ARCADIS
Design & Consultancy
for natural and
built assets

SUSTAINABLE CITIES INDEX 2016

Putting people at the heart of city sustainability

CONTENTS

1. FOREWORD

THE SUSTAINABLE CITIES INDEX 2016

City Sustainability is increasingly accomplished in new and different ways. At Arcadis we believe the best way to truly understand the sustainability of a city is to amalgamate attributes from the perspectives of people, planet and profit to form a holistic view of each location and its position on the sustainability scale. Only then can we obtain a clear picture of how sustainable, or not, a city is.

"What is the city but the people?"

William Shakespeare

As a citizen, I observe how sustainability affects my fellow city dwellers. Increased stresses like water shortages, climate change, housing prices and employment factors are impacting our quality of life. No city could acquire its unique identity without its people; the inhabitants are the heart of a city. They are the change agents, from the city mayors and their constituents who vote and implement laws that progress city needs, through the musicians and artists who influence culture, to the educators and industries that create human capital and new technology, services and products. People make a city.

Rio de Janeiro had the distinction of being an Olympic host in 2016; welcoming guests to experience world-class athletics on a grand stage. The press highlighted Rio's other 'host' attributes such as traffic, security, public transportation, recession, crime and water pollution, to name a few! It seems the social, environmental and economic prevailing characteristics of the host city got as much media attention as the games themselves. As Doha prepares for the 2022 World Cup, they had to assure the FIFA committee, as a host city, that they could prepare enough amenities, lodging, infrastructure and water reserves to sustainably support over a million guests. The ability of a city to properly host and accommodate tourists is a real measure of a city's capacity to elevate the personal experience of what that city has to offer. The sufficiency of a city to appropriately host guests also applies to the city's ability to effectively host its residents. Cities always relish the opportunity to roll out the red carpet, putting their best faces forward and welcome their visitors. However, where the rubber meets the road in truly defining urban sustainability is how well cities perform in meeting and unburdening the everyday needs of their citizens.

The 2016 Arcadis Sustainable Cities Index goes deeper in assessing the people dimension of the urban experience. A city revolves around its people, and sustainability ultimately improves their quality of life. The range of people's needs in a city is broad, encompassing livelihood requirements of nourishment, housing and safety, education and vocational opportunities, recreational outlets and access to culture and arts. A city's built assets, such as buildings, transportation networks and pedestrian thoroughfares, perform optimally when planned and installed to accentuate the living experience of its people. Getting a city to invest, develop, evolve and, ultimately, be a better host for its permanent residents, will propel it to become more sustainable and competitive.

The purpose of the first Sustainable Cities Index was to take 50 of the world's most prominent cities and look at their viability as places to live, their environmental impact, their financial stability and how these elements complement one another. This year, we've created a more robust data set to provide a more comprehensive indication of sustainability and we've increased the coverage of the Index to 100 cities, both developed and emerging, around the world. All of these cities are in various stages of evolution, some further along their sustainability journey than others. Importantly, the purpose of the Arcadis Sustainable Cities Index is not to create a hierarchy of elite cities, but to indicate areas of opportunity. All cities continue to make progress on their missions to become more sustainable economically, environmentally and for the good of their inhabitants. As the world continues to become more reliant on its urban centers, it is our hope that city leaders and industry find this a valuable tool in assessing their priorities and pathways to urban sustainability for the good of all.

John Batten

Global Director of Water and Cities

2. EXECUTIVE SUMMARY

- The 2016 Arcadis Sustainable Cities Index ranks 100 global cities on three dimensions of sustainability: people, planet and profit. These represent social, environmental and economic sustainability and offer an indicative picture of the health and wealth of cities for the present and the future.
- The research shows that cities around the world are not effectively balancing these three pillars of sustainability. Instead, many demonstrate split personalities. While taking the lead in some areas, cities often underperform in one element of sustainability which negatively impacts their overall performance.
- Zurich leads the overall ranking and tops the planet sub-index. But, while it scores highly in profit, it reveals its split personality by appearing in 27th place for people.
- Well-established European cities dominate the top of the ranking, making up 13 of the 15 leading places. Global hubs such as London (5th), Frankfurt (6th) and Paris (15th) perform well. In the two remaining places are the Asian cities of Singapore (2nd) and Seoul (7th).
- The Asian cities of Singapore and Hong Kong rank highly in profit performance, but this seems to be straining social sustainability. Factors such as the high cost of living mean these cities, sitting first and second in the profit rankings, place 48th and 81st respectively for people.
- In North America, the Canadian city of Vancouver (23rd) takes the region's top spot, but no U.S. city makes it into the top quartile. New York is the country's most sustainable city (26th globally) and does particularly well in the profit sub-index (8th place), but at 77th has room to improve on its people ranking. Vancouver and New York are followed by Montreal (28th) and Toronto (33rd) in the region.
- San Francisco, New York and Dallas follow the global trend of having higher rankings for profit but lower rankings for people.
- UAE cities lead the Middle East rankings, with Dubai as the best-performing city in 52nd spot, closely followed by Abu Dhabi in 58th.
- Cities in Australasia sit well within the top half of the ranking. Canberra (18th) leads the way in that region, followed by Sydney (21st).
- Fast-growing, emerging cities in Asia, Latin America, Africa and the Middle East make up much of the fourth quartile of the Index, with many facing significant challenges across each area of sustainability.
- The Brazilian cities of São Paulo and Rio de Janeiro sit out in front of their continental counterparts in the planet sub-index, ranking in 30th and 38th place.
- The span of median ages across the cities in the Index is vast, ranging from just 18.7 years in Nairobi to 46.6 years in Tokyo.
- In order to improve their sustainability, city leaders are encouraged to put people at the heart of their sustainability plans and use the Index to help them to compare and learn from similar cities across the world.
- This journey begins with a clear assessment of where a city is today, identifying the outputs, positive and negative, arising from the interplay between the city's physical, social and economic systems. This will help cities achieve a better balance across each of the pillars of sustainability.

3. SUSTAINABLE CITIES INDEX

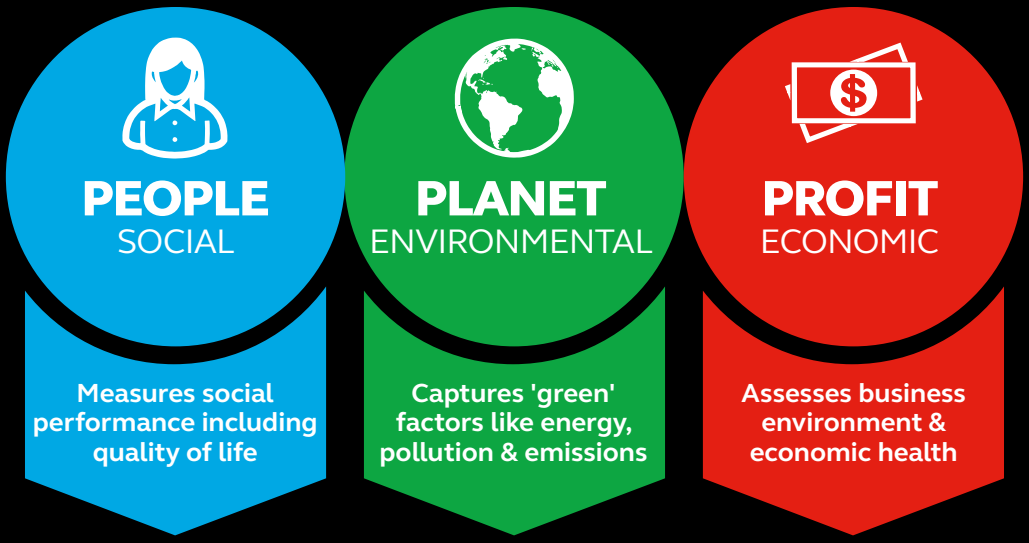
3.1 THE IMPORTANCE OF URBAN SUSTAINABILITY

Cities are under pressure from all angles. Some pressures can be modeled and forecasted, such as population growth and mobility needs, but others, political uncertainly or flash floods for example, are more difficult to predict. Balancing the immediate needs of today without compromising the needs of tomorrow is at the heart of being a sustainable city, and of this report.

As the needs of the present can encompass almost anything, it is necessary to focus on certain dimensions to assess how cities are performing at this essential task. The Sustainable Cities Index seeks to do this through an indication of urban sustainability that encompasses measures of the social, environmental and economic health of cities, as shown in Figure 1. These are the three 'P's – people, planet and profit.

Arcadis partnered with the Centre for Economic and Business Research (Cebr) to explore how cities are doing across these three areas. Cebr assessed 100 of the world's leading cities, using 32 different indicators, to develop an indicative ranking of the sustainability of each. A city receives a score on each of the three pillars of sustainability and a city's overall score is equal to the average of the three sub-indices. A full list of these indicators can be found in Table 1 in the appendix to this report.

FIGURE 1: THE THREE PILLARS OF SUSTAINABILITY



The People sub-index rates health (life expectancy and obesity), education (literacy and universities), income inequality, work-life balance, the dependency ratio, crime, housing and living costs. These indicators can be broadly thought of as capturing "quality of life".

The Planet sub-index ranks cities on energy consumption and renewable energy share, green space within cities, recycling and composting rates, greenhouse gas emissions, natural catastrophe risk, drinking water, sanitation and air pollution. These indicators can broadly be thought of as capturing "green factors".

The Profit sub-index examines performance from a business perspective, combining measures of transport infrastructure (rail, air and traffic congestion), ease of doing business, tourism, GDP per capita, the city's importance in global economic networks, connectivity in terms of mobile and broadband access and employment rates. These indicators can broadly be thought of as capturing "economic health".

While geographical factors such as location, climate and access to resources all make like-for-like comparisons problematic, the report gives cities the opportunity to measure their overarching performance across these three areas, each vital for sustainability, to benchmark and learn from higher placed cities and take action to sustain future performance.

