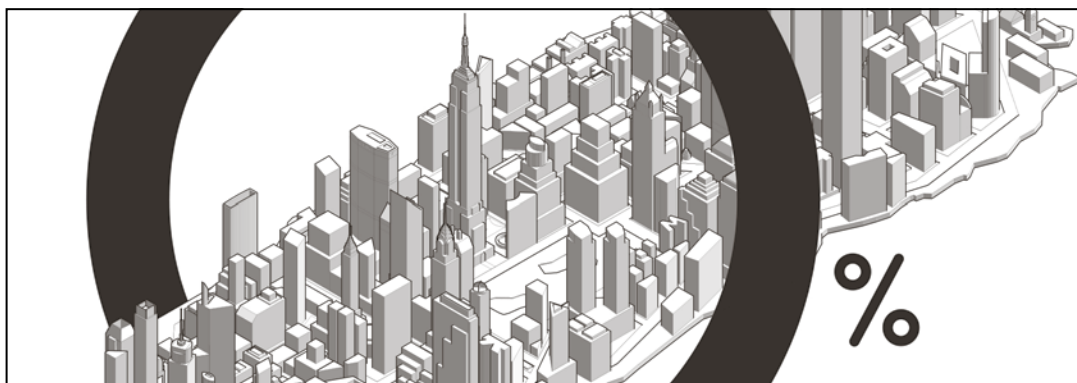


FUTURE OF INFRASTRUCTURE

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in a climate emergency

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FUTURE OF INFRASTRUCTURE

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JAPAN

Society 5.0: Japan's lofty plans face hurdles

Japan's ambition to create a more efficient, integrated society with a thriving economy may be difficult to achieve in a country that is crying out for huge investments in physical infrastructure

Olivia Gagan

Evolution of human society can be split into five phases, at least according to the government of Japan. First, we started out as hunter-gatherers. Then we learnt to till the land and agriculture ensued. The third step was the Industrial Revolution. Fourth, came the internet age. Japan's Society 5.0 is the next step forward.

In Society 5.0, social problems are solved by fully integrating digital technology into the physical world. Carbon emissions are cut by driverless vehicles choosing the shortest route home. Robots take care of the elderly, using body sensors to flag up if additional human help is needed. Artificial intelligence (AI) will sift your online history and health records to build you the perfect itinerary for a city break, for example, tailored just so to your tastes and abilities, and the weather forecast.

Society 5.0 is one of the key tenets of Abenomics, Japan's prime minister Shinzō Abe's suite of fiscal policies. The plans are aimed to power economic growth in a country that is struggling with an ageing population, a falling birth rate and poor rural infrastructure, which is leading to high regional inequalities. In other words, Japan has people problems, which it is hoping to solve with big data.

"Society 5.0 will achieve a forward-looking society that breaks down the existing sense of stagnation, a society whose members have mutual respect for each other, transcending the generations, and a society in which each and every person can lead an active and enjoyable life," according to the Japanese government.

These are lofty aspirations, so how will Society 5.0 play out in real life? Dr Yoshikatsu Shinozawa, an academic at SOAS University of London, specialising in Japanese business and finance, says the Japanese public aren't that aware of Society 5.0, let alone supporters of it. "If you asked, say, ten Japanese people whether they know of the concept, more than half would say they have never heard of it," he says. "A big reason for this is there are no physical achievements related to Society 5.0 yet."

In a country wanting tangible improvements to its physical infrastructure, Society 5.0 relies on things that can't be seen, like data-bases and machine-learning.



Liam Burnett-Blair/Anuphah

For example, poor public transport in rural Japan is a major challenge. The government believes this has led to underpopulation and a flight to other countries by young would-be workers. Under Society 5.0, driverless buses and taxis would bring rural dwellers cheap, easy access to cities and jobs.

Japan's decades-long labour shortage is a huge stumbling block for the construction and engineering sectors, too, and has led to a backlog of much-needed infrastructure improvements. In Society 5.0, this would be solved by using sensors, AI and robots instead of humans to inspect and maintain roads, bridges, tunnels and dams.

Using AI and driverless vehicles to eke out the life of ageing roads, bridges and tunnels is a hard sell in a country where citizens face an estimated \$5-trillion bill for upgrades to infrastructure ravaged by overuse and typhoons. Providing new roads, buses and bridges in remote regions is likely to be a more welcome proposition than the promise of robot-led repairs to crumbling existing infrastructure.

Building up Society 5.0's digital infrastructure will also require citizens to hand over personal information. Japan's populace has been wary of giving such details to the state. A digital identity programme called My Number,

39% of Japanese adults say they are fairly or very satisfied with their national infrastructure in general

48% rate digital infrastructure (such as high speed broadband, full fibre networks and 5G) as fairly or very good

23% say the country is not doing enough to meet its infrastructure needs

Ipsos Mori/GIIA

similar to the UK's national insurance number scheme, assigns citizens a 12-digit ID number and enables them to access social security benefits and taxation information. It launched in 2016, but after a year only a third of the population had joined the scheme.

This year a series of lawsuits have been lodged against the government by citizens, who claim the scheme is unconstitutional. They believe the state is unfairly exposing them to the risk of data hacks and harvesting of their personal information by third parties. The government continues to back the system.

Shinozawa says integrating data, AI and robots deeply into everyday life may in fact drive members of society further away from each other, not closer together.

For example, one of the core aims of Society 5.0 is to alleviate the huge amount of care needed for Japan's ageing population, by replacing human care with robotics. To illustrate the risks, he offers me a hypothetical choice between a cheap plate of sushi from a conveyor belt or sushi handmade to order by an experienced chef. Unsurprisingly, I choose the handmade option.

"If you can afford it, of course you would prefer sushi made by a master, to eating off a conveyor belt," he says. "But if you need to save some money, you go to the conveyor belt."

"Now imagine robotic services become available for nursing homes. Which would you prefer? Someone who can afford it can still enjoy labour-intensive human care. On the other hand, if they can't afford it, it's automatic, conveyor belt-type services by robots. These are the issues we have to think about. It's kind of a dystopia."

Of course, citizens split into silos, with people separated by those who can afford human services and those who cannot, is the opposite of Japan's hopes to create a humane, highly interconnected society.

A promotional YouTube video released in Japan by the prime minister's office promises Society 5.0 will transform big data "into new wisdom... helping us enjoy more fulfilling lives".

The goal, the Japanese government stresses, "is a society centred on each and every person, and not a future controlled and monitored by AI and robots". But blending Japan's digital and physical worlds looks set to be a delicate, and difficult, balancing act. ●



Dominion Energy plans to connect 50 electric buses in Virginia with V2G infrastructure

Dominion Energy

V2G Using electric buses to power the grid

A new vehicle-to-grid infrastructure project in America aims to bring cleaner air to schoolchildren while providing added stability for the grid

Heidi Vella

Vehicle-to-grid infrastructure, also known as V2G, can transform electric vehicles into energy storage assets for utilities, helping them balance the national grid at times of peak demand. Adoption of the technology has so far been slow, however a new \$16-million V2G project being rolled out in the United States this year by Dominion Energy could prove its commercial viability.

The utility company plans to connect 50 battery-powered school buses in 16 different districts in the state of Virginia with V2G infrastructure. By 2025 they hope to scale to 1,500 vehicles.

The objective of the project is to use the electric buses as a grid resource, where Dominion Energy can store and draw energy from when needed, while also achieving cleaner air for schoolchildren and reduced operating costs for local governments.

Before embarking on the project, Dominion Energy's innovation team analysed the use patterns of some of Virginia's 13,000 school buses. They quickly realised the vehicles were a good fit for the V2G concept because of their predictable usage, down to hours or even minutes.

"The unique profile of electric school buses, where they park, the hours they operate and the miles they run, means much of the electric battery capacity isn't needed much of the time, creating a great opportunity for shared battery use," says Mark Webb, senior vice president and chief innovation officer at Dominion Energy.

According to Webb, the V2G system will operate as follows. At the end of the school day, buses will be returned to their depots and plugged into V2G chargers. Once connected, via a digital platform, Dominion Energy can charge the batteries, which takes around three-and-a-half hours, at the most optimal time, which means the company doesn't need to build additional capacity to the grid to support extra demand. When the energy is needed, which almost exclusively will be in the summer when the buses are idle, a signal can be sent to take power into the grid.

Dominion Energy has investigated specific depots where the buses may be parked and what benefit the batteries could bring to the nearby energy distribution network, as well as what upgrades are needed to adapt local systems.

In most cases, a transformer upgrade or increase will be required, with the electric connections being

fed underground, while charging points are mounted above ground.

Bidirectional energy flows will be managed through a digital platform by Proterra called APEX that will eventually be expanded into a new system to manage all the company's distributed assets, including solar and wind generation.

The electric buses cost approximately \$325,000, however Dominion Energy will provide the vehicles to schools at a comparable cost of a diesel equivalent, around \$100,000. Schools will be selected based on the value of the batteries to the local grid. Dominion Energy will own and be responsible for the upkeep of the batteries and the V2G infrastructure.

The first 50 buses are expected to be delivered by the end of the year. This additional infrastructure will help Dominion Energy better integrate renewable energy, in particular a new 2.6-gigawatt offshore wind project it is developing, by providing more flexibility for the grid.

"Offshore wind will produce more electricity to the grid primarily in the evening, afternoon or night time; with this programme we can charge the electric vehicle batteries when those renewables produce energy and have the flexibility to use it when we need it. This helps stabilise the distribution grid for voltage levels and other factors," says Dan Weekley, vice president of innovation policy and development, at Dominion Energy.

