction by 2030

PlaNYC continues to drive sustainability improvements, for example on the housing front, the New York City Economic Development Corporation is facilitating the creation of new transit-oriented neighborhoods with affordable housing and community amenities on formerly underutilized sites.

43 Jeddah
Saudi Arabia

People 37
Planet 39
Profit 41

31 São Paulo
Brazil

People 39
Planet 16
Profit 39

Jeddah is the second largest city in Saudi Arabia and the largest city in the Makkah Provence district where it is located. It is also the commercial capital of Saudi Arabia as well as its largest port.

Another key factor in Jeddah's importance in Saudi Arabia is as the gateway city to Islam's two holiest sites in Makkah and Madinah. Millions of pilgrims from all over the world converge on the city throughout the year as a transit point on their journey to the Kaaba in Makkah and the Prophet's Mosque in Madinah.

With one of the world's fastest growing populations and the increased number of pilgrims visiting each year, there has been an increased strain on the city's infrastructure. Jeddah has also experienced severe flooding in the recent past which it must ensure it is prepared for in the future.

Despite this rapid growth Jeddah has operated without strategic or regional plans and without an updated master plan. These documents are currently under commission by the relevant authorities to fast-track Jeddah into the 21st century. One of the key documents currently under commission is the Jeddah Strategic Master Plan which has earmarked ten target areas necessary for the city's development including Urban Territory & Land Use Planning, Transportation and Environment.

With its beautiful geographic location, historical legacy and sensitive religious context within the Muslim world, the prospects for Jeddah to become one of the region's leading cities are enormous.

São Paulo is the highest ranked Brazilian city and second overall in Latin America. It is the most populous city in Latin America and is among the 10 most populous cities in the world. Occupying an area of 1.5km², it is the largest city of the South hemisphere, features a 7.6 million vehicle (5.4 million cars) fleet, the second largest helicopter fleet in the world (nearly 700) and produces 20 thousand tons of waste daily.

As many other large cities around the world, São Paulo faces several challenges related to urban infrastructure, mainly related to lack of planning and aging infrastructure, aligned to rapid and uncontrolled population and urban growth. In addition, truth is that the city has never had enough investments to answer to its infrastructure demands.

Currently, the city relies on a city Strategic Master Plan which provides a guide for goals, such as developing areas outside the city center (bringing housing and jobs availability closer), implementing popular housing programs and developing transportation corridors.

Despite having its plan São Paulo is still missing some smart solutions such as being able to attract private finance to enable the regeneration of degraded areas, positioning São Paulo as a target for international businesses through reducing the "Custo Brasil" (cost of doing business in Brazil) and developing a more qualified workforce, as well as seeking to adopt new technologies to provide better efficiency in design, control and assessment of urban infrastructure works and demands.

São Paulo is the
second ranked
city overall in
Latin America

3.6. Profit
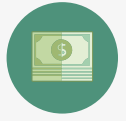
The Profit sub-index aims to capture economic sustainability. On this measure three of the world's largest financial centers lead: Frankfurt comes first, followed by London and Hong Kong. Many well-known commercial and financial centers are impacted by the high cost of doing business, as measured by the cost of living and of property – Tokyo, New York and San Francisco would each receive higher scores if not for this.

Shanghai, mainland China's largest financial center, ranks relatively low, losing out on per-capita GDP, energy efficiency and the ease of doing business.
São Paulo's score is harmed by relatively poor transportation, low GDP per head and Brazil's below-average score on ease of doing business. Inefficient use of energy, which drives up the cost of doing business, holds back Singapore from an even higher score.

Transport infrastructure is calculated as a composite of public transport, commuting time, airport quality ranking and the extent of the rail network. While Los Angeles currently faces challenges with these ratings, significant investment is underway to improve congestion and mobility. The United States' first high-speed rail system is under construction in California, connecting Los Angeles with other regions and LA's Metro Rail system is also being doubled. Elsewhere, some Middle Eastern cities – Doha, Jeddah, Riyadh – also have metro systems that are under construction and underdeveloped bus networks, meaning their score is also low in this respect.

Energy efficiency is measured as the ratio of energy consumption to GDP. This tends to promote service-based economies, which allows cities from the US and Europe to score highly. Copenhagen is the most efficient city in the world at converting energy into economic output.

Economic development measures GDP per capita. At US$93,300 per inhabitant, Doha is the clear leader here, followed by Washington and Boston. Nairobi's population makes only US$1,100 on average. Rotterdam's US$34,500 is relatively low in the global ranking, which harms its overall score for the Profit sub-index.

