

Infrastructure

ISSUE 01: THE FUTURE OF INFRASTRUCTURE

April 2022

One ministry's ambition to improve over 71,064 km of roads and highways

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Unleashing exponential learning for a better future

Futurist John Hagel III reflects on infrastructure's vital role in bringing people together

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Deloitte Global Infrastructure Leaders. From left to right:

Beth McGrath
Luke Houghton
Michael Flynn
Dr. Kellie Nuttall

Deloitte.

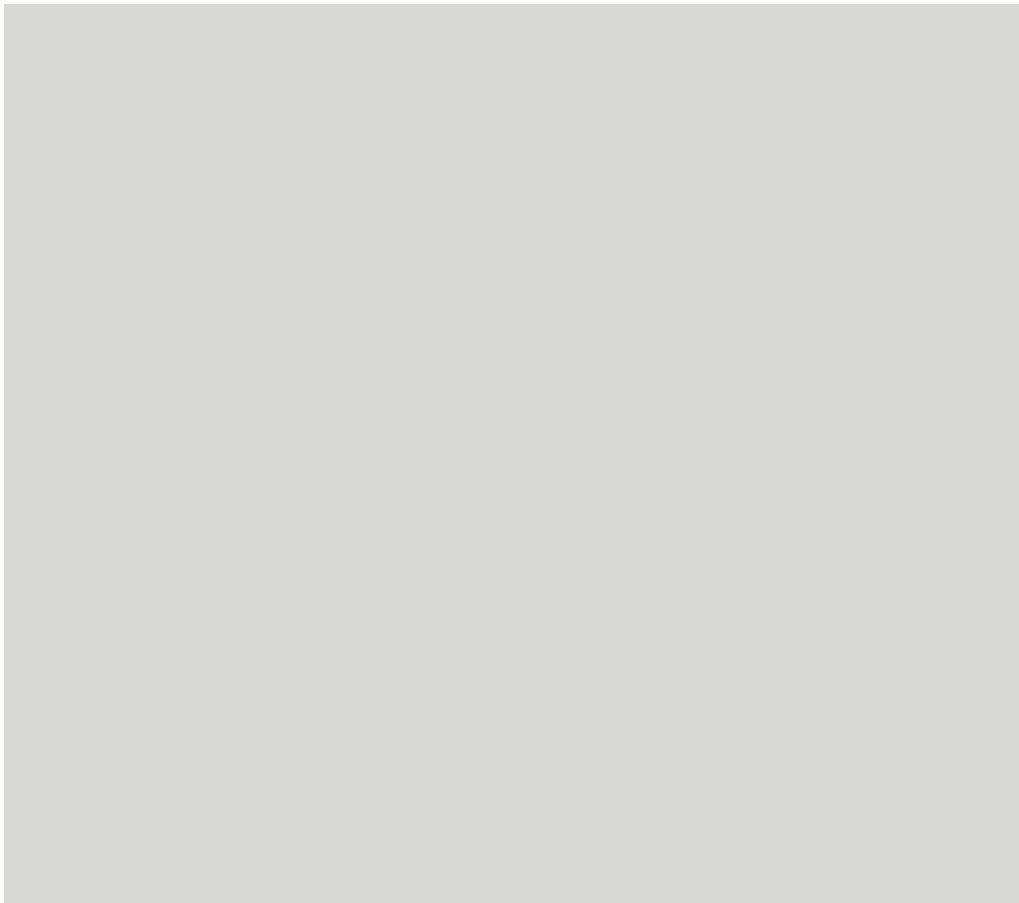
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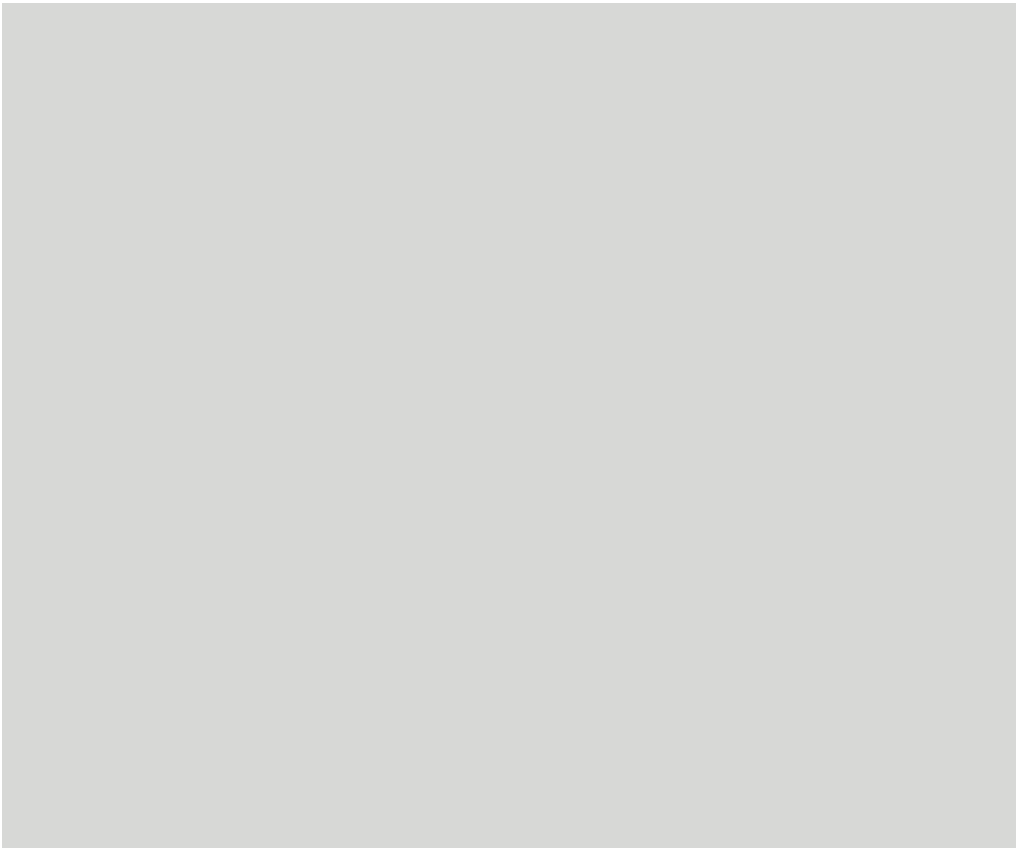