For V2G to provide real benefit to the utility company's grid management, however, it needs to be scaled up significantly, says Weekley. Hence the target of 1,500 buses by 2025.

This number of V2G enabled school buses can provide almost 350 megawatts of power that can serve around 15,000 residential homes for approximately four to five hours a day and carry the company over peak periods in summer, he explains.

Dominion Energy is absorbing the cost of the first 50 buses and accompanying infrastructure, but future investments in the programme will be paid for by its customers, costing around \$1.25 a month for each bus.

This is, however, contingent on approval from the energy regulator which has to examine the cost versus

"This project is unique because the environmental benefits are tied to the localities we serve and will go directly to our customers' kids"

the benefit. Though the company is confident the necessary legislation will pass due to the air quality gains inside the buses, which will be six times better compared to non-electric models, and because the new buses, according to estimates, are 60 per cent cheaper to operate saving municipalities up to \$8,000 a year.

"This project is unique and has been very popular because the environmental benefits, particularly for tail-pipe emissions and those inside the school buses, are tied to the localities we serve and will go directly to our customers' kids," says Weekley.

Webb adds that the success of the programme could see similar projects rolled out in other states, starting with South Carolina.

Indeed, over time, V2G is expected to become more prevalent and could even generate revenue opportunities for electric vehicle fleets, such as taxis, or for owners of electric cars by selling energy back to the grid. Ovo Energy, ENEL X North America and EDF Energy are already running trials, while the Nissan Leaf is the first electric car to offer bidirectional charging.

However, Webb thinks electric cars are the "last horizon" of opportunity for V2G technology because the variables, such as usage and charging location, are less controllable.

"It will work eventually with the right algorithms, but for now we think school buses and other similar fleets with clear patterns of use represent the best opportunity," he concludes. ●



Dominion Energy

Building tomorrow's infrastructure

Seamlessly connected global infrastructure will need to be matched by frictionless and forward-looking regulation, as well as good governance, to avoid potential litigation

What does the future look like for infrastructure?

According to Colin Wilson, partner and head of international projects at global law firm DLA Piper, citizens in a digital age demand a connected and seamless experience across the whole of infrastructure.

"Digital citizens want to take their smartphone and press an app to book a flight that is sustainable, which takes them to a well-connected airport, and then on to a new piece of metro, with the same app telling them the onward route to take by electric car, bike or bus, and to pay for it all at once on that app," he says. "So you take the user concept and apply the journey experience seamlessly across the whole infrastructure."

These technological changes bring significant opportunities for transformational change in the infrastructure industry, but at the same time require connecting competing providers and regulations fit for purpose domestically and internationally. All done in a way the tech-savvy consumer wants and at a price that works.

"However, people then ask 'Why does it take so long to deliver this?' From a legal point of view, it's not just a case of getting your cement mixer out, it's about the legal framework, rule of law and what else is needed to underpin an infrastructure that will deliver on the aspirations," says Wilson.

Worldwide, 1.5 million people move to cities each week to seek a better life. Some 54 per cent of the global population lives in urban areas, with the United Nations estimating this will reach 60 per cent by 2030. Cities

need to redesign themselves for efficiency, affordability and environmental sustainability if this level of urbanisation is to be managed.

"Green cities with smart utilities and efficient networks aren't just a neat idea, they will be a necessity," says Wilson. "High dependence on renewable energy to power electric vehicles will drive transportation-as-a-service, while houses will need innovative green construction providers."

"Green cities with smart utilities and efficient networks aren't just a neat idea, they will be a necessity"

Curiously, in 1897, London's first motorised taxis were introduced and they were electric. Proving too costly and unreliable, they were taken off the road by 1900. But 123 years later, electric cars are expected to become the norm, as part of an infrastructure based on the internet of things engineering the future, with high-speed national communications infrastructure at the heart of everything.

Martin Nelson-Jones, partner and global co-chair of infrastructure at DLA Piper, says: "At first smart cities

may be islands of connectivity, leaving rural communities more dependent on government help than private-sector investment. This begs the question of who is driving this transformation forward and the balance between the private and public sectors. Investment is needed to roll out fibre, because without that the data doesn't flow. So how is this all going to be paid for?"

Migrating to greater data flows is hugely complex. In the UK alone, an additional £1.3 billion is needed each year to provide 5G coverage to most of the country by 2027 and another £2.2 billion each year to deliver full-fibre networks by 2033. Datacentre investments have risen dramatically since 2015, both in volume and value, and momentum is building with deals in 2018 exceeding €1.2 billion, according to a recent report by DLA Piper and Acuris."

Despite infrastructure investment predicted by the World Economic Forum to be \$79 trillion by 2040, investors and asset managers are increasingly concerned about the longer-term demographic, technological and environmental impact.

Most countries are not making a sustainable investment with an annual global shortfall of \$350 billion. McKinsey Global Institute estimates \$3.3 trillion must be spent annually up to 2030 just to support expected global rates of demographic change and growth. Infrastructure assets used to last 30 years or more, but such rapid change and innovation is causing their life cycle to be less predictable.

Nelson-Jones says: "There are issues around the pace of change and future-proofing for infrastructure investors who typically seek long-term, predictable revenues. If they invest in, say, a datacentre or battery storage, they need to assess whether ten years from now the technology is not going to have changed in a way that makes it redundant or needs large amounts of money spent upgrading it. These investors are trying to get their heads round fast-moving technologies and how to achieve a stable, long-term return."

Commercial feature



The regulatory framework internationally must also be updated in a strategic way to strike the right balance between protecting the public and supporting the huge investments needed. The current system of infrastructure regulation may not necessarily require a complete overhaul, but it does need to change, and some regulations go back a long way. For example, the famous London black taxis are still regulated in part under the Town Police Clauses Act of 1847.

Change will require greater co-operation between regulators of different industries and countries. For example, a journey planned by smartphone would span aviation, rail and road, potentially in multiple countries, with data and money crossing borders and corporate groups. Might super-regulators be required? What protections can consumers expect against overcharging and data misuse or if things go wrong? What will insurance companies insure? Predictability and accountability are also important parameters for regulators tackling more complex demands, with the risk of increased regulatory complexity and overlap. Strong checks and balances, clear regulatory guidance

and recourse to effective appeals processes will need to evolve to balance the interests of consumers, service providers, investors and society.

The sting in the tail could be an increase in disputes and more litigation, Wilson warns: "If projects are not prepared or done correctly, and they are not dealing with these changes or responding to new regulation when it comes along, then we will see a lot of litigation domestically and internationally. The idea of putting a good infrastructure deal together also means making sure it is governed and managed well over a long period."

***DLA Piper and Acuris (2019) European Data Centre Investment Outlook: Opportunities and Risks in the Months Ahead**

For more information please visit dlapiper.com/infrastructure



\$3.3trn

needs to be invested each year to 2030 in order to support expected global growth rates

£1.3bn

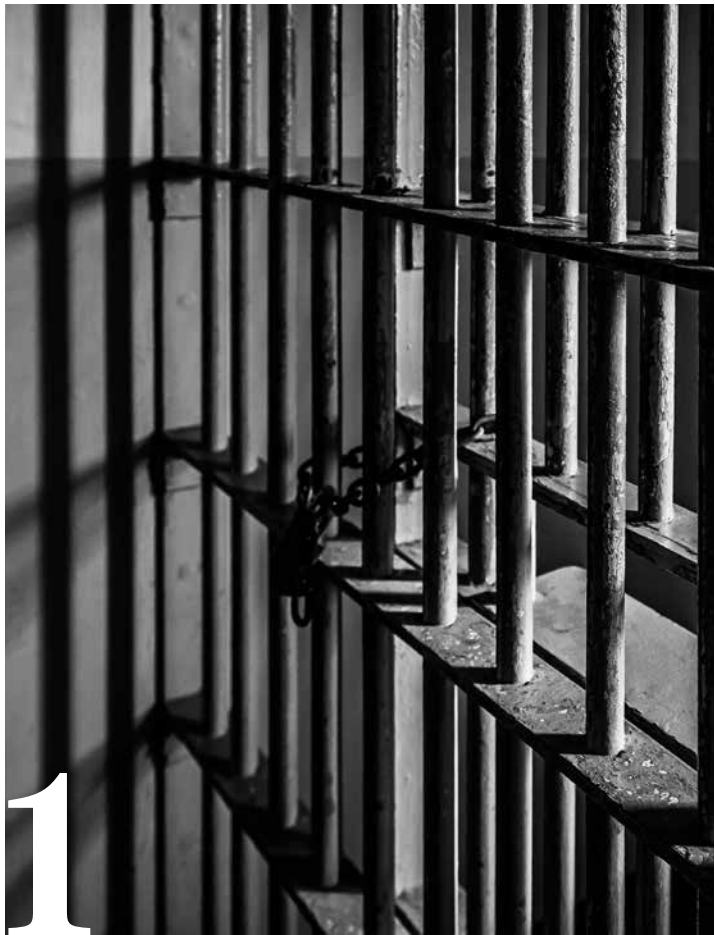
each year is needed to provide 5G coverage to most of the UK by 2027

CIRCULARITY

Overcoming obsolescence by reusing assets

From Olympic villages to bullrings, repurposing sports arenas, after the crowds have gone and the accolades awarded, is an important way of bringing buildings into the circular economy

Mark Hillsdon



Lake Placid Olympic Village

In the run-up to the 1980 Winter Olympics in Lake Placid, a small town in upstate New York, local residents held a referendum to ensure that any new buildings built for the Games had a pre-planned afterlife and wouldn't become white elephants. Having hosted the Winter Olympics in 1932, many facilities were already in place. What was needed, however, was a new Olympic Village for around 1,800 competitors. Several ideas were floated for its post-Games repurposing, including a hospital, residential housing and also permanent athletics facilities. But few local people could have expected that a few weeks after the

closing ceremony it would reopen as a prison. Athletes may have had more of an inkling about their accommodation's future use, with complaints about small rooms and cramped conditions. As *Sports Illustrated* reported, a member of the Italian Olympic Committee was so shocked at the size of the rooms that he wrote: "If two stay inside with the door closed for privacy, they'd feel as if they were in prison: suffocating." More than 900 inmates are still housed in the Ray Brook Federal Correctional Institution, probably one of the most picturesque and remote prisons in the world, and an early example of how a building can transition to the circular economy.



