

An aerial photograph of a city, likely Vancouver, showing a river, a bridge, and various buildings and green spaces.

The
Economist

INTELLIGENCE
UNIT

Safe Cities Index 2021

New expectations demand a new coherence

A report by The Economist Intelligence Unit

Sponsored by:

Orchestrating a brighter world

NEC

About the report

The Safe Cities Index 2021 is a report from The Economist Intelligence Unit, sponsored by NEC Corporation. The report is based on the fourth iteration of the index, which ranks 60 cities across 76 indicators covering digital, health, infrastructure, personal and environmental security.

The index was devised and constructed by Divya Sharma Nag and Pratima Singh. The report was written by Paul Kielstra and edited by Naka Kondo. Findings from the index were supplemented with wide-ranging research and in-depth interviews with experts in the field. Our thanks are due to the following people (listed alphabetically by surname) for their time and insights:

Michele Acuto, Professor, Global Urban Politics, Architecture, Building and Planning, University of Melbourne

Aziza Akhmouch, Head, Cities, Urban Policies and Sustainable Development Division, OECD

Nima Asgari, Director, Asia-Pacific Observatory on Health Systems and Policies

Juma Assiango, Co-ordinator, UN-Habitat Safe Cities Programme

Tim Chapman, Director, infrastructure design group, Arup

Gregory Falco, Assistant Professor, Civil and Systems Engineering, Johns Hopkins University

Dr Jaideep Gupte, Fellow and Lead, Cities Cluster, Institute of Development Studies, UK

Kimihiko Hino, Associate Professor, Department of Urban Engineering, The University of Tokyo

Esteban León, Head, City Resilience Global Programme, UN-Habitat

Tolullah Oni, Urban Health Physician and Epidemiologist, University of Cambridge

Gerald Singham, Chairman, National Crime Prevention Council, Singapore

Lauren Sorkin*, Acting Executive Director, Goal Resilient Cities Network

Lawrence Susskind, Ford Professor of Urban and Environmental Planning, Massachusetts Institute of Technology

Adie Tomer, Fellow, Metropolitan Infrastructure Initiative, Brookings Institution

John Tory, Mayor, City of Toronto

Gino Van Begin, Secretary-General, ICLEI

Aurel von Richthofen*, Senior Researcher, Cities Knowledge Graph, Singapore-ETH Centre

Sameh Wahba, Global Director, Urban, Disaster, Risk Management, Resilience and Land Global Practice, World Bank

Lars Weiss, Lord Mayor, City of Copenhagen

Alice Xu, Head, Connected Communities/ smart City Programme, City of Toronto

Fang Zhao, Professor, Innovation and Strategy, Staffordshire Business School

* Interviewed as part of the index revision process

Table of Contents

Executive summary	1
Introduction	4
The great accelerant	4
The Economist Intelligence Unit's Safe Cities Index 2021	7
Change and continuity in the Safe Cities Index results	11
New leaders in familiar company	11
Box: Q&A with a city leader: Copenhagen lord mayor Lars Weiss	13
Box: Q&A with a city leader: Toronto mayor John Tory	16
Less consistency at the top	14
Income and governmental transparency remain urban safety's boon companions	18
The geography of urban safety	18
The covid-19 pandemic and the understanding of health security	23
The need to focus better on what works	24
Relearning the value of the big picture	25
Towards health system resilience for the whole population	26
Digital security: A red flag on the road to the development of smart cities	28
Risky digitalisation	28
Smart city security: A foundation too often not poured	30
Integrating security into the concept of smart cities	31
Infrastructure security: At a crossroads	34
A blink with lasting repercussions	34
New security challenges in a new kind of city	35
No time to pause for reflection	36
Personal security: Individual safety as a collective endeavour	38
Income and personal security: a complex relationship	38
Necessary elements of security co-creation	39
Covid-19 and the criminal threat landscape	42
Environmental security: Policy progress has still not achieved its goals	43
Strong policies in most cities	44
The pandemic has driven environmental security up the agenda	44
The implementation challenge	45
Conclusion	48
Appendix	50

Executive summary

Covid-19 is the first global pandemic to strike humanity since we became a predominantly urban species. This has enhanced the disease's opportunities to spread, but also comes at a time when healthcare systems have a greater capacity to respond.

In such circumstances, health is an obvious place to begin a discussion of urban security in 2021. Stopping there, though, would miss most of the picture. As Fang Zhao – professor of innovation and strategy at Staffordshire Business School – puts it, “covid-19 has changed the whole concept of urban safety.” Digital security is now an even higher priority as more work and commerce have moved online; those responsible for infrastructure safety have to adjust to dramatic changes in travel patterns and where residents consume utilities; agencies responsible for personal security need to address a large, lockdown-driven shift in crime patterns; and the priority that urban residents and officials assign to environmental security has risen markedly as covid-19 serves as a stark warning of unexpected crises.

Accordingly, it is an appropriate time for The Economist Intelligence Unit, sponsored by NEC, to bring out its fourth edition of the Safe Cities Index. As before, the index covers 60 major cities worldwide and with 76 indicators related to different aspects of urban safety. These are grouped into five overall pillars: personal, health, infrastructure, digital, and – new this year – environmental security. Our key findings this year include:

The top of the table changes dramatically – with Copenhagen first overall and Toronto second – but the “first division” remains largely the same.

In each of the last three iterations, Tokyo, Singapore and Osaka – always in that order – have been our index leaders. This year Copenhagen comes first, with 82.4 points out of 100, and Toronto follows close behind with 82.2. This change reflects not a tectonic shift but more a reordering among cities that have always come close to the top. In all four editions of our index, six cities – Amsterdam, Melbourne, Tokyo, Toronto, Singapore and Sydney – have all figured among the leading ten, with only a few points separating them. Copenhagen likely would be in this group as well, but has been included since only 2019, when it tied for 8th place.

Income and transparency remain strongly correlated with higher index scores...

As discussed in detail in our 2019 report, cities with higher scores in the Human Development Index (HDI) also do better in our Safe Cities results. The statistical correlation is very high. Here our experts warn that cause and effect are not straightforward. Income can help fund safety-increasing investments, but economic growth in turn depends on an environment benefiting from every kind of security. The likely relationship here is a virtuous circle. More straightforward is the likely link between transparency and security: the World Bank's Control of Corruption scores and ours also correlate tightly independent of HDI results. Clean government is a fundamental requirement for a city to be safe.

...but the results suggests that different global regions may have distinct strengths.

Among high income cities, overall scores differ little by broad geographic region. Looking at specific pillars, though, variations appear. In particular, well-off Asia-Pacific cities do better on average when it comes to health security, European ones on personal security and North American ones on digital security. The sample size is too small to generalise about reasons. Nevertheless, these differences suggest that the priority given to various kinds of security may be affected by distinct historical experiences at the regional, national or city level.

The experience of covid-19 shows the need for a more holistic approach to health security and its closer integration into urban resilience planning.

It is still too early to draw detailed conclusions on the implications of covid-19 for health security. The pandemic continues at the time of writing. Even were it over, robust, internationally comparable data on what has happened are still rare. Nonetheless, the need to rethink health system preparedness is already clear. This must have several elements. The first is to look at different kinds of diseases and the wider determinants of disease as an inter-related whole rather than considering them in silos. The second is to think of populations as a whole, which will especially involve providing effective care for currently marginalised groups. The third is to integrate health emergency planning more fully into urban resilience measures that, often, have focused more on dealing with natural disasters and environmental concerns.

Digital security at the city level is too often insufficient for current needs and insecurity will multiply as urban areas increasingly pursue smart city ambitions.

The index data show that internet connectivity is becoming ubiquitous, even in our lower-middle-income cities, and could be effectively universal within a decade. Meanwhile, 59 of our 60 cities have started the process of becoming a smart city or expressed the ambition. This makes current levels of digital security worrying. To cite two examples from our figures, only around a quarter of urban governments have public-private digital security partnerships and a similarly small number look at network security in detail in their smart city plans. Such data are representative, not exceptional. Gregory Falco – assistant professor of civil and systems engineering at Johns Hopkins University – notes that “the digital security of cities is generally pretty terrible.” Improvement requires rethinking digital security on several levels: cities must see it as an investment, or at least an essential insurance policy, rather than an unproductive cost; they must understand that the nature of the technology requires a city-wide approach rather than one fragmented by departmental silos; and, finally, digital security – and especially protection of smart city networks – needs to involve providing the level of safety that citizens expect and demand. Indeed, smart cities need to be built around what urban residents want, or they will fail.

Although our index data show little change in various infrastructure security metrics, experts report that covid-19 has brought this field to a fundamental inflection point.

Change in infrastructure can be slow, with decisions sometimes having repercussions for centuries. Accordingly, certain indicator results, such as those covering power and rail networks, show little change. This stability does not reflect the current state of this field. Covid-19 has brought a level of uncertainty around the likely demands on urban infrastructure – and therefore how to keep it secure – which Adie Tomer, leader of the Brookings Institution’s Metropolitan Infrastructure Initiative, describes as “nuts compared to just two years ago.” It is unclear the extent to which lockdown-associated developments will diminish, or accelerate, when the pandemic ends. Greater levels of working from home, increased digitalisation of commerce, and growing resident demands for more sustainable urban communities with services within walking or cycling reach all have extensive infrastructure implications. Meanwhile, ongoing urbanisation, especially in Asia and Africa, mean that the next two decades must be ones of rapid infrastructure development in order to meet the basic needs of city residents. This will require a shift to greener infrastructure and better management of existing assets. Our index results, though, show that in these areas the majority of cities will have to raise their game.

Personal security is a matter of social capital and co-creation. Our index figures show, as elsewhere, that personal security

pillar scores correlate closely with HDI figures for cities. A closer look yields a less predictable result. A number of cities, in particular Singapore, seem to combine low levels of inputs with excellent results in this field, in particular when it comes to judicial system capacity and crime levels. While most of the examples of this combination are in Asia, they exist elsewhere too, as in Toronto and Stockholm. One way that these various cities can accomplish apparently doing more with less, say our experts, is higher levels of social capital and cohesion. The resultant sense of connectedness, shared values, and community also allows greater co-creation of security with citizens. The latter not only multiplies the efforts of city authorities to improve personal security, but it also helps define security in ways that are more meaningful to residents.

Most cities have strong environmental policies, but now must deliver results.

Unlike other pillars, low- and middle-income cities often do well on environmental security. Bogota, for example, comes 4th overall. One explanation is that good environmental policies are widespread. The increased interest in reaching carbon neutrality that has accompanied the pandemic will only strengthen the impetus for still better plans. The challenge, though, remains implementation. Here, even higher-income cities are lagging noticeably behind their ambitions. As in other areas, the key to success will be to take an overarching approach to environmental issues rather than a fractured one, and for cities to work with residents rather than seeking to direct them.

Introduction

The great accelerant

Covid-19's challenge to humanity is simultaneously old in kind and new in specifics. Humans have faced widespread disease since ancient times, but the current pandemic is the first to attack us as a predominantly urbanised species. The last worldwide pandemic of a comparable scale – the Spanish flu – occurred at a time when just 14% of humans lived in cities. The most recent UN Population Division estimate puts this figure at 57%. The least developed countries today are more urbanised (35% of their populations live in cities) than the most developed were in 1920 (30%).¹

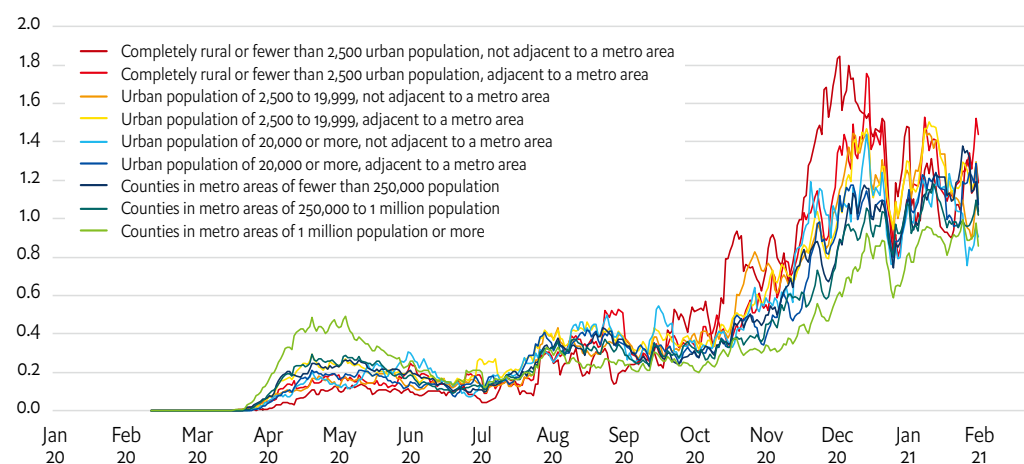
This shift matters greatly for the dangers that today's pandemic poses and the tools

available to respond. Although it is still too early to benefit from detailed studies, some things are clear. In countries where the pandemic took hold, cities – if for no other reason than better international transport links and closer proximity between residents – in general saw case rates rise faster at first than surrounding rural areas. With that came greater initial mortality rates.

As a result, recalls Esteban León – head of the City Resilience Global Programme at UN-Habitat – initially, “some said compact cities are not good for pandemics. But you have to see it from another point of view. In cities, hospitals and services are at a reachable distance. You don't have to walk miles to see a doctor.” Unsurprisingly, when covid-19 started spreading to rural areas, in many cases the

Figure 1: COVID-19 deaths per county group (rural-urban), US

COVID-19 daily deaths per 100,000 population, US by county, 7-day rolling average



Source: Author's elaboration based on data from: USDA, USA Facts

¹ Data from: United Nations Department of Economic and Social Affairs, *Growth of the world's urban and rural population, 1920-2000*, 1969, [https://population.un.org/wup/Archive/Files/studies/United%20Nations%20\(1969\)%20-%20Growth%20of%20the%20World%27s%20Urban%20and%20Rural%20Population,%201920-2000.pdf](https://population.un.org/wup/Archive/Files/studies/United%20Nations%20(1969)%20-%20Growth%20of%20the%20World%27s%20Urban%20and%20Rural%20Population,%201920-2000.pdf); United Nations Population Division, *World Urbanization Prospects: The 2018 Revision*, 2018, <https://population.un.org/wup/>

death rates were higher, especially where there was no nearby city.² The accompanying chart shows this transition for the US.

The preceding account, however, requires more nuance. Beyond the proximity of health services, social determinants of health, including poverty, played an important role. Here, being in a city is again potentially relevant: 5% of urban populations worldwide live in extreme poverty, compared with 11% in rural areas.³ Meanwhile, Nima Asgari, director of the Asia-Pacific Observatory on Health Systems and Policies, explains that leadership, governance, social cohesion and trust in authority – all elements of general resilience – helped in addressing the pandemic more effectively (as discussed in a later section).

Covid-19, then, was not a narrow assault on health systems, but one that tested safety-related attributes, including urban ones, more generally. As Michele Acuto, professor of global urban politics, architecture, building and planning at the University of Melbourne, notes, during the pandemic, “one key thing that urban policymakers first realised is that, although this is a health crisis, the response has to deal with a whole lot of other things, such as access to green space and the quality of urban infrastructure. Basic systems have to be up to scratch and often weren’t.” As time has gone on, explains Ms Zhao, “covid-19 has changed the whole concept of urban safety. People realise the importance of things like environmental security, air quality and reducing pollutants. Another thing has

been infrastructure security because remote working has changed people’s conception of the city as a centre or hub for workplaces.”

This conceptual shift has, in turn, expanded understanding of what a city should do to promote safety. Aziza Akhmouch – head of the OECD’s Cities, Urban Policies and Sustainable Development Division – notes that the pandemic again made clear “cities don’t necessarily have that much to do with the health box in the traditional sense of the term, but have a lot of leverage to manage the determinants of health.”

As the pandemic has changed thinking on the nature of urban security, it has also scrambled the risks facing cities. Lockdowns in various countries were consistent with a drop in reported street crime, even as the volume of cyber-crime rose. Meanwhile, reports Adie Tomer, Fellow of the Brookings Institution’s Metropolitan Infrastructure Initiative, the extent to which changes in how different types of infrastructure are now being used, and the attendant uncertainty of how best to secure those assets, “is nuts compared to just two years ago.”

However undeniably broad and deep the immediate security challenges arising in the wake of covid-19, an inevitable question is whether they are lasting or will fade along with case and fatality numbers. Although presumably some of the disease’s wider impacts will diminish, experts repeatedly told us that many changes would last. One obvious

2 OECD, *The territorial impact of COVID-19: Managing the crisis across levels of government*, November 2020, <https://www.oecd.org/coronavirus/policy-responses/territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government-d3e314e1/>

3 World Poverty Clock, <https://worldpoverty.io/headline>, accessed May 8th 2021



reason is that cities now remember that further novel diseases can always arise. More important, the pandemic has, as Ms Zhao puts it, “accelerated positive change as well as exposed and exacerbated the dark side” in a host of fields, including social inequality. Ms Akhmouch adds that covid-19 and attendant

lockdowns “have not revealed a lot of new things in terms of structural problems which cities are facing, but have acted as an accelerator, or magnifying glass, while also making some transitions more acceptable, urgent, or even possible than they were just a few years ago.”

Accordingly, it is now imperative to look at the broad field of urban security as cities work to bring the pandemic finally to heel and to rebuild from, and in light of, the experience.

The Economist Intelligence Unit's Safe Cities Index 2021

To understand the state of security in leading urban centres worldwide, The Economist Intelligence Unit, sponsored by NEC, maintains a regularly updated and revised index. This publication accompanies the release of the Safe Cities Index 2021, its fourth edition, which covers 60 major urban areas.

Any such index includes an implicit conception of urban safety. Ours is intentionally broad, including personal, infrastructure, health, digital and – starting this year – environmental security. As Ms Akhmouch notes, the EIU approach goes beyond the “traditional urban safety box.” In doing so, it is consistent with changes in thinking brought about by covid-19, as well as the wider lens which others are applying to this field. For example, the OECD has been driving to go beyond GDP to look at the multi-dimensionality of well-being. At the local level, it finds urban safety, inclusivity, and sustainability as ever more closely connected. Meanwhile, Juma Assiago, Co-ordinator of UN-Habitat's Safe Cities Programme, reports that its upcoming new set of indicators for urban safety will include an assessment of the cultural context of cities – including elements such as social cohesion – and the resultant

capacity of authorities and residents to co-create safety.