The World Bank ranks each country's regulatory regime in terms of the ease of doing business. This accounts for factors such as the number of steps involved in setting up a company, the ease of enforcing contracts and the ease of trading across borders. Singapore is the world leader in the latest Index, with Hong Kong, Denmark and South Korea other high performers. India ranks the lowest of our countries. Brazil and Argentina also rank much lower on this than on other indicators.
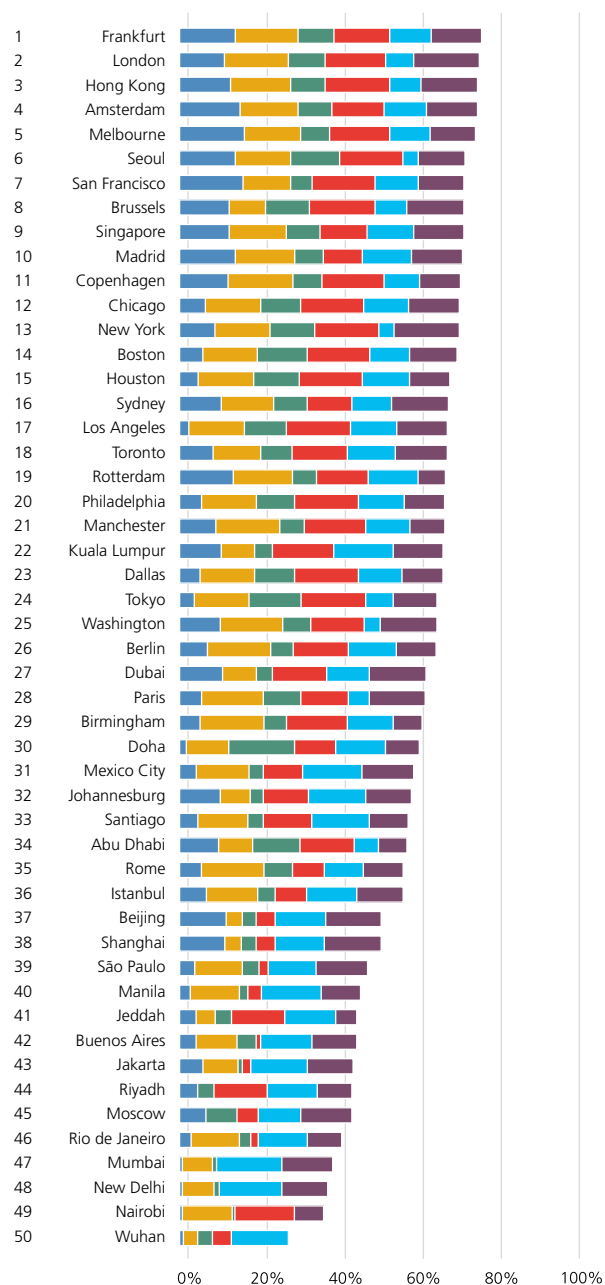
The final indicator, importance to global networks, measures the degree of connectivity as determined by the Globalization and World Cities initiative. London and New York are classed as 'Alpha++' cities, the highest ranking. Wuhan loses out somewhat, achieving the lowest ranking here of 'Sufficiency'. The Sustainable Cities Index measures economic connectedness, "based upon the office networks of 175 advanced producer service firms in 526 cities." It scores cities based on how many of these firms' offices they host, and the importance of these offices in the firms' global networks.

Singapore

Figure 4:

Well-known financial centers come top, with some big names held back by expensive office space

1	Frankfurt	
2	London	
3	Hong Kong	
4	Amsterdam	
5	Melbourne	
6	Seoul	
7	San Francisco	
8	Brussels	
9	Singapore	
10	Madrid	
11	Copenhagen	
12	Chicago	
13	New York	
14	Boston	
15	Houston	
16	Sydney	
17	Los Angeles	
18	Toronto	
19	Rotterdam	
20	Philadelphia	
21	Manchester	
22	Kuala Lumpur	
23	Dallas	
24	Tokyo	
25	Washington	
26	Berlin	
27	Dubai	
28	Paris	
29	Birmingham	
30	Doha	
31	Mexico City	
32	Johannesburg	
33	Santiago	
34	Abu Dhabi	
35	Rome	
36	Istanbul	
37	Beijing	
38	Shanghai	
39	São Paulo	
40	Manila	
41	Jeddah	
42	Buenos Aires	
43	Jakarta	
44	Riyadh	
45	Moscow	
46	Rio de Janeiro	
47	Mumbai	
48	New Delhi	
49	Nairobi	
50	Wuhan	

0%   20%   40%   60%   80%   100%

Key

Transport infrastructure Energy efficiency Economic development Ease of doing business
Cost of doing business
Importance to global networks
Source: Cebr analysis

Los Angeles
USA

28

People 29
Planet 43
Profit 17

LA is the second largest city in the US, a center of a five-county metropolitan area and is considered the prototype of the future metropolis – a city on the cutting edge of all of the advantages and the problems of large urban areas. LA is a city of fascinating diversity, incorporating one of the largest Hispanic populations in the United States, a major Asian community, and sizable populations of nearly every ethnic background in the world.

The people, institutions of knowledge, great climate and infrastructure have enabled the LA region to emerge as a leading business, trade and cultural center. LA is a hub of international trade, tourism, is the largest manufacturing center in the West, has one of the world's busiest ports, is a major financial and banking center, and is the largest retail market in the US.

In 2013 the city appointed its first ever Chief Sustainability Officer to lead the effort to create a greener city through investments in transit, renewable energy, energy efficiency and water efficiency.

Sustainability metrics have been defined and are measured to achieve specific goals. For example, the Los Angeles Department of Water and Power has an energy efficiency goal to reach 15% by year 2020, the highest and most ambitious energy efficiency goal by a major municipal utility in the US.

Despite its relatively low ranking in the Sustainable Cities Index, Los Angeles leaders have begun investing heavily in measures to ensure that it is able to lead the world in resolving them and creating a long term, sustainable city.