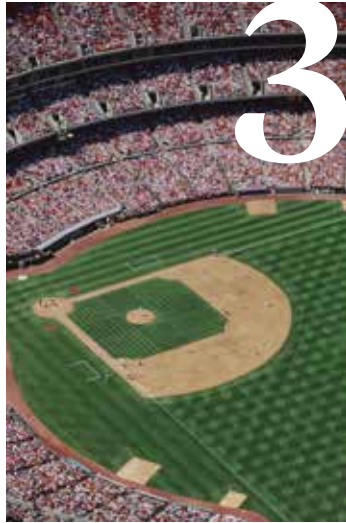
Las Arenas

In 2010, Catalonia banned bullfighting and a year later one of its greatest bullrings, Las Arenas, reopened with a new purpose and identity more befitting 21st-century Barcelona. The great cylindrical arena, with its Moorish design and symmetrical arches, opened as a bullring in 1900 and became a much-loved civic icon. But as the popularity of bullfighting waned, so did the venue's fortunes, until it finally closed in 1997. Determined not to lose such an architectural treasure, the local authorities mothballed it for over a decade, until the British architect Lord Richard Rogers was hired to breathe new life into the building. With just the historic outer shell preserved, a huge dome was added to the roof to enclose the building. The interior was then gutted and transformed into an up-market shopping mall, complete with cafés and roof-top terrace, giving 360-degree views over the city.

The developers have since been praised for providing the building with a long-term and sustainable future, and for preserving an important piece of the Barcelona's history.

Bush Stadium

Opening in 1931 as home to the Indians baseball team, the ornate Bush Stadium in Indianapolis became one of the city's great landmark buildings and was eventually added to the National Register of Historic Places in 1995. Two years later, however, it had closed, the Indians having left for a new home at Victory Fields, leaving the stadium to fall into disrepair. A brief flirtation with dirt car racing was followed by the ignominy of becoming a storage depot for second-hand cars, as part of the national Cash for Clunkers programme, before a plan to convert the stadium into apartments was announced in 2011. While part of the stadium was demolished to make way for some new buildings, the developers set out to transform the stadium in a sympathetic way. The 100-plus apartments that now make up



the Stadium Lofts circle the original ballpark and many original features, such as the old ticket booth, have been retained, while residents and visitors still pass through the stadium's original art deco stone entrance.



Pyramid Arena

Unlike the delicate flourishes of the Bush Stadium, the Pyramid Arena in Memphis, Tennessee is a child of the 1980s. The 98-metre-tall steel clad building was designed by Atlanta-based architect-engineers Rosser Fabrap and is a 60 per cent scale replica of the Great Pyramid at Cheops in

Egypt. On completion, it became the third tallest pyramid in the world. Opened in 1991 as a 20,000-seat arena for the University of Memphis basketball team, it was ear-marked to become home to the professional Memphis Grizzlies, when they moved to the city from Vancouver a decade later. But the deal fell through, with the Grizzlies deciding a new stadium, not a refurbished arena, was the best option. The Pyramid Arena stuttered on, enjoying one last sporting hurrah in 2002 when it staged the boxing world heavyweight showdown between Lennox Lewis and Mike Tyson. It closed in 2004 and was soon dubbed the Tomb of Doom by locals, with demolition looking likely for the kitsch arena. However, in 2015 it was saved from the wrecking ball and reopened as a retail heaven for the hunting, shooting and fishing fraternity, the retrofit also including an archery range, 16-lane bowling alley and a recreation of a cypress swamp, complete with alligators.

2026 World Cup

Much has been made of the sustainable objectives of recent major sporting events, perhaps in response to the sad images of derelict arenas and weed-strewn swimming pools often used to portray the legacy of the 2000 Athens Olympic Games. At London 2012, and in Rio four years later, there was a lot of noise about how venues would be dismantled and re-erected in areas where they could serve a new purpose and role in the local community. Words, sadly, were largely unmatched by deeds. In advance of the 2026 FIFA World Cup in North America, architects Archstorming launched a competition, called Residential Stadium: Adaptive Reuse, that placed buildings at the centre of the circular economy. The winning entry InsideOut envisages an arena organised into two halves, the top providing accommodation, the bottom stadium facilities.



But it is also turns the traditional insular, inward-looking view of a stadium on its head by making it both inside and outside-looking, enabling it to stage multiple events and giving it a long-term future. Another entry, Breathing City, features a stadium that is pre-designed so it can be transformed after the soccer event has ended, in this case with a split between green space and housing. ●

Engineering net-zero carbon in a climate emergency

Played out on TV screens and front pages worldwide, the upsurge in interest and activity around climate breakdown over the last 12 months may seem dramatic and sudden, but the signs were already there

The influential report of the Intergovernmental Panel on Climate Change set alarm bells ringing about timelines for achieving the 1.5C target in the Paris Agreement. In its wake came the call from the Committee on Climate Change for governments to legislate for net-zero emissions by 2050. The UK then promptly became the first major world economy to enact that goal and pass it into law.

At the same time, there has been a mainstream raising of both public consciousness and business awareness around the climate emergency, involving everyone from Sir David Attenborough and Greta Thunberg, via Mark Carney at the Bank of England to BlackRock and Extinction Rebellion. With public, private and third-sector actors therefore becoming visibly aligned, society is fast approaching a tipping point around climate risk and resilience, in which infrastructure will not only be seriously impacted, but significantly involved, says Duncan Price, head of sustainability at Buro Happold. "We have seen a complete sea-change in terms of awareness, appetite and commitments around climate change, across the whole of the built environment, whether at city level, with local authority declarations of climate emergency, or owners and developers realising the need to heavily decarbonise their portfolios. The low-carbon transition is truly under way," he says.

Call for collective action

As an international, integrated engineering consultancy, Buro Happold operates in 24 locations worldwide. In the face of a climate emergency, its role is to help shape and steer the built environment towards a sustainable low-carbon future, working with other leaders in the field, including multiple city leaders, clients and collaborators. As well as publishing its own *Climate Emergency Action Plan*, the firm has been instrumental in engaging and mobilising the wider professional community through the Engineers Declare initiative. Buro Happold has championed the need for structural, civil and building services engineering firms to sign up to an online climate emergency declaration, backed by the Happold Foundation. Alongside institutions and academia, collective industry action is critical, says Price. "Spearheading the adoption of climate emergency declarations among our peer group is absolutely the right thing to do," he says. "Getting government, city leaders, clients and

fellow professionals pointing in the same direction will help decouple economic success from negative impacts and align it with positive social and environmental outcomes." Building a coalition of leaders, consensus and momentum is tremendously important for rapid learning across the infrastructure sector. Contributing strategically and specifically, Buro Happold is on the steering group of the net-zero carbon buildings framework definition project, which is effectively the UK interpretation of the World Green Building Council and C40 Cities global campaign to which they contributed significantly alongside numerous global cities.

Low-carbon transition plans

Buro Happold places a lot of value on receiving peer-group recognition for its leadership on sustainability and climate change matters, with its work with C40 Cities recently winning the NCE100 award for impact on climate resilience. Being seen to walk the talk on climate is key and the company has made a public commitment to be net-zero carbon for its own operations by the end of the next financial year, April 2021. Suitably inspired and empowered to act on climate, clients are now beginning to ask what is most material to their assets and what can be done to decarbonise. In a position to leverage its expertise and experience, Buro Happold is therefore advising developers and owners on strategic low-carbon transition plans for a whole host of infrastructure projects and portfolios, from 20-year developments to large nationwide assets. Strategies and synergies In this joined-up world, transitioning to a low-carbon future means taking a systemic approach, looking not just at built assets, but the spaces between them and the connective tissue, the infrastructure, whether it is inclusion of low-carbon heat networks and smart grids or electric-vehicle charging points and public transport. The classic view of infrastructure sees it as pipes, wires and bridges, but there is another argument that buildings are our infrastructure, too. As part of a national energy efficiency programme, the UK should be retrofitting 20 million homes and other existing buildings, and this programmatic approach to wholesale improvement of our building stock should be treated as a national infrastructure priority. There is also growing interest in the idea of the co-benefits of climate



Buro Happold worked with C40 Cities on New York's 1.5° Plan, outlining the actions the city should take to reduce greenhouse gas emissions and significantly decarbonise

action; how we can assess, quantify and value them. So, with C40 Cities, Buro Happold is working with the leaders of 25 cities around the world to identify the air-quality, health and economic benefits. This synergistic approach to systemic change across cities is increasingly going to be key for unlocking action and building a business case.