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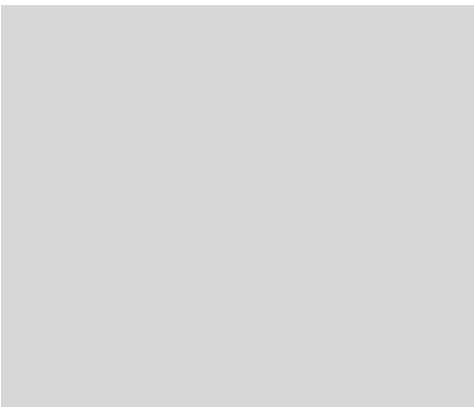


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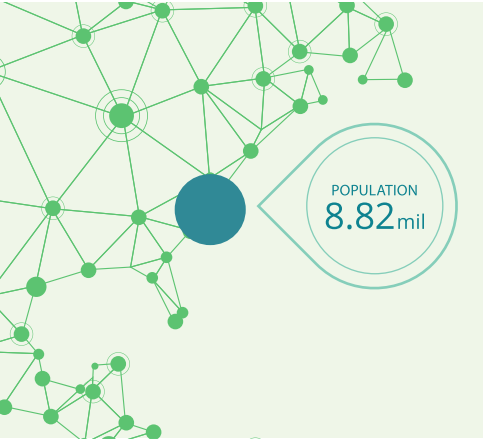
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We "virtually" sat down with three Deloitte Canada partners to find out more about their clients' priorities, and the biggest challenges and opportunities the Canadian transport sector will face in the years ahead.

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GOODBYE WASTE, HELLO OPPORTUNITY

In a world of finite resources, today's "take-make-waste" approach to production is no longer an option. To change this, we need a total rethink of how we live by starting to imagine a globally net-zero, climate-resilient future with a more "circular economy".

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HOW CAN OPTIMAL REALITY SOLVE FOR REAL TIME OPERATIONAL EXCELLENCE?

Answering this question gets two Melbourne colleagues, Deloitte partner, Sean McClowry, and Deloitte principal, Caleb Sawade, out of bed every day.

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BRIDGING THE GAP FOR A BETTER FUTURE

We've all seen the divide between advanced countries and economies versus those still in development, but how can the private and public sectors bridge the gap? We talk to Ryo Tsujimoto to find out more about his team's work.

Foreword

BY JEFF WEIRENS
LEADER, DELOITTE GLOBAL FINANCIAL ADVISORY

INFRASTRUCTURE IS ABOUT MUCH MORE THAN BRICKS AND MORTAR; IT IS ABOUT PEOPLE, IMPROVING THE QUALITY OF LIFE FOR ALL AND RAISING LONG-TERM ECONOMIC GROWTH.

I’VE ALWAYS BEEN PASSIONATE ABOUT INFRASTRUCTURE AND THE VITAL ROLE IT PLAYS IN SOCIETY, GOVERNMENT, ECONOMIC PERFORMANCE AND OUR COLLECTIVE PAST, PRESENT AND FUTURE. WHEN DONE WELL, IT SIGNIFICANTLY IMPROVES THE WAY WE LIVE OUR LIVES EVERY DAY_____

Investments in roads, bridges and highways, public transit modernization, and broadband expansion creates the kind of economic and

social opportunities necessary for individuals and communities to thrive.

As a global society, we are at a crossroads as we bounce back from a devastating pandemic, face geo-political uncertainties, battle climate change and look to fuel economic recovery.

With each of these challenges comes significant opportunity for new and different collaborations to future-proof the way we work, live and thrive. Now, more than ever, we need to build on the lessons learned to create new

and different ways to build back our economies and improve the lives of our citizens – inspired by diverse global thinking and the full gamut of technology available at our fingertips.

This inaugural publication of our global *Infrastructure* magazine examines many cutting-edge infrastructure topics with some of the best minds in the business. From Norway’s lessons on zero-emission construction sites, to the role of indigenous communities in infrastructure planning, to rethinking our cities towards the future of sustainable

urban development, these are complex and exhilarating stories. *Infrastructure* is focused on sharing unique case studies and leading practices from around the world – as well as considered views on the future of the sector to prompt new ideas, debate and ultimately action and impact.

I hope you enjoy this first edition.

To contribute to the next edition or nominate topics that you’d like us to explore, please email our editor Ike Levick, ilevick@deloitte.com.au

CHANGES ON THE HORIZON

From Brazil up to the States, eastwards to Norway and Jakarta, and down under to Australia – we can see that infrastructure is continually evolving and morphing. Whether it’s responding to climate change by taking

clear steps to net-zero or relocating a capital city to avoid rising sea levels, or governments playing a key role with bold visions or through partnerships with the private sector – there are many positive signs of progress all around the

world. Let’s be inspired by this sea of change and celebrate its significance to everyday citizens and society at large.

URBAN LIVING IS BEING REVOLUTIONIZED IN THE KINGDOM OF SAUDI ARABIA WITH THE ESTABLISHMENT OF THE WORLD’S MOST FUTURISTIC “CITY”_____

Located on the northern coastline of the Red Sea, NEOM – an acronym for New Future – is a vision of what the future could be. It will consist of towns and cities, ports and enterprise zones, research centers, sports and entertainment venues and tourist destinations.