10

Singapore
Asia-Pacific

People 16
Planet 7
Profit 8

Whilst Singapore is placed in the top ten in the Sustainable Cities Index, it ranks lower than Hong Kong and Seoul through achieving low scores for indicators like work-life balance, having expensive property prices, low use of renewable energy and a high cost of doing business.

However, these areas do not deter from Singapore's many attributes. Only 50 years on from achieving full independence, Singapore now stands as one of the world's biggest financial centers, a global transportation hub, and the location of choice for many multinational organizations looking to set up their regional headquarters in Asia. A large part of its success has been built upon having a masterplan that links city planning with business and social requirements.

To achieve its vision, a number of strategic initiatives are currently underway which should see the city continue to perform well, and address some of the areas highlighted by the Sustainable Cities Index. For example, with the population predicted to grow to more than six million people by 2030,

the government has committed significant investment over the next decade to improving mobility and connectivity within the city. This includes two new underground lines, extensions to four existing MRT lines, a new terminal and runway at Changi Airport, a high-speed rail link between Singapore and Malaysia and the relocation of the container port.

Similarly, with almost 19% of the population expected to be aged 65 or over by 2030, there's also a major push to develop new social infrastructure including community care homes, specialist hospitals and nursing homes.

Another major focus area for the city is around green urbanization and ensuring that sustainability is at the heart of all future designs and masterplans.

Singapore has set an ambitious goal to make at least 80% of all buildings 'green' by 2030 as part of a concerted push to create a vibrant and high quality living environment, that is resilient and which supports the broader climate change agenda.

4.

Global urbanization challenges

The challenges cities face are large and varied since sustainable development requires a wide range of outcomes to be achieved. Moreover, nearly all of the cities studies are growing all the time – creating constantly evolving demands and pressure. According to UN analysis, only two of the world's largest 71 cities will experience a decline in population between 2010 and 2015. Indeed, some city populations are growing at rates of 4%, 5%, or even 6% per year over the same period, making it incredibly difficult for urban planners and policymakers to keep up. Table 1 includes data from the United Nations which illustrates the projected population growth of the cities included within the Sustainable Cities Index analysis.

The population expansion between 2010 and 2015 demonstrates the short-term stress that cities are facing as they strive to achieve sustainable development. A notable feature here is the difference between developed-world cities, which are experiencing more moderate population growth, and developing-world cities, which are experiencing rapid increases. Large population growth combined with rapid rural-to-urban migration has tended to accompany economic development everywhere, and currently poses huge challenges for planners in developing countries.

Looking at the longer-term, Table 1 also illustrates forecasts for urban populations through to 2030. Six cities in the analysis – Nairobi, Dubai, Abu Dhabi, Kuala Lumpur, Beijing and Delhi – will see growth of more than 60% over this time period. This growth will place tremendous stress on transport networks, water supply, waste collection systems, sewage systems and land values, unless these cities work hard to keep up with the influx of migrants. Tokyo is the world's largest city today and is projected to remain so in 2030, yet has the lowest rate of growth of any city listed. In contrast emerging market cities

such as Jakarta and Mumbai are growing relatively slowly in the short term from 2010 to 2015, but have among the highest projected expansions between today and 2030.

Sustainability and development are intimately connected: elements such as health, education and quality of life are common to both. The consequence of faster growth in developing cities is that many of the lower performers in the Sustainable Cities Index are the ones that will come under the most pressure. This is clearly visible in Table 1: the upper half of the table is composed of high-growth, relatively low-sustainability cities. The lower half of the table is where low-growth, highly sustainable cities are concentrated. The medium-growth cities are a mixed bunch, including an array of cities that rank both low and high in sustainability terms. The faster growing cities that are concentrated towards the top of Table 1 face particular challenges: not only do they have to make up the ground to reach higher positions in the Sustainable Cities Index, they also have to work hard just to stand still. Otherwise, with the same policies, regulations and infrastructure, developing world cities could actually see deterioration in sustainability as a consequence of added strain on their environment.

The same applies to some developed world cities. London and Toronto are already placed high in the sustainability rankings but still need significant investment to maintain their position. However, this is a relative indicator – even the top-ranked sustainable cities could become significantly more sustainable. Moreover, in the long-term there will be further population growth that will stretch city infrastructure to the limit. For example, Toronto's population is set to grow by over a quarter, and London's by a fifth by 2030, which will create new challenges for policymakers in those cities.

Table 1:

Selection of the world's largest cities with growth rates and ranking in the Sustainable Cities Index

Source: United Nations, Department of Economic and Social Affairs, World Urbanization Prospects: The 2014 Revision

Green:
high ranking & lower population growth
Red:
low ranking & higher population growth