Long term, dispersed and agile
Some of the decision-making on the part of cities is taking a very long-term

perspective, looking well beyond 100 years. Thinking not just in terms of decarbonisation, but climate resilience as well, municipalities and communities are seeking to future-proof their built assets against flood risk, overheating, water stress and more. Traditionally, the infrastructure involved has tended to be highly capital intensive, but there is now increasing potential to see it as more dispersed and agile. In response, Buro Happold is actively engaged at the leading edge of thinking about adaptive pathways and working to identify the trigger points for when decisions need to be made about infrastructure. Scenarios are multiple. Continuing the rapid decarbonisation of the electricity grid will need a shift from old to new technologies. Cracking energy storage could have a big impact on peak energy loads. Plus, going fossil free with vehicle fuels, via electrification or hydrogen, should transform air quality. Digital transformation will help move us towards zero carbon, creating better integration and

efficiency of infrastructure city systems. Opportunities also remain around integration of low-carbon infrastructure to promote active travel, walking and cycling. Driving this low-carbon transition is going to be both challenging and rewarding. Buro Happold's Price concludes: "Ultimately, we need to scale up and accelerate action on climate and that means being bold and moving fast, based on evidence and technical understanding of the art of the possible. The aim with infrastructure is to get a net-zero development plan for every city and every company, every asset and every project."

For more information please visit www.burohappold.com

BURO HAPPOLD

The aim with infrastructure is to get a net-zero development plan for every city and every company, every asset and every project

PUBLIC PERCEPTIONS

The work and money that goes into running and maintaining public infrastructure goes mostly unnoticed. In fact, citizens only ever get involved when there are problems or big projects planned that could disrupt their daily lives. This infographic explores how satisfied the public is with their country's infrastructure and how they think it needs to change in the future



of adults worldwide believe investing in infrastructure is vital to their country's future economic growth



accept that businesses in the private sector are investing money in infrastructure so their country can get the infrastructure it needs



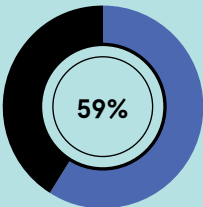
believe their country is not doing enough to meet its infrastructure needs
Ipsos MORI/Global Infrastructure Investors Association 2019



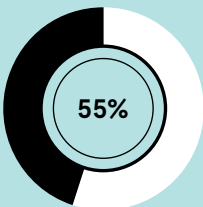
say their city government lags behind those of other cities in implementing or encouraging environmentally sustainable practices
Aecom 2019

PUBLIC POLICY AND POLITICS

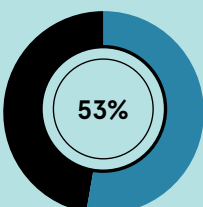
Percentage of consumers who agree with the following views of infrastructure policies and strategy



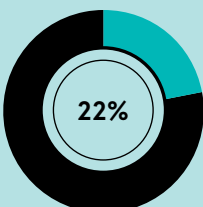
Technical experts should mostly make decisions about new infrastructure projects because they know more about what my country needs



We should prioritise maintaining and repairing existing infrastructure before spending on new infrastructure



Public spending is already high, taxes and government borrowing should not be increased any more to spend more on improving infrastructure



Spending on improving infrastructure should be increased, even if that means higher taxes or more government borrowing

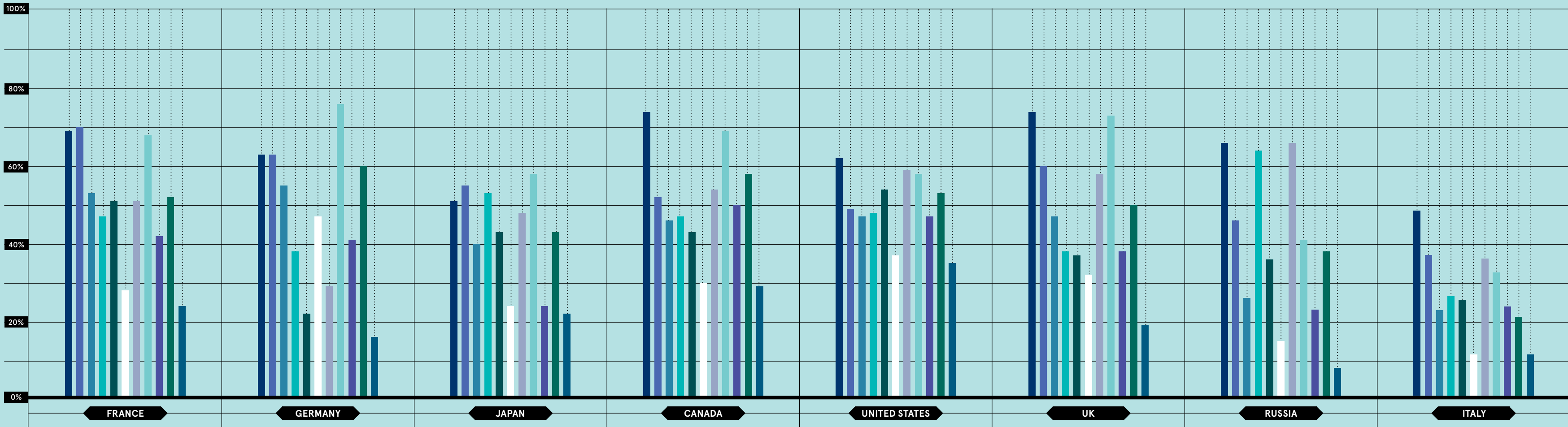
Ipsos MORI/Global Infrastructure Investors Association 2019

PUBLIC SATISFACTION WITH INFRASTRUCTURE ACROSS THE G8

Ipsos MORI/Global Infrastructure Investors Association 2019

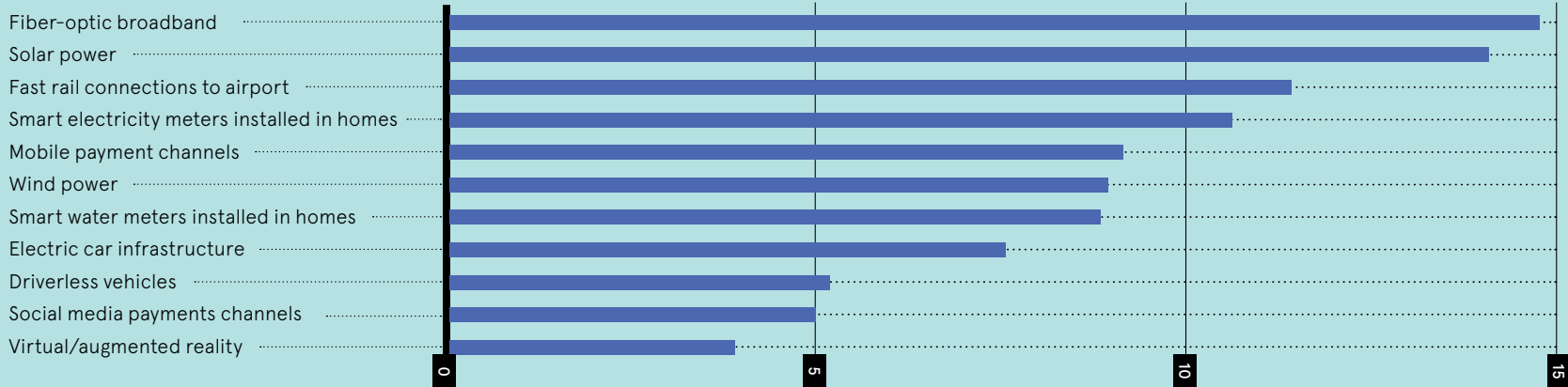
Percentage of citizens who ranked the following very or fairly good

Airports Motorways Local roads Rail Housing supply Flood defences Digital Water supply and sewerage Cycle facilities Pavements, footpaths and pedestrian areas Electric vehicle charging



MOST IMPACTFUL TECHNOLOGIES

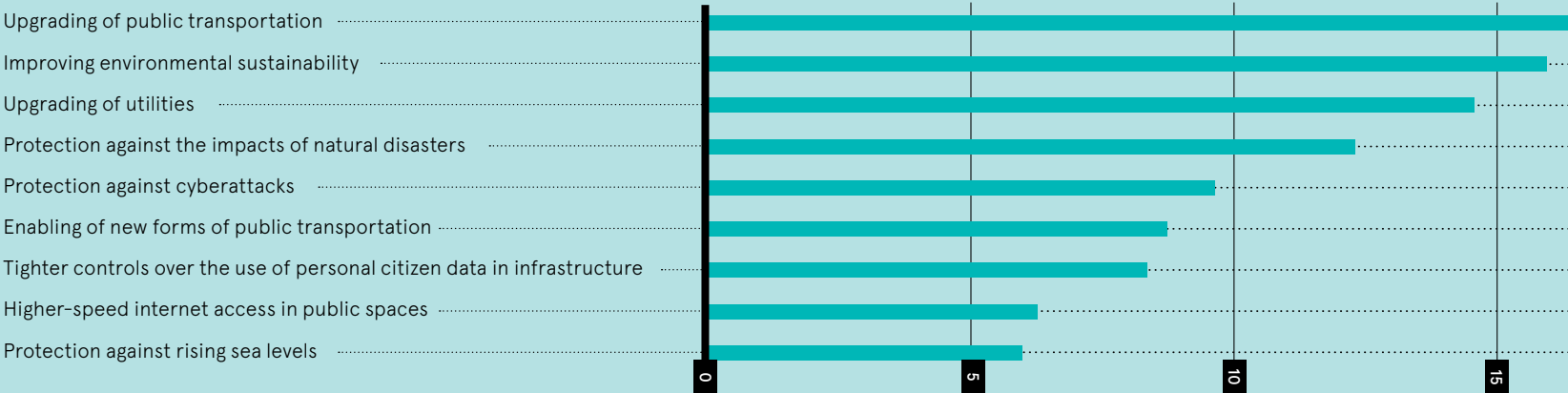
Technologies that will have the biggest impact on the public's quality of life; each value is an impact score out of 100, where for example a score of 20 is twice as important as 10*