Urban safety is not just multi-faceted. As Sameh Wahba, global director of the World Bank's Urban, Disaster Risk Management and Resilience Practice, reports, another emerging issue in this field is “the intersection and interconnectedness of different risks.” To cite one of innumerable examples, Kimihiro Hino, associate professor in the The University of Tokyo's department of urban engineering, explains that “the built environment is one of the most important health determinants. Its improvement is a population-wide disease prevention measure that affects many citizens.” He adds that residents of Tokyo on average walk more than those in other major cities because its layout supports and encourages it.

Just as the challenges of city security are intertwined, so must strategies to address them take account of these complex inter-relationships. “Many years ago,” recalls John Tory, mayor of Toronto, urban safety “was seen just as policing and pedestrians or traffic safety. Now it is those things but also other dots need to be connected: the more you are marginalised and struggling, for example, the more likely you are to have threats to your health or problems with using infrastructure.”

It is no surprise that interviewees commonly used the word “holistic” to describe the need for approaches that overcome traditional silos both within and across different kinds of urban security. As Mr Tory explains, “a holistic

SCI2021 Pillars and indicators



1. Digital security

Inputs

- 1.1.1) Privacy policy
- 1.1.2) Citizen awareness of digital threats
- 1.1.3) Secure smart cities
- 1.1.4) Cybersecurity preparedness
- 1.1.5) Public-private partnerships

Outputs

- 1.2.1) Percentage with internet access
- 1.2.2) Secure internet servers
- 1.2.3) Risk of attacks
- 1.2.4) IT infrastructure risk
- 1.2.5) Percentage of computers infected from online attacks

2. Health security

Inputs

- 2.1.1) Universal healthcare coverage
- 2.1.2) a) Availability of public healthcare
- 2.1.2) b) Availability of private healthcare
- 2.1.2) c) Availability of OTC drugs
- 2.1.3) a) Quality of private healthcare provision
- 2.1.3) b) Quality of public healthcare provision
- 2.1.4) a) No. of beds per 1,000
- 2.1.4) b) No. of doctors per 1,000
- 2.1.5) Access to safe and quality food
- 2.1.6) Policy on substance abuse / drug use
- 2.1.7) Pandemic preparedness
- 2.1.8) Mental health

Outputs

- 2.2.1) Emergency services in the city
- 2.2.2) Life expectancy years

- 2.2.3) Infant mortality
- 2.2.4) Cancer mortality
- 2.2.5) Lifestyle related disease burden
- 2.2.6) Mental health burden
- 2.2.7) Covid-19 mortality

3. Infrastructure security

Inputs

- 3.1.1) Enforcement of transport safety
- 3.1.2) Pedestrian friendliness
- 3.1.3) Disaster management / business continuity plan
- 3.1.4) Water infrastructure
- 3.1.5) Hazard monitoring

Outputs

- 3.2.1) Road traffic deaths
- 3.2.2) Deaths from climate-related disasters
- 3.2.3) a) Transport infrastructure: Air transport facilities
- 3.2.3) b) Transport infrastructure: Road network
- 3.2.3) c) Transport infrastructure: Rail network
- 3.2.4) Power network
- 3.2.5) Institutional capacity and access to resources
- 3.2.6) Catastrophe insurance
- 3.2.7) Disaster-risk informed development
- 3.2.8) a) Percentage living in slums
- 3.2.8) b) Percentage of homeless population

4. Personal security

Inputs

- 4.1.1) Use of data-driven techniques for crime
- 4.1.2) Gun regulation and enforcement

- 4.1.3) a) Threat of terrorism
- 4.1.3) b) Threat of military conflict
- 4.1.3) c) Threat of civil unrest
- 4.1.4) a) Police personnel per capita
- 4.1.4) b) Prosecution personnel per capita
- 4.1.4) c) Professional judges or magistrate personnel per capita
- 4.1.5) Expenditure on social security
- 4.1.6) a) Laws on domestic violence
- 4.1.6) b) Laws on sexual harassment

Outputs

- 4.2.1) a) Prevalence of petty crime
- 4.2.1) b) Prevalence of violent crime
- 4.2.2) Organised crime
- 4.2.3) Severity of terrorist attacks
- 4.2.4) Deaths from substance use disorders
- 4.2.5) Level of corruption
- 4.2.6) Enforceability of contracts
- 4.2.7) a) Income inequality levels
- 4.2.7) b) Share of population in vulnerable employment
- 4.2.8) a) Female homicide rates
- 4.2.8) b) Prevalence of domestic violence

5. Environmental security

Inputs

- 5.1.1) Sustainability masterplan
- 5.1.2) Incentives for renewable energy
- 5.1.3) Green economy initiatives
- 5.1.4) Waste management

Outputs

- 5.2.1) Sustainable energy
- 5.2.2) Rate of water stress
- 5.2.3) Air quality levels
- 5.2.4) Urban forest cover
- 5.2.5) Waste generation

concept of safety is something governments need to understand and implement.”

Professor Acuto agrees: “it doesn’t matter what the challenge is, it is the intersection of sectors that gives strength and capacity to respond.”

Finally, our concept of urban safety is a humane one. It would be easy to construct a different kind of index. Jaideep Gupte, Fellow and Lead of the cities cluster at the Institute of Development Studies, UK, notes, for example, “you may have perceived good outcomes from a policy, but the processes to get there need to be inclusive.” This explains, for example, why we have dropped a measure on recidivism rates from the index in 2021: it was impossible to get robust data that differentiated between effective rehabilitation and draconian over-incarceration, which reduce re-offending in drastically different ways.

Accordingly, our index scores draw on 76 indicators, some of which in turn aggregate multiple data points. The judicial system capacity indicator, for example, looks at each of the number of police, prosecutors and judges or magistrates per capita. The indicators also balance breadth and detail, covering areas diverse as kinds of climate hazards monitored and internet access. Inevitably, we need to balance the possible and the ideal, so some indicators are proxies to reflect likely performance for an area where more detailed measurements are not available. For example, the number of doctors and hospital beds per capita are important metrics, and should give a good idea of health system investment, but do not reflect levels

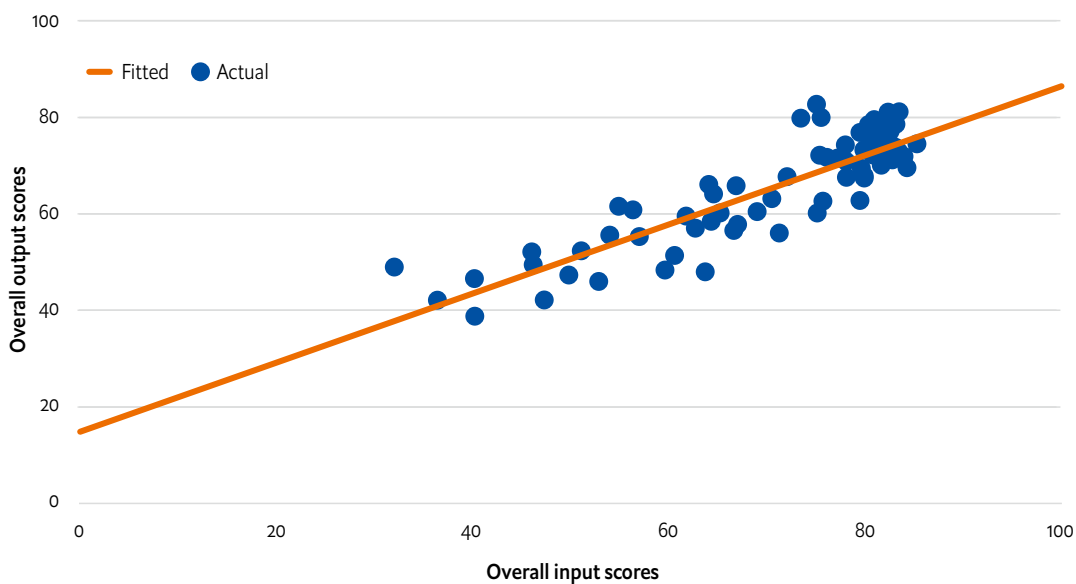
of medical training or access to cutting-edge medical equipment within a city.

As noted previously, the indicators fall into five broad pillars: personal, infrastructure, health, digital and environmental security. Within each of these, the relevant indicators are grouped into inputs of safety – normally policies or resources dedicated to some aspect of security – and outputs, which are as diverse as air pollution levels and crime rates.

Put simplistically, outputs measure how safe a city currently is, while the inputs indicate which cities are doing the right things to enhance safety. Both are essential to understanding the security situation. Not only will policies likely enhance safety-related outcomes in the future, but they may also be essential to preserving them in the present.

An appendix discusses this year’s index in greater detail, including some of the differences with previous versions. One change from 2019, however, is worth highlighting. For 2021, we have added an extra pillar: environmental security. This field was present to an extent in the past. Indeed, the discussion of resilience in our 2019 report included substantial consideration of environmental issues. In the development of this year’s index, however, it became abundantly clear that the environmental indicators previously spread across other pillars had impacts on every element of security and deserved independent consideration.

This specific consideration of the environment is, again, consistent with international thinking. Mr Léon explains that “every time you

Figure2: Sum of input vs sum of output scores

mainstream something it disappears because it has no owners. Environmental issues should be a standalone.” Gino Van Begin, secretary-general of Local Governments for Sustainability, also believes that “it is good that environmental security is a pillar in the index. Cities progressively over the years have come to understand that the more environmental security they have, the more health security and other kinds of security they have.”

Although any work may have weaknesses, we have confidence in the index’s accuracy. The combined input and output scores from the five pillars have a statistically significant correlation, as do the inputs and outputs for each individual pillar.

More instructive is the statistically significant link between almost all of

the input scores and the output scores in every other pillar. The only two exceptions are a low correlation between both digital and health inputs on the one hand and environmental security outputs on the other. These close connections between our measures of almost every kind of effort and each type of result have two plausible explanations. One is that cities focusing on any form of security tend to work on every type. The other is that the data illustrate the inter-related nature of all kinds of security discussed above: investments in infrastructure and policing that create public spaces where citizens feel safe, for example, can improve health outcomes. Urban safety has multiple, diverse elements, but they are ultimately too closely intertwined to ignore any.

Change and continuity in the Safe Cities Index results

New leaders in familiar company

In some ways, the results of this year's index differ dramatically from those of the previous three iterations. In the past, the top three spots have been held, in the same order each year, by Tokyo, Singapore and Osaka. This time, Copenhagen comes first, with an overall score of 82.4 points out of 100, followed in a nearly dead heat by Toronto at 82.2. Singapore and Tokyo remain in the top five – third and fifth respectively – with Sydney coming in fourth.

A closer look, though, shows that this change represents more jostling within a crowded field of front-runners than a substantial reordering. The cities doing best in our index each year have always had similar overall results. In 2015, our initial effort, fewer than eight points out of 100 separated first and tenth place. In

each subsequent iteration, that difference has dropped to under five points. Meanwhile, in every year, six cities – Amsterdam, Melbourne, Tokyo, Toronto, Singapore and Sydney – have all finished in the top ten. Copenhagen likely would have as well, but has been included since only 2019.

The headline changes in which cities come first this time may simply reflect differences in how we measure and weight the elements of urban safety within the index. To cite one example, Toronto and Copenhagen do noticeably better in the new environmental security pillar than do any of the top-three cities from earlier years. Copenhagen is definitely a worthy overall leader and Toronto a well-deserving runner-up, but as much because of long-term success in making residents secure as from any particular improvements in the last two years.



The SCI2021 results

The complete scores are as follows:

Figure 3: SCI2021

All data are normalised to a scale of 0 to 100, where 100 = best health

Very high (75.1–100) High (50.1–75) Medium (25.1–50) Low (0–25)

Overall score	1 Digital Security	2 Health Security	3 Infrastructure Security	4 Personal Security	5 Environmental Security
1 Copenhagen 82.4	1 Sydney 83.2	1 Tokyo 87.7	1 Hong Kong 93.4	1 Copenhagen 86.4	1 Wellington 91.7
2 Toronto 82.2	2 Singapore 82.8	2 Singapore 84.1	2 Singapore 92.1	2 Amsterdam 80.5	2 Toronto 90.3
3 Singapore 80.7	3 Copenhagen 82.2	3 Hong Kong 84.0	3 Copenhagen 89.0	3 Frankfurt 80.3	3 Washington, DC 87.6
4 Sydney 80.1	=4 Los Angeles 82.0	4 Melbourne 81.9	4 Toronto 88.6	4 Stockholm 79.7	4 Bogota 85.5
5 Tokyo 80.0	=4 San Francisco 82.0	5 Osaka 81.8	5 Tokyo 87.7	5 Brussels 79.2	5 Milan 84.9
6 Amsterdam 79.3	6 New York 81.6	6 Seoul 81.1	6 Stockholm 87.3	6 Paris 79.0	6 Copenhagen 84.5
7 Wellington 79.0	7 Amsterdam 79.3	7 Toronto 80.0	7 Osaka 86.6	7 Wellington 78.3	7 Stockholm 83.7
=8 Hong Kong 78.6	8 Melbourne 78.3	8 London 78.8	8 Washington, DC 86.5	8 Toronto 77.2	8 Rio de Janeiro 83.3
=8 Melbourne 78.6	9 Wellington 77.3	9 Barcelona 78.1	=9 Chicago 84.5	9 Lisbon 76.9	9 Zurich 82.3
10 Stockholm 78.0	=10 Chicago 76.7	10 Sydney 77.7	=9 Sydney 84.5	10 Madrid 76.6	10 Kuala Lumpur 81.0
=11 Barcelona 77.8	=10 Frankfurt 76.7	11 San Francisco 77.3	11 New York 84.4	11 Sydney 76.3	=11 Amsterdam 80.9
=11 New York 77.8	12 London 76.6	12 Abu Dhabi 76.5	=12 Wellington 84.2	12 Barcelona 75.8	=11 New York 80.9
13 Frankfurt 77.7	13 Dallas 76.5	13 Dubai 75.5	=12 Zurich 84.2	13 Singapore 74.5	13 Tokyo 80.6
14 Washington, DC 77.4	14 Toronto 75.0	14 New York 75.2	14 Frankfurt 84.1	14 London 74.4	14 Taipei 80.3
=15 London 77.2	15 Zurich 74.8	=15 Chicago 74.8	=15 Madrid 84.0	15 Zurich 73.4	15 Quito 80.1
=15 San Francisco 77.2	=16 Barcelona 72.9	17 Dallas 74.6	=15 Melbourne 84.0	16 Tokyo 73.3	16 Sydney 79.0
17 Osaka 76.7	=16 Madrid 72.9	18 Washington, DC 74.0	17 Barcelona 83.7	17 Osaka 73.2	17 Buenos Aires 78.8
18 Los Angeles 76.5	18 Stockholm 72.6	=19 Beijing 73.6	18 San Francisco 83.6	18 Melbourne 73.0	18 Barcelona 78.4
19 Zurich 76.3	19 Washington, DC 72.1	=19 Tokyo 73.6	19 Amsterdam 83.5	19 Taipei 70.9	19 San Francisco 78.3
20 Chicago 75.0	20 Tokyo 71.0	=19 Shanghai 73.6	20 Seoul 83.0	20 Santiago 70.7	20 Rome 78.0
21 Madrid 74.7	21 Hong Kong 70.1	21 Taipei 73.5	=21 Dallas 82.9	21 Hong Kong 70.4	21 Dallas 77.2
22 Dallas 74.5	22 Paris 69.4	22 Bangkok 73.1	=21 Los Angeles 82.9	22 Seoul 69.9	22 Osaka 77.0
23 Paris 74.3	23 Brussels 68.5	23 Amsterdam 72.5	23 London 82.7	23 Rome 69.4	23 Sao Paulo 76.7
24 Taipei 74.0	=24 Abu Dhabi 66.8	24 Frankfurt 72.3	24 Paris 82.6	24 Milan 68.7	24 Los Angeles 76.3
25 Seoul 73.8	=24 Dubai 66.8	25 Istanbul 71.9	25 Taipei 82.4	=25 Abu Dhabi 67.0	25 Melbourne 76.1
26 Brussels 73.6	26 Milan 65.1	26 Copenhagen 70.0	26 Brussels 82.3	=25 Dubai 67.0	26 Frankfurt 74.9
27 Milan 71.3	27 Osaka 64.8	27 Kuwait City 69.7	27 Shanghai 80.3	27 New York 66.9	27 Hong Kong 74.8
28 Lisbon 70.1	28 Lisbon 64.3	=28 Moscow 68.6	28 Lisbon 77.4	28 Washington, DC 66.8	28 Lisbon 74.3
29 Rome 69.4	29 Santiago 64.2	=28 Paris 68.6	29 Abu Dhabi 77.3	29 Los Angeles 66.6	29 Chicago 74.0
30 Shanghai 67.9	30 Taipei 63.2	=28 Riyadh 68.6	30 Milan 76.6	=30 Chicago 64.9	30 Jakarta 73.8
31 Abu Dhabi 66.9	31 Seoul 62.1	31 Brussels 67.8	31 Beijing 76.5	=30 San Francisco 64.9	31 London 73.7
32 Kuala Lumpur 66.6	AVERAGE 61.7	32 Buenos Aires 67.4	32 Dubai 76.0	AVERAGE 62.3	32 Madrid 73.1
AVERAGE 66.1	32 Rome 60.1	33 Madrid 67.0	33 Rome 74.5	32 Dallas 61.4	33 Seoul 72.9
33 Santiago 65.3	33 Buenos Aires 60.0	AVERAGE 66.7	34 Moscow 74.2	33 Kuala Lumpur 60.1	34 Mexico City 72.1
34 Buenos Aires 64.9	34 Moscow 59.4	34 Zurich 66.6	35 Istanbul 72.1	34 Beijing 59.5	35 Paris 71.7
35 Dubai 64.6	35 Kuala Lumpur 59.1	=35 Santiago 66.5	AVERAGE 71.5	35 Shanghai 59.0	36 Brussels 70.4
36 Beijing 63.8	36 Istanbul 58.7	=35 Stockholm 66.5	36 Santiago 70.8	36 Rio de Janeiro 58.4	37 Singapore 69.9
37 Istanbul 62.9	=37 Mexico City 57.2	37 Rome 65.2	37 Kuala Lumpur 69.0	37 Kuwait City 58.0	38 Shanghai 69.3
38 Moscow 62.5	=37 Shanghai 57.2	38 Kuala Lumpur 64.0	38 Sao Paulo 66.5	38 Ho Chi Minh City 56.5	39 Lagos 68.8
39 Rio de Janeiro 61.8	=39 Rio de Janeiro 53.8	39 Ho Chi Minh City 63.9	39 Bangkok 65.7	39 Buenos Aires 55.9	AVERAGE 68.5
40 Sao Paulo 61.7	=39 Sao Paulo 53.8	40 New Delhi 63.6	40 Jakarta 63.7	40 Sao Paulo 53.9	40 Ho Chi Minh City 66.4
41 Bogota 60.8	41 Casablanca 53.7	41 Wellington 63.4	41 Rio de Janeiro 62.9	41 New Delhi 52.8	41 Manila 65.9
42 Mexico City 60.3	=42 Johannesburg 53.1	42 Milan 61.3	42 Buenos Aires 62.6	42 Mexico City 52.5	42 Johannesburg 65.6
43 Bangkok 60.2	=42 Riyadh 53.1	43 Johannesburg 61.0	43 Mexico City 62.1	43 Riyadh 51.8	43 Bangkok 62.9
44 Quito 58.8	44 Bangkok 52.7	44 Mumbai 60.8	44 New Delhi 59.8	44 Johannesburg 51.7	44 Istanbul 62.8
45 Ho Chi Minh City 58.5	45 Beijing 52.2	45 Bogota 59.0	45 Ho Chi Minh City 59.5	=45 Bogota 50.9	45 Moscow 60.5
46 Jakarta 56.4	46 Bogota 51.6	=46 Jakarta 58.9	46 Quito 59.1	=45 Quito 50.9	46 Mumbai 60.1
47 Johannesburg 56.2	47 Baku 48.9	47 Quito 58.3	47 Baku 58.6	47 Moscow 49.9	47 Dhaka 58.2
48 New Delhi 56.1	48 New Delhi 47.5	48 Sao Paulo 57.7	48 Mumbai 57.3	48 Istanbul 48.8	48 Beijing 57.0
49 Riyadh 55.1	49 Manila 47.4	49 Lisbon 57.5	49 Bogota 57.0	49 Casablanca 48.5	49 New Delhi 56.8
50 Mumbai 54.4	50 Lagos 46.4	50 Mexico City 57.4	50 Riyadh 55.2	50 Mumbai 48.2	50 Santiago 54.3
51 Manila 52.5	51 Ho Chi Minh City 46.2	51 Casablanca 51.4	51 Kuwait City 53.4	51 Cairo 48.1	=51 Abu Dhabi 46.7
52 Baku 49.8	52 Quito 45.7	52 Dhaka 50.9	52 Manila 52.9	52 Jakarta 47.6	=51 Baku 46.7
53 Kuwait City 49.4	53 Mumbai 45.4	53 Rio de Janeiro 50.7	53 Casablanca 52.2	53 Baku 47.3	=51 Riyadh 46.7
54 Dhaka 48.9	=54 Cairo 43.6	54 Manila 49.9	54 Johannesburg 49.8	54 Dhaka 46.6	54 Yangon 45.3
55 Casablanca 48.2	=54 Kuwait City 43.6	55 Karachi 48.4	55 Dhaka 49.6	=55 Bangkok 46.4	55 Caracas 41.9
56 Lagos 45.0	56 Dhaka 39.0	56 Baku 47.3	56 Cairo 47.2	=55 Manila 46.4	56 Dubai 37.7
57 Cairo 43.7	57 Karachi 38.5	57 Cairo 45.6	57 Karachi 43.0	57 Caracas 46.1	57 Karachi 35.4
58 Caracas 40.5	58 Jakarta 38.0	58 Yangon 44.6	58 Yangon 40.5	58 Yangon 39.2	58 Casablanca 35.1
59 Karachi 39.7	59 Caracas 37.4	59 Lagos 43.7	59 Caracas 38.0	59 Lagos 33.7	59 Cairo 33.8
60 Yangon 39.5	60 Yangon 28.1	60 Caracas 39.0	60 Lagos 32.4	60 Karachi 33.3	60 Kuwait City 22.0