Sustainable Cities Index 2015 rank	City	Population, thousands		Short term pressure	Long term pressure
		2010	2030	Expansion 2010–2015 %	Expansion 2010–2030 %
41	Doha	529	837	36%	58%
33	Dubai	1,778	3,471	36%	95%
34	Abu Dhabi	879	1,608	30%	83%
39	Beijing	16,190	27,706	26%	71%
44	Riyadh	5,227	7,940	22%	52%
50	Nairobi	3,237	7,140	21%	121%
35	Shanghai	19,980	30,751	19%	54%
43	Jeddah	3,452	4,988	18%	44%
26	Kuala Lumpur	5,810	9,423	18%	62%
37	Johannesburg	7,992	11,573	18%	45%
49	New Delhi	21,935	36,060	17%	64%
21	Houston	4,976	6,729	13%	35%
36	Istanbul	12,703	16,694	11%	31%
29	Dallas	5,149	6,683	11%	30%
10	Singapore	5,079	6,578	11%	30%
12	Toronto	5,499	6,957	9%	27%
46	Manila	11,891	16,756	9%	41%
47	Mumbai	19,422	27,797	8%	43%
25	Washington	4,604	5,690	8%	24%
45	Jakarta	9,630	13,812	7%	43%
31	São Paulo	19,660	23,444	7%	19%
9	Madrid	5,787	6,707	7%	16%
38	Buenos Aires	14,246	16,956	7%	19%
17	Melbourne	3,951	5,071	6%	28%
3	Copenhagen	1,192	1,455	6%	22%
2	London	9,699	11,467	6%	18%
42	Moscow	11,461	12,200	6%	6%
48	Wuhan	7,515	9,442	5%	26%
1	Frankfurt	681	774	5%	14%
13	Brussels	1,958	2,203	4%	12%
32	Mexico City	20,132	23,865	4%	19%
40	Rio de Janeiro	12,374	14,174	4%	15%
14	Manchester	2,538	2,968	4%	17%
30	Santiago	6,269	7,122	4%	14%
8	Hong Kong	7,050	7,885	4%	12%
16	Paris	10,460	11,803	4%	13%
18	Birmingham	2,429	2,808	4%	16%
24	Rome	3,592	3,842	4%	7%
11	Sydney	4,364	5,301	3%	21%
4	Amsterdam	1,057	1,213	3%	15%
23	Tokyo	36,834	37,190	3%	1%
6	Berlin	3,475	3,658	3%	5%
22	Philadelphia	5,449	6,158	2%	13%
15	Boston	4,185	4,671	2%	12%
19	Chicago	8,616	9,493	1%	10%
20	New York	18,365	19,885	1%	8%
28	Los Angeles	12,160	13,257	1%	9%
27	San Francisco	3,283	3,615	1%	10%
7	Seoul	9,796	9,960	0%	2%
5	Rotterdam	996	1,077	0%	8%

41

Doha
Qatar

People 34
Planet 50
Profit 30

Doha is one of the up and coming global cities that is expected to rise rapidly through the rankings over the coming years.

The Qatar National Vision 2030, produced by Qatar's general secretariat for development planning in 2008, outlines a comprehensive framework for the country's path to a brighter future for its citizens, which rests on four pillars: environmental, human, social and economic development. Coupled with the rapid development associated with hosting the 2022 FIFA World Cup, Qatar is experiencing huge expansion of its built environment.

The 2030 Vision updates and expands this commitment by embarking Qatar on a mission to cut its carbon dioxide emissions, improve energy efficiency, minimize water use in new, green buildings and invest in renewable energy solutions and environmental science and technology.

The country has both the highest per capita income and per capita carbon footprint on earth, which explains why it has a long way go in its Planet ranking. Qatar has leveraged its natural gas wealth for the benefit of its 300,000 citizens

that enjoy free water and electricity. However, 1.5 million expatriates do pay water and electricity on a monthly basis. Furthermore, petrol is inexpensive.

For many observers, however, this is a real problem. For Qatar to become a sustainable society, citizens including expatriates would have little incentive to mind water and fuel consumption. This is compounded by the lack of planning which has gone into the development of Doha and other towns in the country, following its rapid rise in economic development. Doha is currently under developed in regards to urban environments for new visitors or expats – pavements and crossings often lack development and provide little provision for pedestrians and street life and for a country that relies on desalination for water and where temperatures can reach 50°C in the summer, the use of cars – rather than walking – has become the norm.

Conscious of its own environmental position, Qatar has made sustainable development a priority and is pushing ahead with a growth plan to grow more of its own food while sharing its knowledge and experience to help modern cities across the world thrive in an eco-friendly way.

Shanghai
China

35

People 22
Planet 33
Profit 38

Shanghai is already an enormous city and faces a huge increase in population to over 30 million people by 2030. In 2010 Shanghai hosted the World Expo to much acclaim welcoming record numbers of visitors to the city. Held under the banner 'Better City, Better Life', the forum saw significant investment into the city's infrastructure to respond to this demand and improve mobility within the city. The success of the forum built real momentum around Shanghai's potential to become this century's "great world city".

The on-going transformation of Shanghai is evident in a number of areas today. Initiatives like the new Free Trade Zone in Pudong reflect a wider push to position Shanghai as a financial epicenter for Asia, on a par with other global cities like London and New York.

One of the biggest challenges facing Shanghai, and many other tier one cities in China, will be around improving the quality of the living environment. Directives within the most recent Five Year Plan have driven a renewed focus on cleaning up old industrial zones within the city so that the land can be repurposed for alternative use. Similarly, efforts are underway to try and clean the three main rivers running through the city, to improve water quality, and to future-proof the Northern parts of the city against the risk of flooding.

Throughout the rest of this decade improvements in Shanghai's built and natural environments will play a key role in helping to cement its place as the city of the 21st century. There is a lot of work to do and success will be dependent on thorough planning and management of this portfolio of work. However the speed of progress the city has made over the last decade demonstrates what it can achieve. Supported by a well-educated workforce that is increasingly confident around the city's status, the future looks very bright for Shanghai.