3.2 THE FINDINGS

The research indicates that there are three significant areas of correlation:

- No one city is effectively balancing all three areas of sustainability. Many cities do well in two of the people, planet and profit ratings, but very few do well in all three, indicating the challenge that cities have in balancing all three needs effectively to ensure long-term sustainability.
- There is a geographical bias, with European cities achieving higher scores overall and emerging cities towards the bottom of the Index. Comparing cities with their geographical peers or with similar sustainability challenges (such as age demographics) therefore offers a better comparison.
- The challenge of putting people at the heart of a city's sustainability is one that many cities struggle with. A clear vision and identity for the city is the starting point of this process, and has the benefit of giving people, business and finance a much clearer idea of what will attract them to the city in question. The built and natural environment has a critical part to play in forming a city's unique identity.

The report is divided into the overall ranking and sub-indices of people, planet and profit. It explores each of these in depth, and contains profiles of some of the key cities in the Index.

3.3 OVERALL INDEX RANKINGS

Cities around the world are living at extremes and exhibit polarized performance across the three pillars of sustainability

The Swiss city of Zurich tops the overall Sustainable Cities Index, scoring particularly well across the planet and profit categories. With the exception of Singapore and Seoul, the top ten ranked cities are mostly from northern and central Europe – three of the top ten are in Germany alone.

Around the middle of the Index are cities from southern Europe, the U.S. and some cities of the Middle East. The U.S. cities show a differing performance across the categories. Overall they rank far higher for profit compared to people and planet, which brings them down in the overall rankings. New York leads the pack at 26th, while Tampa (68th) and Detroit (69th) finish out the U.S. rankings.

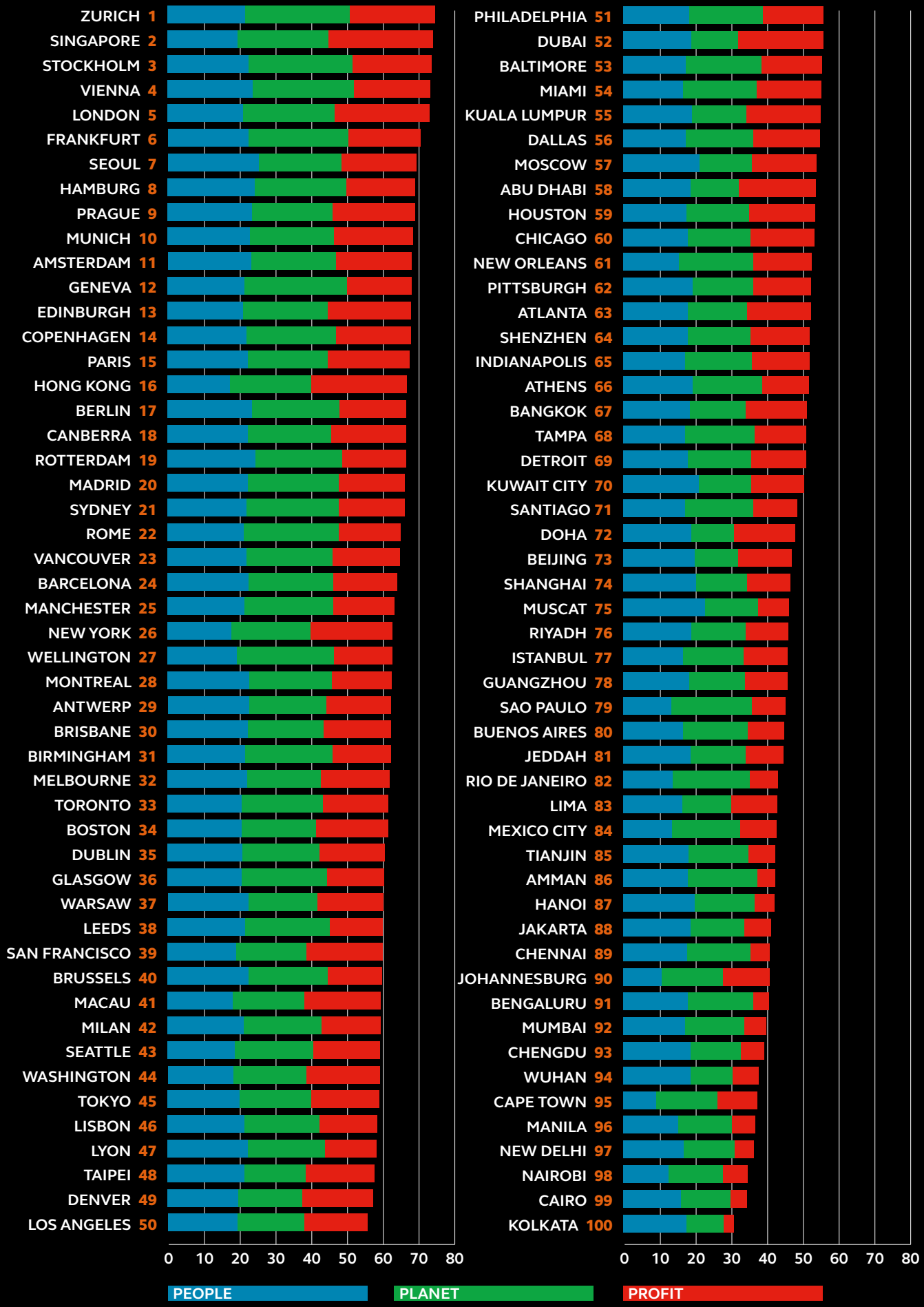
The lower half of the Index contains all of the mainland Chinese cities, with cities from Latin America mostly following. The less advanced Asia-Pacific metropolises are a little further down, with the least-developed cities in the Index, predominantly those in India and Africa, finishing the Index. The cities of the Middle East are spread throughout the lower half.

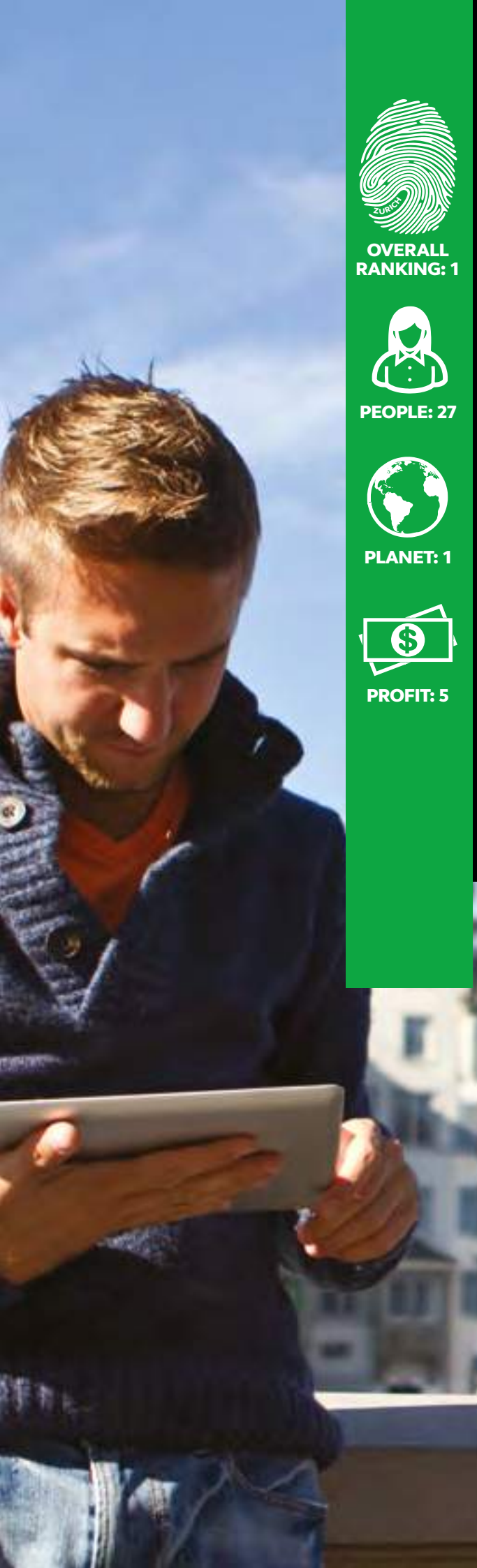
A clear link between economic development and environmental sustainability is apparent. Therefore, cities in advanced economies are largely at the top while those in emerging and developing economies tend to cluster towards the bottom.

The tension inherent in a sustainable economy, be it a city or a country, is whether future generations' well-being is jeopardized by today's lifestyles. At present, all advanced economies put future standards of living at risk through high emissions of greenhouse gases, by not recycling enough of the finite resources we use and by depleting our non-renewable energy sources. Some contain the adverse effects of these activities better than others, and this report seeks to show how different cities compare in this respect.

As such, the Sustainable Cities Index does not look like a typical development ranking. Some emerging economies are unexpectedly high relative to a "standard" development ranking, while some developed economies fall down in their obligations to the future. We can look at the three sub-indices to see in which dimensions of sustainability cities are performing well and in which they have opportunities for further investment and improvement.

FIGURE 2: OVERALL INDEX RANKINGS:
ZURICH ON TOP OF THE SUSTAINABLE CITIES INDEX (SOURCE CEBR)





OVERALL RANKING: 1

PEOPLE: 27

PLANET: 1

PROFIT: 5

CITY PROFILE
ZURICH

Zurich, the number one city in the Sustainable Cities Index, has a strong reputation as a liveable, contemporary city known for its strong focus on environmentalism as well as world-renowned financial institutions. Despite leading both the overall ranking and the planet sub-index, and ranking 5th in profit, Zurich appears 27th on the people sub-index; affordability and work-life balance are the primary causes of this disparity.

Topping the planet sub-index, the city pioneers the long-term goal of becoming a 2000-watt society by 2050. The 2000-watt society is Zurich's approach to tackling climate change and resource scarcity: a goal for its people to use 2000 watts of energy per capita (the global amount established as 'sustainable' energy use). Commitments include investment and focus on energy efficiency and renewable energies, sustainable buildings, mobility for the future and an effort to increase public awareness, including events such as annual environment days and the Zurich Multimobil action day.