Box: Q&A with a city leader: Copenhagen lord mayor Lars Weiss



The Economist Intelligence Unit: This year Copenhagen had the highest score in our Safe Cities Index after finishing strongly in 2019 as well. What would you say are the key factors making your city safe?

Everyone should feel safe in Copenhagen, whether child or senior, male or female, LGBTI+ or part of any other minority. That is why we work continuously to improve safety for our citizens.

One key factor that makes Copenhagen such a safe city is its low crime rate, currently at its lowest level in more than a decade. We focus greatly on early intervention with preventive initiatives. Many of these are led through locally based cooperation between schools, youth clubs, social services and the police – the so-called SSP [schools, social services, police] system.

Copenhagen is also characterised by great social cohesion and a relatively narrow wealth gap. It is a mixed city where both the cleaning assistant and the CEO meet each other at the local supermarket and have their kids in the same school. This is one of the very cornerstones of Danish culture, and it contributes greatly to the high levels of trust and safety that we benefit from.

The Economist Intelligence Unit: What key urban safety challenges remain and where would you like to see further improvement?

Although the crime rate is dropping year by year, we still have some challenges from repeat youth offenders. It is extremely important that we continue to focus on gang suppression and intervention. It is crucial to make sure that vulnerable children and young people receive the right preventive support as early as possible, so that they never become involved in crime.

Another area that needs our focus is infrastructure, especially for bicycles. Almost half of us ride our bikes to school or work. Therefore, one of my key priorities is to continue to create even better and safer infrastructure for cyclists. Particularly our youngest citizens should always feel safe riding their bikes or walking to school.

The Economist Intelligence Unit: How is Copenhagen addressing issues related to the environment and security?

We aim to be the world's first carbon-neutral capital city – by 2025. That requires a dual

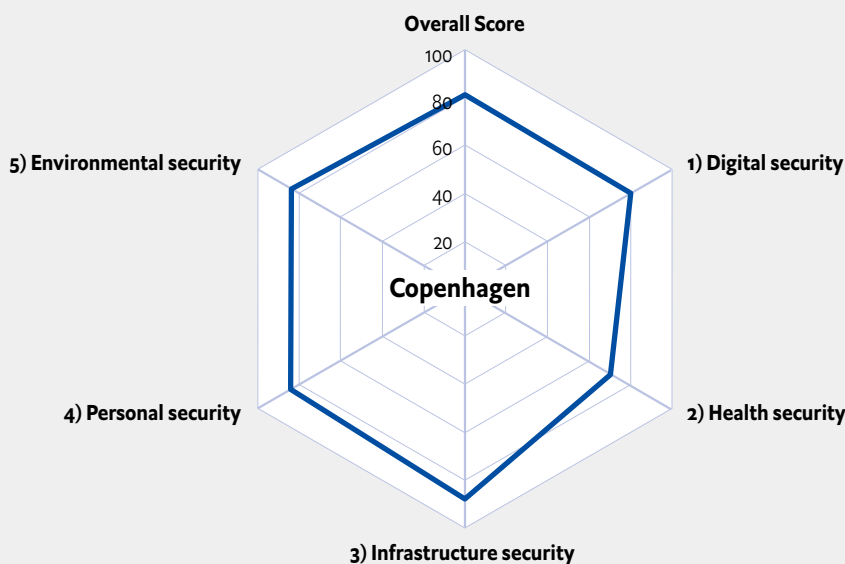
approach in our case. We have a responsibility both to mitigate the effects of climate change and to reduce carbon emissions while also adapting our city to future climate changes.

On mitigation, we are putting extensive effort into reducing energy consumption, investing in green energy, and encouraging green mobility, thereby developing our city in a sustainable way. Furthermore, Copenhagen is taking climate adaptation measures that both improve environmental security and contribute to liveability in the capital. We have created new parks and green urban spaces to collect water. The once industrial and polluted harbour has now become a unique urban space and a popular place for swimming, partly because we modernised the sewage system diverting local rainwater.

The Economist Intelligence Unit: Where has Copenhagen been able to use smart city tools and approaches to improve different aspects of safety?

Although not a part of our formal smart city programme, data also play a key role in our yearly survey on safety. The use of data contributes to a deeper and more complex understanding of safety in the city, which is paramount for initiating specific actions to improve safety.

Data have also played a crucial role in our effort to prevent the spread of covid-19. Detailed monitoring of cases has enabled us to target our preventive actions in those local areas of the city with outbreaks of different variants of covid-19. Next, we will be conducting an experiment screening wastewater for covid-19 infection in order to monitor its spread in different areas without the need for citizens to be tested.



The Economist Intelligence Unit: Following up on that last point, what other tools related to urban resilience has Copenhagen used to address the challenges of pandemic and lockdown?

On the prevention level, we have carried out extensive communication campaigns on social media and in public spaces in many different languages. We have also communicated more directly to specific groups through different organisations and key figures, including youth organisations as well as spokespersons for ethnic minorities. Bringing communication closer to citizens has made it more effective.

We have, from an early stage of the pandemic, worked proactively to prevent the spread of coronavirus while also helping businesses and citizens through the lockdown. For instance, we earmarked considerable money for extra activities as children return to school, and for initiatives boosting the mental health of senior citizens. Also, a wide range of activities have been initiated to give restaurants, hotels, and shops a much needed economic boost.

The Economist Intelligence Unit: Following up on that last point, what other tools related to urban resilience has Copenhagen used to address the challenges of pandemic and lockdown?

On the prevention level, we have carried out extensive communication campaigns on social media and in public spaces in many different languages. We have also communicated more directly to specific groups through different organisations and key figures, including youth organisations as well as spokespersons for ethnic minorities. Bringing communication closer to citizens has made it more effective.

We have, from an early stage of the pandemic, worked proactively to prevent the spread of coronavirus while also helping businesses and citizens through the lockdown. For instance, we earmarked considerable money for extra activities as children return to school, and for initiatives boosting the mental health of senior citizens. Also, a wide range of activities have been initiated to give restaurants, hotels, and shops a much needed economic boost.



Box: Q&A with a city leader: Toronto mayor John Tory



The Economist Intelligence Unit: Toronto came a very close second overall in the 2021 Safe Cities Index. It has also finished in the top seven – out of 60 cities – in the three previous versions. What would you say are the key factors making Toronto safe?

It starts with mutual respect and a shared fundamental set of values around that within the city, including things like a strong pushback against racism or prejudice of any kind. I think if you start there, everyone is more likely to want to create an environment that is safe in a broader context.

Second, and related to that, are a series of support systems that are in place. For example, we have a strong public education system that gives opportunity to anybody who wants it a chance to have a post-secondary education. We also have, more closely related to safety, different kinds of supports for people who are struggling.

Third, there is an increasing whole-of-city approach to safety. One thing we learned during the pandemic is that you can do your most effective job, by far, if everybody is involved in safety – in particular grassroots community organisations. That way, you don't leave anybody out to be marginalised and get into unsafe circumstances in their own lives or to create unsafe circumstances for others.

We are not anywhere near perfection on this, but we are making strides to build up support systems and make sure civil society is involved in creating a holistic concept of safety.

The Economist Intelligence Unit: On the other hand, what key areas are challenges for Toronto in terms of urban safety?

We still have to work at connecting all the dots in safety, broadly defined. One example is our new low-income transit pass. The challenge is to roll it out to as broad a group as we need to in as quick a time as possible. What has that got to do with safety? It has to do with the ability to seek out opportunity using transit. It allows people to access support in different parts of the city, and affects their general ability to get around in an equitable manner.

Also, in Canada we have three levels of government and the challenge is to get all of them on the same page as well as fully engaging civil society – and not assuming that the government has the answers to all these problems.

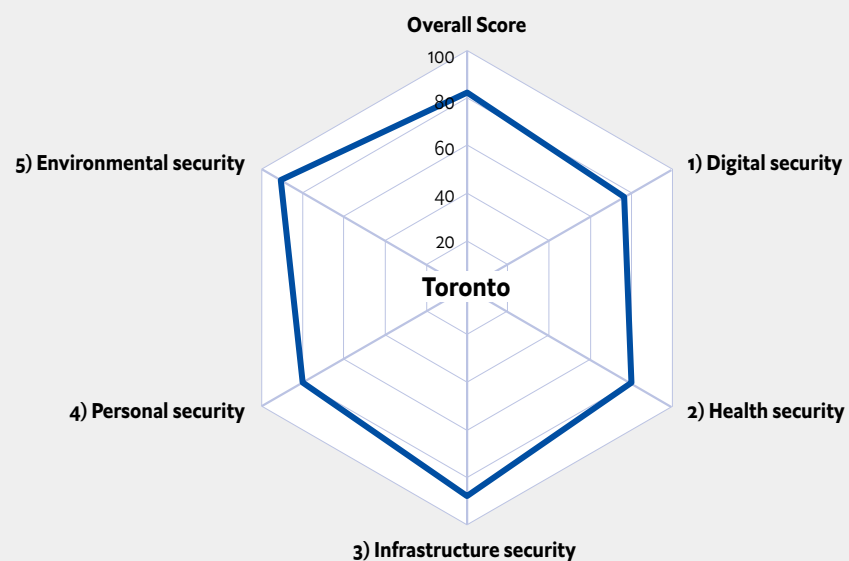
We also need to take a broader view of safety because you want to create an environment where people can be safe, prosperous and healthy. Everything we are doing

is heading in the direction of a holistic concept of safety, but it takes time, because it takes investment and reforms.

The Economist Intelligence Unit: In Canada, many elements of the response to the covid-19 pandemic are the responsibility of the provincial or national governments. Where has the City of Toronto been able to contribute most effectively in addressing these challenges?

Our ability to get things done comes from the fact we are local. Relative to other levels of government in Canada, we have no power and real ability to raise money, and yet, in every case – especially with something like covid-19 – who do they turn to in order to do something like knock on a door with a vaccine or get somebody tested? You are going to call the local government and local community organisations which the local government has a closer relationship with almost by definition.

Dealing with the pandemic has proven the importance of the city's role and its ability to get things done. It has been shown that if you want to get to people, including marginalised groups in a targeted and effective way, then you have to turn to cities.



Less consistency at the top

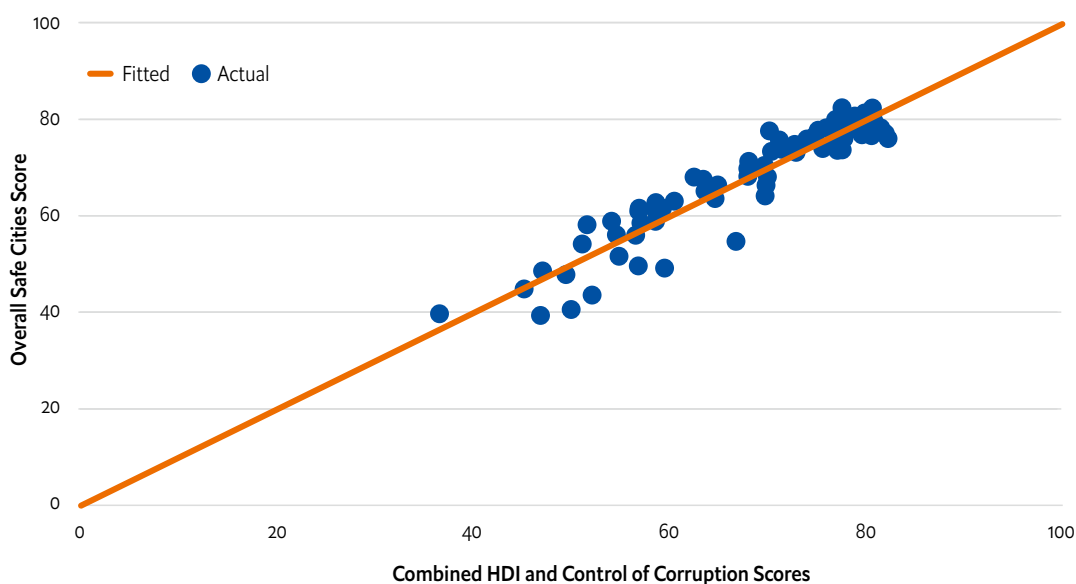
Another noteworthy change in our results from previous years is how leaders and those at the bottom of the table perform across every pillar. In 2019, the three leaders – Tokyo, Singapore and Osaka – finished among the top eight cities for each pillar, with the partial exception of Osaka, which was 11th in digital security. This time, every one of the leading cities overall has a more pronounced relative weak spot. Copenhagen, for example, comes 26th for health security, but finishes in the top six for every other category. Similarly, Toronto finishes no worse than eighth everywhere except digital security, where it comes 14th. This pattern of mostly strong results with one area of weakness repeats itself across all of the top ten cities.

By contrast, those cities earning the lowest overall scores have, as in 2019, tended to struggle with every kind of security. That said, some signs exist of a shift mirroring that seen among the leaders. Lagos, for example, although in 56th place overall, scores slightly above average in environmental security, while 55th-place Casablanca comes 41st in digital security.

Income and governmental transparency remain urban safety's boon companions

As discussed in detail in our last report, average income and urban safety go together. Of the 60 cities covered in our study this year, the top 29 are in high-income countries. Looking in greater detail, statistically highly

Figure 4: HDI and corruption control vs Overall index score



significant correlations exist between HDI scores and overall index results, as well as between HDI and the output, input and combined scores for each individual pillar. If anything, as reported in 2019, the link between income and inputs is slightly more pronounced than that between income and outputs.

This outcome elicits no surprise. Ms Akhmouch speaks for many of our expert interviewees when she says “I’ve been working on cities for a decade. Each time you talk to a local government, the main challenges flagged relate to money and power.” Some initiatives require substantial investment and running costs.