*Survey of 10,000 citizens from ten major cities worldwide. Aecom 2019

DESIRED INFRASTRUCTURE IMPROVEMENTS

The public's most important infrastructure improvements for the future; each value is an impact score out of 100, where for example a score of 20 is twice as important as 10*



*Survey of 10,000 citizens from ten major cities worldwide. Aecom 2019

INVESTMENT

Putting available funding to work

At a time of historically low interest rates and government bond yields, infrastructure remains an attractive sector for investment

Ian Fraser

The world is facing a humongous \$15-trillion infrastructure investment gap. According to Lawrence Slade, chief executive of the Global Infrastructure Investor Association (GIIA): “A huge amount of money is required around the world for infrastructure investment. It is one of those areas where governments cannot do it by themselves, so they absolutely need the assistance of private capital.”

The \$15 trillion number came from the Global Infrastructure Hub, an initiative of the Group of 20 countries (G20), last April. The organisation calculated the size of the gap by subtracting the \$79 trillion that is likely to be invested globally in infrastructure projects between now and 2040 based on current trends, from the estimated

\$94 trillion of global infrastructure investment required.

The fact prevailing interest rates have remained ultra-low since the 2008 global financial crisis – in the United States they were slashed from 1.75 to 1.25 per cent in response to the coronavirus outbreak in early-March – coupled with bond yields at near historic lows, is boosting the attractiveness of so-called real assets.

And infrastructure’s ability to ride out economic downturns, by offering investors uncorrelated, stable and resilient returns at a time of geopolitical uncertainty, enhances its appeal

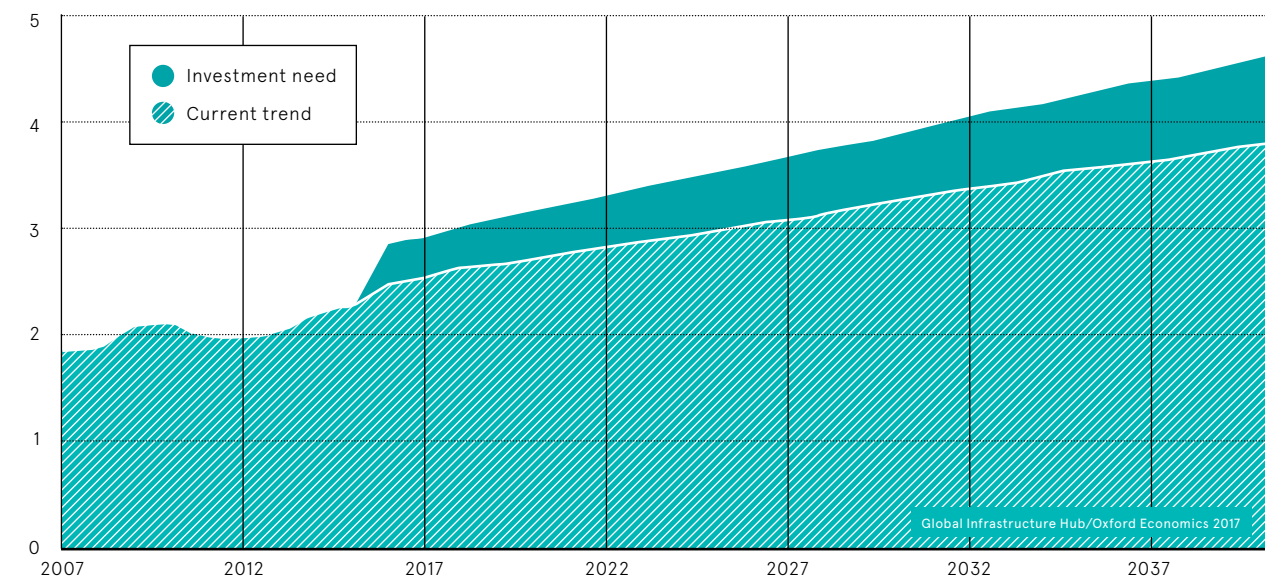
Gershon Cohen, global head of infrastructure funds at Aberdeen Standard Investments, believes

that even if bond yields were to rise, investors would not turn away from infrastructure. “If bond yields were to rise modestly, the overall cost of borrowing would rise, causing the borrowing costs of private-sector-funded infrastructure projects to also rise. This cost is generally passed on to

“
New and evolving technologies are presenting investors with many new areas to consider

GROWING INFRASTRUCTURE INVESTMENT GAP

Infrastructure investment at current trends and investment needed (\$ trillions)



Global Infrastructure Hub/Oxford Economics 2017

the user, giving projects a higher return,” he says.

According to financial data company Preqin, annualised returns from infrastructure investment, which includes investment in roads, railways, bridges, water supply, sewers, energy, fibre broadband and mobile networks, has averaged 8.9 per cent over the past ten years. That is ahead of the returns from global equities (7 per cent) and bonds (3.4 per cent) though lower than private equity (15 per cent).

Cohen says: “There’s little doubt that investing in infrastructure will give investors a better return than investing in bonds. The reason is that you’re taking on more risk. New and evolving technologies are presenting investors with many new areas to consider, so I see the infrastructure space continuing to offer lots of opportunities.”

The biggest opportunities, especially in Europe and the 24 US states that remain committed to the Paris Agreement, are going to come from meeting net-zero-carbon targets. “The scale of investment that’s needed there is vast. If you throw in the digitalisation of our economies, including 5G and fibre broadband, technological changes could swamp individual economies’ ability to deliver, so they’re going to need all the help they can get,” says GIIA’s Slade.

“Overall, we see the prospects for the infrastructure sector as very positive. Obviously, there are uncertainties in the markets, a lot of which are political, but even in the UK this has settled down since the general election and in Europe you have a new European Commission which is starting to find its feet now.”

Another risk comes from investor naivety and irrational exuberance. When institutional investors, such as pension funds and life insurers, pile into the sector without knowledge or experience of infrastructure investing, they can lose their shirts.

“
What investors need to avoid is buying or selling at the wrong point in the cycle

\$79trn

Estimated value of infrastructure investment at current trends between 2015 and 2040

\$94trn

Value of infrastructure investment needed

\$15trn

Size of the infrastructure investment gap

Global Infrastructure Hub/Oxford Economics 2017

“There are examples where projects that investors thought were safe, with monopoly positions and stable cashflows, turned out to be nothing of the sort,” says Cohen, citing some of the toll roads that were built in the United States in the 1990s and 2000s, for which the traffic projections turned out to be wildly optimistic.

He also warns that, when too much capital chases too few assets in parts of the infrastructure investment market, bubbles can inflate and ultimately burst. “In the near term, it’s fairly frothy and competitive out there. People are, in some instances, paying 20 or 30 times EBITDA [earnings before interest, tax, depreciation and amortisation] for established assets, such as London City Airport. What investors need to avoid is buying or selling at the wrong point in the cycle. Ideally, to offset macroeconomic risk, they should hold infrastructure assets for long periods of time,” says Cohen.

Ensuring a healthy string of viable opportunities is going to be key to the future success of the infrastructure investment market. Slade concludes: “In terms of dry powder, there’s an awful lot of funding available. We just have to work to make sure the project pipeline is in place so realistic homes can be found for that.” ●

OPINION

‘People are less concerned about who owns and operates infrastructure as long as they can see the wider community benefits’

Around the world billions of people rely on infrastructure, to get them to work, to get food to market, to power their homes and businesses, and to support and provide access to the internet and connect families over thousands of miles.

But infrastructure is under pressure like never before. In every jurisdiction the Global Infrastructure Investor Association (GIIA) is engaged, infrastructure investment and renewal is high on the agenda.

In the United States, the National Governors’ Association (NGA), under the chairmanship of Maryland governor Larry Hogan, is leading an initiative to support infrastructure investment at state level. As advisory council members to the NGA, GIIA is pleased to be playing its part in bringing the right players to the table to explore ways to unlock more private-sector investment in US roads, airports, telecoms, water and renewable energy.

European Union president Ursula von der Leyen has set out a vision for a new Green Deal for the EU bloc. This assumes that the private sector will play a significant role in supporting the transition to a carbon-free economy through greenfield and brown-field investment. GIIA looks forward to continued dialogue in Brussels as the details of the Sustainable Europe Investment Plan are developed.

The UK has traditionally been seen as one of the most attractive markets for infrastructure investors – more than one third of all our members’ stakes are in the UK – but the signals from the last government and opposition during 2019 undermined investor confidence. If the new Johnson government wants to leverage the private sector to help deliver its infrastructure ambitions, including meeting net-zero targets, climate resilience and addressing digital connectivity, then that confidence could quickly return. But there is need for clarity around the mechanisms to achieve that.