His Royal Highness Mohammed bin Salman, Crown Prince and Chairman of the NEOM Company Board of Directors, revealed plans for THE LINE in 2021, describing a linear

city that will form part of NEOM and have “a million residents with a length of 170 km that preserves 95% of nature within NEOM, with zero cars, zero streets and zero carbon emissions”. The development will consist of hyperconnected, AI-enabled communities powered by 100% clean energy. Built around nature, THE LINE represents the first time in 150 years that a major urban development has been designed around people, not roads.

Walkability will define life in THE LINE – all essential daily services, such as schools, medical clinics, leisure facilities, as well as green spaces, will be within a five-minute walk. The first section of NEOM will open by 2025.

The floating industrial hub, Oxagon, is just one of the planned components of NEOM. (Image: NEOM.com)

BRAZIL IS AUCTIONING OFF INFRASTRUCTURE TO CLOSE FUNDING GAP_____

The government of Brazil is trying to narrow the largest infrastructure funding gap in Latin America, help reduce its budget deficit and spur growth with an ambitious privatization agenda. To attract investors, the Ministry of Infrastructure has been hosting virtual roadshows featuring a host of concession opportunities in Brazilian railways, airports, highways and ports. This approach to finding funds is paying off. In August 2021, the Brazilian minister of economy, Paulo Guedes, who is in charge of finding private investors, noted

the government has collected over US\$24 billion in concession fees, with more than US\$96 billion in committed investments. The momentum continues with the largest and busiest port in Latin America, the Santos Port Authority, which goes to public auction in late 2022. The government recently nearly doubled the land area of the port to add more value and sharpen investor interest.

It’s hoped private sector port management players will generate a greater flow of investments, improve port activity and dynamism and help modernize and improve service.

AMERICA’S NEW US\$1 TRILLION
INFRASTRUCTURE BILL:
WHAT NEXT?_____

A few months ago, the new Infrastructure Investment and Jobs Act was passed by Congress to become the Bipartisan Infrastructure Law. Bold and far-reaching, the new bill touches every sector of American infrastructure – including transport, energy, broadband, water, roads, climate and natural resources. This isn't about economic stimulus; it's about taking a considered approach to rebuilding American competitiveness through great infrastructure. The lives of everyday Americans will also be improved.

According to the White House, the bill will “rebuild America's roads, bridges and rails,

expand access to clean drinking water, ensure every American has access to high-speed internet, tackle the climate crisis, advance environmental justice, and invest in communities that have too often been left behind”.

President Joe Biden confirmed employment will be boosted by over 700,000 new jobs per year for the next decade across manufacturing, construction and transportation. He says, “This deal makes key investments to put people to work all across the country – in cities, small towns, rural communities, and across our coastlines and plains.”

Ongoing construction at the Route 50 interchange with Interstate 66 in Fairfax, Virginia, US.
(Image: EPA-EFE/Jim Lo Scalzo)

AUSTRALIA’S NEW INFRASTRUCTURE
PLAN EMBRACES INDEFINITE
UNCERTAINTY_____

Australia’s resilience has been tested in recent years from a number of angles. Like other countries, it’s making a recovery from the still unfolding COVID-19 pandemic. Its communities have also been devastated by bushfires, floods and cyberattacks. The 2021 Australian Infrastructure Plan launched by the Australian government is a practical and actionable roadmap for infrastructure reform. It is intended to deliver infrastructure for a stronger, more secure Australia: where access to high-quality infrastructure is equitably balanced across cities, regional centers, and rural and remote areas; where the infrastructure is resilient and adaptable in the face of changing

trends and potential global shocks and stresses; and where the infrastructure sector has the capacity and capability to deliver on a record investment pipeline and continue supporting the national pandemic recovery.

The plan is pragmatic and community-centered. It will help grow the economy, increase the number of jobs, maintain and enhance an already enviable standard of living, and ensure the nation’s cities and regions remain world-class. It acknowledges that communities are recovering from, and preparing for, new shocks and stresses, making their infrastructure needs more complex. “Tomorrow's infrastructure is likely to look very different than today's, and the way it is planned needs to embrace this uncertainty,” says Julieanne Alroe, chair of Infrastructure Australia.

Community-centered infrastructure for world-class regions. (Image: Getty Images)

FROM JAKARTA TO NUSANTARA:
THE WORLD’S MOST RAPIDLY
SINKING CITY IS ON THE MOVE_____

Jakarta has been Indonesia’s capital city since 1947. More than 70 years later, and after several years of discussion, the Indonesian Lower House has passed a draft law to relocate the nation’s capital to Nusantara on the island of Borneo. The new purpose-built smart city comes with a price tag of US\$34 billion – to be funded by the public and private sectors – and will occupy 256,000 hectares of land.

So, why the move? The answer is complex. Jakarta’s island home of Java has become increasingly saturated with economic activity, resulting in a disproportionately large population of 31 million people. It’s also frequently subjected to Mother Nature’s earthquakes. Pollution and congestion are

also rife. More concerningly, the island continues to sink a little more into the Java Sea each day – leading to further instability.

“The construction of the new capital city is not merely a physical move of government offices. The main goal is to build a smart new city, a new city that is competitive at the global level, to build a new locomotive for the transformation ... toward an Indonesia based on innovation and technology, based on a green economy,” says Indonesian President Joko Widodo.

In constructing a purpose-built capital, Indonesia follows in the footsteps of other countries and their changing capitals including Pakistan, Brazil and Myanmar. Careful consideration will need to be given to the impact the move will have on both Java’s and Borneo’s locals.