That said, the provision of a safe urban environment is not simply a matter of greater income allowing cities to buy security. Instead, income and different elements of safety create a virtuous circle. For example, as Mr Tomer notes regarding infrastructure, “in general, you will not find a developed economy without a healthy water system.” Similarly, Ms Zhao says one lesson of the recent pandemic has been that “health safety comes first; the economy will follow. Safety and the economy are not binary; they can be developed side by side and urban governments play a key role.”

Indeed, Ms Akhmouch warns that, in the area of environmental security in particular, governments must improve areas they can at present rather than delaying until obtaining a bigger budget: “we can’t afford the traditional path of ‘grow now and green later.’ The cost of inaction is actually too high to accept the status quo.”

Cause and effect is clearer when it comes to governmental transparency. As in the past, this year statistically highly significant correlations exist between the World Bank’s Control of Corruption figures and our cities’ overall scores. These statistical links also exist for aggregate scores for total inputs and outputs across the index, as well as for the the output, input and combined scores for each individual pillar. These tight connections exist independently of the income-related correlations discussed above.

As noted in 2019, any number of links exist between transparency and different elements of urban safety. Transparency is important on its own and also a good proxy measure of effective governance. The latter is another attribute emphasised by interviewees when discussing what cities need to deliver different elements of safety. The higher statistical impact that corruption control has on our index scores in middle-income cities compared with high-income ones points to how transparency can help deliver safety well before financial resources to invest in security-related assets become available. To enter the virtuous circle toward higher levels of safety and income, transparent and effective governance is an essential step.

The geography of urban safety

No single region has a monopoly on good results in our index. Looking at the top 15 in the overall scores – or 16, as London and San Francisco tie for 15th – six are from Asia-Pacific, six from Europe, and four are from

Figure 5: The average pillar scores for cities in high-income countries

	Overall	Digital	Health	Infrastructure	Personal	Environmental
Asia-Pacific	77.9	72.5	79.5	86.4	73.3	78.0
Europe	75.5	72.0	68.6	82.5	76.9	77.8
North America	77.2	78.0	75.8	84.8	67.0	80.7
Middle East	59.0	57.6	72.6	65.5	61.0	38.3

North America. Similarly, the average scores for high-income cities in these three regions are similar, between 75.5 and 77.9.⁴

The average pillar scores for cities in high-income countries, however, reveals slightly more variation. Infrastructure and environmental security results are broadly similar. North American cities, though, have noticeably better results for digital security, Asia-Pacific ones for health, and those in Europe for personal security.

It is dangerous to generalise too much over differences between regions that are much smaller than those in the scores of, say, high-income and low-income cities. These variations, though, are a reminder that differences in attitudes and experience may lead to distinct patterns of investment in search of safety enhancement or in acceptance of security levels in different parts of the world. These divergent views can have unexpected impacts on different kinds of security. Gregory Falco, assistant professor of civil and systems engineering at Johns Hopkins University, notes that, for example, in his experience it is more challenging to get city

authorities in Iceland to give digital security a high priority than it is their peers in Saudi Arabia. This comes down to the fact that the latter live in a region where other forms of insecurity – such as international violence – are a more pressing consideration in general.

Insofar as these differences fall under the label of “culture”, it is important to heed the warning of Mr Gupte that “culture is not static. It can be seen as a process of evolution and dialogue memorialised in many ways. Our understanding of ‘safety’ or ‘security’ may vary and should be attentive to culture, but it is important to continually ask ‘safety for whom’ to ensure our security regimes do not leave people behind.”

Regional differences in these processes of cultural evolution may help explain some of the differences in the index results. North America’s high scores in digital security make sense if the region’s earlier experience with the decades-old IT revolution created a more embedded sensitivity to the need for digital safety. On the other hand, lower personal security scores may also reflect a different attitude toward what is normal.

⁴ Only high-income cities are used in this discussion of geography to improve comparability between regions

Such generalisations are inevitably speculative. Lower average scores for low-income Middle Eastern cities are easier to explain. Among the index cities in this group, those in this region have the lowest HDI scores. They have also grown wealthy more recently than the cities in other regions. Over time, their scores may improve, although the

very low environmental security results in the region may prove a longer-lasting challenge for cities built in or beside deserts.

With this overview as context, we now look more deeply into the individual pillars beginning, inevitably in the current global situation, with health.

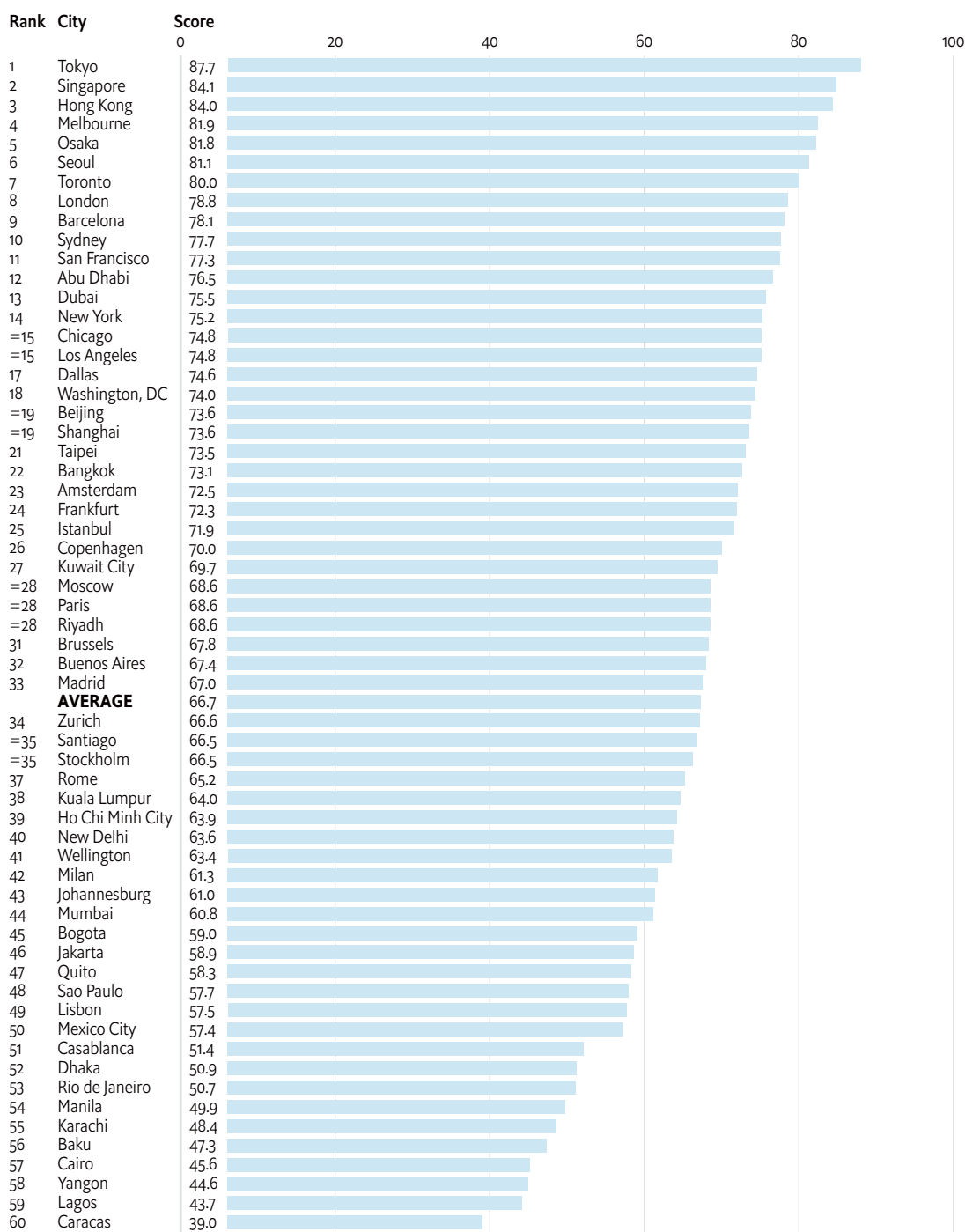






The covid-19 pandemic and the understanding of health security

The need to focus better on what works



Tolullah Oni – an urban health physician and epidemiologist at the University of Cambridge – believes that, insofar as covid-19 was a surprise, it was “unsurprising” in many ways. On any number of levels, she has a point. Since 2000 Gavi, the Vaccine Alliance, and since 2017 CEPI – the Coalition for Epidemic Preparedness Innovation – have been warning about Disease X, an unknown virus that could have extensive global health, societal and economic repercussions. Covid-19 certainly fits that description, and is unlikely to be the last such contagion. Similarly, Dr Oni notes, a wide variety of factors have been known to influence health outcomes for decades. These include the classic social determinants of health – including income, education, environment and work patterns, among others – as well as variations in health system investment within countries, and levels of societal trust and cohesion. That they play a major role in shaping variations in the impact of the pandemic both between and within countries was entirely predictable.

And yet, the impact of the pandemic was a surprise, or at least important elements of it were. Many health systems, including well-resourced ones with advanced infrastructure and equipment, have been nearly overwhelmed. The pandemic caught even students of public health unawares.

A case in point comes from The Economist Intelligent Unit’s own work, which necessitates a *nostra culpa*. In 2019, along with the Johns Hopkins School of Public Health and others, we published the Global Health Security

Index (GHSI).⁵ The disconnect between its scoring and the severity of the pandemic in different countries became obvious early on. The covid-19 mortality data as of March 2021, used in the Safe Cities Index as an indicator, continue to show no correlation with the GHSI scores. The disconnect led to press debate that would be unhelpful to rehash in detail here. Indexes such as the GHSI inevitably look at the degree of capacity rather than predict how it will be used; however, major revisions to what gets measured are sometimes necessary. The more substantial worry about the lack of correlation between GHSI prognosis and pandemic outcome is that it was far from exceptional. Dr Asgari says that “most people got their scores and indexes wrong as well.”

Understanding of health security therefore needs to be revisited in light of the pandemic. That said, talking in any detail about lessons from it can still be an act of hubris. At the time of writing, it remains substantial. Moreover, certain countries that early on received praise for rapid action – including Japan, Thailand and India – later faced significant challenges from surges in case numbers.

Meanwhile, such existing data may not be reliable. Some health systems simply lack the capacity to test for, let alone report, cases and deaths accurately. In some instances, for various reasons, governments may obscure the true toll. Finally, as Dr Asgari explains, individual countries can differ over basic metrics such as how to define a covid-19 death. Even when comparing two reasonable

⁵ <https://www.ghsindex.org/>

approaches, the numerical variation can be profound. In August 2020, the English NHS changed its definition of a covid-19 death from a person who died after ever having a covid-19 diagnosis to having received the diagnosis only within the preceding 28 days before dying. This cut the reported toll by 13%.⁶

Relearning the value of the big picture

So, amid a shifting and obscured pandemic landscape, detailed conclusions remain dangerous to draw. Nevertheless, covid-19 has already taught, or more accurately reminded, the world of two things directly relevant to urban health security.

The first is the need for a holistic understanding of the challenges of urban health. This begins with appreciating the inter-connectedness of all illnesses. The “epidemiological transition” is an influential concept in understanding disease burden. In very general and simplified terms, it posits that, with socio-economic development, the impacts of communicable disease lessen and those of non-communicable disease (NCDs) become greater. This concept can help with understanding important elements of healthcare needs – such as for developing countries to adjust their health systems to respond to growing NCD levels alongside dealing with communicable ones.⁷

Such adjustments would be welcome, but the danger of thinking in terms of a “transition” is the ultimately false dichotomy that it suggests between different types of disease. Dr Oni points to any number of well-known connections between communicable diseases and NCDs – such as those between tuberculosis and diabetes or various infections and cancer. Now, various studies have found that obesity – long linked with NCDs such as cancer, cardiovascular disease and diabetes – is a significant mortality risk factor for covid-19, a communicable disease.^{8,9}

Another area where covid-19 has provided a clear reminder of the need for a more holistic approach is in the way health systems perceive the population that they are serving. Dr Asgari notes, for example, that the biggest outbreaks in Singapore were among foreign and migrant workers. Meanwhile, amid Thailand’s May 2021 surge, on some days over half of the cases were found in Bangkok’s over-crowded prisons.¹⁰ “One take home point from covid-19,” Dr Asgari explains, “is that you cannot ignore marginalised populations on public health issues. That is not new. For decades, we’ve been talking about the need to control tuberculosis in refugee camps.” Protecting the most vulnerable from communicable disease is not just ethical in itself; it protects the health security of everyone in the population.

6 Carl Heneghan and Jason Oke, “Public Health England has changed its definition of deaths: here’s what it means”, August 12th 2020, Centre for Evidence-Based Medicine blog, <https://www.cebm.net/covid-19/public-health-england-death-data-revised/>

7 For a more detailed discussion of the concept, see Ailiana Santosa et al, “The development and experience of epidemiological transition theory over four decades: a systematic review”, *Global Health Action*, 2014, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4038769/>

8 Yanan Chu et al, “Obesity is associated with increased severity of disease in COVID-19 pneumonia: a systematic review and meta-analysis”, *European Journal of Medical Research*, 2020, <https://eurjmedres.biomedcentral.com/articles/10.1186/s40001-020-00464-9>

9 World Obesity Federation, *COVID-19 and Obesity: The 2021 Atlas*, 2021, http://s3-eu-west-1.amazonaws.com/wof-files/2722_WOF_-_COVID-19_and_Obesity-The_2021_Atlas_WEB.pdf

10 “Thai prisons holding democracy activists drive record Covid figures”, *Guardian*, May 13th 2021, <https://www.theguardian.com/world/2021/may/13/thai-prisons-holding-democracy-activists-drive-record-covid-figures>

Similarly, even where universal health coverage is available, it needs to address the concerns of different communities within cities. Dr Oni points out that a significant issue surrounding vaccine hesitancy in London, and indeed the UK, has been mistrust of this medical intervention among members of minority ethnic communities. Dr Oni believes that some people in communities that feel alienated from lower levels of provision “are saying, ‘if you haven’t cared about my health in the past, why are you interested now?’ To address vaccine hesitancy, it is importance to build trust in a sustained way beyond the emergency.”

Toward health system resilience for the whole population

This focus on the interaction between societal issues and health points to the largest likely shift that the pandemic experience will bring to urban health security. And that is “about health system resilience, how to manage and recover from shocks to the health infrastructure. That is where the focus of change will be” states Dr Asgari.

This development will in turn integrate discussions of health crises more closely into broader plans for urban resilience – a link that has been missing. Dr Asgari believes that previously “the conversation around urban resilience has always been about sudden shocks, such as disasters, floods and so on, probably because people never thought the health system would collapse as a consequence of continuous demand

from outbreaks.” Mr Acuto agrees. “Covid-19 teaches that there is always a blind spot, even when there is a lot of activity,” he says, adding that among the many, very valuable city programmes and partnerships on resilience, “only a handful [are] focused on health responses and fewer still looked at health security.”

Examples from Asian countries with early success in limiting the pandemic show that, often, the general tools of resilience helped as much as health system capacity. Among these are Singapore, South Korea and Taiwan, which until April 2021 have all had reasonable success in containing the pandemic within their borders. It is no coincidence that they were also all affected by SARS, MERS or both. In such places, notes Dr Asgari, “legislation – which took into account the need for multi-sectoral decisions – was in place and robust enough, and societal memory was fresh enough, that policymakers, technicians and populations could remember what could happen and ramp up quickly.”

Behind such formal capacity needs to be softer elements of resilience, in particular social cohesion and citizens’ relationship with the authorities. “A big part of the conversation”, explains Dr Asgari, “is the level of trust in government by the local population and how much officials listen.” Dr Oni adds that one attribute found in more successful pandemic responses has been “clear communication and involvement of communities and regular people in tailoring the response.”

The way information technology has helped deal with the pandemic shows that even digital tools work best within a context of resilience rather than providing solutions on their own. As early as January 27th 2020, for example, the Taiwanese government, within 24-hours, fully integrated data from its national patient health insurance system and national immigration database to help track possible cases that had arrived from mainland China. This kind of innovative and potentially valuable move could occur so quickly because Taiwan already had a multi-step plan for dealing with pandemics. Its roll-out began with activation of a central epidemic command centre on January 20th. A National Security Council meeting involving the Ministries of Health and Welfare, Transportation, Economics, Labour, Education, and Environmental Protection Administration convened the following day. The use of various IT tools was simply one more part of a previously mapped out programme.¹¹

Social capital and cohesion are also a fundamental requirement for IT tools to be effective in pandemic response. Track and trace efforts are an important example. As discussed in the section on digital security, privacy concerns have affected the uptake of tracking apps in many countries. Dr Asgari notes that South Korea has used a more holistic approach than simply keeping tabs on mobile phone locations. It draws on CCTV footage and credit card data as well. He adds that such an approach was more readily accepted in the country than it might have been elsewhere. This reflected transparency

about how the data would be used, trust in the government, and belief that it would keep its promise to delete the information after 28 days. Even absent a state role, those with social capital can improve resilience during such situations. Mr Gupte reports that in informal settlements in Indian cities such as Mumbai and Kochi, efforts by existing community groups – using social media tools – gave a more accurate picture of what was happening on the ground than many formal, government-managed IT tools.

If there is a clear lesson for cities from covid-19 already, then, it is the need for enhanced society-wide resilience that includes health. Mr Acuto believes cities should already have known this. “SARS showed that we needed local-level planning,” he says, but “most cities did not have plans, or maybe had ones that were ten years old; so, they did not know where to get information.” He adds that cities in general are bad at learning lessons from the mistakes of others, including those revealed by SARS and Ebola. Now that so many have experienced covid-19 first hand, they may be more ready the next time.