5.

Moving towards a more sustainable city

A huge volume of work has been done to research, analyze, discuss and bring together collective knowledge to answer the most pressing of questions: How do we create more sustainable cities?

ARCADIS is involved in many of these forums including the World Urban Campaign, the World Business Council for Sustainable Development (WBCSD), the C40 Connecting Delta Cities Network and Eurbanlab. All of these initiatives, in addition to the many others, offer valuable insight into the ways in which cities can thrive.

One of the most important focal points in the debate will be the Third United Nations Conference on Housing and Sustainable Urban Development (Habitat III) which will be held in Quito, Ecuador in October 2016. The Habitat III conference will address sustainable urbanization and the future of urban spaces. It will also serve as an opportunity to assess the state of our cities, to develop solutions, and to revisit our shared urban future.

As UN-Habitat states, "While cities are at the heart of today's global crisis, they are also the source of solutions for a sustainable future."

Balancing priorities

Taking the framework for a sustainable city being to find a balance between People, Planet and Profit, we can see from the research in this report that no city has been able to achieve top ratings for all criteria. This is understandable in that each city is unique, so there is, rightly, no one-size-fits-all solution. Instead, we can see that a city needs to have a clear vision for what it wants to be and set a roadmap for how it can get there. To do this cities need to take a balanced view of their sustainability vision. This needs to take into account a range of principles to provide a solution that balances the city's requirements.
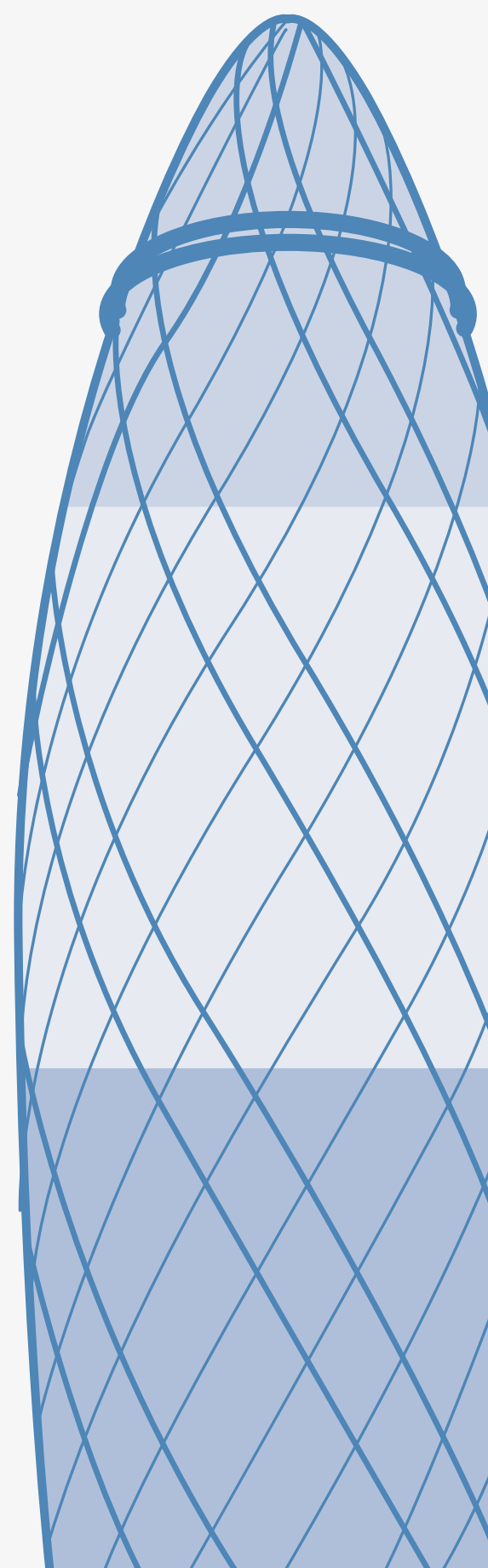
This will support cities in their master planning, strategy development and CSR strategy in relation to sustainability.
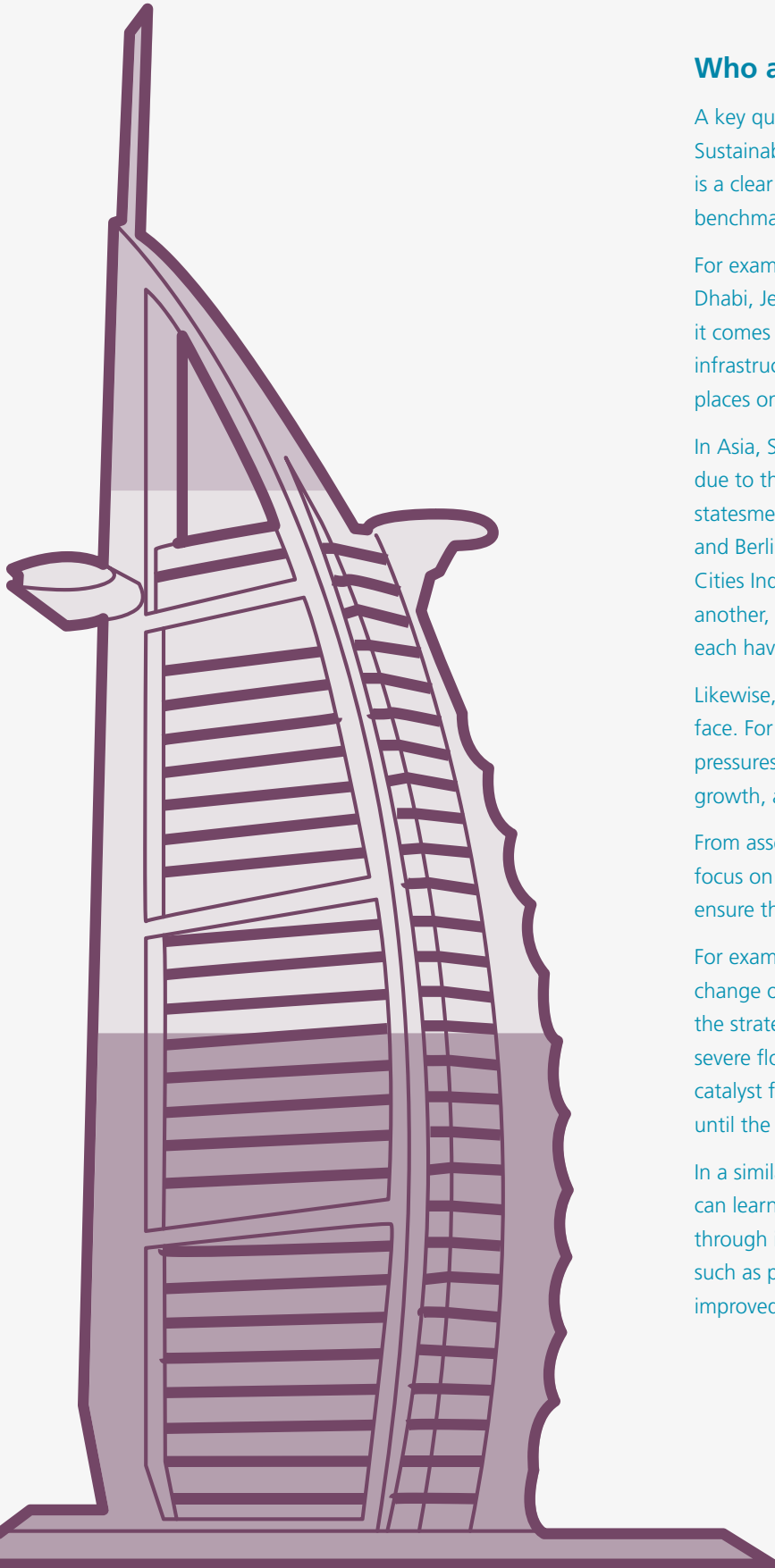
While cities are at the heart of today's global crisis, they are also the source of solutions for a sustainable future.