Smog covers the capital city of Jakarta, Indonesia. (Image: Reuters/Ajeng Dinar Ulfiana)

NORWAY IS LEADING THE WAY
ON ZERO-EMISSION CONSTRUCTION
SITES_____

Norway has the rare benefit of an electricity grid with 98% renewable energy, most from hydropower, which makes the Scandinavian country an ideal testing ground for zero-emission construction sites. When work began in 2019 on the Olav Vs gate site to convert a once busy turning zone for the city’s taxis into a new pedestrian area in Oslo, it became a world first: all the machinery used – from excavators to diggers to loaders – was electric. Philip Mortensen, senior adviser at the City of Oslo’s Climate Agency, noted, “We observed shops keeping their doors

open towards the street, even when construction work was going on just outside on the pavement. Workers also reported much better communication on site due to lower noise levels, and that as a consequence the working environment felt safer.” In total, by using electric construction machines, the Olav Vs gate pilot project was able to save 35,000 liters of diesel and the equivalent of 92,500 kg of CO2, compared to the use of regular machinery. This equates to taking 20 cars off the road for a year. The city now wants all municipal construction sites to be zero-emission by 2025, and all construction work, public or private, to be zero-emission by 2030. More Norwegian cities are following suit.

Clean construction works at Olav Vs gate in Oslo, Norway. (Image: C40/Frederik Varfjell)

FEATURE

Listening broadly to create trusted data to make better, faster decisions

A FIRESIDE CHAT WITH
SIMON THOMAS – VICE PRESIDENT, POTASH, BHP CANADA INC.

NO INDUSTRY IS IMMUNE TO CHALLENGES. ACCORDING TO BHP VP SIMON THOMAS, THE MINING SECTOR FACES MANY OF THE SAME CHALLENGES AS THE REST OF THE INFRASTRUCTURE SECTORS

He views these challenges as opportunities for improvement or transformation, to make sure organizations never stand still and continue to respond to what industry and people need and want.

Let's start with one of the biggest challenges: how to handle climate change. Mining organizations have to articulate their position on climate change, says Simon, because "We're at the front end of the commodity supply chain;

it's important to be clear on a path to net-zero, with significant reductions of scope 1 and 2 emissions holding a prominent place within all future planning."

Other challenges include securing renewable or "green" energy sources, overcoming disruption to the supply chain, and transitioning from obtaining a social license to operate towards creating lasting social value. It's the way we respond that's important.

Simon says, "At BHP, this is becoming critical to the way we make decisions, how we respond to the big shifts in public sentiment across all these matters – including how we foster connectivity between our employees and the organization."

Being driven by clear values and principles makes business sense, too. Communities, along with their local and federal governments, are all interested in working with organizations that have a strong moral compass and are committed to doing the right thing - by the planet and by the communities in which they operate.

The rapid shifts that we are experiencing today require both an understanding and focus on what society needs now while also considering

the longer term. It is a challenge when making planning and investment decisions to avoid investment in areas that don't become redundant or superseded by something else in the future.

Simon has been reflecting on what this means in the current era – to listen – beyond just hearing, "What if we extrapolate listening to be a broad concept, in which we use all our senses as a form of listening? Technology and infrastructure planning are also allowing us to have access to new ways of listening – like gathering data and different sources of information using smart sensors, devices or drones. But how do we manipulate those various sources of information and bring it all together? With modern data management

systems augmented by Artificial Intelligence – that’s listening!” says Simon.

Simon believes that when we truly listen, we’ll question the way we have always done things, enabling organizations and governments to become more responsive and organic. Historically, the progressive development of infrastructure has been driven by “linear” factors such as population growth, global trade, or improving basic living standards. However, there is a shift as populations are changing the way in which they interact with infrastructure around them.

A great example is the smart city. The combination of facilities and services that supported housing and commerce were cities before they were “smart.”

They are evolving to be able to respond to and inform what their populations want – usually connectivity – and in turn, giving governments and corporates insights to inform decisions about where resources need to be applied, and when. Simons says it’s all about our ability to listen broadly and being able to rely on good data to inform the best decisions.

Infrastructure is facing continued disruption through the increased frequency and severity of extreme weather conditions. Rising sea levels, flooding caused by intense high rainfall, extreme temperatures ... interestingly, it’s when critical infrastructure is placed at risk, when conditions are tough, that organizations manage to quickly revert to crisis mode and make much quicker decisions to enable recovery. “Imagine if we made decisions like that more often, at times when we’re not responding to a crisis. It poses the challenge of how we structure governance. How can the need for good governance, for the purposes of the future benefit of infrastructure, be balanced with holding back development through a continued risk-based governance that continues to reflect on the past?” reflects Simon.

“What if we thought a bit more about how people think about sharing the valuable things individuals own – like the car and Uber, or homes and Airbnb – and how they make available what they own to others who want access to it. For instance, sharing, renting, leasing? In that same vein, how do corporations think about the things that they want to own and operate themselves, and what they want to outsource or establish supply agreements to service? This is becoming increasingly prevalent, and good data and digital platforms are the key to enabling that,” says Simon.

DATA IS A GAME CHANGER

In fact, having instant access to trusted data is a game changer. Digital solutions can transform the way infrastructure programs are run, and Simon has seen this firsthand with BHP’s recent South Flank expansion in Western Australia. He was responsible for leading this complex project, which was made possible by changing the way decisions were made to progress the development, underpinned by a Deloitte offering called Intelligent Major Capital Projects, which is an advanced digital solution that helps deliver projects smarter, faster and with more certainty.