Public transit in the city is highly regarded as a sustainable model for other cities. Trams, trains, buses, light rail and more are highly coordinated, making mobility simple, quick and affordable.

As a global economic hub the city is not only able to attract business but also people, with a good quality of life, attractive educational and employment opportunities as well as a leading health ranking on the Index. Various innovative businesses and industries, both small and large, form an important basis of the Zurich economy. In addition, high productivity levels and low non-wage labor costs make production costs lower than competing economies around the world. All in all, this makes Zurich an attractive place to invest, live and work.

OVERALL RANKING: 5

PEOPLE: 37

PLANET: 9

PROFIT: 3

CITY PROFILE
LONDON

London is one of the world's foremost economic powerhouses, ranking third in the profit sub-index. Sitting at the center of global finance, London's heavyweight position, combined with a long history of cultural and economic evolution, means it is well equipped to reap the long-term benefits of its status as a true world city. However, if the capital is to maintain its long-term competitiveness, there are a number of issues that still need to be addressed.

With an environmental ranking of 9, there is a commitment to improving environmental performance of the city through, for example, low-emission buses, environmental clean-up programs, infrastructure such as the Thames Tideway Tunnel and volunteer actions from its citizens.

Ranking only 37 on the people sub-index, the mobility and housing needs associated with a densely populated, growing metropolis are at the forefront of the city's challenges. With London's population projected to reach 10 million people by 2030, improving infrastructure capacity and providing the right number and type of homes that will enable all people to live and work is critical. 28% of the city's population are living below the poverty line, and addressing income inequality and the high cost of living will do much to improve London's people score and its overall rankings.

London has reached a tipping point, as the large differential between its people and profit rankings demonstrates. Yet, in the aftermath of Brexit, the Mayor needs to persuade global businesses that London's infrastructure priorities have not changed and that the capital remains just as viable outside of the EU.

CITY PROFILE
SHANGHAI

OVERALL RANKING: 74

PEOPLE: 43

PLANET: 91

PROFIT: 77

Shanghai is one of the key gateway cities into China. It has always been a hub for international trade, finance and business. It ranks 74th overall on the Arcadis Sustainable Cities Index and scores highest among all the mainland China cities on the people sub-index ranking.

With Shanghai continuing its quest to be one of the most sustainable cities in China, urban regeneration and innovation hubs will be important elements of its future development, as the city transforms itself from a manufacturing center to a knowledge, technology and innovation center for the nation. Zhanjiang and Caohejing developments play an important part in Shanghai's future as they continue to expand and evolve.

Shanghai's urban transformation is underpinned by an evolving transportation system. 13 of the city's 25 metro lines are completed and operational. The region continues to evolve its transportation connectivity to the greater Yangtze River Delta with new high-speed rail and urban highway connections.

Tourism will also become a major element of Shanghai's urban transformation, with the opening of the Disney resort and other entertainment-related mixed-use developments. The future growth of Pudong will bring more resort and entertainment development to the city, making it one of the key aspects of Shanghai's continued growth and evolution.

Education plays an important role in Shanghai in ensuring the quality of future workforce supply. With the opening of the Shanghai tEch campus, in addition to well-established universities such as TongJi and Fudan, the future is looking optimistic.

OVERALL RANKING: 50

PEOPLE: 49

PLANET: 60

PROFIT: 47

CITY PROFILE
LOS ANGELES

Los Angeles continues to be a main hub for economic growth and innovation in the U.S., attracting population growth, entrepreneurship and international investors. With the first full year of the "Sustainability City Plan" implementation under its belt, Los Angeles is now more focused than ever on developing creative ways to expand overall city sustainability, ensuring a future improvement in its ranking.

Water quality improvements and conservation efforts are priority areas, as the state of California experiences the fifth year of its current drought crisis. Recent reports have found that the region's underground plumes of pollution are steadily expanding. The Los Angeles Department of Water and Power has said that within five to eight years the plumes will become so dense that the groundwater wells will likely shut down unless a solution can be implemented. Despite these challenges, Los Angeles has been successful in meeting the Mayor's goal of decreasing water usage by 25% by early next year. The rollout of the upcoming One Water LA plan will also serve as a guiding force to instill resilience in all aspects of water management to support the city's future. With a planet sub-index ranking of 60th, it is fitting these environmental initiatives are being addressed.

Los Angeles' continued population growth is driving infrastructure-related initiatives, such as improved affordable housing options, downtown revitalization and increased transit connectivity. The city is also committed to reducing the affordability gap (which contributes to their middle-of-the-road ranking of 49th for people) by increasing the minimum wage rate and developing social programs to support the homeless community, continuing on the path to a more sustainable future.

3.4 PEOPLE SUB-INDEX

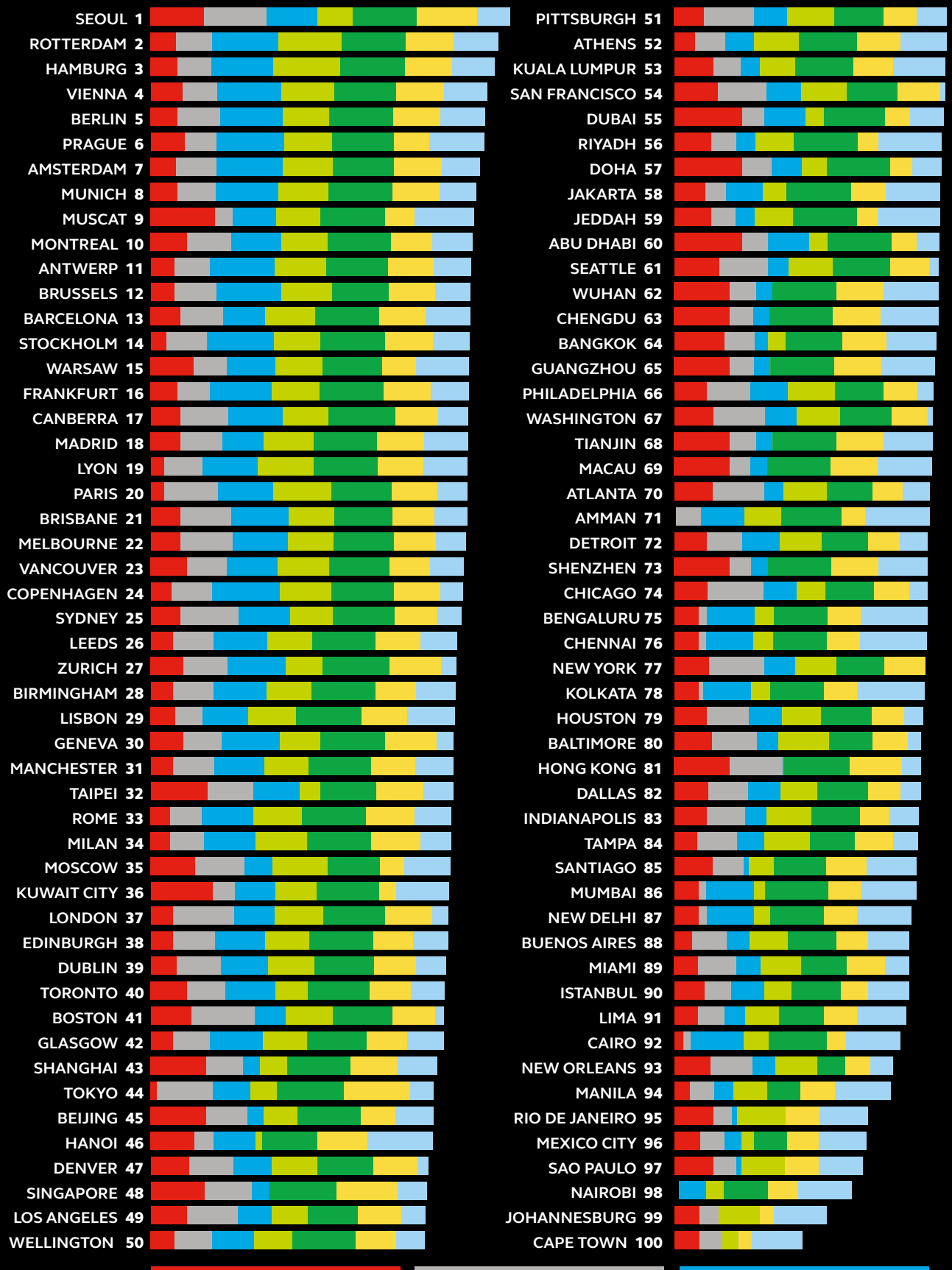
LOW INEQUALITY THE SECRET OF SOCIAL SUSTAINABILITY

The people sub-index measures social sustainability and gives some surprising results, showing a substantial degree of departure from many of the other ways of comparing cities. Seoul ranks first and, although the remaining top five cities are European, Muscat and Montreal enter the top ten, at 9th and 10th respectively. The U.S. cities are generally weighed down by a high degree of income inequality, high crime, obesity (as part of the health indicator), a lack of affordable housing and long working hours. Many cities that rank higher in the planet and profit sub-indices tend towards lower people rankings, often hampered by long working hours, a skewed distribution of wealth and the affordability of both housing and consumer goods and services.

To some extent, cities with low affordability scores are victims of their own success. High land values, which in turn raise the prices of not just housing but also goods and services, are a result of successful urban economies. Over time, however, unaffordability poses a threat to lower-paid workers who are essential to a city's proper functioning, as well as the cheap workspaces that start-up businesses require. This illustrates the need for cities to address these issues to enable and drive future growth.

The most reliable predictor of where a city ranks in the people sub-index is income inequality. This has strong links with the other indicators: crime, education, work-life balance, health and affordability. The link explains the high performance of many northern European cities and the low performance of cities in Latin America and sub-Saharan Africa. This pattern holds despite the unfavorable demographics in much of Europe versus Chinese cities (whose inhabitants are largely of working age). The power of equality to influence other social objectives has been noted by many social researchers (e.g. Wilkinson & Pickett, The Spirit Level) and its acknowledged effects on a range of issues such as health, drug abuse, education and obesity mean it is bound to correlate strongly with the people sub-index, as a broad social-sustainability indicator.