Figure 5:

Sustainability Target Assessment Rating Framework

Source: ARCADIS

Who are your urban peers?

A key question here is who to benchmark against. Whilst the Sustainable Cities Index provides a strong global view, there is a clear grouping within the ratings that can help cities to benchmark against their appropriate peers.

For example, cities in the Middle East – Doha, Dubai, Abu Dhabi, Jeddah and Riyadh – all face similar challenges when it comes to issues such as water scarcity, transportation infrastructure and wanting to develop rapidly to take their places on the global map.

In Asia, Singapore and Hong Kong have a long standing rivalry due to their statures as thriving economic centers. The elder statesmen cities in Europe including Amsterdam, Copenhagen and Berlin achieve similar high rankings across The Sustainable Cities Index, and the US cities can easily be compared with one another, although the sheer diversity of the US does mean they each have particular challenges of their own.

Likewise, cities can be compared globally and by the issues they face. For example, the cities built on a river delta face similar pressures no matter what continent they are in, and population growth, as we have seen, is an issue for all.

From assessment of priorities and clustering, cities are able to focus on their most pressing needs and learn from others to ensure they achieve a sustainable outcome for themselves.
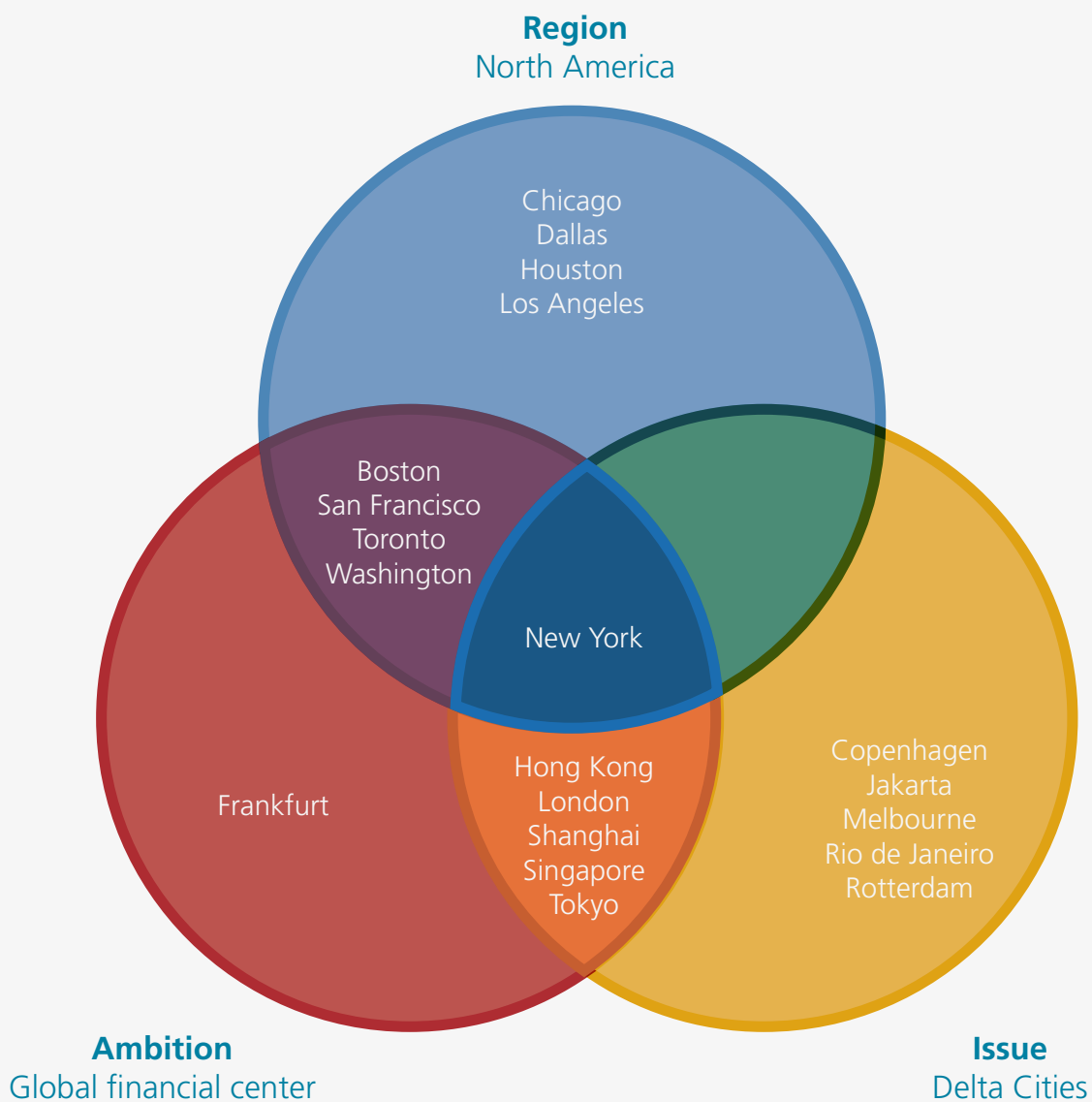
For example, cities at risk of flooding as a result of climate change or due to their geographical location, can learn from the strategies undertaken in places like Rotterdam, where severe floods in the middle of the 20th Century were the catalyst for actions to be taken that have kept the city safe up until the present day.

In a similar way, with limited finance available, city developers can learn how others have attracted private sector money through innovative finance packages, or have fought issues such as poor air quality, regenerated contaminated land or improved their transportation infrastructure.

Figure 6:

Sample city clusters by issue, region or ambition
Source: ARCADIS

Region
North America

Chicago
Dallas
Houston
Los Angeles

Boston
San Francisco
Toronto
Washington

New York

Frankfurt

Hong Kong
London
Shanghai
Singapore
Tokyo

Copenhagen
Jakarta
Melbourne
Rio de Janeiro
Rotterdam

Ambition
Global financial center

Issue
Delta Cities

Concluding thoughts: Delving deeper into the Sustainable Cities Index

The pattern of learning from others makes the ARCADIS Sustainable Cities Index a very interesting tool that can be used to gauge how cities are seeking to strike the balance between People, Planet and Profit and the interdependencies between them. For example, the Planet indicators show that cities that perform well economically often do so at a high environmental cost. The breakdown into sub-indices demonstrates where cities need to make investment to improve their overall performance. Cities like New York, Hong Kong, London and Singapore are victims of their own success in some ways with very high land costs. For long term economic and social sustainability, this requires a heavy program of investment in housing and office space.

Similarly, the findings demonstrate that European cities need to refocus their attention on the business environment and achieving stronger economic performance. On various components of the Profit sub-index the European cities perform weakly as the Eurozone financial and sovereign debt crisis continues to drag on. The findings highlight the major competitiveness challenges faced by the continent.

On the other hand, many US cities would perform much better in the Sustainable Cities Index if it were not for their energy use characteristics, with heavy reliance on cars and lower ranking waste management practices. The Middle Eastern entrants, bar Jeddah, share in common this outperformance on the Profit sub-index relative to the Planet rankings.

One of the most compelling findings is the urgency with which developing cities need to act to address sustainability challenges. The Sustainable Cities Index points to the need for rapid improvement across the board among fast-growing cities in the emerging markets of Asia and South America, as they will see the fastest population growth over the coming decades. Those cities that achieve the lowest ranking on the Sustainable Cities Index are generally also the fastest growing, which brings into focus the real challenges that lie ahead to deliver improved social, environmental and economic outcomes for huge swathes of the world's population.

It is through taking insights such as this and seeking global expertise and best practice that city leaders will be able to achieve their ambitions and create cities with a stable, sustainable future.

ARCADIS is already working with many of the cities featured in this report to help them to meet their challenges and become more sustainable. Through this report, we look forward to opening up further opportunities to bring our global experience to more cities and help them to achieve their goals.