Simon explains how using this digital solution fundamentally changed the way the expansion unfolded. “We were able to influence decision making and move people’s paradigm from traditional project management to gaining instant access to clean data to inform rapid

decisions. Combined with an integrated project team, we took away hierarchy and empowered people to make the right decisions. It brought data and project information to light and allowed us to develop tools to manage emerging risks.” This saved precious time, costs and also improved job satisfaction for all those involved because there was greater empowerment and more emerging leaders who could see a different future.

REFLECTING ON THE PAST TO INFORM THE FUTURE

We can’t just keep on doing what we have always done. Simon believes that previously, a lot of infrastructure was developed to allow communities and societies to advance, improve their standard of living, or elevate their quality of life – from water treatment, energy generation and transmission to national road networks. While important and essential, the planet’s future also needs to be considered. The way people come together and live in society impacts our natural habitats and ecosystems, the quality of the land, air and water, so Simon says it’s important to enhance our living environments with future thinking for “the whole”.

“This isn’t just about humanity. The whole ecosystem is coming into play, as well as human development. How do we reduce the fresh water we use and increase the water we treat and reuse? How do we shift practices in agriculture as a potential answer to global warming, through making the current farmland more productive and less impactful on the globe as a whole?” says Simon.

Potash, primarily comprised of potassium, can play a role in sustainable farming practices and improving nutrient levels in soil. A natural compound, it can be used in direct application or in combination with elements to produce fertilizer. Potash enhances the water absorption rates in plants and promotes increased yield. Its environmental benefit lies in the fact it doesn’t leave a build-up of negative soil residue and, although unused potash will remain in the soil, it continues to be available for future plant growth. “It can play a vital role for improving food security, and improve crop yield across common farming areas,” explains Simon.

When thinking about his legacy, Simon says he’d “love to shift more towards the way we operate when there’s a crisis and extrapolate that out across business in normal operating practices. Rather than increasing governance, I’d like to see how it can be reassessed to influence the way decisions are made, and at what level, supported by reliable digital solutions. It’s all about speeding up our decisions so we can be nimbler, more often.”

Modern technology can help us to quickly anticipate the impact of decisions and stop us from making the same mistake more than once, because we’re better informed.

“It’s all about getting the balance right and moving forward with appropriate consideration for the past to achieve a better future for everyone,” says Simon. After all, when we listen with all our senses and draw on all the insights provided by good data, that’s when the best decisions get made for society, the planet and the economy.

***Simon Thomas** is Vice President of BHP’s Jansen Potash Project in Canada. He has extensive expertise in major projects delivery spanning the oil and gas, minerals processing, materials handling, agriculture and manufacturing sectors with a capex of >A\$4 billion. He is based in Saskatoon, Saskatchewan, Canada.*

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FEATURE

From livable to lovable – making cities more human

A CONVERSATION WITH
DULEESHA KULASOORIYA – MANAGING DIRECTOR OF DELOITTE CENTER FOR THE EDGE IN ASIA PACIFIC

CITIES ARE OFTEN RANKED FOR THEIR LIVABILITY, SUSTAINABILITY OR TECH SMARTS, ALL OF WHICH MATTER. BUT WHAT IF THEY COULD ALSO TAKE CONCRETE STEPS TO EMBODY ELEMENTS OF WHAT MAKES A CITY LOVABLE, HELPING RESIDENTS FEEL MORE CONNECTED? THE PAYOFF WOULD BE HAPPIER, MORE RESILIENT CITIZENS – POISED TO DRIVE ECONOMIC GROWTH.

So, what drives that special pride, passion and joy in a city? Why wouldn't New Yorkers dream of living anywhere else? And what makes Paris so magnetic to its citizens? Lima's eclectic cultures are a drawcard, and locals love Hong Kong's unequivocal commitment to the art of commerce ... what does it all mean?

DULEESHA SAYS THERE ARE READILY IDENTIFIABLE ATTRIBUTES THAT MAKE A CITY LOVABLE

City planners and governments can shape those attributes to help cities and their citizens form an emotional, resilient bond. Given that more and more people will be living in cities every year (World Bank, *Urban Development*, 2020), the more closely citizens relate to their cities, the more both will benefit.

All around the world, cities are becoming more quintessentially human, and more

representative of their people. A great example is SuperKilen Park in Copenhagen, Denmark. Duleesha explains, "This space came about as an effort to better connect the residents of the Norrebro neighborhood in a meaningful way."

It was co-created with the multiethnic community, and showcases over 60 artifacts from around the world – including a picnic table from Armenia, swing set from Baghdad, Palm trees from China and three tons of soil from the Palestinian territories. The design features were all common typologies of their respective cities. "The space was co-created with the resident

communities, therefore creating a deep sense of ownership and connection. Most importantly, this was a move to shift away from an image of a homogenous Denmark to one that more accurately reflects a much more diverse urban population in Copenhagen," says Duleesha.