FIGURE 3: PEOPLE SUB-INDEX:
AFTER SEOUL, EUROPE LEADS THE WAY (SOURCE CEBR)



CITY PROFILE
SEOUL

OVERALL RANKING: 7

PEOPLE: 1

PLANET: 26

PROFIT: 18

Seoul, an up-and-coming global cultural capital, tops the people sub-index. Health and education rankings propel Seoul to the top, with programs such as the 2030 Seoul Plan focusing on five core issues: "a people-centered city without discrimination", "a dynamic global city with a strong job market", "a vibrant cultural and historic city", "a lively and safe city" and "stable housing and easy transportation, a community-oriented city".

The program also includes urban planning policies to strengthen the city's identity, global competitiveness, development direction and innovation in the living environment for citizens. It has 139 projects in 13 districts that plan to transform the urban metropolis into a "safe, warm, dreaming, breathing city".

Seoul's leaders have taken serious steps towards city sustainability with projects like the Cheonggyecheon urban renewal and river restoration project. This previously polluted area has been transformed into a public recreation space in the heart of the city. Restoration not only spurred economic development but also provided much-needed flood protection for the downtown area, boosting Seoul's economic, environmental and social sustainability.

Seoul's 2030 plan will positively impact all three sustainability areas in the Index. In addition, Seoul is active in the C40 and 100 Resilient Cities initiatives, actively participating in these knowledge exchanges and global initiatives.

OVERALL RANKING: 19

PEOPLE: 2

PLANET: 17

PROFIT: 46

CITY PROFILE
ROTTERDAM

Rotterdam, situated with multiple major river deltas flowing into the sea, has unique characteristics and sustainability challenges. Rotterdam has learned how to deal with water; not only does the city have the largest port in Europe (which has the ambition of being the most sustainable port in the world), but it also drives global best practices on resiliency. It deploys multifunctional flood protection, a water plaza and innovative water storages under new, iconic buildings, for example. Rotterdam is actively sharing its knowledge with other cities through the Connecting Delta Cities program, C40 and the Rotterdam Center for Resilient Delta Cities.

Now halfway into their 2015–2018 sustainability plan, the city of Rotterdam aims to get sustainability closer to all people, with programs on green cities, clean energy and innovative economic developments. There are many bottom-up initiatives driven by the city's inhabitants, making Rotterdam more appealing and sustainable. Collaboration between inhabitants and the municipality is very successful, contributing to Rotterdam's current rise in attractiveness for businesses, tourists and inhabitants and its ranking of second on the people sub-index.

An example of a successful sustainable, collaborative initiative is the 7 Square Endeavour program which has an international mission to prepare cities for the future. The initiative will enhance Rotterdam's theatre district and act as an experimental area for new innovative technologies, cyclical processes and business models. Rotterdam serves as the first of seven squares in a series worldwide.

CITY PROFILE
BERLIN

OVERALL RANKING: 17

PEOPLE: 5

PLANET: 16

PROFIT: 32

Ranking 17th on the Index, Berlin is diverse and innovative. As the largest city in Germany, it provides a home for more than 3.5 million people. Its ethnic and cultural diversity is a significant advantage for the city. To continue the enhancement of the city, different programs and measures are being defined to retain and improve the quality of life.

Named as a "green city", Berlin has set ambitious sustainability goals to achieve by 2050 which will improve both its environment and its social sustainability. These goals include the city becoming CO2 neutral, additional urban mobility through the new bicycle paths, 5% re-densification allowing residential space usage to be reduced, and a rise in the energy refurbishment rate. These measures will enhance Berlin's attractiveness as an economic hub and accelerate its growth by assisting people and companies in adopting sustainable practices.

Additionally, because Berlin is in the lower half of the Index for air pollution and greenhouse gas emissions, one of its most important goals is to eliminate coal-powered plants and notably reduce reliance on oil for power. By 2030, the city aims to have a third of the vehicles on its roads powered by renewable fuels.

OVERALL RANKING: 72

PEOPLE: 57

PLANET: 98

PROFIT: 50

CITY PROFILE
DOHA

Doha ranks fourth out of the eight cities in the Middle East covered in this year's report, and 72nd overall. While this score may appear low, it's important to place it in context. Doha is a young city with much of its development taking place over the last 20 years. It's all but inevitable that emerging major cities in rapidly developing economies will score well on the profit sub-index, but leave room for improvement on the planet sub-index due to extensive natural resource consumption. The city's 2030 National Vision offers a positive glimpse of the future in this respect and includes a commitment to offset any environmental impact with investment in areas like green technology and cleaner energy sources. So it's no surprise to see Doha score highest in the profit sub-index. The average GDP per capita is high, and the country is also making a significant investment in its transport infrastructure and in improving its overall business environment.

Doha, along with Qatar, is also building a strong presence on the world stage. Its commitment to becoming a home of major sporting events is evidenced in their hosting of the 2022 FIFA World CupTM, which in turn drives development and economic growth.

The city scores reasonably well on the people sub-index. The 2030 National Vision provides a real focus on improving human development, resulting in the construction of a number of new education and healthcare facilities like Hamad Medical City. Areas where Doha is challenged in the people sub-index (income inequality and work-life balance) are in part due to the size of the city's expatriate workforce in its construction and service industries.

3.5 PLANET SUB-INDEX

ENERGY SUPERPOWERS FIND ENVIRONMENTAL SUSTAINABILITY MORE DIFFICULT

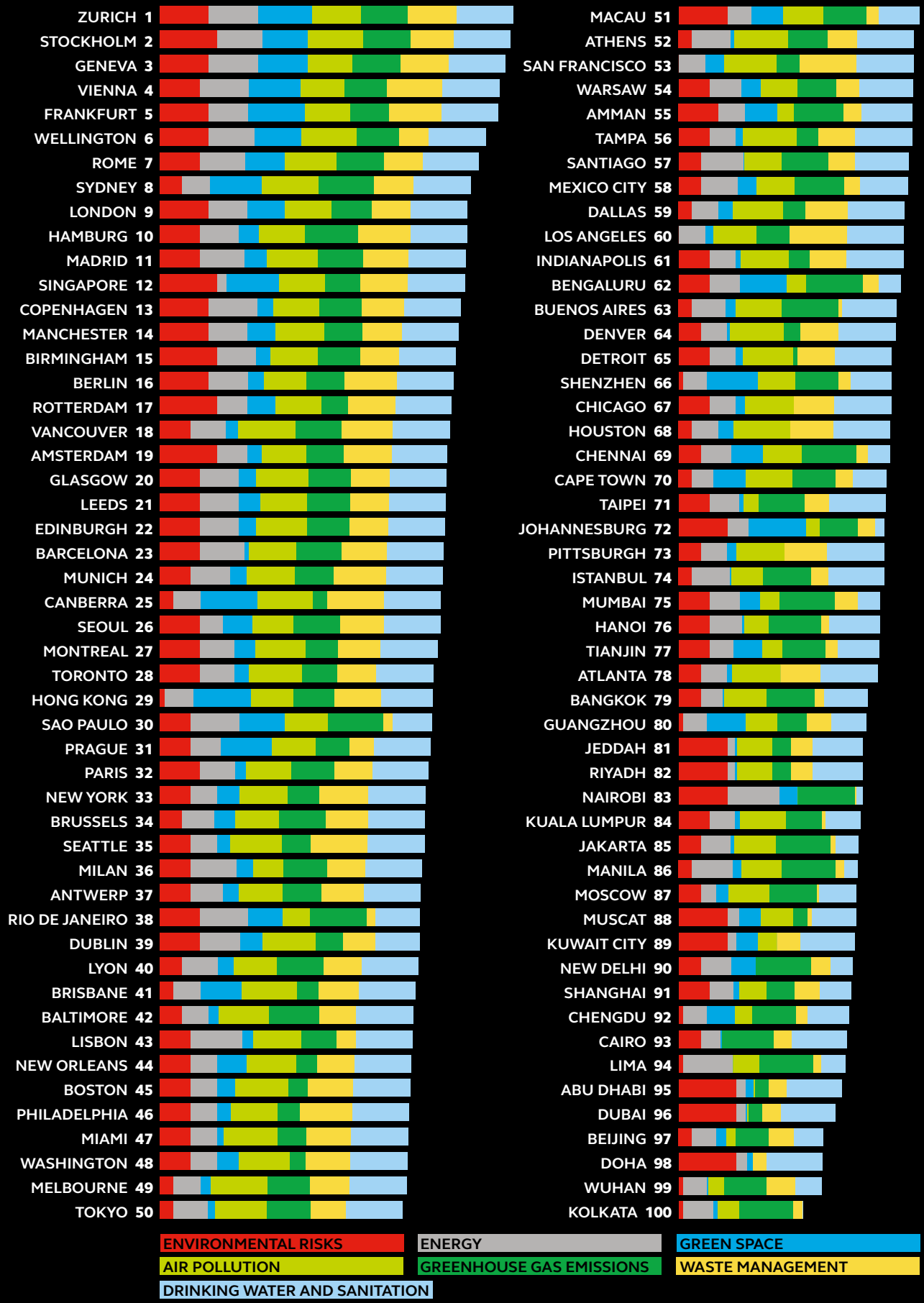
The Swiss cities of Zurich and Geneva dominate the top three positions in the planet sub-index (first and third places respectively) with Stockholm in second. Wellington and Sydney join the top ten which is otherwise made up of European cities.

U.S. cities are negatively affected by their high per-capita emissions, energy use and lower amount of green spaces. San Francisco (53rd) and Los Angeles (60th) feature in the lower half of the sub-index. While these two Californian cities have the highest recycling rates in the world, they also have the highest exposure to natural disasters. This indicator affects developed and emerging cities alike and, while there is some reflection in the rankings of the degree to which cities prepare themselves, some are inevitably left vulnerable and exposed regardless of the actions they've taken to reduce risk in this area.