Although the political and economic context for infrastructure investment varies considerably across the world, there is much commonality around the issues to be addressed. People expect timely, good-quality infrastructure at affordable prices. They are less concerned about who owns and operates infrastructure as long as they are treated fairly and can see the wider community benefits.

In research we published with Ipsos MORI last year, the Global Infrastructure Index questioned 20,000 people from 28 countries on public attitudes to infrastructure; the biggest survey of its kind. The results were clear.

Three quarters (76 per cent) of citizens see investment in infrastructure as vital to economic growth, but 60 per cent don’t believe their country is doing enough. Some 64 per cent were comfortable with private investment in infrastructure, if it means the country gets what it needs. While those supportive of foreign investment outnumbered those opposed by 3:1, if it leads to better quality infrastructure. Meanwhile, 59 per cent would prefer technical experts to take decisions on new infrastructure compared to only 21 per cent who believe politicians should mostly take these decisions.

These results reinforce the view that the debate over ownership of our infrastructure distracts from what really matters to the public, which is getting the environmentally friendly, quality and resilient infrastructure countries and communities need.

It is the role of government to champion the mechanisms it chooses to deliver infrastructure renewal and investment, and to create the right framework that works for investors, customers and communities. It is for the private sector to respond by bringing innovation, efficient management, customer-focused service, responsible stewardship and sustained investment. Where those ingredients are in place, countries will make the best progress in tackling the many complex infrastructure challenges ahead.

As the membership body for the leading investors in infrastructure, we will make sure we, and our members, are at the heart of our infrastructure renewal. ●



Lawrence Slade
Chief executive
Global Infrastructure Investor Association

Commercial feature

Investing in infrastructure for the longer term

For investors to achieve regular and long-term returns, they need to take a longer view that benefits all concerned

Europe’s infrastructure landscape has evolved significantly over the past ten years amid a trend which has seen institutional investors encouraging the emergence of an increasing number of asset managers. In this new climate, the emphasis should be on enhanced stakeholder supervision to not just invigorate the sector, but to carry it into a period of long-term prosperity sustainably.

A concerted issue for core infrastructure assets during this period has been the focus of public grantors on exit values of assets, with the extraction of cash flow restricting the sustained care of vital public services. To this end, Vauban Infrastructure Partners (Vauban IP) have looked to champion the influence stakeholder-driven projects could have on reversing the trend.

“We believe that for our clients to attain long-term regular cash flows from their investments, they need to take a more long-term approach so all parties are satisfied, not least the local communities benefitting from these assets,” explains the company’s founding partner and deputy chief executive Mounir Corm. “Low satisfaction rates yield short-term thinking, an effect of a shareholder-driven approach.

“Vauban IP want assets to instead benefit from long-term, regular, targeted investments, which go hand in hand with a stakeholder-driven approach.”

This focus fits seamlessly within Vauban IP’s ongoing drive for longevity and sustainability in infrastructure. Founded in 2005, with a focus on greenfield opportunities, the business has practised what it preaches on continuous improvement and trend adherence.

Now, with a refreshing view on preservation, conservation, community enrichment and sector stability, the company is urging others to follow suit.

“We have seen the evolution of our market over the past ten to fifteen years



and managed to evolve too, moving from being an infrastructure partner initially focused on greenfield opportunities, which we were very active in until around 2013, to a shift towards brownfield investments,” says founding partner and chief executive Gwenola Chambon.

“Over the past five years we have been fundraising and deploying several generations of brownfield funds, all through this view of longevity. We are convinced that the best way to deliver revenue on core assets is to ensure long-term sustainability, especially in an environment of very low interest rates.

“We have consequently become a huge draw in the market because we’re aiding its evolution, responding and adapting to new trends and policies, rather than thinking short term to safeguard against them.”

Few operators can claim the client base, experience, quality of service and reputation for positive transactions and interest alignment that Vauban IP now enjoys. The very essence of this success, however, is not to stay with the status quo and instead to prepare for what’s next.

Chief among these future trends, Corm believes, is the rapid digitalisation of the infrastructure sector, as leveraging data becomes more of a differentiator in a traditionally tech-resistant domain. He adds the influences of environmental sustainability and the pressure that should be exerted on public governance spending as additional market fluctuations, providing both risk and opportunity for asset managers.

For those wanting to embrace and capitalise on all three, a similarly forward-thinking perspective will have to be taken.

“I think it is becoming more popular as an approach,” Corm affirms. “Our clients have seen how we changed approach five years ago, to challenge the industry, and they are seeing the benefits of it more and more.”

Chambon concludes: “There are so many asset managers out there. To face this increasing competition, over the past decade, we have managed to build an outstanding track record of investments, to network with industrial entities and to build industrial platforms to successfully deliver strong performance to our investors.

“Looking forward I now hope that players in this market not only see the benefits of long-term thinking, but also encourage better alignment between private and public investment, which is essential for the very legitimacy of private investment in these essential assets. Ultimately, it is all for the greater good of the communities affected and there is so much money ready to be invested.

“By finding a more sustainable and appropriate solution to this balancing act, we can see a real infrastructure boom in the months and years to come.”

For more information please visit www.vauban-ip.com





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WEATHER-PROOFING

A rising tide of extreme weather

Recent flooding has reinforced the urgent need to future-proof public infrastructure against growing climate risk

Jim McClelland

Extreme weather has been breaking records and writing headlines across the UK in 2020, as the country endures the double-whammy impact of storms Ciara and Dennis. Images have flooded our screens almost daily of residents evacuated by boat and sodden furniture submerged in abandoned homes.

Infrastructure, though, is arguably the big story seldom told, says Simon Crowther, founder of Flood Protection Solutions and himself a victim of flooding as a teenager in 2007. “Flooding is the biggest threat the UK faces as a result of climate change,” he says. “Yet the response is often reactive rather than proactive. While media attention is usually on those directly affected with flooded homes and businesses, when critical infrastructure is at risk, devastation can be huge.”

Infrastructure is woven throughout the fabric of our society and essential services soon start to unravel in extreme weather, especially following disruption due to surge tides and flooding, explains Dr Andrew Russell, senior analyst at the Committee on Climate Change (CCC).

“Risks to communities and local economies are closely linked to resilience of local infrastructure, in particular energy, transportation and communications systems. Electricity sub-stations, road and

rail networks, water treatment works, ports and airports, plus fixed-line and mobile communications assets, are all exposed to increasing flood risks,” he says.

The CCC advises the UK government on emissions targets and reports to parliament on progress made. Across all infrastructure sectors, it has warned that the number of assets and networks exposed to significant levels of flood risk could double by the 2080s.

Furthermore, in its recent report looking specifically at coastal risks, the CCC identified 1,600km of major roads and 650km of railway line, and no fewer than 92 railway stations and 55 disused landfill sites, all at 0.5 per cent or greater risk of flooding or erosion by the end of the century.

For insurers, the numbers are not just big, but different. Market players reliant on traditional catastrophe models that fail to consider forward-looking climate risk are finding the past no longer provides an accurate guide to the future, says Emilie Mazzacurati, founder and chief executive of Four Twenty Seven.

“Floods considered one-in-five-hundred-year events have begun to occur every few years,” she says. “Infrastructure assets planned and built to withstand historical conditions are often not prepared to endure repeated inundation, extreme wind or record-breaking temperatures.”