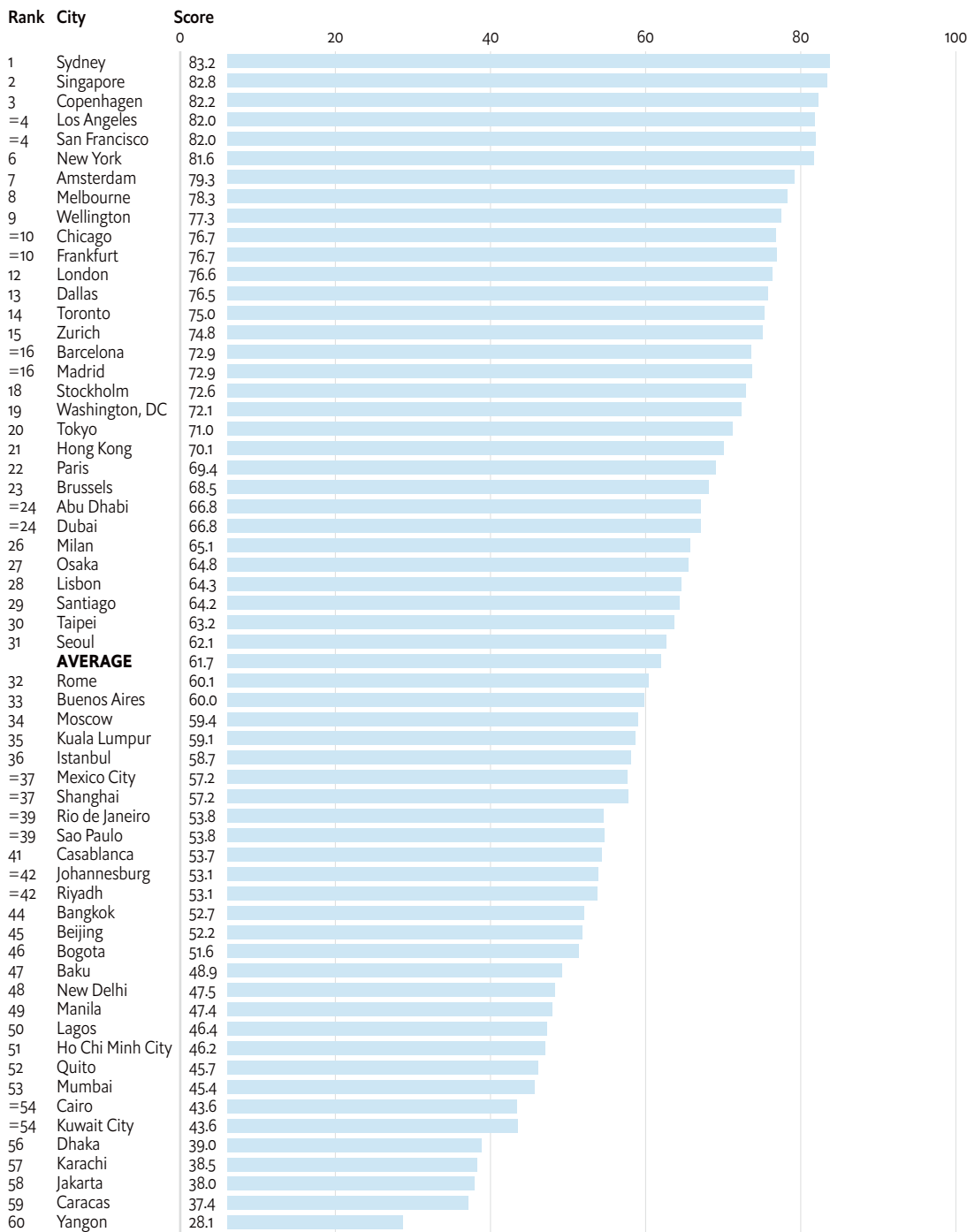
This is also about more than just being ready. “If we are not building into resilience the prevention of the preventable,” Dr Oni says – by doing things from reducing obesity rates to building trust within communities – “we miss a trick.”

¹¹ C Jason Wang et al, “Response to COVID-19 in Taiwan Big Data Analytics, New Technology, and Proactive Testing”, *JAMA*, March 2020, <https://jamanetwork.com/journals/jama/fullarticle/2762689>



Digital security: A red flag on the road to the development of smart cities

Risky digitalisation



Digitalisation has become pervasive in our index cities, even most of those in middle-income states. Comparing the 59 cities that appeared in 2019 and 2021, on average the percentage of people with access to the internet has risen from 73.6% to 77.8%. At that rate, it would take a little over a decade for access to become universal. Moreover, some of the most rapid growth in connectivity is in lower-middle-income cities. In 2019, we reported that in just two of these – out of 11 – over half of residents could get online. In 2021, this has risen to six in ten. If anything, reliable equipment is even more common, at least for businesspeople who may, as a group, have more resources than the population on average. In only three of our cities do businesses have to live with a high or very high risk that IT infrastructure will not prove adequate for their needs.

This does not mean that everyone can use the technology in the same way. A country's number of secure internet servers per million people is a proxy of the possibility to engage in safe e-commerce. Our data show that residents in wealthier cities have far more capacity to do this: the US, for example, has roughly 1,000 times more such servers per capita than does Myanmar. That said, as with internet access, even those with the lowest scores on this indicator are seeing rapid improvement. The number of secure servers in Myanmar has risen by more than tenfold since 2015, and in Nigeria and Pakistan (tied for 57th on this indicator) the figure has gone up over 20-fold.

Meanwhile, the wish for city leaders to use digital technology to become smart cities is nearly unanimous. In 59 out of 60 index cities, we found evidence of an existing smart city plan or intention to invest in this transformation in the coming five years. Caracas is the only exception.

The development of smart cities could be a boon to urban security in general. Lawrence Susskind – Ford Professor of Urban and Environmental Planning at the Massachusetts Institute of Technology – points to Seoul as one of the world's most advanced smart city. It shares with the public extensive data about the city, from across urban government departments, CCTV cameras, and automated Internet of Things (IoT) sensors monitoring activity and environmental quality. Amid the rapidly growing body of applications drawing on these data are any number related to elements of urban safety: billions of late-night calls to taxi companies were analysed to plan an after-hours bus service route; a so-called AI-detective monitors crime reports in real-time to spot incipient trends; reports of traffic accidents involving the elderly are used to identify areas to turn into special elderly protection zones; and installing IoT sensors for elderly people living alone to monitor whether they need medical assistance.¹²

This growth of internet usage among populations and interest in expanded application of IT by urban administrations comes with a worrying weakness. City governments are often not able to protect even their own technology. Mr Acuto says that

12 "Seoul: A city based on data," *Smart Cities World*, March 2020, <https://www.smartcitiesworld.net/special-reports/special-reports/seoul-a-city-based-on-data>

most have “an enormous fragility to any form of cybersecurity threat, let alone complex ones.” Mr Falco agrees: “the digital security of cities is generally pretty terrible. They often don’t have the money or expertise to understand what is going on.” Worse still, adds Mr Susskind, especially in US cities – many of which actually score highly on this pillar – no senior person has overall responsibility (and authority) for cybersecurity. “Each functional department has its own IT budget, but security can’t be the responsibility of individual departments because all the systems are connected. If you don’t have an emergency action plan then, when there is an attack, nobody has the power to shut down the system.” Although it is hard to measure directly the extent of urban security efforts – or lack thereof – our index figures indicate that only a worryingly small 16 of our cities have active public-private security partnerships.

This situation raises greater concern because the online world is not a safe one. In our index cities, a median of 10.5% of computers faced at least one known malware attack in 2020. More worrying still, governments and businesses in all but seven index cities are at moderate, high or very high risk of cyber attack. Even major urban areas have been suffering high-profile onslaughts. A 2018 attack on Atlanta’s government left software unusable months later. In 2019, Baltimore, after its principled stand to not give into to ransomware, had to spend over US\$18m on restoring data and repairing systems. Nor does the attack have to be on a city government directly. When malware shut down the Colonial Pipeline in

eastern US in May 2021, it left nearly 90% of gas stations in Washington, DC, without fuel. As Mr Tomer notes, “these threats are here today and very real.” Typically, they are ransomware. Looking to the future, warns Tim Chapman – director of the infrastructure design group at engineering firm Arup – a bigger challenge looms: “what will become scary is when states are acting malevolently. You end up with future wars fought in hybrid space and we have vulnerable digital systems. Even setting all the traffic lights to red would paralyse a city.”

Smart city security: A foundation too often not poured

This is the context for one of the most worrying findings in our index. Of the 59 cities with smart city plans, only 15 focus in detail on the security of the underlying networks and data. Mr Falco is not surprised. From his experience both advising on and helping to implement smart city technology, the figure “sounds right.” Mr Susskind agrees. Although some cities are doing a lot, overall “the commitment to cybersecurity is still minimal,” he says.

The implications of low attention to security combined with greater digitalisation are stark. The kind of attacks described previously will only multiply as the number of vulnerable targets grows. Mr Falco warns that improvements to digital security related to physical infrastructure “should be done, but we are not even seeing advanced cities thinking about this.” One problem, he adds, is

that because cities and how they have chosen to digitise their systems are so different, each needs its own bespoke security strategy.

Moreover, a lack of attention to security can lead officials to miss issues inherent in smart cities. Mr Van Begin notes that there is no “logical, directed link between a smart and a sustainable city.” One issue, for example, is energy usage. Before the covid-19 pandemic, data centres were already responsible for as much carbon emission worldwide as the airline industry. A greatly expanded use of IT will only exacerbate the problem. As cities increasingly try to adopt smart approaches, Mr Van Begin adds, they must find ways to “use the technology to solve [environmental security] problems without creating new ones.”

Finally, if citizens believe that security for their own data is lacking, it will undermine the effectiveness of smart city tools. Alice Xu – head of the connected communities/ smart city programme at the City of Toronto – explains that the low uptake of the Canadian federal government’s covid-19 contact tracing app, around 15%, in part seems to reflect privacy worries. Those deploying technology have to “think about these from the perspective of citizens and make sure that security fits in with the concerns of residents.” Toronto is far from alone. Low uptake of tracking apps is a global issue and studies rank privacy concerns as a leading reason.¹³ Most of the commonly cited, successful data-enabled tracking programmes, on the other hand, are not so much voluntary as reliant on legislation

allowing health authorities to mine credit card and phone GPS data – as in Seoul and Taipei – or in practice to restrict the activities of those who do not have the app – as did Singapore.

Integrating security into the concept of smart cities

“None of the impetus toward smart cities has anything to do with improving people’s security,” says Mr Susskind, “since it was not focused on security.” Ms Zhao adds that, when it comes to smart cities, urban officials have narrow perspectives focused largely on what IT is available. “We need a mindset change,” she concludes. “We need a holistic approach that thinks about an entire safe, smart city in a comprehensive way.”

Mr Falco explains that one reason for a lack of discussion around security in smart city plans is that “often they aren’t a real thing; saying you have a smart city policy is a marketing window.” Mr Léon adds that this reflects the term’s origins: “it started as a nice slogan. Nobody wants a Dumb City.”

Accordingly, the idea needs a more robust definition. The key to success in creating one will involve taking the emphasis off the word “smart” and putting it on “city.” Ms Akhmouch speaks for many when she says cities must “avoid thinking more data is the solution to everything. smart cities need to be thought of as something more people-centred and demand driven, the end being to improve citizen and city well-being.” As Mr Léon adds, this may not always even be related

¹³ Séverine Toussaert, “Upping uptake of COVID contact tracing apps”, *Nature Human Behaviour*, January 2021, <https://www.nature.com/articles/s41562-021-01048-1>; Dyani Lewis, “Why many countries failed at COVID contact-tracing — but some got it right”, *Nature*, December 2020, <https://www.nature.com/articles/d41586-020-03518-4>; Emily Seto et al, “Adoption of COVID-19 Contact Tracing Apps: A Balance Between Privacy and Effectiveness”, *Journal of Medical Internet Research*, March 2021, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7935397/>.

to technology and innovation but to “the capacity of the city to provide adequate living conditions to all.”

One inevitable element of this approach, says Mr Gupte, is that “citizens should be creators, architects and arbiters of technology.” This, in turn, adds Mr Assiago, will make smart cities more focused on safety issues in general. “The smart city approach so far has not necessarily tried to promote safety as a public good; it has positioned it as a privatised good.” With better governance, the use of, and access to, data can be aligned with improving local safety as a public good – something he says is too often missing.

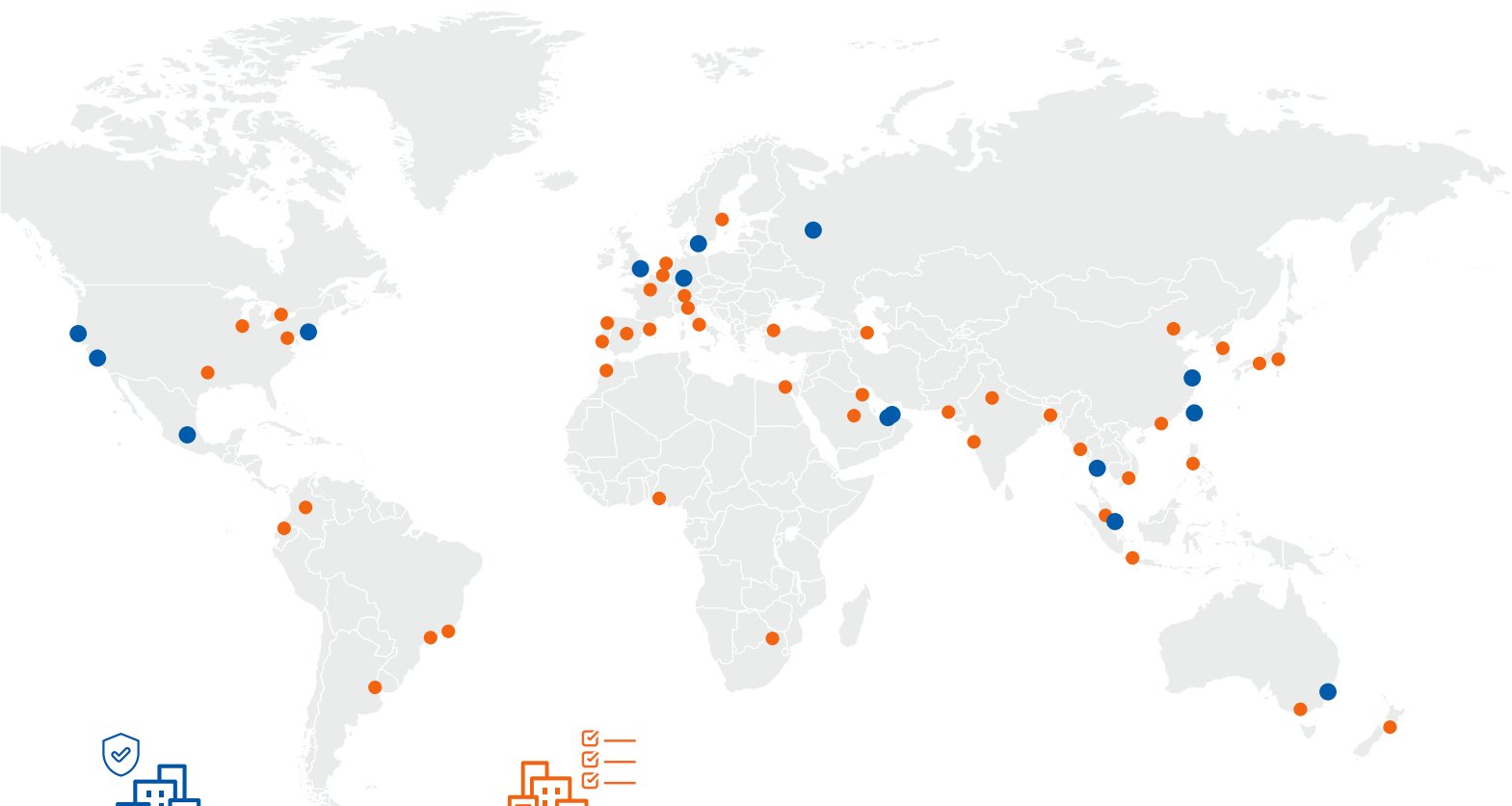
Toronto shows what this can look like. Its smart cities programme had been putting in place a clearly people-centered approach. Ms Xu explains that “nobody wanted to use technology for its own sake.” Indeed, the formal vision statement of her office – to make Toronto “a globally leading resilient, future-ready, and equitable city” – does not even explicitly mention technology.

This citizen-focus shapes initiatives in various ways. For example, one of the biggest projects in response to covid-19 involved providing free wifi to a substantial number of large apartment buildings. The inhabitants – generally of lower socio-economic status than the general urban population – frequently did not have connectivity. Ms Xu explains that the initiative gave these individuals and families access to the digital tools and strategies others were using to address lockdown-

related restrictions on activity. Indeed, plans anywhere in the world to extend the scope of e-government cannot work well until all citizens can access such services.

Ms Xu adds that one benefit of building a smart city around people is that “security is a natural inclusion. The public expects that to be front and centre. There is no debate.” Moreover, the definition of security cannot be imposed from above for it to be effective, she says. “A big question for people is who feels safe and who doesn’t.” Even for something like building smart technology into traffic lights, “we are looking at best practice [to avoid hacking] and what the residents want in terms of safety.”