Middle Eastern cities also feature towards the bottom of this sub-index. One cause of this is the energy indicator, which measures the proportion of electricity from renewable sources, the energy intensity (i.e. the amount of energy consumed to produce each dollar of GDP), and energy use per capita. The Middle Eastern cities are using an increasing proportion of renewable energy but, given their vast fossil fuel resources, incentives to conserve energy are much weaker than elsewhere. Moscow is in a similar predicament and also appears near the bottom at 87th.

There are also a few unexpected high performers in emerging economies. For example, Bengaluru is fairly high (62nd); while its performance for waste management is one of the worst in the sub-index, the city makes up for it by having very low greenhouse gas emissions and energy use.

FIGURE 4: PLANET SUB-INDEX:
SWISS CITIES GREENEST ON THE PLANET (SOURCE CEBR)



CITY PROFILE
SYDNEY

OVERALL RANKING: 21

PEOPLE: 25

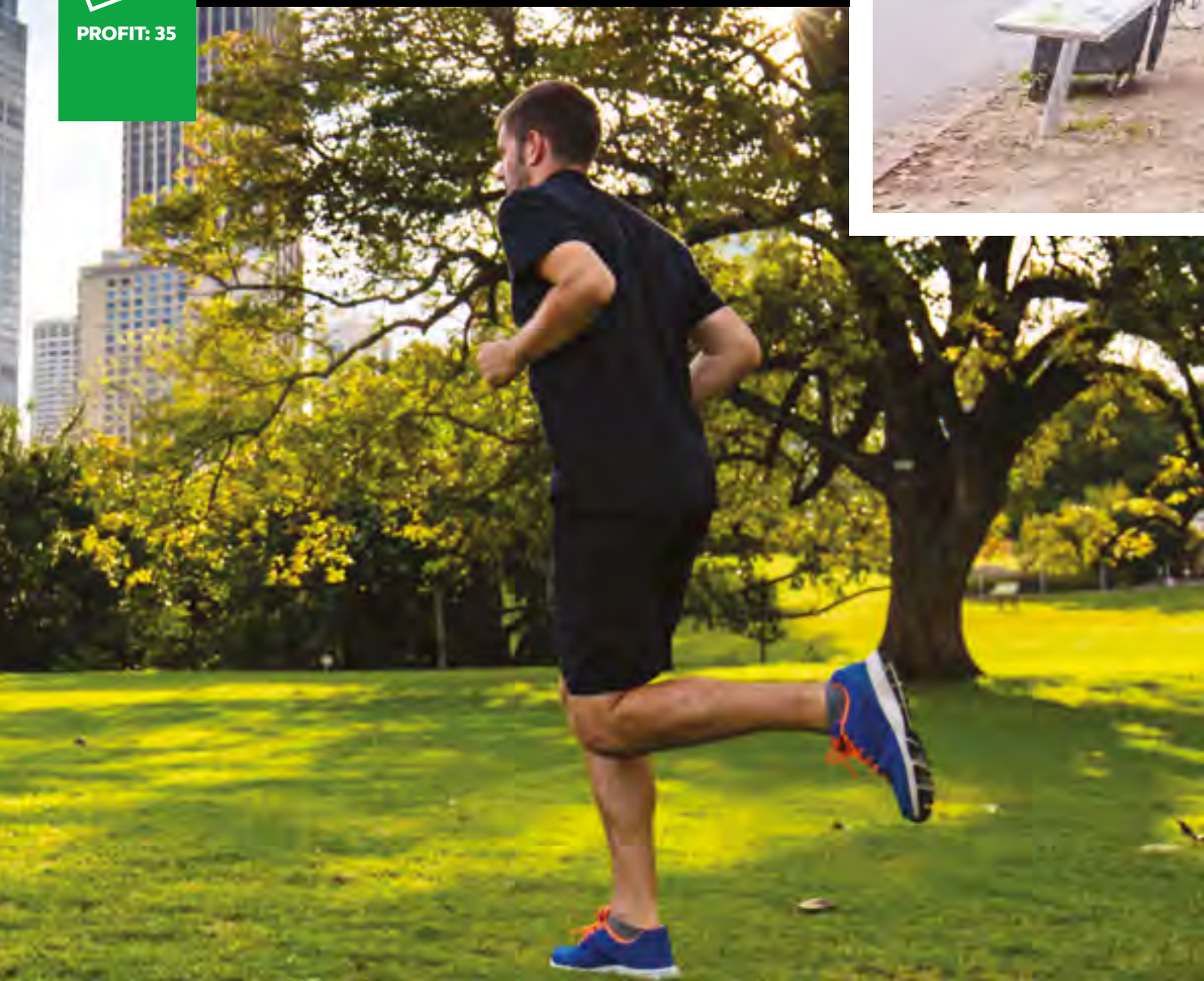
PLANET: 8

PROFIT: 35

Sydney scored strongly in the planet sub-index, ranking 8th, reflecting the abundance of green space and the quality of its air, drinking water and sanitation. The Sustainable Sydney 2030 initiative has ambitious targets to reduce the city's carbon emissions by 70%, reflected in its performance against the greenhouse gas emissions indicator. Geographic vulnerability and susceptibility to natural disaster impacted its planet sub-index ranking, something which is likely to be further exacerbated by the effects of climate change.

In the profit sub-index, Sydney's score was outside the top 30 in all profit indicators except connectivity. Interestingly, for one of the world's most iconic and visited cities, tourism and transport infrastructure were two of its lowest rankings. Sydney's vision is to create easy and affordable mobility to address the current constraints, including enhancing walkability, transit and cycling networks.

Sydney's people sub-index ranking of 25th is bolstered by a world-class education system, including six universities, as well as low crime rates, but hampered by high housing prices and cost of living. The city's demographics, health and work-life balance were all ranked 'middle of the road' compared to other global cities.



CITY PROFILE
AMSTERDAM

Amsterdam exhibits one of the best balances in the Index across the three pillars of sustainability. Historically, Amsterdam is recognized as a city of commerce and entrepreneurship. Its successful entrepreneurial background has built an innovative ecosystem creating synergies between inhabitants, public organizations, schools and businesses. Amsterdam was awarded the European Innovation Capital for 2016. One of the driving factors behind this award was the AMS institute, a consortium of public and private partners developing interdisciplinary metropolitan solutions. 179 European companies are headquartered in Amsterdam.

Amsterdam continues to invest in sustainability measures to improve quality of life. Examples include its involvement in the Zero Emissions Cities (ZEC) program, the World Business Council for Sustainable Development (WBCSD) and Amsterdam ArenA's Utility Hub (The Hub). The Hub will help the entertainment area move towards the shared use of energy resources and infrastructures. These partnerships help people visit, live, work, invest and do business in Amsterdam.

Amsterdam is a safe, healthy and equitable place overall. 58% of Amsterdam's residents cycle daily, enjoying the city's 40 parks, 1,500 cafes and bars, as well as its universities and famous canals.

OVERALL RANKING: 11

PEOPLE: 7

PLANET: 19

PROFIT: 16

CITY PROFILE
SÃO PAULO

OVERALL RANKING: 79

PEOPLE: 97

PLANET: 30

PROFIT: 84

Considered the largest city in the Southern Hemisphere, São Paulo is the home of more than 22 million people, making it the most populous city in Latin America. With this large population, São Paulo faces many urban challenges such as transporting more than 3 billion passengers a year on public transportation, handling 20 tons of waste a day and providing 180 liters of water per person every day.

The effects of rapid urban growth, an aging infrastructure and a lack of sufficient planning are felt throughout the city daily (traffic jams and water outages are common, for example). These are all reflected in São Paulo's people sub-index ranking.

São Paulo intends to implement a 2030 plan which includes housing programs, geographically dispersed businesses, improved mobility, an environmental agenda and initiatives that generate cultural and economic vibrancy. The implementation and success of the 2030 plan are challenged by a lack of strategies to attract investment and stakeholders, and barriers in adopting technology and innovation.

OVERALL RANKING: 60

PEOPLE: 74

PLANET: 67

PROFIT: 45

CITY PROFILE
CHICAGO

Chicago has been enhancing the lives of its residents through its aggressive "Sustainable Chicago" plan and has led the way on several fronts, such as the development of more than 225 miles of cycle lanes and the successful launch of Divvy, a cycle-sharing program where residents can rent cycles and return them to any of 580 conveniently located stations. Chicago currently ranks as one of the most cycle-friendly cities in the U.S.

The city also prides itself on having high quality water, with little-to-no pollutants in its freshwater sources. The Chicago Department of Water Management has been replacing 100 miles of water and sewer lines each year and the Metropolitan Water Reclamation District is now looking into technologies to become energy neutral, taking Chicago's water infrastructure to the next level.

As with any urban city, limited land for green space and congestion both continue to be a challenge. But the city is making the necessary strides towards greater sustainability. The Chicago Park District has been working aggressively in support of the Building on Burnham plan, which is focused on reaching the goal of 2,020 acres of protected natural areas by 2020 and enabling each Chicagoan to be within a two-block radius of green space. Additionally, with the Chicago Transit Authority's Wilson Station on plan to open in 2017, commuters will have a much more efficient experience transferring between rail lines. The station will also serve as a strong, revitalized anchor point in Uptown, further enhancing the strength of the city.

3.6 PROFIT SUB-INDEX

THE KEY TO ECONOMIC SUSTAINABILITY: EASE OF DOING BUSINESS

The profit sub-index measures economic sustainability. It is headed by the East Asian financial centers of Singapore and Hong Kong. These two cities are well known as recent developers and now rank among the most prosperous cities in the world. Their high scores derive from a strong performance across a number of metrics, particularly tourism, connectivity and ease of doing business. Completing the top five are London, Dubai and Zurich.