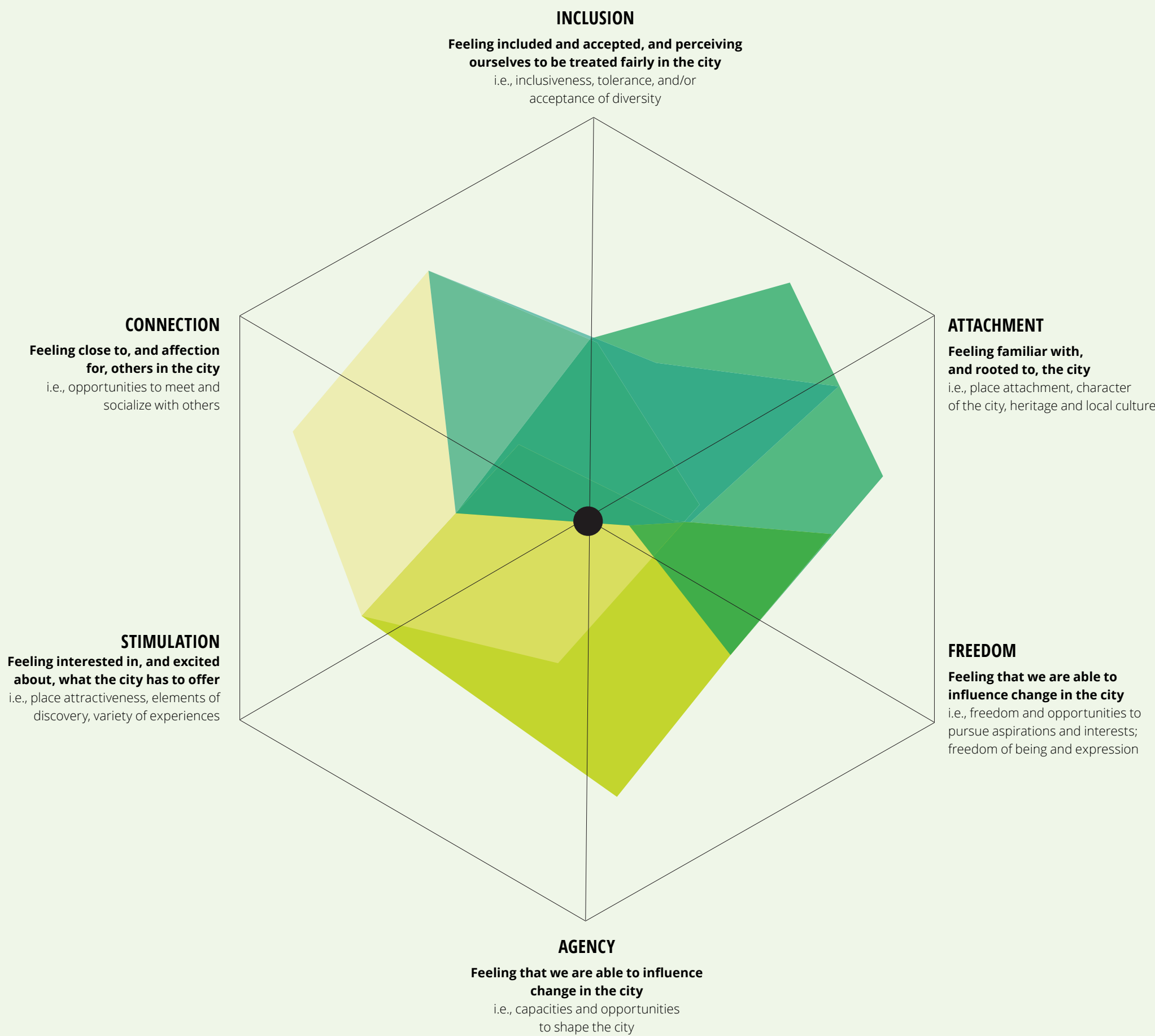
The park is just one example of the six attributes that make cities lovable, namely a sense of **connection**, as shown in the diagram overleaf. The other lovable senses are: **attachment** (think of Chinatown or Little Italy in all big cities), **stimulation** (like London's

commitment to being a 24-hour city), **freedom** (the open joy of gay pride festivals in Sydney and San Francisco), **inclusion** (like creating pro-home ownership policy structures to include most Singaporeans in wealth creation through home ownership).

And last but not least is a sense of **agency** (the increasing influence from the masses, like a communal three-year clean-up of Versova Beach in Mumbai to transform it to its former natural beauty).

Duleesha Kulasooriya is based in Singapore.

IF YOU BUILD OR ADAPT CITIES TO HAVE THESE SIX ATTRIBUTES, CITIZENS WILL
BE MUCH MORE ENGAGED IN SOLVING THAT CITY’S PROBLEMS,
AND THIS CREATES MORE RESILIENT CITIES.



“This is a new conversation we should have at a global scale. I’m committed to accelerating the thinking that was first commissioned by the Design Council of Singapore for that city, and steering this further towards the edge – encouraging global debate of what makes cities the best they can be. If future policies could factor in what makes cities lovable, it would transform lives.”

DULEESHA KULASOORIYA

Read the Deloitte Insights article,
*From livable to lovable – Making cities
more human* by Duleesha Kulasooriya

A CONSERVATIONIST APPROACH

Ancient wisdom to build a more resilient future

"IN OUR RUSH TOWARDS THE FUTURE, WE TEND TO FORGET ABOUT THE PAST. WE HAVE THOUSANDS OF YEARS OF ANCIENT KNOWLEDGE THAT WE JUST NEED TO LISTEN TO, ALLOWING IT TO EXPAND OUR THINKING ABOUT DESIGNING SYMBIOTICALLY WITH NATURE. BY LISTENING, WE'LL ONLY BECOME WISER AND READY FOR THOSE 21ST CENTURY CHALLENGES THAT WE KNOW WILL ENDANGER OUR PEOPLE AND OUR PLANET. I'VE SEEN IT."

WISE WORDS WITH
JULIA WATSON – CONSERVATIONIST AND LANDSCAPE DESIGNER

“IT’S IMPORTANT THAT WE PUT INDIGENOUS KNOWLEDGE KEEPERS, EXPERTS AND THINKERS INTO PLACES WHERE THEY HAVE AUTHORSHIP AND AUTHORITY ON DECISIONS BEING MADE ABOUT OUR ENVIRONMENTS. LET’S MOVE FROM GLOBALISM TOWARD A DIFFERENT FRAMEWORK OF HOW THE WORLD WILL EVOLVE BASED ON REGIONALISM.”

ANCIENT WISDOM FOR A MORE SUSTAINABLE WORLD

Technology holds one of the keys to tackling climate change. Not just what many of us often refer to as high-tech, but the local and slow tech that has been successfully adopted by indigenous communities around the world for centuries. Julia Watson is passionate about bridging this technology divide to make sure we learn from the past to inform plans for the future of infrastructure – and how we live in better sync with natural environments everywhere.