Nahr el-Bared Palestinian Camp

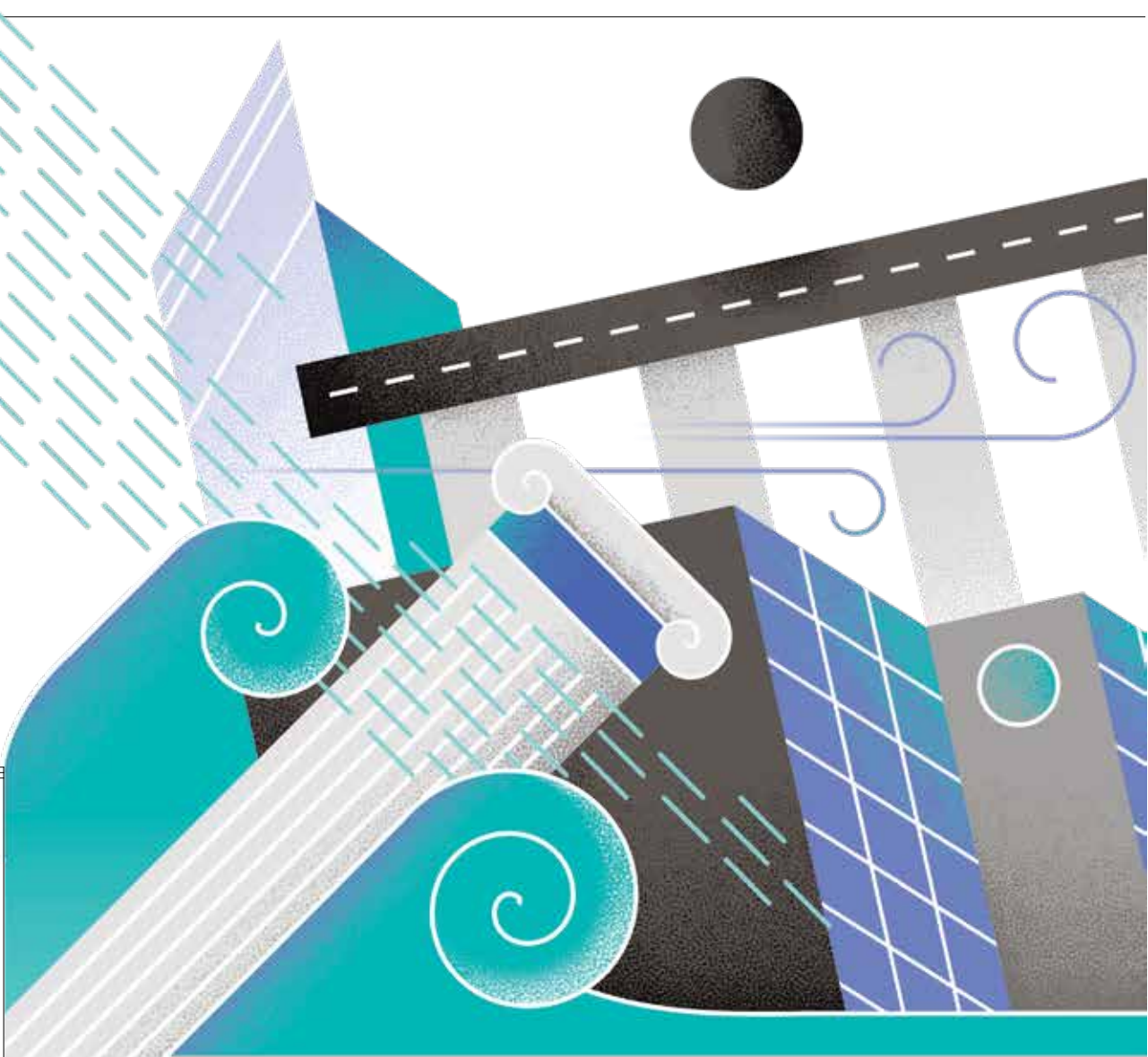
Originally home to 27,000 people, Nahr el-Bared Palestinian Camp in north Lebanon was destroyed during a three-month conflict in 2007. Its reconstruction, now 70 per cent complete, represents the largest single such project ever undertaken by the UN Relief and Works Agency (UNRWA).

Of the original population of approximately 6,000 Palestinian refugee families displaced, almost 5,000

are registered to return. The total UNRWA budget is \$329 million, with a further \$51 million still required.

Such was the destruction, all planning had to start from scratch. This provided an opportunity to redesign the 200,000sq m camp with a full infrastructure solution comprising sewerage, stormwater and water-supply networks, future-proofed against flooding. The sewerage network has also been connected to a treatment plant in Tripoli, ending direct discharge into the Mediterranean Sea.

Of many infrastructure lessons learnt, one stands out, concludes UNRWA project manager John Whyte. “Water in all its forms is a critical climate-risk factor for the reconstruction,” he says. “Whether we are talking sewerage, stormwater or water supply, it is a matter of environmental justice in the face of extreme weather events that the infrastructure is designed to future-proof the homes and livelihoods of the thousands of families and multiple generations living here.”



As a publisher of climate data for financial markets, Four Twenty Seven risk-scores infrastructure assets, such as pipelines and highways. It sees investors increasingly expressing concern over climate risk and engaging with operators around their preparedness, with financial implications, says Mazzacurati.

“For municipalities seeking infrastructure financing, this can catalyse policies around ensuring new projects consider climate risk. For example, the province of Ontario in Canada requires all cities to integrate climate vulnerability into their infrastructure planning, which can help minimise costs over time,” she says.

While major UK infrastructure providers are making progress boosting resilience of existing and future assets, applications of nature-based solutions, such as floodable parks, can work at a land-scaping scale and will also appeal to investors, says Bram Miller, technical director at Ramboll.

“Floods considered one-in-five-hundred-year events have begun to occur every few years

living things, natural capital effectively covers everything from mountains to fish. The Office for National Statistics has estimated its value to the UK economy at almost £1 trillion.

Much more can be done, however, to leverage potential benefits of greening the built environment, argues president of the European Federation of Green Roof and Wall Associations Dusty Gedge.

“We need new models and awareness within the construction industry around dealing with water at source. Buildings are responsible for a lot of rainwater, which green infrastructure in the form of living roofs and walls can help manage,” says Gedge.

The road ahead points towards adaptability, rather than resistance. Crowther concludes: “There has been a general shift within the flood protection industry to work with nature, rather than against it. We can’t keep building higher and higher walls.” ●

“As investment decisions will increasingly be evaluated in terms of natural capital, this may well drive uptake of more nature-based solutions,” he says. “Green infrastructure can not only help manage flood risks, but also bring added benefits such as biodiversity net gain, carbon sequestration and public-amenity uses.”

Defined as the totality of world stocks of natural assets, including geology, soil, air, water and

Closing Africa’s infrastructure gap with sustainability at the heart of Helios Towers

Independent telecommunications tower companies reduce costs for mobile operators, drive environmental efficiencies and upskill the local workforce, while closing Africa’s infrastructure gap

The growth opportunities in sub-Saharan Africa are unparalleled. Home to 1.2 billion people and hosting the world’s fastest-growing economies, the continent possesses many exciting attributes. However, Africa’s development continues to be held back by an infrastructure gap, including the telecommunications towers required to service such growth.

The tower infrastructure gap is typically quantified by dividing the number of subscribers in a country by the number of base stations transmitting a signal. In developed markets, it can be as low as 1,000 subscribers per base station. In Africa, it can range from around 3,500 in Tanzania to as high as 6,500 in the Democratic Republic of Congo (DRC). This means up to six times as many people are served mobile connectivity by an individual tower in Africa compared to the United States.

“That’s only the people with mobile phones,” says Kash Pandya, chief executive of Helios Towers, a telecom tower infrastructure group that enables mobile operators to roll out and enhance coverage in Africa.

“Mobile penetration is over 100 per cent in developed markets because people have multiple devices. In the markets we cover, penetration ranges between 38 and 67 per cent. Fewer people have mobile phones, but the

networks still struggle with capacity. The pressure on mobile network operators (MNOs) will increase as more people use data to do things we take for granted like accessing social media and video-streaming applications.”

Two thirds of the 240 million people Helios Towers serves through its approximately 7,000 sites in Tanzania, DRC, Ghana, Republic of Congo and South Africa are under the age of 30, the most data-intensive user demographic. This is set to rise by a further 40 million people by 2025.

As many African markets have skipped fixed-line networks altogether, all their traffic must go through mobile networks, creating an urgent need for more points of service and the infrastructure required to be able to deliver a quality, useable service.

Digital access is crucial to economic growth anywhere in the world. In Africa, the challenge is exacerbated by a parallel infrastructure gap in the lack of paved roads, making it extremely difficult to execute some projects. Helios Towers had to transport towers up to 90 metres high through jungle terrain to build an infrastructure backbone in DRC, where half the towers are run off solar-hybrid power systems independent of grid connection.

“The whole basis of modern economic growth is access to markets and information,” says Pandya. “If you don’t have access to data or market pricing, how do you know you’re selling at the right price? Telecom infrastructure is a really enabling technology and we see communities grow based on getting that access. It’s amazing how much commerce can come just from a tower.

“In many areas we have started bringing solar charging stations with our towers enabling more of the community to be online. When mobile coverage comes to an area, we see huge uptake in the distribution of SIMs and there is a clear correlation between mobile access and economic development. It catalyses growth in these markets as much as highways or other physical infrastructure.”

In 2018, 73 per cent of mobile telecommunications towers in Africa were owned by MNOs, compared to 33 per cent globally. This is highly inefficient in terms of the costs required from MNOs to operate in the region. Helios Towers has pioneered a co-location model in the region, allowing MNOs to lease space on one of its towers to save significant new-build capital expenditure and vastly accelerate



01 Helios Towers has established one of Africa’s most extensive tower portfolios with close to 7,000 towers across five countries



02 Helios Towers pioneered the towerco model in Africa, enabling a more cost-effective and higher quality mobile economy

their speed to market, while ultimately helping to close Africa’s mobile infrastructure gap.

There are also inefficiencies in an environmental sense when a country’s towers are predominantly owned by individual MNOs, as opposed to co-location which drastically reduces the environmental impact through avoidance of any duplication of infrastructure, including the associated power systems.

Furthermore, between 2016 and 2018, Helios Towers has installed solar-powered technology at 430 sites, made more than 400 connections to power grids where available and created over 740 hybrid, off-grid, solutions. In 2018 alone, these investments by Helios Towers saved more than 5,000 tonnes of CO2 emissions as well as delivering fuel cost savings.

The company is also keen to return value to Africa’s economies by leveraging and upskilling its workforce. As opposed to the numerous international organisations that have invested in Africa, but

flowed in expats to run their operations, 99 per cent of Helios Towers’ teams are from local African talent.

Around half its staff are trained in lean six sigma, a framework used to drive product improvement and reduce operational costs. This approach of large-scale training is enabling all levels of the organisation, whether it’s the in-country managing director or the field manager at the end of the chain, to improve efficiency daily.

Helios Towers not only employs around 400 people directly, but also supports more than 7,000 contractor employees who are engaged in the maintenance and security of its tower network. The company has helped to raise business standards locally among its suppliers and also the people they employ. Fostering a higher level of health and safety, and execution standards, creates a better environment for the whole ecosystem.