The profit sub-index is related to cities' wealth, as the economic development indicator is the city's gross domestic product (GDP) per capita (essentially, average economic output). Global importance also plays a role via the indicators of tourism and importance to global networks, a metric that maps economic and commercial links between the cities of the world. However, this does not tell the whole story, as shown by major Latin American financial centers like Mexico City and São Paulo which rank 83rd and 84th respectively in the profit sub-index. If doing business is difficult, and transport networks are neglected, even economic powerhouses can struggle for sustainability in the profit arena. For example, Brazil's rapid transition from a star emerging economy to deep recession shows that sustainability requires stronger systems and foundations.

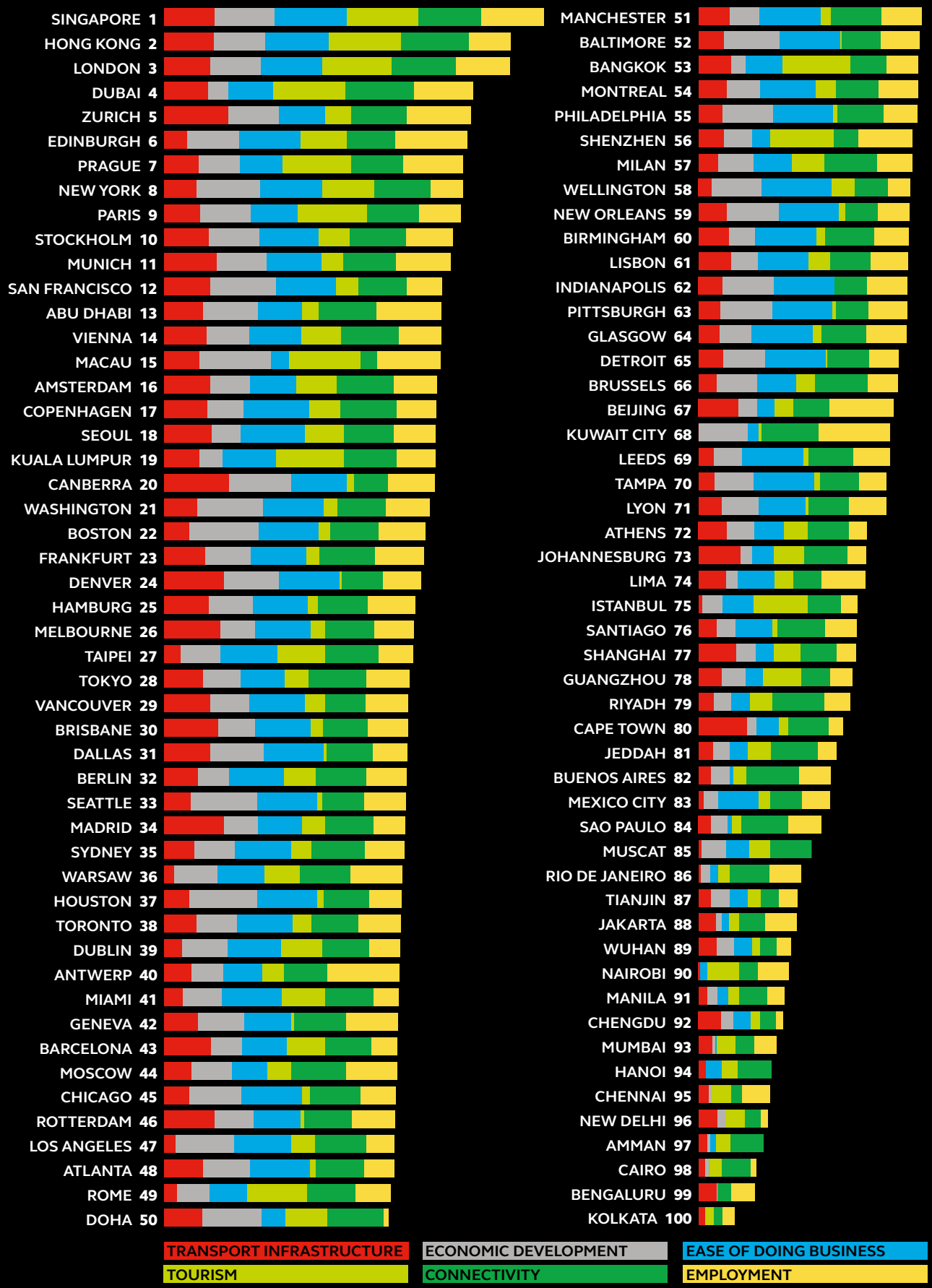
Five American cities make the top 25 of the profit ranking, led by the financial capital of New York and followed by the digital hub of San Francisco.

Shanghai, low in the ranking at 77th, is impacted by low GDP per capita, barriers to doing business and lower employment rates.

In Europe, the profit sub-index reveals the split personalities of a number of cities. Istanbul, Athens, Lyon, Brussels, Leeds, Glasgow and Lisbon, for example, all sit in the bottom 40 cities for profit but are further ahead in the people and planet pillars.

Of the indicators assessed in this ranking, the two that have the greatest impact on the profit rankings are ease of doing business and GDP per capita. The World Bank's ease of doing business rating started in 2002 and assesses issues like how many days and procedures are needed to start a business, the ease of cross-border trade, and the ease of obtaining credit from banks. Economic sustainability requires investment in the future, without which a city would not fare as well on the other indicators.

FIGURE 5: PROFIT SUB-INDEX:
GLOBAL FINANCIAL CENTERS REIGN (SOURCE CEBR)



CITY PROFILE
SINGAPORE

OVERALL RANKING: 2

PEOPLE: 48

PLANET: 12

PROFIT: 1

A number of sustainability initiatives are currently underway which will proactively help Singapore to evolve and remain competitive. Even as the top ranked city in Asia, and second in the world, the city is continuing to be proactive. For example, with a population predicted to grow to more than six million people by 2030, the government has committed significant investment over the next decade to improve mobility and connectivity within the city. This investment 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.

The city also faces an aging population and a need for greater investment in social infrastructure. This, coupled with long working hours, income inequality and affordability, impacts Singapore's people sub-index ranking.

Singapore has also 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 supports the broader climate change agenda. Additional resiliency investment is underway in Singapore, including its 'close the loop' water strategy.

Ranked first in profit, Singapore is in the top ten for all six indicators in the profit sub-index, topping the world in ease of doing business and tying with Macau for the top spot for tourism.

OVERALL RANKING: 26

PEOPLE: 77

PLANET: 33

PROFIT: 8

CITY PROFILE
NEW YORK

New York's dynamic culture and environment continues to attract and sustain millions of residents, while serving as an international hub for commerce and politics. With key infrastructure located along its coasts, climate change continues to be a driving force in an effort to protect New York's residents and economy. The first phase of the East Side Coastal Resiliency Project is planned to break ground in 2017. The project, also known as the "Big U", is a riverfront barrier system in lower Manhattan aimed at safe-guarding the city from rising sea levels. Despite headways with this development, future projections show that storms and flooding events will occur more frequently and possibly with even more intensity over the next century. New York's biggest concern is determining the best solutions to withstand these impending events. This vulnerability heavily impacts New York's planet sub-index ranking, along with lower green space and higher greenhouse gas emissions.

As part of the "One New York" plan, the Mayor's Office has been focused on implementing social programs to improve poverty; nearly 45% of the city's population live at or close to the poverty line, impacting its people sub-index ranking of 77th. The city is on track with increasing its minimum wage by 2019, providing more affordable housing options and improving access to education by rolling out a free, universal pre-kindergarten program. The city has also made great strides in improving air quality and lowering greenhouse gas emissions, but transportation infrastructure continues to deteriorate as more people migrate to the city. An additional emphasis on infrastructure expansion and modernization, as well as streamlining commutes, are key factors for an even stronger New York.

New York's tourism, ease of doing business and GDP per capita all bolster its profit ranking of 8th in the world, and first in North America.

CITY PROFILE
DUBAI

OVERALL RANKING: 52

PEOPLE: 55

PLANET: 96

PROFIT: 4

Dubai ranks higher than any of the other eight cities in the Middle East and is placed 52nd overall. It is widely recognized as the region's most developed city, a global business hub, and a world-class tourist destination.

Dubai, finishing fourth in the profit category, is today considered the capital of the Islamic economy and the preferred destination for foreign direct investment into the Middle East. With economic prosperity projected to rise, Dubai has the goal of becoming the most business-friendly city in the world.

The city's '2021 Dubai Plan' features a strong focus on people, aspiring to become a city of happy, creative and empowered citizens. Dubai currently ranks well in many indicators within the profit sub-index, notably tourism, connectivity and employment. However, like many cities in the Middle East, it scores lower on income inequality due to the disparity between the mega-rich and the blue-collar expatriate communities and lower-income workers.

Dubai scores lowest in the planet sub-index largely due to energy consumption, pollution and the lack of available green space. Dubai, like the other Middle East cities in the Index, is partially constrained by its desert climate. However, the city has set targets to reduce CO2 emissions per GDP and the level of solid waste generated. It has also launched an Integrated Energy Strategy action plan, which aims to reduce energy demand by 30% by 2030 and diversify the city's energy portfolio.

With the World Expo confirmed to take place in Dubai in 2020, the city continues to make significant investment in improving quality of life for the people that live there.

OVERALL RANKING: 55

PEOPLE: 53

PLANET: 84

PROFIT: 19

CITY PROFILE
KUALA LUMPUR

Kuala Lumpur's regional ranking in Asia is 7th overall, and 8th in the people sub-index, 15th for planet and 5th for the profit sub-index.

Malaysia's current Economic Transformation Program (ETP), improving Kuala Lumpur and the Greater Klang Valley around the capital, has been identified as a key growth engine in delivering its 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, one that appeals to both residents and tourists alike. Specific large projects are being implemented to improve Kuala Lumpur's ranking, ranging from the 118 Tower to KL-Singapore High Speed Rail and the Tun Razak Exchange.