Figure 6: Cities that have Smart City Plans and Cities that have Secured Smart City Plans



The city has a smart city plan and explicitly focuses on cybersecurity of the smart city infrastructure/network

- Abu Dhabi
- Bangkok
- Copenhagen
- Dubai
- Frankfurt
- London
- Los Angeles
- Mexico City
- Moscow
- New York
- San Francisco
- Shanghai
- Singapore
- Sydney
- Taipei

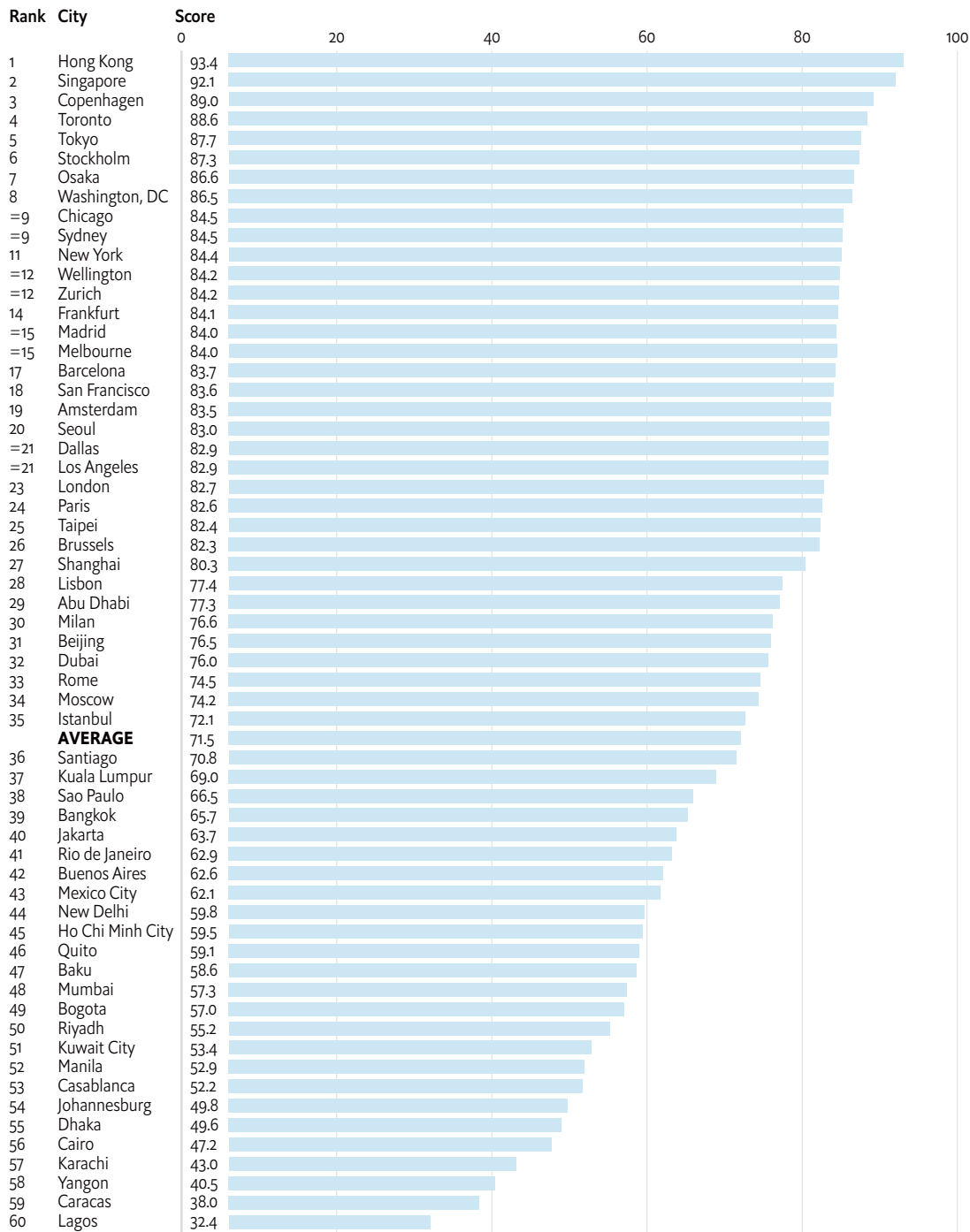
The city has a smart city plan or plans to invest in the next five years

- | | | | |
|--------------|------------------|----------------|----------------|
| Amsterdam | Ho Chi Minh City | Melbourne | Seoul |
| Baku | Hong Kong | Milan | Stockholm |
| Barcelona | Istanbul | Mumbai | Tokyo |
| Beijing | Jakarta | New Delhi | Toronto |
| Bogota | Johannesburg | Osaka | Washington, DC |
| Brussels | Karachi | Paris | Wellington |
| Buenos Aires | Kuala Lumpur | Quito | Yangon |
| Cairo | Kuwait City | Rio de Janeiro | Zurich |
| Casablanca | Lagos | Riyadh | |
| Chicago | Lisbon | Rome | |
| Dallas | Madrid | Santiago | |
| Dhaka | Manila | Sao Paulo | |



Infrastructure Security: At a crossroads

A blink with lasting repercussions



When considering developments at the urban level, digital assets are the hare to physical infrastructure's tortoise. Mr Chapman explains that "city planning can take decades, in some cases centuries." Mr Tomer agrees: "infrastructure works in about the longest cycles we have for humans."

As a result, some index indicator results are little changed from 2019. For example, those cities with the top of the rail network and power network scores in each year are almost identical. Similarly, certain drivers of success remain constant. In 2021, infrastructure scores – overall, input and output – correlate closely with both the HDI and the control of corruption scores we have for each city. More relevant here, the extent of correlation is nearly the same as that seen in 2019. This is the case even though we have changed and re-weighted several of our indicators in the new index. In that sense, as Mr Chapman says, "in city planning terms, covid-19 is but the blink of an eye."

As blinks go, though, it is having a profound effect. Mr Tomer explains that "this is the most disruptive infrastructure-related development in a very long time. The uncertainty is off the charts relative to any other moment in living memory."

The nub of the problem is that the pandemic has undermined the conventional answers to some basic questions, including what kind of physical city would best serve how residents want to live. In particular, the possible voluntary continuation of working from home

and an ever greater shift of commerce online could have substantial and diverse knock-on effects that bring with them fundamental implications for infrastructure.

Water and electricity usage in cities may become much more diffuse. The resultant large shifts in distribution patterns for such utilities may require substantial revisions to their networks. Even the concept of essential infrastructure is evolving. Mr Tomer recalls that, before the pandemic, it "was a minority view that broadband was a central infrastructure. Now you won't find a mayor anywhere in world who isn't saying 'we need broadband connections to every home and business.' The tenor is fundamentally different."

At least some of these changes in infrastructure demand may subside when covid-19 does. This, though, remains highly uncertain, especially because, as our experts told us time and again, the pandemic rarely introduced new urban trends: it accelerated existing ones. As for whether these will reverse and to what extent, Mr Chapman comments, "nobody has a clue. Everybody is guessing."

New security challenges in a new kind of city

Instead of a temporary blip, the experience of the last year may lead to a broader reconceptualisation of the city by citizens, at least to an extent. To begin with, Ms Zhao explains, widespread remote working means

that many people no longer see cities as the inevitable physical hub for the economy. Instead, a focus on liveability seems to be growing. One result, discussed in the environmental security section of this report, is a greater focus on urban sustainability. Another is a greater interest in more integrated cities with services within easy walking or cycling distance. Ms Akhmouch says that “we are seeing the expectation of urban dwellers changing. It is now having all the amenities and services locally. The discourse shifts from mobility to accessibility, which changes planning.”

The most high-profile example is Paris’ ambition to become a 15-minute city, with everything residents need within 15 minutes of their front doors. Once again, though, the pandemic may be making existing ideas of greater interest rather than simply creating new ones. Brussels’ plans for a “City of Proximity” – which aims at all needed services within 10 minutes – and Melbourne’s aspiration for 20-minute neighbourhoods both predate covid-19.

The implications of a lasting transition towards more sustainable, compact urban areas will bring winners and losers. Mr Hino explains that in Tokyo and surrounding areas, transit-oriented, high-density, compact cities have already developed around railway stations. Residents can, or have to, walk every day to many nearby shops and other destinations. On the other hand, certain urban areas might not survive the transition. Mr Chapman believes that, in future, “some cities designed solely

around the car will have to be abandoned. There is too much sprawl.” Managing that decline will bring its own societal and safety issues.

Indeed, efforts to respond to changing thinking of urban citizens about the kind of cities they want will require a reordering of urban infrastructure on a large scale, with a host of disparate security challenges. The digital security section of this report has already discussed some of those associated with digitalisation and the increasing use of smart city tools for infrastructure. This is only a part of such issues. Any shift in traffic and utility usage patterns has potential benefits and difficulties for keeping the city safe. Meanwhile, novel challenges have appeared. Mr Tomer notes, for example, that the ability of transport providers to tell apart real or fake proof of covid-19 vaccinations has the potential to become a public health issue.

No time to pause for reflection

One could understand a wish to slow down infrastructure development until the nature of what would best serve the city becomes clearer. That, though, is never an option, no matter how extensive an upheaval a city faces. For example, Mr Chapman notes that London city officials in the early 1940s had no choice but to engage in extensive planning to rebuild the city even before the tide of the second world war had turned.

Rapid urbanisation – especially in Asia and Africa – makes action on infrastructure

development too urgent to pause. From the combined effect of greater migration to urban areas and births within them, the total number of people living in cities will roughly double by 2050. As a result, even to keep the quality of life in urban areas around the world where it is, cities will have to build as much infrastructure in the next 30 years as they have accumulated over their previous existence.

The actual requirement will be larger, notes Mr Gupte, because in many cities, especially in the developing world, infrastructure is insufficient for current needs. “The extent of this infrastructure gap,” he says, “is a huge issue. It may well be the most important question in meeting the Sustainable Development Goals.”

For both cost and environmental reasons, Mr Gupte and Mr Van Begin stress that such investment needs to be, to the extent possible, nature-based and people-centred green infrastructure solutions. As the former explains, “it is costly to build ‘against nature’. Think of huge air conditioning systems built to cool down homes built using materials and designs that absorb or retain heat. Instead, the most exciting innovations work ‘with nature’, trees and green roofs to cool down the built environment, using local or ‘traditional’ materials and designs flexible enough to accommodate changing temperatures, while being much more cost effective to rebuild in case of disaster.” This is part of a wider need for natural resilience and environmental security planning dealt with in a later section.

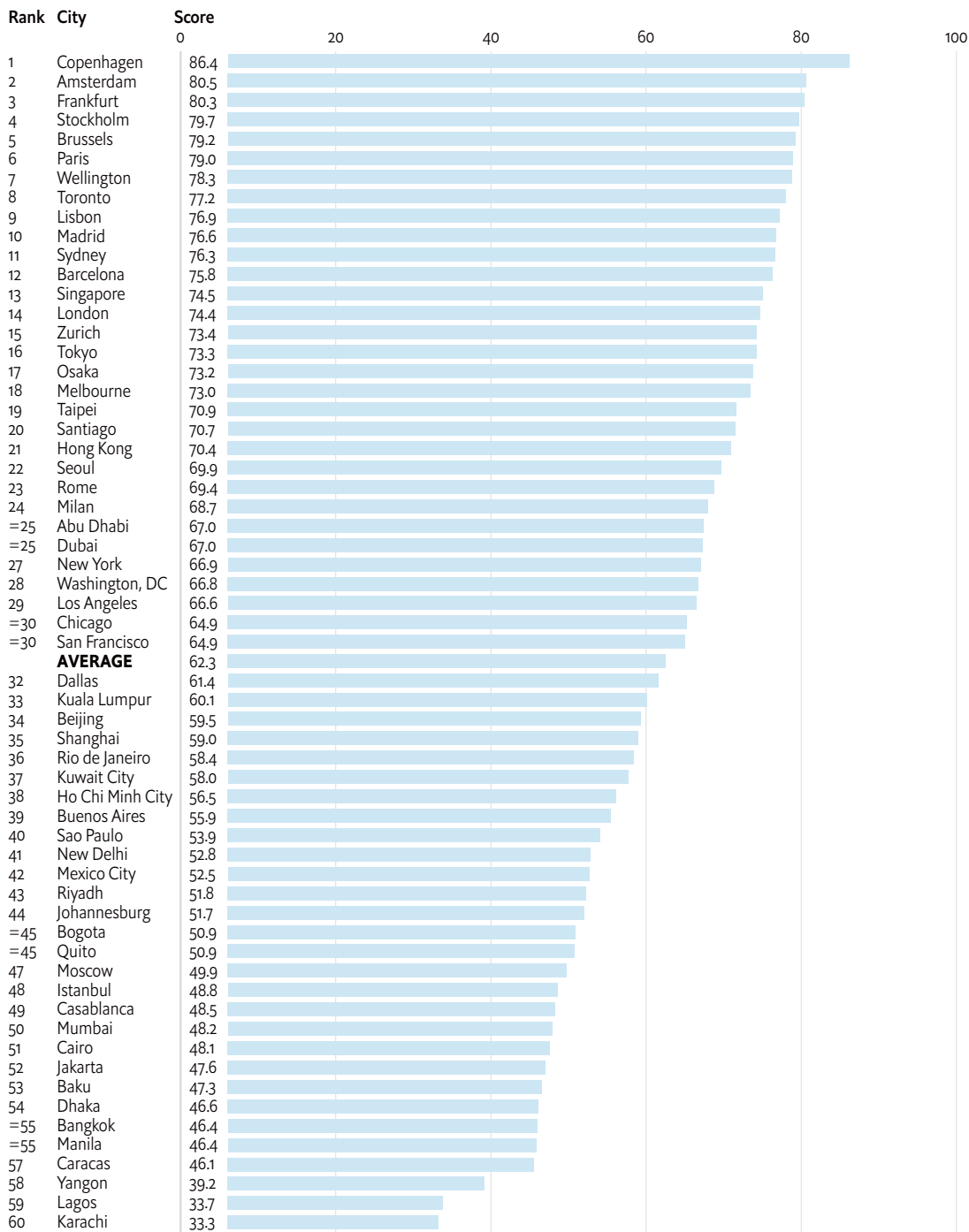
Here, though, it is worth noting that, while sustainability policies are widespread in index cities, they are not having a universal effect on infrastructure development. Of particular relevance to infrastructure security, while just five index cities do not account for disaster risk at all in their urban planning and design, of the remaining 55, over half (29) show little evidence of compliance.

Meanwhile, as cities try to expand infrastructure to meet demand, they will also need to focus on the governance of existing assets. Here too, our index cities can sometimes fall short. Water is a case in point. All but eight of our cities are rated as having tolerable or better water infrastructure, yet more than half have medium or higher levels of water stress. Part of this reflects the natural resources available, but that is far from the whole story. “You need good management,” explains Ms Akhmouch. “Infrastructure is not the full solution. Most countries have a good idea of what they have to do. The big problem is who does what and who pays for it. It is often more a governance issue than a technical one.”



Personal security: Individual safety as a collective endeavour

Income and personal security: a complex relationship



The index data this year, as in the past, seem to give a clear message: at the urban level, personal security and income levels are connected. The correlation between city scores for personal security in the 2021 Safe Cities Index and those for the HDI are, after infrastructure, the closest for any pillar. Mr Assiago warns, however, that seeing personal security as a function of wealth proves to be an analytical dead end. UN-Habitat, he recalls, looked into the apparent link some years ago and found “no direct correlation between poverty and crime levels. On the contrary, some cities with higher absolute levels of poverty had more safe contexts.”

The way to explain this statistical connection without apparent direct causation is to look for attributes that wealthier cities may have in common apart from money. An unexpected disconnect in this pillar’s results, in particular the indicators specifically dealing with policing and crime, can focus the search in the right place.

As with other pillars, personal security inputs and outputs have a high level of statistical correlation. Within this context, some individual cases differ markedly. On personal security outputs, Singapore scores an average of 97.3, markedly ahead of second place Copenhagen (92.7) and well over the index average (67.2). At the same time, it finishes in 40th place on inputs (51.7), falling below the average (57.3). Although the most extreme case, several other Asian cities, notably Tokyo, Osaka, Seoul and Taipei, have much lower input than output scores.

The difference is particularly noticeable when comparing scores for judicial system capacity – based on per capita personnel levels – and those for the prevalence of crime rates. On the latter measure, Singapore, Tokyo and Osaka are tied for the best result, getting full points. At the same time, all three finish among the bottom ten cities for capacity. Singapore also gets full marks for organised crime control. Although the Japanese cities secure only middling scores here, these are still much higher than the ones they get for judicial system inputs. Similarly, albeit to a lesser extent, Taipei and Seoul also have low levels of crime and organised crime mixed with fewer people per capita in the judicial system than in many cities.

Although examples of this apparent dichotomy seem more common in Asia, these are not unique to the continent. Toronto and Stockholm, for example, also have a similar combination of scores. Rather than an artefact of regional culture, this ability to achieve a higher degree of personal safety with apparently lower levels of investment must arise from something else.

Necessary elements of security co-creation

This secret sauce does not work apart from high-quality state institutions related to personal security. The latter are an essential foundation anywhere. Gerald Singham, chairman of Singapore’s National Crime Prevention Council, a multi-stakeholder NGO, believes that his city’s success in this

field begins with its “first class police force that is technically well-trained and equipped.” Similarly, the judiciary is of high quality, while laws are both clear and transparently enforced. More important, he adds, these actors are “not corrupt. Once your police force is corrupt, law and order goes down the drain and there is no hope.” This is consistent with our data: the correlation between scores for control of corruption and personal security output in our index is very high.

Effective government activity, though necessary, is insufficient. In fact, too great a reliance on it can be counterproductive. Mr Hino explains his concerns about possible plans for prototype cities with “CCTV and various sensors that can detect suspicious activity, identify suspicious individuals, but make people feel that they are being monitored as if they were in the Panopticon. These will be ‘safe cities’, but I am concerned about the protection of personal information and privacy.” The kind of proposals have appeared in different parts of the world and can spark strong negative reactions. A ground-up smart neighbourhood development in Toronto’s Waterfront area aroused notable public opposition, and a company’s discussions with Portland, Oregon, for gathering data on public transit numbers broke down in early 2021 over issues of transparency and privacy.

Mr Assiago explains that, at whatever level of development, the best way for a city to reach a high level of personal security is through its co-creation by the public and the authorities.

This requires both effective local government institutions and the enabling of citizens to play a key role in enhancing their own and their neighbours’ security. “Safety is an issue of urban governance,” explains Mr Assiago “and from that perspective a better governed city allows the participation of non-state actors.” Indeed, he adds, in true co-creation, citizens define what it means to be safe. This meaning may differ even between neighbourhoods within the same city but meeting such needs is essential to making people feel safe.

Citizen co-creation of security benefits heavily from social cohesion and commitment. Mr Hino explains that, in Japanese cities, a “strong territoriality” in neighbourhoods, including high levels of home ownership and low relocation rates, have traditionally undergirded efforts in this area by promoting the deepening of social links and commonalities between those living in the same area and across the local community as a whole. In particular relevant here, “crime prevention activities by the neighbourhood associations,” he says, have been “supported by social capital – that mutual sense of belonging, community, and shared responsibility – and have enhanced social capital in turn.”