“It’s a cliché, but it really is far better to teach someone how to fish than to just give them a fish,” says Pandya. “We’ve developed a language of talking about waste, data-driven decisions and

how we look for root causes. Before, a lot of the individuals would make decisions on gut feeling. Now we have people going to the root cause so we can solve problems better and identify efficiencies quicker. That’s happening at every level of the organisation.

“The great thing about this economic development is it’s intrinsic to our business activities. You build one tower, which improves the economy in an area, and suddenly an area that was a low-population area becomes a higher-population area, which means more infrastructure is needed and there are more business opportunities. As we spread our products in partnership with our customers, we’re enabling African economies and some fantastic innovation.”

For more information you can visit www.helios Towers.com



240m people served by Helios Towers across its five markets

400 people are employed directly by the business

>7,000 contractor employees are engaged in the maintenance and security of our tower network

430 sites have solar powered technology installed

“There is a clear correlation between mobile access and economic development



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SMART CITIES

When cities are built from the internet up

The backlash felt in Toronto surrounding its Quayside development raise serious questions about such significant private involvement in building a smart city

Oliver Balch

On paper, it all looked flawless: a futuristic downtown neighbourhood of self-driving rubbish bins, heated pavements and “intelligent” kerbs that retract or expand depending on traffic flows.

Yet the smart city innovations proposed for Toronto's Waterfront development are struggling to get sign-off. In the early days of the internet of things, such hitches were usually technical. Now they are as likely as not to relate to security.

Will smart cities make life better for citizens in a metropolis like Toronto, or are they the thin end of a surveillance-state wedge or an open door to cybercriminals?

The small minority of vocal citizens in Toronto has already decided it's big brother, arguing that the digital technologies embedded in the Waterside plan infringe on their privacy and endanger their personal data.

Behind this “techlash” in Canada lies a latent suspicion that digital partners on smart city projects, many of which are commercial tech companies, are more interested in their own private profit than the public good. The source of concern in Toronto's case: Google (albeit through its connection to sister company Sidewalk Labs, which is owned by parent group Alphabet).

To the cynically minded, smart cities are the perfect environment for data-hungry “surveillance capitalists” that, in the words of Harvard Business School professor Shoshana Zuboff, want to “modify behaviour in ways that serve the bottom line”.

The complex interconnectivity inherent in city-based digital solutions – Toronto's Waterfront project anticipates 18 digitally enabled systems enmeshed with 52 sub-systems – presents a second security threat: terrorism.

Cities appeal to those looking to create maximum damage in the shortest amount of time. In cyber-warfare, expect key urban infrastructure to be a frontline target, warns Kevin Curran, professor of cybersecurity at Ulster University.

Examples are, for now, fortunately few and far between. Curran cites the cyberattack against Ukraine's power system as a taste of things to come. In December 2015, hackers with IP addresses traced back to Russia were able to shut down 30 electricity sub-stations remotely, temporarily cutting power to 230,000 people.

At present, urban digitalisation projects remain early stage so the risk of major disruption is small. Yet it is not difficult to imagine the chaos

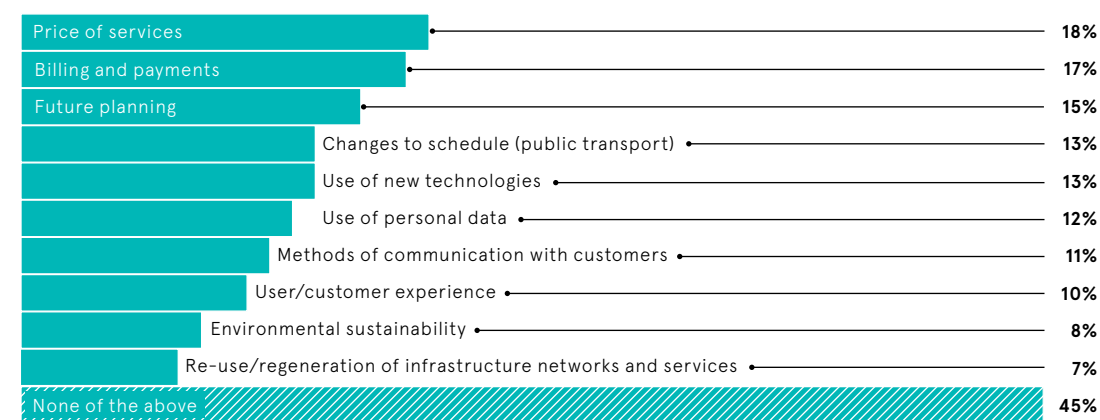
that could happen when they scale up. Visa customers had a taster a few years ago when the firm's card network briefly crashed, leaving millions unable to pay their supermarket bill or for the bus home, all because of an unmalicious technical fault.

Smart cities are also vulnerable to digital-savvy criminals, warns Curran. Any infrastructure that poses real risks to public safety if it goes down

“Are smart cities the thin end of a surveillance-state wedge or an open door to cybercriminals?”

PUBLIC FEEDBACK

Types of public infrastructure issues where there have been an opportunity to provide feedback in 2019, according to a survey of 10,000 citizens from ten major cities worldwide



Aecom 2019



Google-affiliate Sidewalk Labs' model for the Quayside development master plan in Toronto

is perfect for ransomware, given the urgency faced by municipal authorities to get it back online, he adds.

“Without a doubt, they [criminals] will move on to smart city systems because it's an easy victory for them,” says Curran. “When the smart city is brought to its knees and people are complaining, politicians will easily release the money demanded.”

So what can municipalities and regulators do to ensure the cities of tomorrow gain the benefits of digital solutions while mitigating security concerns?

Firstly, all those involved in digital solutions need to be frank about the risks involved. The smart city market is a boom market at present, with leading analyst firm MarketsandMarkets predicting its global value will hit \$717 billion by 2023, more than double the current value.

It is easy to be blinded by the hype, but city authorities should adopt a security-minded approach from the get-go, warns Alexandra Luck, project manager for the security stream of the Cambridge-based Centre for Digital Built Britain (CDBB).

To that end, CDBB published a draft set of broad principles in late-2018 to create alignment on how information is managed. The *Gemini Principles* insist that “holistic security principles must be built in from the outset” and that steps to protect private data be prioritised.

Precisely what such steps should look like is addressed in a longer set of guidelines, entitled PAS 183, co-authored by Luck for the UK government. Specific to privacy issues, the advice calls on project managers to carry out a triage process to identify if individuals are identifiable. If so, a full privacy impact assessment should be put in place.

The end-goal, according to Luck, is to help cities better understand their key vulnerabilities and what risk-management controls are required. It is not, she emphasises, to reduce the risk to zero. To arrive at a level of security risk “tolerable to the relevant parties” is the best to be hoped for.

Such an argument might satisfy some but, as in the case of Toronto, it may not wash with everyone. Much depends on political and cultural attitudes, says Richard Karpinski, research director at the analyst firm S&P Global Market Intelligence.

Citizens' expectations in an open, liberal country such as Canada, for instance, differ markedly from those in China, where personal freedoms are more restricted. The latter, as such, may very likely find themselves with greater wiggle room.

That said, the level of potential intrusion from the application of artificial intelligence and video surveillance is now reaching another level, according to Karpinski. Current technology allows for much deeper and rapid analysis of data than before, as well as longer storage times, he adds.

As a minimum, smart city developers should ensure legal protections are in place. Such is the pace of technological change, however, that legislators are struggling to keep up with events.

The preference of policymakers to date has been to encourage smart city proponents to self-police. The government-endorsed Cybersecurity Framework in the United States and the European Union's Network and Information Security Directive are notable examples of this hands-off compliance approach.

Bettina Tratz-Ryan, research vice president at advisory firm Gartner, says city authorities and their

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private-sector partners need to be far more proactive. In a recent white paper on the subject, she lays out at least ten steps security managers should consider adopting.

The list includes everything from developing internal training on security threats through to leveraging cloud-based security programmes and preparing for tougher privacy regulations down the track.

Strong governance systems are the key mechanism to hold accountable all stakeholders, namely private companies as well as city governments, for implementing security procedures. She adds: “After all, cities are only as strong as their weakest link.”

Proving smart city projects do not contravene the law is only half the battle. They need community buy-in. Fail to gain this and digitalisation initiatives risk precisely the same kind of citizen opposition and project delays as in Toronto.

Glasgow City Council is an example of good practice. A pioneer in smart city applications, it is considering implementing new technologies such as 3D-printable bins with sensors as part of an upgrade of the city's waste-management system.

Before sending the idea out to tender, however, it contracted a local organisation specialising in community engagement to speak to local residents and glean their opinions. Not only did this generate valuable feedback, it also gave Glaswegians a sense of being involved in any potential changes.

Done well, digitalisation should deliver efficiencies and cost-savings to municipalities, says Sarah Drummond, co-founder of Snook, the firm employed to lead Glasgow's consultation. But, ultimately, improving citizens' everyday lives should be the primary objective, which implies putting people at the heart of any smart city project.

Ben Snaith, researcher at the Open Data Institute, concurs. He points to the use of civic panels in Gdansk, Poland, and an e-participation tool in Madrid as examples of just this kind of citizen-centric thinking in action.

As smart cities begin to move from hype to reality, now is the time to put the processes in place to ensure citizen safety, he argues. This means prioritising open data, open government, open infrastructure and open standards.

Indeed, if Snaith had his way, he would bin the term “smart cities”, with its connotations of shareholder interest. Far better, he says, is “open cities”, the value of which flows to the people, businesses and communities that form them. ●

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