Please look out for next year's ARCADIS Sustainable Cities Index to see how these cities have moved on over the year.

> One of the most compelling findings is the urgency with which developing cities need to act to address sustainability challenges.

New York

Appendix: methodology and data sources

Methodology

In total, 20 input indicators were taken into account to compile the Sustainable Cities Index, comprising nine for the People sub-index; six for the Planet sub-index and six for the Profit sub-index (property prices appearing twice). The data behind these indicators was processed so that higher scores represent more sustainable cities, and give the highest-ranked city in each indicator a score of 100%, while the lowest-ranked city receives 0%, so that each city's performance within each category is measured relative to each of the other 49 cities. By averaging the indicators, a score for every city in each of the three sub-indices is derived and combined to deliver an overall score. Some indicators, such as transport infrastructure, are deemed to have importance to multiple sub-indices, where this is the case these indicators are suitably discounted before entering the overall score to avoid double counting. The output is a percentage score: theoretically a city could attain 100% if it came top in every category, but in reality no city does – the highest score, that of Frankfurt, is 70%.

Where one indicator appears in more than one sub-index (for example, transport appears in both People and Profit indices), it enters the overall Sustainable Cities Index only once. Otherwise the overall Sustainable Cities Index score is comprised of one third of the scores on each of the sub-indices. Table 2 provides an overview of each of the indicators that enter the Sustainable Cities Index.

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Authorship and acknowledgements

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Table 2:
Sustainable cities indicators

| Indicator		People	Planet	Profit	Source	Description
Literacy		●			World Bank World Development Indicators	Adult total literacy rate (% of over 15s who can read and write)
Education		●			QS World University rankings	University scores based on six categories
Green spaces		●			Siemens Green City Index, municipality websites, others	Percentage of green space within city area (parks or undeveloped nature)
Health		●			World Bank World Development Indicators	Life expectancy at birth
Dependency ratio		●			World Bank World Development Indicators	Ratio of economically active population to economically inactive population
Income inequality		●			World Bank World Development Indicators	Gini coefficient (0=perfect equality, 1=all income goes to one person)
Work-life balance		●			International Labor Organization, UBS and OECD	Average hours worked per employee per year
Property prices		●			UBS prices and earnings and Numbeo	Purchase price for residential property, $US per sq meter
Transport infrastructure (composed of--)	Public transport	●		●	Siemens Green City Index, others	Density of public transport network, km/km2
	Commuting time				TomTom traffic index, Numbeo commuting times	One-way commute time
	Rail infrastructure				World Metro Database	Kilometers of metro/light rail network per capita
	Airport satisfaction				Skytrax World Airport Awards	Survey of customer satisfaction in airports
Energy use and renewables mix (composed of--)	Energy consumption		●		Energy Information Administration	Primary energy consumption per capita
	Renewable consumption				Energy Information Administration	Share of renewable energy in energy mix (country-level)
Natural catastrophe exposure			●		EM-DAT: International Disaster Database	Number of categories of natural catastrophe (out of a possible 8) that a city has been affected by
Air pollution			●		World Health Organization Ambient Air Pollution Database	Annual mean concentration of fine particulate matter
Greenhouse gas emissions			●		Carbon Disclosure Project	Total CO_2 emissions
Solid waste management			●		World Bank	Rates of landfill/recycling/compost/waste-to-energy of solid waste
Drinking water and Sanitation (composed of…)	Drinking water		●		WHO/Unicef Joint Monitoring Program for Water Supply and Sanitation	Urban improved (e.g. piped) drinking water (as opposed to unimproved, e.g. surface)
	Sanitation					Urban improved sanitation facilities (as opposed to unimproved)
Energy efficiency				●	Energy Information Administration	Total energy consumption per dollar of GDP
Importance to global networks				●	Globalization and World Cities (GaWC) Research Network	Measures how integrated a city is into the world's network of cities
GDP per capita				●	Brookings institute	Gross domestic product per capita
Ease of doing business				●	World Bank Ease of Doing Business Index	Composite indicator of EoDB including regulations, corruption, etc
Cost of doing business	Goods and services costs			●	UBS Prices and Earnings	Comparison of goods and services costs across cities
	Property prices				UBS prices and earnings and Numbeo	Purchase price for residential property, $US per sq meter

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Further reading
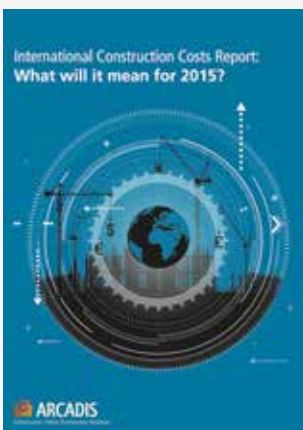
Built Asset Performance Index

Global Infrastructure Investment Index

Construction Disputes report
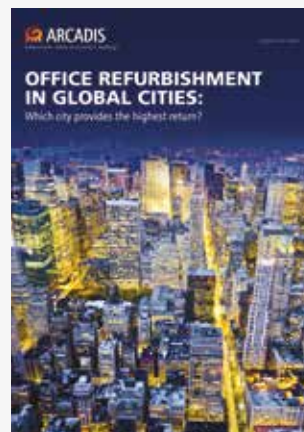
Global Office Refurbishment

International Construction Costs