Meanwhile, Mr Singham observes that one of the key messages of his organisation is that “crime prevention is a shared responsibility. The individual has a duty to participate.” Singaporeans seem to agree. The city has a large neighbourhood watch programme, which goes beyond keeping an eye on the

local area to include volunteers going on patrol together around where they live; a new programme started in 2019 for commuters to act as police eyes and ears, Riders on Watch, had 26,000 people sign up in its first five months; and one of the most popular TV shows produced in Singapore, reports Mr Singham, is Crimewatch, which features current crime concerns and provides crime prevention advice.

Nor is the social capital needed to enhance safety limited to high income cities or neighbourhoods. Mr Assiago explains that, “people keep saying that slums are some of the most dangerous neighbourhoods, based on levels of crime, but they don’t look at social capital. In these neighbourhoods, you have some of the highest level of social capital because they cope and adapt. If we are looking to prevent crime and violence, we need to look at the cultural context in order to understand low-cost, community-oriented solutions that work to promote liveable cities, especially found in the low-income neighbourhoods of cities.”

Social capital and cohesion can dissipate. Mr Hino warns that increasing fluidity in Japanese urban areas is reducing the security impact of neighbourhood associations. On the other hand, it can also be built up. One way, Mr Hino adds, is city design. “The key,” he says, “is to have security included in the considerations of planners. Individual physical security is associated with social relationships. Designers should maintain and encourage these.” This often involves

creating public spaces that people will want to use and where they will interact, building further connections. He posits one explanation of Tokyo’s and Seoul’s relatively low crime rates is that “there are more ‘eyes on the street’ in such cities” due to urban structures that reduce use of motor vehicles and increases human, in particular pedestrian, interaction in public spaces. Unfortunately, though, few policymakers understand crime prevention through environmental design. “Almost all of them consider SDGs, but few consider health and even fewer consider crime,” Mr Hino concludes.

Another important way to enhance social cohesion, says Mr Singham, is to make sure that people feel being part of society benefits them. “When people feel that they have a stake in what tomorrow will look like, they will make sure that today’s society is safe and protected. You need good buy-in to the laws, practices and ethos.” Mr Assiago makes the same point from a different perspective. UN-Habitat has found in its research that the key driver of insecurity is the extent of social exclusion.

This provides an important new explanation for one connection in our index data. A higher percentage of the population living in informal settlements correlates with lower personal security scores. If Mr Assiago is correct, the reason is not so much that slums represent an inherent source of insecurity but that they are a proxy measure of the extent of social exclusion more generally.

Covid-19 and the criminal threat landscape

As Mr Singham notes, “the modality of crimes doesn’t stay still, it evolves.” As in other areas, covid-19 again has acted as an accelerant here. In general, the greater movement of activity online has driven an increase in cybercrime worldwide¹⁴ such as greater use of malware and ransomware. The most widespread problem, however, has been a rise in scamming – with initial contact made online or by telephone.¹⁵ In Singapore, online scams have been a particular challenge. Mr Singham reports that during 2020 the already low crime rate in the city dropped by 16% if one left out scams, but rose by 6% overall if included.

The shift to cybercrime during the pandemic appears to be associated with a drop in physical crime. It may be that criminals are obeying work from home orders as much as everyone else, but both Mr Hino and Mr Singham warn that this might not be the case.

It may just be harder in a lockdown to report a crime, especially when, Mr Hino adds, the likely culprit may be a close family member.

Mr Singham explains that success against scams begins with educating residents so that they understand how to avoid being drawn in. That effort is paying off: “people are more alert to it and know how to make a report.” Similarly, the police have worked with private telecoms companies and internet service providers to reshape the environment. In particular, they have made it harder for those seeking to perpetrate scams from outside the country to hide the fact they are not phoning from a local number. Equipping the public and enhanced police efforts are leading to progress. In 2020, the authorities were able to freeze more than 9,000 bank accounts and recover 35% of funds reported lost to scams.

Even as crime evolves, the lessons of physical security can help create a more secure digital environment.

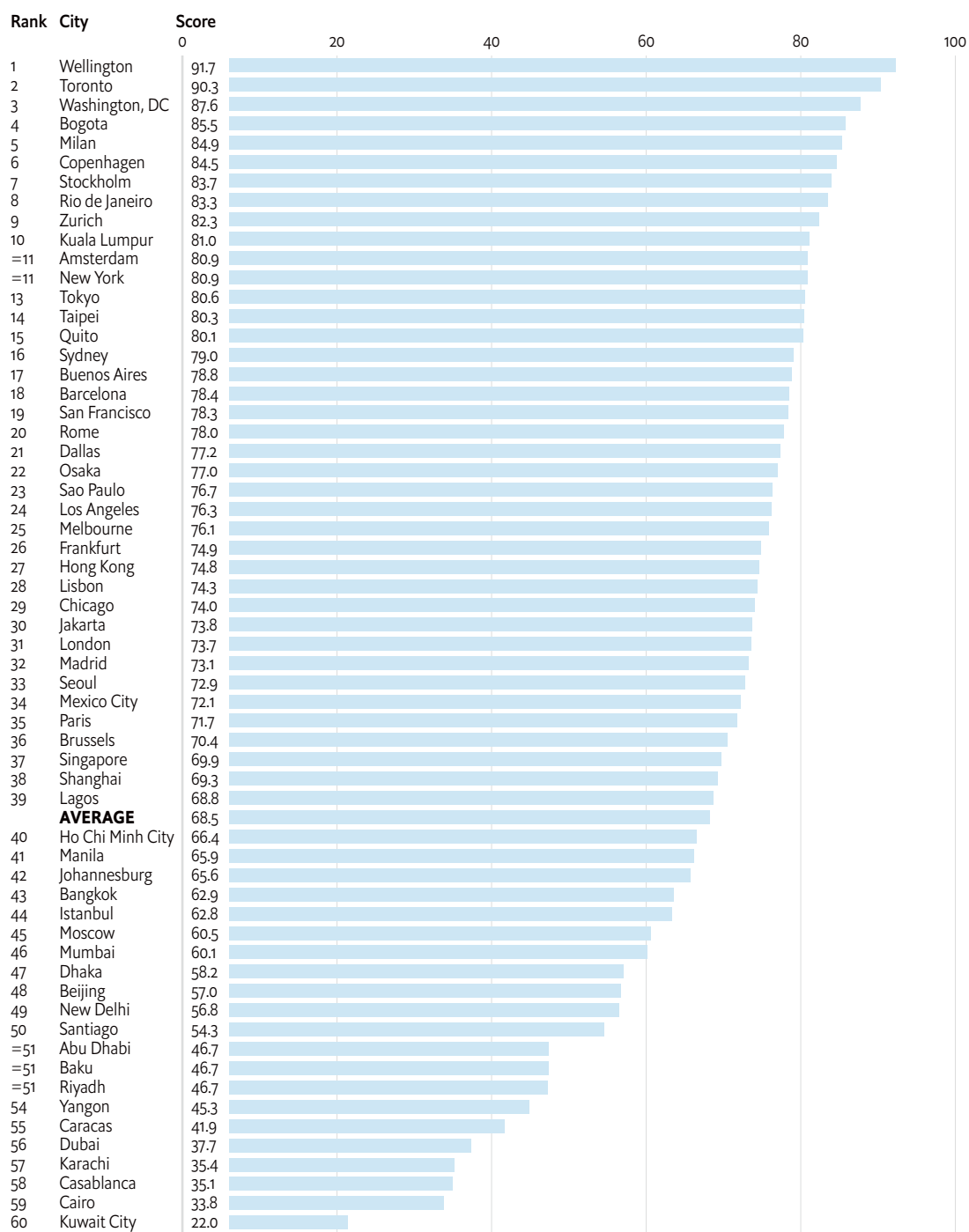


¹⁴ *The COVID-19 pandemic and trends in technology*, Chatham House Research Paper, February 2021, <https://www.chathamhouse.org/2021/02/covid-19-pandemic-and-trends-technology/03-covid-19-changing-cybercrime-landscape>

¹⁵ Interpol, *Cybercrime: COVID-19 Impact*, August 2020, <https://www.interpol.int/en/News-and-Events/News/2020/INTERPOL-report-shows-alarming-rate-of-cyberattacks-during-COVID-19>



Environmental security: Policy progress has still not achieved its goals



Strong policies in most cities

As with every other pillar, a city's level of economic development correlates closely with its environmental security scores. An important difference, though, shows that leading middle-income cities do far better in this area than in any other. In particular, three at this income level finish in the pillar's top ten: Bogota (4th); Rio de Janeiro (8th); and Kuala Lumpur (10th). The highest that a middle-income country finishes in any other pillar is in health, where Beijing and Shanghai tie for 19th. This relative strength among middle-income cities may reflect history: both Mr Léon and Mr Van Begin note that environmental resilience at the urban level had a high profile in the global south before moving up the agenda in the north.

Moreover, in some cases, the source of income may matter more than its extent. Four high-income cities that finish in the bottom ten places of the environmental security pillar overall – Abu Dhabi (tied for 51st), Riyadh (tied for 51st), Dubai (56th) and Kuwait City (60th) – as well as the two upper middle-income ones – Baku (tied for 51st) and Caracas (55th). They have in common the high contribution of fossil fuel exports to their national economies.

Another reason why scores in this pillar are less tied to income levels than the others is that policies related to environmental security are ubiquitous. Although the depth of detail varies, our index scores show that only five cities fail to mention sustainability in

their master plans altogether; just seven lack any renewable energy incentives; and only three fail to provide wider green economy incentives. This widespread success in our scoring does not result from choosing overly easy indicators. Mr Van Begin comments that “your research confirms what we see. Sustainability planning has become mainstream. Rarely do we get to a city that says ‘we don't have anything.’ Many policies are in place, which is good.” Although the precise local definition of environmental security varies with the specific challenges that a city faces, he continues, the growing profile of issues related to sustainability, climate change and resilience have driven city leaders worldwide.

The pandemic has driven environmental security up the agenda

As in other areas of urban security, covid-19 has exercised a substantial impact on the environment. The immediate outcomes can be mixed: the World Bank's Mr Wahba notes that reduced travel has improved air quality in many cities, but efforts to reduce viral transmission through packaging has led to an increase in single-use plastics and attendant pollution.

Looking at the longer term, if anything, the experience of the pandemic will lead to more extensive and ambitious green policies. Several of our experts report seeing, in Mr Van Begin's words, “a direct link between

the impact of covid-19 and an enormous uptake on sustainability issues at the urban level.” Part of this, explains Ms Zhao, is the greater appreciation that the pandemic and associated lockdowns gave to the importance of environmental issues such as air quality and pollution. More important, she and others add, is that by exposing weaknesses in the area of health, the experience of the virus has increased city officials’ focus on the need for resilience in the face of other challenges. As Mr Van Begin puts it, city leaders have “understood that we are exposed to many other possible abrupt catastrophes. So resilience, more than ever, has become front of mind at the local level.”

The foremost catastrophes are those potentially arising from climate change. The thinking, notes Mr Léon, is that “while in the relatively short term, covid-19 is bringing us a health crisis, the crisis in the medium term will be socio-economic. However, we must not forget that in the long term climate change will be one of the most important challenges we face.” The extent of the growth in urban leaders’ focus on climate issues is difficult to measure robustly. That said, one study from September 2020 found that within the preceding year the number of cities worldwide with net-zero carbon pledges rose from 101 to 823.¹⁶ Since that publication appeared, several hundred new cities have joined the UN-led Race to Zero coalition.¹⁷ Although not likely to have an immediate, direct impact

on environmental security, this can be only good news for mitigation efforts over the longer term.

Some of this increase would have happened anyway: the net-zero movement began to gain traction in 2019, before covid-19 made its presence felt. It is, nevertheless, hard to disagree with Ms Akhmouch when she says “the pandemic is going to accelerate the rethinking of cities and how we live,” especially with regard to the environment, “because of the unique combination of the ‘Zoom effect’ and the ‘Greta effect.’”

This heightened focus on resilience and environmental security is timely for two reasons. First, as Mr Susskind notes, while cities can provide leadership on climate change mitigation, it “is ultimately a global problem. Adaptation, on the other hand, needs to be done locally.” The latter will require engaged cities.

Second, explains Ms Akhmouch, the expected growth in cities in the coming decades can – with correct policies – create a huge resilience opportunity. Mr Chapman predicts that green infrastructure and natural capital together form “the next big piece” that will differentiate the most desirable cities.

The implementation challenge

While policy performance in this field is strong and getting stronger, “the problem”, as Mr Van

¹⁶ Data-Driven EnviroLab and NewClimate Institute, *Accelerating Net Zero: Exploring Cities, Regions, and Companies’ Pledges to Decarbonise*, September 2020, https://newclimate.org/wp-content/uploads/2020/09/NewClimate_Accelerating_Net_Zero_Sept2020.pdf

¹⁷ Compare figures in “Celebrating one year on from the Climate Ambition Alliance, the #RaceToZero campaign has brought together the largest global alliance committed to net zero”, Cop25 blog post, September 21st 2020, <https://cop25.mma.gob.cl/en/celebrating-one-year-on-from-the-climate-ambition-alliance-the-racetozero-campaign-has-brought-together-the-largest-global-alliance-committed-to-net-zero/>, and in “700+ cities in 53 countries now committed to halve emissions by 2030 and reach net zero by 2050”, C40 press release, April 16th 2021, https://www.c40.org/press_releases/cities-committed-race-to-zero.

Begin says, “lays in implementation. There is still a lot to be done.” Our index results reflect this well. Environmental security has both the highest average input, or policy, score (86.5 points) and the lowest output, or results, score (50.5) of any pillar. To put it in context, this gap of 36 points is 12-fold the average difference between combined input and output scores for the other pillars.

In explaining the difficulties in policy implementation, as Ms Akhmouch puts it, “of course economic development matters,” but it is far from the only thing. Indeed, while some environmental security initiatives are no doubt expensive, Mr Gupte notes that “sustainable solutions can be cost-effective [compared with, for example, more traditional infrastructure] and do not have to be difficult to finance.” He cites as one example the Emergency Resilient Recovery Project of Mozambique’s Ministry of Education. With UN-Habitat’s technical assistance and World Bank funding, this rehabilitated and rebuilt resilient schools in severely flood affected and climate precarious areas. The effort employed traditional skills and local materials such as mud, rocks, and bamboo, as well as a participative approach that used local skills and materials while providing training to the community on resilient construction techniques and employment.

Again, a more detailed look at our data yield an unexpected yet relevant result. On the one hand, both environmental security aggregate input and output scores correlate with city HDI results, indicating that levels of

policy ambition and the state of the urban environment improve with income. On the other hand, the size of the gap between input and output scores also rises with HDI. In other words, although richer cities tend to have more extensive policies, they are still not achieving results consistent with their ambitions.

This study is far too short to provide a detailed manual to urban environmental policy implementation. Our interviewees, however, point to two basic prerequisites for success, both related to holistic governance.

The first involves urban administrations. Ms Akhmouch explains that the main practical barrier that the OECD sees to environmental policy implementation “is a huge fragmentation of planning systems and the persistence of silos. Many cities are investing a lot in plans that on paper are holistic, but use a sectoral approach for implementation.” This results in a failure to consider the inevitable trade-offs between sectors or how best to sequence change. “You don’t get coherence,” she continues. To address the issue, she adds, a growing number of cities are accordingly using Sustainable Development Goals within planning to “connect the dots within the city and rethink planning, investment and budget allocation from the ground up” in order to foster effective implementation.

Second, effective action in this field requires city governments not to command change but to lead an effort with actors from across society. Mr Susskind explains that “the

majority of actions required to respond seriously to climate risk involve collective choices. The whole community has to legitimise an overall action plan; it can't just be the responsibility of individual departments." Similarly, says Mr Van Begin, "political governance is a defining element of success, including the way to reach out to citizens and get them on board. These kind of actions require a number of stakeholders. You cannot just do this top down."

Urban partnerships of various social actors are necessary for much environmental activity, not just large-scale measures in the face of climate risk. "Nobody can do environmental security alone," notes Mr Tory. Success "comes from partnerships." He cites a telling, intentionally small example. A commonly used takeout container in Toronto is non-recyclable. Impeding change is consumer preference: many think that the food simply looks better in these black, plastic trays than when sold in other containers. To address this, Mr Tory says, requires "a partnership between consumers and the private sector. One has to say 'we will get over how it looks but you have to find ways to make it recyclable.' That is the spirit needed." Meanwhile, if research is necessary to solve that problem, funding partnerships with the local public sector may be appropriate. "There is deep caring about the environment and buy-in for change," he concludes. "We will have to change how institutions partner and know how to use financial and regulatory tools to incent."

It is suggestive that, of those cities finishing in the bottom ten in aggregate scores of environmental security outputs, only New Delhi is in a country that scores greater than 5.1 out of ten in The Economist Intelligence Unit's latest Democracy Index. Even those cities with more democratic environments, however, will need to find better ways to engage. Mr Susskind points out that the the collective decisions needed to achieve environmental security will in some cases involve drastic steps, such as emptying out sections of the community that cannot be protected. The capacity to engage stakeholders and co-ordinate collective action to this extent "is not there in northern, developed places or in places in the less-developed global south. We have no good models yet for collaborative decision-making and risk management. It is not enough to have a policy. The policy needs to reflect collective choices."

Conclusion

Covid-19 has driven the broader city safety agenda in at least four ways. The most obvious is that the disease has posed its own danger to the health of urban residents, especially for people who are older or have underlying medical conditions. Second, it has forcefully reminded us of dangers that success against infectious disease had allowed many to ignore for some time: as biological organisms, humans need cities with a wide range of assets – including not just healthcare, but also those related to infrastructure and the environment – in order to deal with the multi-faceted problems arising when microbes attack. Third, this ongoing blink in history has alerted us to risks arising from what we are becoming: as lockdowns have accelerated technological and social trends, it has become clear that many cities remain unprepared for at least some of the resultant vulnerabilities. Finally, it has led us to think about the kind of cities we want to live in, a reconsideration that, in turn, has led us to reassess longer term dangers in the way of achieving safe, sustainable, liveable cities as well as opportunities for getting there.