The local city hall, DBKL, has also embarked on Kuala Lumpur city competitiveness masterplan studies and InvestKL is offering global businesses access to a growing workforce, a sophisticated business ecosystem, world-class infrastructure and connectivity, competitive cost advantage and a principal hub tax incentive that caters to their business models.

CITY PROFILE
HONG KONG

With a ranking of 16th overall, Hong Kong scored strongly in second place in the profit sub-index. With a world-class infrastructure, vibrant economy and well-educated talent pool it's no surprise that Hong Kong is considered one of the world's best places to do business.

Hong Kong is one of Asia's leading cities (third in region) in relation to the planet sub-index. Its national parks and islands provide easy access to an extensive natural playground, though it needs to improve the quality of open space within the urban environment. Despite being located in a typhoon zone, Hong Kong is a world leader in mitigating the associated risks and rarely suffers significant disruption.

Compared with its global peers in the people sub-index, Hong Kong faces significant challenges in work-life balance and the wealth gap. It has to find solutions to housing and social infrastructure issues affecting both its young and its increasingly aging population. These factors have to be among the city's top priorities if it's to ensure a brighter, more sustainable future for its people. The city is extremely safe with low crime levels.

As other Asian cities grow in prosperity and dominance, Hong Kong is under increasing pressure from regional competitors and, critically, it has to maintain its relevance to China's continued development. The city's plan should enable it to rise to these challenges provided it's delivered in a faster, more connected and sustainable manner. If so, it will rightly maintain its mantle of "Asia's World City".

OVERALL RANKING: 16

PEOPLE: 81

PLANET: 29

PROFIT: 2

4. SPOTLIGHT ON GLOBAL CHALLENGES - DEMOGRAPHICS

The variance in median ages across the 100 cities in the Sustainable Cities Index is astonishing, ranging from just 18.7 years in Nairobi to 46.6 years in Tokyo.

Demographics are particularly important to the economic and social elements of sustainability. They are economically significant because the production of a society depends on its workforce, which in most countries means those aged between approximately 16 and 65 years (with the exception of the unemployed, students and other non-participants in the labor force).

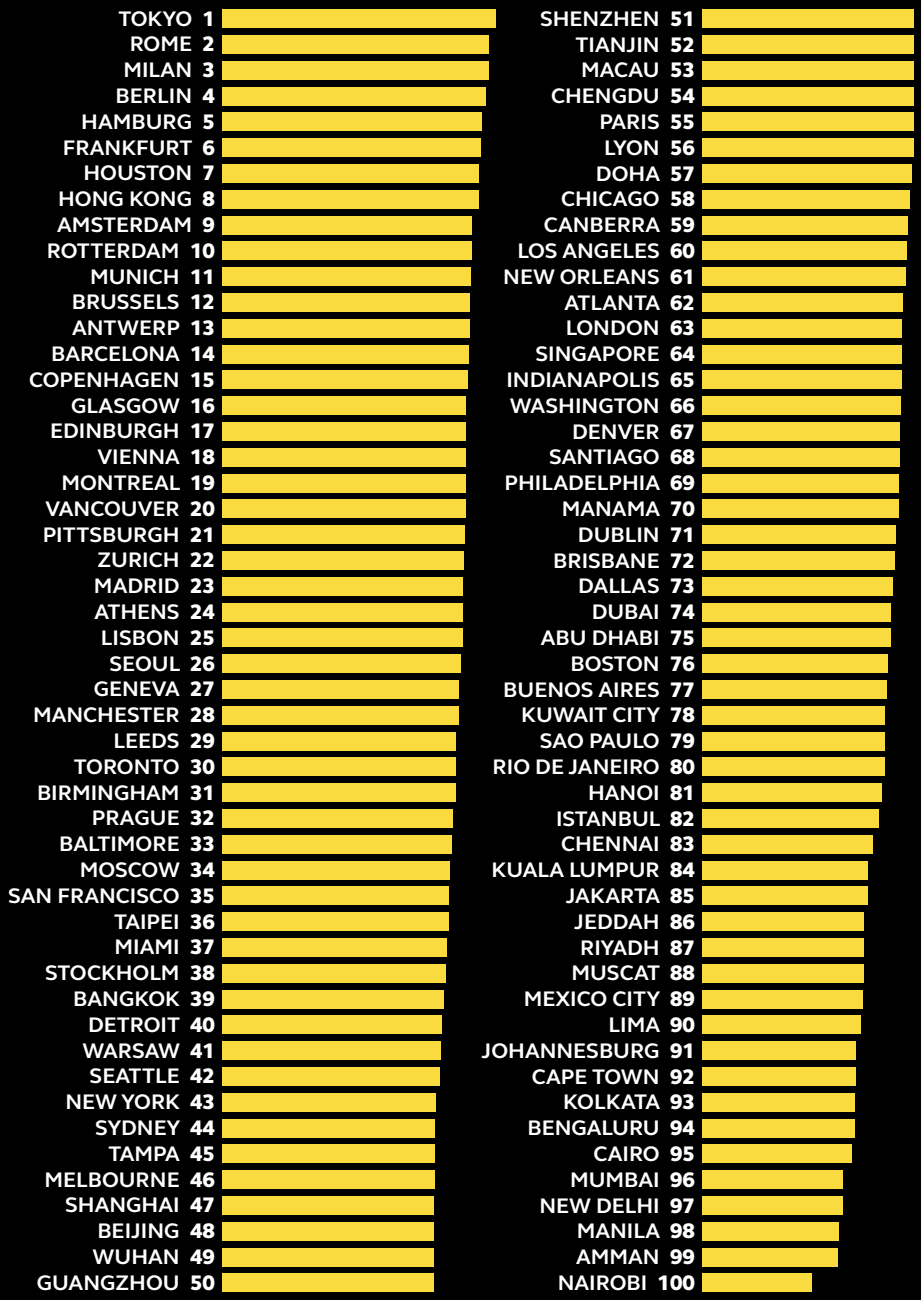
However, the consumption of a society depends on its total population, and the ratio between those of working age and those outside it is an important factor in the standard of living. Demography is of social concern because two key public services – health and education – are mostly used by those outside working age, but funded by those within it. The amount available to spend on each person's health and education is affected by how the resources are sourced; if few are providing the resources, but many need the services, the quality will suffer.

So, in the short to medium term, it's desirable to be "in the middle" in age terms – not to have too many people either in education or in later life. Cities that are highest on the demographic indicator are in the UAE, while China scores well too. Cities in Europe and the U.S. are challenged, but then so are Nairobi and Cairo, where huge young populations put immense pressure on education meaning these economies find it hard to provide proper training for their youth.

However, seen over a longer horizon, a young cohort in education will eventually join the labor force and the population will hit the demographic "sweet spot", just as China is experiencing, enabling far faster growth than can be achieved in the mature - in both senses - economies.

This changes the picture. Which economies are best placed demographically in the long run? This is crucially dependent on the median age of their inhabitants.

FIGURE 6:
CITIES IN THE SUSTAINABLE CITIES INDEX, BY MEDIAN AGE IN YEARS [1]



[1]Some cities did not have data available on the city level; here we have used national-level sources

6. PUTTING PEOPLE AT THE HEART OF CITY SUSTAINABILITY

CITIES, PEOPLE AND SUSTAINABILITY

What makes a city sustainable for its people? It's a question that is being asked more and more frequently by planners, developers and policymakers as they try to shape the conditions that help cities compete in what is an increasingly global tussle for talent and investment. A city's character is formed by the dynamic mix of multiple influences that contribute to its appearance, culture and shared values. But, above all, a city's strengths and its character come from its people. How can cities do more to ensure that, as they develop and implement strategies and policies to address the considerable challenges they face (from environmental to socio-economic), they do so in a way that puts people at the forefront of their sustainability?

On a fundamental level, providing adequate access to basic resources for all citizens, such as shelter, clean water and air, is essential. But for many cities – particularly, but by no means exclusively, in the developing world – this is far from straightforward. The systems that enable a city to function and thrive, from mobility to housing and culture to education, create a highly complex ecosystem of interacting and intersecting services and infrastructure that is under constant pressure to change, regenerate and respond to the developing needs of the population.

The trend to localism and devolution of powers is evident across many urban centers, making questions of governance increasingly important. Cities' governance varies from top-down to bottom-up, greater or lesser influence of private or public interests and a range of decision-making, from formal to informal processes and routes. A city's values, too, are key drivers of its 'personality' affecting both the day-to-day experience of citizens and creating the city's wider image and global impression that can attract business, talent, investment and tourism.

Of course, none of these elements is static. Cities can, and do, constantly reinvent themselves as they strive to compete and secure an advantage over each other. Throughout, people are at the heart of that change. If cities are today generally falling short of meeting the needs of their people, what changes do they need to make in order to improve? There are a number of key dimensions to address.

CREATING A SENSE OF COMMUNITY

Cities create a sense of community from built and natural assets. This is visible in the multiple neighborhoods of which cities are comprised. Each has its own style and distinct sense of community. Scale is important, as it enables people to feel a strong connection to their core neighborhood community and, through that, with the wider secondary community of the entire city. A successful city, therefore, is likely to have many different neighborhoods with their own unique sense of themselves, but which, together, can form a common identity.

To that end, the degree of equality evident in a city is important for shaping people's experience and perceptions. When the differences in a city are too big and visible, this will affect inhabitants' sense of community. People will struggle to build a common identification with parts of their city that are very different from their own. This is not to say that there should be no differences, for example, in income. Cities are inevitably associated with disparities in wealth. However, taking steps to ensure that all people enjoy at least a basic standard in the quality of life, with water and food, a dwelling, education and health and a sense of opportunity, is critical in binding a city's diverse population together. By doing so, citizens understand that everyone has their own role and responsibility in the city.

Greater equality in a city drives a sense of inclusion in its people. When people feel included, they start collaborating, taking responsibility for their own areas and achieving greater wellbeing. A city attracts a variety of people, and it's this diversity that makes a city productive: everybody feels empowered and incentivized to make a positive contribution that improves the quality of life for all and drives a more sustainable city environment.