An environmentalist at heart, Julia has always been deeply interested in the unique, generational relationship indigenous cultures have with nature. Her interest was piqued by a small multicultural suburb in Brisbane, Australia where she grew up, which was steeped in indigenous history. Then she studied to become an architect at the University of Queensland, where her interest in learning from the past to inform the future was cemented by a compulsory second-year subject called “aboriginal environments”.

“I’m passionate about looking at indigenous communities all over the world through the lens of an architect – and really looking back to that knowledge that has been out in the world for hundreds of years, and bringing that into our contemporary view. Then looking at architecture, and its role in developing more sustainable, resilient infrastructure. Rather than just looking at what we classify in the US-European world as ‘high-tech’, we also need to look at climate-resilient technologies that indigenous cultures have been working with for millennia to survive and thrive,” says Julia.

LIVING IN HARMONY WITH NATURE

Far from being ignorant or primitive, these nature-based technologies are in sync with their environment to create long-lasting, sustainable infrastructure assets. Take the Khasi people, who live in the jungles of Meghalaya in northern India, a place that gets more rain than anywhere else on earth – a staggering 500 inches per year. The monsoonal high rainfall means locals need to live with incredibly fast-flowing rivers, and bridges just don’t cut it because of high water levels and rot. So villagers have found unique ways to avoid being cut off from neighboring villages – by growing living structures from trees to cross rivers during the monsoon season.

Julia continues, “The Khasi people intentionally plan generations in advance – planting beautiful ficus trees along the fluctuating river corridors, waiting for them to grow, and then training their root systems to hang down from the huge branches and grow across the river. Eventually, they become a huge, living root bridge. They’re beautiful, elegant, truss-system bridges that look like a scaffolding system. Everyone takes care of the structure, managing how that growth happens until about 50 years later when it’s safe to cross. This is generational thinking at its best – and it’s embedded into their way of life, and part of how they relate to the local forest. It’s not about the individual; it’s identifying as part of the local community and environment.”

During the last two decades, Julia has traveled far and wide and has witnessed cultures like the Khasi who have been living with floods for thousands of years and have evolved ancient

A Ma’dan house (mudhif) in the southern wetlands of Iraq, built of qasab reed without using mortar or nails, can be taken down and re-erected in a day.

technologies that allow them to work with the water. Another great example is in Iraq’s southern wetlands where a unique, water-based civilization lives. For 6,000 years, the Ma’dan have floated villages on man-made islands that are constructed from a single species of reed that grows around them on the islands. This qasab reed is integral to every aspect of life, in the same way that the ficus trees and its roots permeate the way the Khasi people live.

Julia explains, “The qasab reed’s use is so diverse – food for water buffalo, flour and building materials for humans to support

those biodegradable, buoyant islands and their cathedral-like houses. The reed is used for columns, rafters and is woven into the walls and roofs – and it’s made into twine which eliminates the need for nails. Everything about this community is closely linked to the local natural environment. Frustratingly, this amazingly innovative existence is largely undocumented in terms of how we can think about mobile, flood-resilient island architecture, and this inspires me to help spread the word every day.”

NEW PLATFORMS FOR OLD VOICES

Julia reminds us that we’re all custodians of the land we live on. So we need to strategize, discuss and finance climate-adaptive technologies – not instead of, but in addition to, high-tech solutions. A more socially responsible, environmental and equitable approach will help us respond better to climate change – including rising sea levels, storm events, floods and fire – to name a few global issues.

“We need to create new platforms for people from outside the dominant cultural framework to be invited into the conversation to get true diversity of opinions. We need to make resources, money and expertise available – as well as all forms of technology – to change the landscape of how we think about climate resilience, and how we approach the complexity of climate change,” says Julia.



Qasab reed has long served as raw material for homes, handicrafts, tools, and animal fodder with the distinctive mudhif houses of the Ma’dan people appearing in Sumerian artwork from 5,000 years ago.

Another example of how indigenous communities adapt to their environments is just outside Kolkata in India. Here exists what Julia refers to as “a new renewable” and what could be the next generation of green technology. The Bheri waste water and fish farming system was first introduced in 1920 to clean sewage in water, so it can be used multiple times by local communities. It’s not only convenient, it’s also creating jobs, sustaining livelihoods and saving the government money it would otherwise spend on sewage plants.

“On the periphery of Kolkata, a community of fourth generation Bengalese local fishermen and women are using nature-based waste water systems to clean half of Kolkata’s sewage. In simple terms, natural sunlight works in symbiosis with the water’s algae and bacteria to make it safe and usable. Named the East Kolkata Wetlands, this constructed system is the largest of its kind in the world. It isn’t just attuned to the local biodiversity and feeding the city, it’s also supporting 80,000 people who rely on the wetlands for jobs in fish farming, agriculture and recycling. Wetland activities lead to the production of 13,000 tons of fish per year, 16,000 tons of rice per year, and about 156 tons of vegetables per day – all of which are sourced locally and save the city millions in transportation costs,” says Julia.

REFRAMING THE CONVERSATION

These indigenous ways of living and adapting to nature offer food for thought in how we think about infrastructure, how it can be different, and how we can build cities in new ways to protect our natural biodiversity while responding to climate change. We need to declassify the way we usually approach things and open our minds to include insights from thousands of years of successful coexistence with nature.

“Taking a more deliberate and inclusive approach to the way we build cities and infrastructure may take a little longer, but it’s important to realize that not all solutions need to be high-tech,” Julia says.

“Let’s not forget the past: Let’s embrace it and do even better in the future. As a designer and practitioner, I want to work with indigenous communities, sharing their knowledge to reframe the way we look at the growth of our cities.”