As a result, as Mr Léon puts it, while “for some this is a crisis, for some it is an opportunity.” Both are correct. The pandemic is an immediate health challenge, but it has also created a potential turning point across every pillar of urban safety. A renewed, more holistic understanding of urban safety gives hope for cities that are not just more secure, in every sense, but more sustainable and enjoyable places in which to live.

Not everything, however, is positive. Mr Gupte warns against the risk of “many decisions, taken in heat of the moment of the pandemic, which bend or burden data privacy relationships or raise broader legal and ethical worries, getting hardwired into the longer-term status quo.” Indeed, the opportunity that covid-19 provides comes with old challenges for urban societies in new forms – what Mr Hino calls the “trilemma of safety (including health), economic security and liberty (including privacy).” As cities address the intertwined maze of safety-related challenges raised in the wake of covid-19, they will need to balance these – and other – fundamental considerations.

In doing so, our experts repeatedly refer to two underlying pieces of guidance. One is to take a holistic, resilient approach that is flexible enough to focus on immediate crises while seeing the implications of different kinds of security for all the others. Reaching this state, says Mr Léon, takes a lot of difficult decisions, “but I think the cities of the world will adapt.” More important, officials, experts – and, indeed, those of us who define city safety implicitly through indexes – need to be humble. The constantly evolving contours of what urban security means must be decided on by citizens and achieved with their cooperation. It is in this context that a range of promising developments – from the smart cities to the increasing deployment of green infrastructure – can make the greatest contribution. As Mr Assiago explains, the goal should not be “securitised cities, but to have ones where people can interact while feeling safe and not intruded on.”



Appendix: Index methodology

A. Overview

The Safe Cities Index is a global, policy benchmarking tool developed to measure urban safety. The index measures urban safety in an objective manner around the world, enabling comparability across cities of varying sizes and at different income levels. The index encompasses multiple dimensions such as infrastructure, socioeconomic factors, governance and technological systems. The index covers major cities across different geographies, income levels, and size. In recent years, urban safety has evolved to include factors that range from the physical to the virtual. Moreover, the covid-19 pandemic has exposed gaps and weaknesses in existing city-defenses, leading policymakers to urgently refocus their attention on the evolving risks and rethink their urban strategies.

The Safe Cities Index was first launched in 2015 with 44 indicators and 50 cities. Since then, the index has been updated once every two years, increasing city coverage as well as strengthening the framework to include emerging challenges in urban safety. As the index moves into its fourth iteration in 2021, the framework has been further updated to reflect the dynamic nature of the urban safety landscape with a special focus on health security as the world struggles to emerge from the pandemic.

B. The Safe Cities Index 2021 framework

The covid-19 pandemic has played a major role in shaping the index framework for this year's edition. The 2021 Safe Cities Index consists of 76 sub indicators grouped under 5 domains. Below is a summary of the updates made to the framework.

Framework updates

The index framework has been subjected to an extensive reevaluation and has undergone significant changes, including updates to existing indicators, updates to scoring methodology, addition of new indicators under existing domains and the addition of a new domain to the framework.

- 1. Addition of a new domain:** With the growing importance of sustainable development, particularly in urban areas, we decided to include environmental security as a stand-alone category in the index for this year. In prior editions of the index, sustainability-related indicators were distributed across the index. However, given the growing attention to sustainability by city planners and policy makers, we decided to cut this out into a separate stand-alone category by itself. The focus on environmental sustainability in cities has become an important factor in urban safety.

2. Deepening existing domains: The initial four domains have been updated with new indicators to capture emerging issues in urban safety over the years. Key updates that have been made are to the domains of health and personal security. The health security domain has been updated to include indicators assessing the pandemic preparedness and performance of cities. The personal security domain has been updated with additional indicators to measure economic security, women's safety and the capacity of the judicial system.

3. Other updates: Some indicators from the 2019 framework have been removed, while others have been modified with updates to their scoring guidance and data sources in line with their broader relevance to urban safety.

City updates

The 2021 index benchmarks 60 cities. The composition of cities remains similar to 2019, with the exception of one replacement. The city of Lima from Latin America has been removed. Lisbon from Europe has been added to the list of cities in the 2021 index. Please refer to table A2.1 for a complete list of cities in the 2021 index.

C. Index domains

Digital security assesses the ability of urban citizens to freely use the internet and other digital channels without fear of privacy

violations, identity theft and malicious online attacks. On inputs, cities are scored on their awareness of digital threats and cybersecurity preparedness and the safety of smart cities. On outputs, the index measures the number of secure internet servers and the risk of online attacks. New indicators were added to measure the safety of smart cities.

Health security measures how cities fare on the level and quality of healthcare services and infrastructure in the city. On inputs, cities are scored based on the availability, access and quality of healthcare service. Output indicators include metrics such as life expectancy, infant mortality and other sub-indicators. New indicators have been added to both inputs and outputs to measure pandemic preparedness and performance and mental health issues.

Infrastructure security considers the built physical environment, measuring the availability, quality and sufficiency of existing city infrastructure and its vulnerability to man-made and natural disasters. On inputs, the index takes into account sub-indicators such as the quality of infrastructure as well as the enforcement of transport safety, while outputs include metrics such as the number of deaths from road traffic accidents and climate related disasters.

Personal security considers how at-risk citizens are from crime, violence, terrorist threats, natural disasters and economic vulnerabilities. Input indicators in this domain

take into account policies and decisions such as the capacity of the judicial system, gun regulation, political stability, laws around women's safety and economic security. On outputs, the index takes into account the prevalence of petty and violent crime, threat of civil unrest, corruption levels and new indicators assessing income inequality.

Environmental security considers how the city has incorporated sustainability parameters into its urban planning to reduce carbon emissions and manage climate risks. It takes account of policy inputs aimed at improving the health of the natural and physical environment in urban areas, where many have witnessed severe deterioration in recent years. Input indicators in this domain look at the city's sustainability master plan and market incentives for renewable energy sources. Output indicators include urban tree cover and the rate of water stress in cities.

D. Indicators

The Safe Cities Index 2021 includes both quantitative and qualitative indicators. The index comprises 76 individual sub-indicators.

Quantitative indicators: 31 of the 76 sub-indicators are based on quantitative data. For example, the number of secure internet servers and life expectancy at birth.

Qualitative indicators: 45 of the 76 sub-indicators are qualitative assessments based on a methodology decided upon by The EIU. For example, privacy policies and prevalence of petty crime.

E. Indicator normalisation

In order to be able to compare data points across cities, as well as to construct aggregate scores for each city, the gathered data is made comparable. To do so, the quantitative indicators were normalised on a scale of 0-100 using a min-max normalisation, where each score represents the standard deviation/s from the mean, with the best performing city scoring 100 points and the weakest performing city scoring 0.

Qualitative indicators were normalised as well. In some instances, those scores were on a scale of 0-4 with 0 being the lowest or most negative score, and 4 being the highest or most positive score — these were normalised in a similar manner to quantitative indicators.

While normalised values (that is, a score of 0-100) allows for direct comparability with other normalised indicator scores, min-max scoring also leads to changes in scores from the previous edition of the index, even without an actual change in raw data-driven performance. For example, in an indicator with normalised scoring, if the score of the weakest-performing city is lower than that of the previous edition of the index, the scores of other cities in scope will be impacted regardless of actual (raw data-driven) performance.

F. Index construction

The index generates an aggregate score/ ranking across all the underlying indicators. The index is first aggregated by

domain — creating a score for each domain (for example, personal safety) — and finally, overall, based on the composite of the underlying domain scores. To create the underlying domain scores, each underlying indicator was aggregated according to an assigned weighting. Sub-indicators are all weighted equally, as are the four domains.

G. Index weights

By default, each domain in the index is weighted equally while calculating the final scores and ranks. The EIU default weights for each domain in the 2021 index are as follows:

Digital security:	20%
Health security:	20%
Infrastructure security:	20%
Personal security:	20%
Environmental security:	20%

In the 2021 edition, we have included an option of “covid-weights” that awards a higher weight to the health security domain. The covid weights for each domain in the 2021 index are as follows:

Digital security:	18.8%
Health security:	25%
Infrastructure security:	18.8%
Personal security:	18.8%
Environmental security:	18.8%

Table A2.1 The Index framework

INDICATOR	UNIT	SOURCE	TYPE
1. Digital security			
Inputs			
1.1.1) Privacy policy	Scale: 0-4	DLA Piper Data Protection Laws of the World	Qualitative
1.1.2) Citizen awareness of digital threats	Scale: 0-4	Economist Intelligence Unit analysis	Qualitative
1.1.3) Secure smart cities	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
1.1.4) Cybersecurity preparedness	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
1.1.5) Public-private partnerships	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
Outputs			
1.2.1) Percentage with internet access	%	World Bank; International Telecommunication Union; Economist Intelligence Unit analysis	Quantitative
1.2.2) Secure internet servers	# per million	World Bank	Quantitative
1.2.3) Risk of attacks	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
1.2.4) IT infrastructure risk	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
1.2.5) Percentage of computers infected from online attacks	Scale: 0-5	Kaspersky Lab	Quantitative
2. Health security			
Inputs			
2.1.1) Universal healthcare coverage	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
2.1.2) a) Availability of public healthcare	Scale: 0-4	EIU Liveability Index	Qualitative
2.1.2) b) Availability of private healthcare	Scale: 0-4	EIU Liveability Index	Qualitative
2.1.2) c) Availability of OTC drugs	Scale: 0-4	EIU Liveability Index	Qualitative
2.1.3) a) Quality of private healthcare provision	Scale: 0-4	EIU Liveability Index	Qualitative
2.1.3) b) Quality of public healthcare provision	Scale: 0-4	EIU Liveability Index	Qualitative
2.1.4) a) No. of beds per 1,000	#	Economist Intelligence Unit analysis	Quantitative
2.1.4) b) No. of doctors per 1,000	#	Economist Intelligence Unit analysis	Quantitative
2.1.5) Access to safe and quality food	Score: 0-100	EIU Global Food Security index	Quantitative
2.1.6) Policy on substance abuse / drug use	Scale: 0-1	Economist Intelligence Unit analysis	Qualitative
2.1.7) Pandemic preparedness	Score: 0-100	EIU Global Health Security Index	Quantitative
2.1.8) Mental health	Scale: 0-1	Economist Intelligence Unit analysis	Qualitative
Outputs			
2.2.1) Emergency services in the city	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
2.2.2) Life expectancy years	# of years	Economist Intelligence Unit analysis	Quantitative
2.2.3) Infant mortality	# per 1,000	Economist Intelligence Unit analysis	Quantitative

INDICATOR	UNIT	SOURCE	TYPE
2.2.4) Cancer mortality	Age-standardised	International Agency for Research on Cancer; World Health Organization	Quantitative
2.2.5) Lifestyle related disease burden	Mortality rate	Global Health Data Exchange; Economist Intelligence Unit analysis	Quantitative
2.2.6) Mental health burden	DALYs, rate per 100,000	Global Health Data Exchange	Quantitative
2.2.7) Covid-19 mortality	DALYs, rate per 100,000 # per 100,000 (as on March 2021) ¹	Economist Intelligence Unit analysis	Quantitative

3. Infrastructure security

Inputs

3.1.1) Enforcement of transport safety	Scale: 0-10	World Health Organization	Qualitative
3.1.2) Pedestrian friendliness	%	Pedestrians First, Institute for Transportation & Development Policy; Economist Intelligence Unit analysis	Quantitative
3.1.3) Disaster management / business continuity plan	Scale: 0-4	Economist Intelligence Unit analysis	Qualitative
3.1.4) Water infrastructure	Scale: 0-4	EIU Liveability Index	Qualitative
3.1.5) Hazard monitoring	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative

Outputs

3.2.1) Road traffic deaths	# per million population	Economist Intelligence Unit analysis	Quantitative
3.2.2) Deaths from climate-related disasters	Rank	German Watch	Quantitative
3.2.3) a) Transport infrastructure: Air transport facilities	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
3.2.3) b) Transport infrastructure: Road network	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
3.2.3) c) Transport infrastructure: Rail network	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
3.2.4) Power network	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
3.2.5) Institutional capacity and access to resources	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
3.2.6) Catastrophe insurance	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
3.2.7) Disaster-risk informed development	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
3.2.8) a) Percentage living in slums	%	World Bank; Economist Intelligence Unit analysis	Quantitative
3.2.8) b) Percentage of homeless population	%	Economist Intelligence Unit analysis	Quantitative

4. Personal security

Inputs

4.1.1) Use of data-driven techniques for crime	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
4.1.2) Gun regulation and enforcement	Scale: 0-10	Economist Intelligence Unit analysis	Qualitative
4.1.3) a) Threat of terrorism	Scale: 0-4	EIU Liveability Index	Qualitative
4.1.3) b) Threat of military conflict	Scale: 0-4	EIU Liveability Index	Qualitative

¹ Note: Mortality rates have been used to examine the response to the covid-19 pandemic as, at the time of reviewing the framework and gathering the data, the global vaccination drive was only getting started.

INDICATOR	UNIT	SOURCE	TYPE
4.1.3 c) Threat of civil unrest	Scale: 0-4	EIU Liveability Index	Qualitative
4.1.4 a) Police personnel per capita	# per 100,000	Economist Intelligence Unit analysis	Quantitative
4.1.4 b) Prosecution personnel per capita	# per 100,000	Economist Intelligence Unit analysis	Quantitative
4.1.4 c) Professional judges or magistrate personnel per capita	# per 100,000	Economist Intelligence Unit analysis	Quantitative
4.1.5) Expenditure on social security	%	Organisation for Economic Co-operation and Development	Quantitative
4.1.6 a) Laws on domestic violence	Scale: 0-4	Organisation for Economic Co-operation and Development	Qualitative
4.1.6 b) Laws on sexual harassment	Scale: 0-4	Organisation for Economic Co-operation and Development	Qualitative
Outputs			
4.2.1 a) Prevalence of petty crime	Scale: 0-4	EIU Liveability Index	Qualitative
4.2.1 b) Prevalence of violent crime	Scale: 0-4	EIU Liveability Index	Qualitative
4.2.2) Organised crime	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
4.2.3) Severity of terrorist attacks	Scale: 0-10	Global Terrorism Index, Institute for Economics & Peace	Qualitative
4.2.4) Deaths from substance use disorders	Age-standardised (rate)	Global Health Data Exchange	Quantitative
4.2.5) Level of corruption	Scale: 0-4	EIU Liveability Index	Qualitative
4.2.6) Enforceability of contracts	Scale: 0-4	EIU Operational Risk Briefing	Qualitative
4.2.7 a) Income inequality levels	Gini coefficient	Economist Intelligence Unit analysis	Quantitative
4.2.7 b) Share of population in vulnerable employment	%	World Bank	Quantitative
4.2.8 a) Female homicide rates	# per 100,000	Economist Intelligence Unit analysis	Quantitative
4.2.8 b) Prevalence of domestic violence	%	Organisation for Economic Co-operation and Development; Economist Intelligence Unit analysis	Quantitative

5. Environmental security

Inputs

5.1.1) Sustainability masterplan	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
5.1.2) Incentives for renewable energy	Scale: 0-1	Economist Intelligence Unit analysis	Qualitative
5.1.3) Green economy initiatives	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative
5.1.4) Waste management	Scale: 0-2	Economist Intelligence Unit analysis	Qualitative

Outputs

5.2.1) Sustainable energy	%	Economist Intelligence Unit analysis	Quantitative
5.2.2) Rate of water stress	Scale: 0-4	World Resources Institute	Qualitative
5.2.3) Air quality levels	µg/m ³	Economist Intelligence Unit analysis	Quantitative
5.2.4) Urban forest cover	% of city area	Economist Intelligence Unit analysis	Quantitative
5.2.5) Waste generation	Kg/capita/year	Economist Intelligence Unit analysis	Quantitative

Table A2.2 List of Cities

Abu Dhabi	Caracas	Istanbul	Madrid	Paris	Singapore
Amsterdam	Casablanca	Jakarta	Manila	Quito	Stockholm
Baku	Chicago	Johannesburg	Melbourne	Rio de Janeiro	Sydney
Bangkok	Copenhagen	Karachi	Mexico city	Riyadh	Taipei
Barcelona	Dallas	Kuala Lumpur	Milan	Rome	Tokyo
Beijing	Dhaka	Kuwait City	Moscow	San Francisco	Toronto
Bogota	Dubai	Lagos	Mumbai	Santiago	Washington, DC
Brussels	Frankfurt	Lisbon*	New Delhi	São Paulo	Wellington
Buenos Aires	Ho Chi Minh City	London	New York	Seoul	Yangon
Cairo	Hong Kong	Los Angeles	Osaka	Shanghai	Zurich

* New city added in 2021

While every effort has been taken to verify the accuracy of this information, The Economist Intelligence Unit Ltd. cannot accept any responsibility or liability for reliance by any person on this report or any of the information, opinions or conclusions set out in this report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor.

LONDON

20 Cabot Square
London, E14 4QW
United Kingdom
Tel: (44.20) 7576 8000
Fax: (44.20) 7576 8500
Email: london@eiu.com

GENEVA

Rue de l'Athénée 32
1206 Geneva
Switzerland
Tel: (41) 22 566 2470
Fax: (41) 22 346 93 47
Email: geneva@eiu.com

NEW YORK

750 Third Avenue
5th Floor
New York, NY 10017
United States
Tel: (1.212) 554 0600
Fax: (1.212) 586 1181/2
Email: americas@eiu.com

DUBAI

Office 1301a
Aurora Tower
Dubai Media City
Dubai
Tel: (971) 4 433 4202
Fax: (971) 4 438 0224
Email: dubai@eiu.com

HONG KONG

1301
12 Taikoo Wan Road
Taikoo Shing
Hong Kong
Tel: (852) 2585 3888
Fax: (852) 2802 7638
Email: asia@eiu.com

SINGAPORE

8 Cross Street
#23-01 Manulife Tower
Singapore
048424
Tel: (65) 6534 5177
Fax: (65) 6534 5077
Email: asia@eiu.com