BALANCING PEOPLE AND PROFIT

Access to natural resources is critically important. As well as clean water and air, for example, the availability of green spaces is becoming a more important requirement and a source of differentiation for a city. In response, cities are developing some innovative solutions to address this need. Cities are beginning to build with, rather than against, nature. The natural capital within the city is being incorporated to create new spaces that can make a direct contribution to the shared quality of life available to citizens and can attract visitors. New York's High Line turned an abandoned transport asset into an extremely popular and successful new urban park that has spurred economic development along its route.

BUILDING A RESILIENT CITY

The physical, social and economic systems that together create a city need to be resilient in order to enable a city to grow and develop in a way that is sustainable and secures the greatest benefits for the widest possible group of people. Infrastructure that works, community cohesion and stability, and the conditions in which business can flourish are all key elements of a city that meets the

needs of its people. This is as true for developed cities, such as Miami that must balance its people and profit with its resiliency to flooding and climate change, as it is for developing cities in parts of Asia and Africa that strive to accelerate their development in the midst of resiliency pressures.

According to the 2016 Arcadis Sustainable Cities Water Index, most cities across the world are in need of greater prioritization to improve their resiliency to extreme weather events and unforeseen water shortages. From rising sea levels and rapid urbanization hindering permeability to lack of diverse water portfolios, the report finds that most cities need greater investment when it comes to their ability to withstand natural disasters and drinking water shortages. Cities that are proactive in responding to these resiliency issues have a competitive advantage for future investment as well as in attracting people.

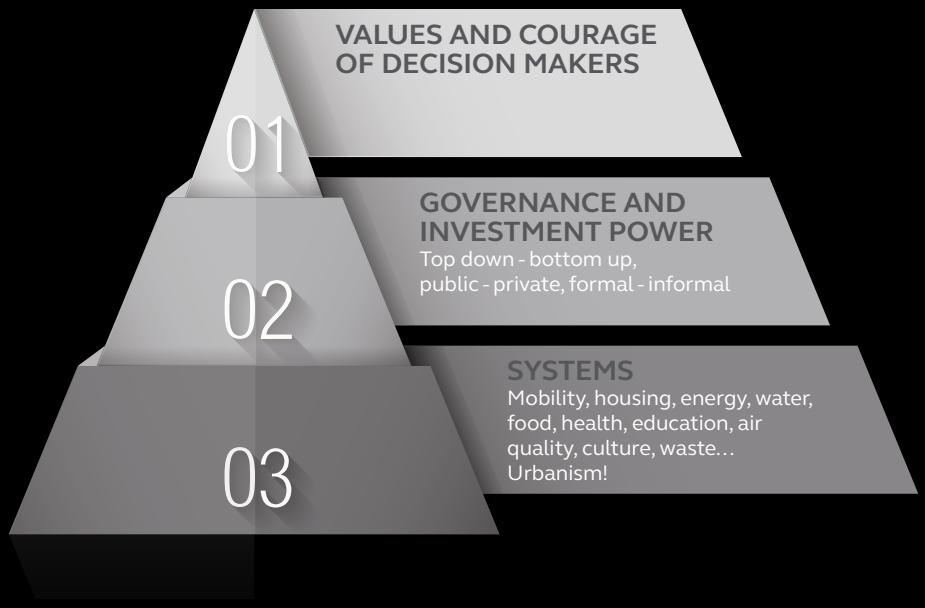
ASSESSING A CITY'S ECOSYSTEM

Given all these competing needs, getting the right start is essential. Each city will have its own unique vision for achieving those aims. And each will need a distinct road map to reach its destination. But starting the journey begins with a clear assessment of where the city is today, and the outputs (positive and negative) arising from the interplay between its physical, social and economic systems.

Figure 7 shows three layers of assessment that city leaders should undertake in order to evaluate their city's ecosystem.

With that understanding in place, city planners and policymakers can start taking steps to shape a city with people and their wellbeing at its heart.

FIGURE 7:
CITY ECOSYSTEM ASSESSMENT - THREE LAYERS



6. APPENDICES

METHODOLOGY

Table 1 shows the indicators that form the building blocks of the Sustainable Cities Index. The rightmost column shows which pillar each indicator belongs to. Indicators within each category are averaged to calculate the pillar's score. Each city receives a percentage score reflecting its place in relation to the others.

WHAT'S NEW FOR 2016?

Incorporating feedback from the first report published in 2015, Arcadis and Cebr have both sought to create a more indicative global picture of urban sustainability by including an additional 50 cities in the ranking and incorporating seven new indicators of sustainability in the Index. This provides a broader view of the world and captures the rapid globalization of and competition between our cities. As a result of this, it would be inaccurate to compare the rankings to last year's. Future reports will seek to follow the same methodology and allow year-on-year comparisons to be made.

The Sustainable Cities Index is constructed by a three-stage averaging process. Some of the indicators are composites. These take the simple average of their component sub-indicators. The three sub-indices are calculated by taking simple averages of their component indicators. In turn, the overall score is calculated by taking the simple average of the three sub-indices.

Therefore, there is no weighting system applied, although, since the number of indicators differs across sub-indices, the weights in the overall Index do differ. The same applies for the sub-indicators: two components which go into one indicator will naturally have half the weight of another indicator within the same pillar which has only one component to it.

The averaging process demands that the scores be converted into common units, for which we use percentages. Each is scaled such that the worst-performing city receives 0% and the best performer receives 100%. Since the sub-indices and the overall Index are simply averages of the indicators, they are also measured in percentage terms.

Several of the indicators have outlying values – these are defined as observations two standard deviations away from the mean. These are given the maximum or minimum score, as appropriate, and the next-highest/lowest value is defined as the boundary observation which is used to calculate the scores of the other (non-outlier) values.

City-level data is used wherever possible, though in some cases only national-level data exists. Where there is no comparable city-level data across countries, the national value is taken and a national database is used to scale the cities so that they are given a spread around the national average.

6.1 METHODOLOGY AND INDICATORS

TABLE 1: LIST OF INDICATORS USED IN THE SUSTAINABLE CITIES INDEX.

New indicators to the 2016 Index are shown in orange

INDICATOR NAME	INDICATOR DESCRIPTION	MAIN SOURCE	SUB-INDEX
Education	Literacy rate	World Bank	People
	University rankings	QS	
	Share of population with tertiary education	Barro & Lee, various national sources	
Health	Life expectancy	World Bank	People
	Obesity rate	World Health Organization	
Demographics	Dependency ratio	World Bank	People
Income Inequality	Gini coefficient	World Bank	People
Affordability	Consumer price index	UBS Prices and Earnings	People
	Property prices	UBS Prices and Earnings	
Work-life balance	Average annual hours worked	OECD, UBS Prices and Earnings	People
Crime	Homicide rate	UN Office on Drugs and Crime	People
Environmental risks	Natural catastrophe exposure	The International Disaster Database	Planet
Green spaces	Green space as % of city area	Siemens Green City Index	Planet
Energy	Energy use	Energy Information Administration (EIA)	Planet
	Renewables share	Energy Information Administration (EIA)	
	Energy consumption per $ GDP	Energy Information Administration (EIA)	
Air pollution	Mean level of pollutants	World Health Organization	Planet
Greenhouse gas emissions	Emissions in metric tonnes (per capita)	CDP Cities open data	Planet
Waste management	Solid waste management (landfill vs recycling)	World Bank	Planet
	Share of wastewater treated	OECD & FAO Aquastat	
Drinking water and sanitation	Access to drinking water (% of households)	World Health Organization	Planet
	Access to improved sanitation (% of households)	World Health Organization	
Transport infrastructure	Congestion	TomTom Traffic Index	Profit
	Rail infrastructure	Metrobits World	
	Airport satisfaction	Skytrax World Airport Awards 2015	
Economic development	GDP per capita	Brookings Global Monitor	Profit
Ease of doing business	Ease of Doing Business Index	World Bank	Profit
Tourism	International visitors per year, absolute & per capita	Euromonitor International	Profit
Connectivity	Mobile connectivity	United Nations Statistics Division	Profit
	Broadband connectivity	United Nations Statistics Division	
	Importance in global networks	Geography Department, Loughborough University	
Employment	Number of people employed, % of city population	Brookings Global Monitor	Profit

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AUTHORSHIP AND ACKNOWLEDGEMENTS

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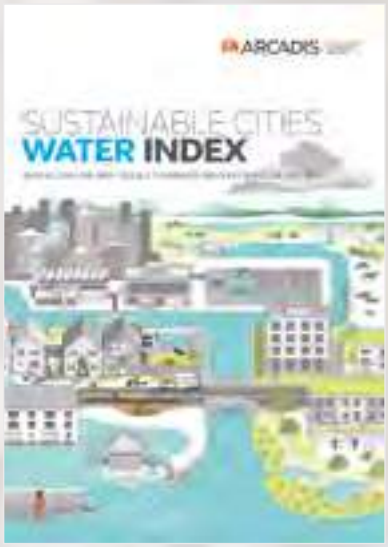
7. FURTHER READING



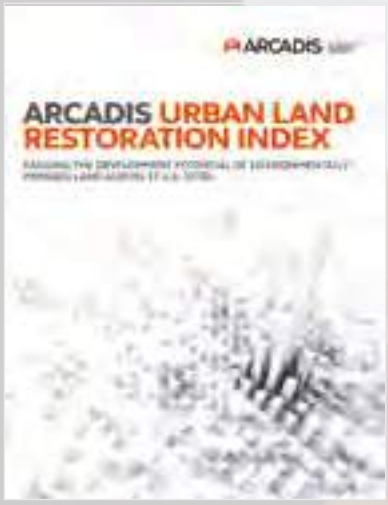
SUSTAINABLE CITIES
WATER INDEX

INTERNATIONAL
CONSTRUCTION COST

SUSTAINABILITY REPORT 2015

MODE

GLOBAL INFRASTRUCTURE
INVESTMENT INDEX



URBAN LAND
RESTORATION INDEX

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