Julia Watson lives in New York City, US. She is the author of Lo—TEK Design by Radical Indigenism (2019), Taschen. All photos were provided by her.

OUR TIME ON EARTH

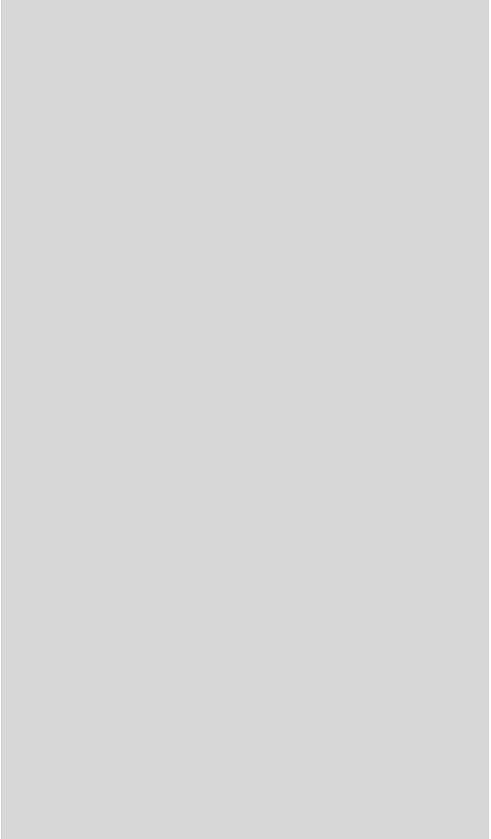
Julia is passionate about finding new platforms for indigenous voices to contribute toward how we think about infrastructure in the future. *Our Time on Earth* is a major exhibition celebrating the power of global creativity to transform the conversation around climate change, to be presented by the Barbican in London from May until late August 2022.

Curated by Franklin Till, Julia was invited to create an exhibition piece showing how indigenous technologies are invaluable to our collective.

Representatives from the Khasi community in the northeastern Indian state of Meghalaya, the Subak community of farmers in Bali, and the Ma’dan community of southern Iraq are collaborating with Julia, Mordak Smith and sustainability engineers from Buro Happold to look at how urban environments in 2040 could benefit from incorporating indigenous, local knowledge and technologies.



Rubber trees in Meghalaya, India, are trained by the Khasis to grow into bridges across rivers that swell during monsoons. Visually stunning, the bridges are a symbol of how humans work with, not against, nature.



The combined impact of commuting for work and recreational trips add up in terms of climate impact

WHY? BECAUSE CAR EMISSIONS ARE WORSE THAN WE REALIZE. ACCORDING TO WWF, TRANSPORTATION ACCOUNTS FOR 25% OF GLOBAL ENERGY USE, WITH SHORT CAR TRIPS RESPONSIBLE FOR 75% OF TRANSPORT EMISSIONS. RECENT RESEARCH BY THE GLOBAL FOOTPRINT NETWORK ALSO REVEALED THAT PERSONAL TRANSPORTATION MAKES UP 14% OF HUMANITY'S CARBON FOOTPRINT.



FIND OUT MORE ABOUT DELOITTE'S COMMITMENT TO TAKING CLIMATE ACTION

BOGOTÁ

Alleviating city congestion with a new commuter train

SHARING PERSPECTIVES WITH

LUIS NIÑO – LEAD PARTNER ON THE REGIOTRAM DE OCCIDENTE PROJECT, DELOITTE COLOMBIA
EDUARDO DE LA PEÑA – LEAD PARTNER, INFRASTRUCTURE & CAPITAL PROJECTS, DELOITTE SPANISH LATIN AMERICA

Bogota, Colombia - Home to millions of people and a key destination for thousands more who work here each day. (Image: Getty Images)

WELCOME TO BOGOTÁ, COLOMBIA’S SPRAWLING, HIGH-ALTITUDE CAPITAL LOCATED IN THE ANDES – HOME TO MILLIONS OF PEOPLE, AND A KEY DESTINATION FOR THOUSANDS MORE WHO WORK THERE EACH DAY

Although this busy city has an integrated public transport system called SITP which consists of regular buses and Transmilenio, a mass rapid transit system, this isn’t enough. City workers who live in the peripheral areas of Bogotá and the surrounding Cundinamarca municipalities are getting stuck in traffic on the congested highway for hours every day, making accessibility and connectivity to the city center a big challenge.

For some time, these long travel times and the characteristics of the available infrastructure to access the Colombian capital have limited commuters’ ability to use public transport in the region. In the last few years, the city of Bogotá has been advancing with plans to carry out a series of works in order to close the gap in the city’s mass public mobility infrastructure – including a green road corridor, cable car lines, and the first line of the city’s metro system which will prioritize pedestrians and sustainable transport.

SUPPORTING CITIZENS IN THEIR DAILY COMMUTE

Now the government of Cundinamarca, through the urban transit company Empresa Ferrea

Regional (EFR), has decided to structure, launch and operate a new commuter train called Regiotram de Occidente. This decision makes this new infrastructure project the very first commuter train between Bogotá and its surrounding municipalities.

“Bogotá is going to be a city in which railways will predominate for mass public transport of passengers ... with metro lines and cable car lines ...” Bogotá Mayor Claudia López, January 2022.

Regiotram de Occidente will significantly improve and modernize urban mobility – and the welfare conditions for the people who rely on public transport to commute. The new light rail commuter train will connect Bogotá with at least four neighboring municipalities west of the city, run for 41.1 kilometers, and serve nine train stations in Bogotá and eight in Cundinamarca. Importantly, the new line running to Bogotá will avoid the central station and terminate at Calle 26/Avenida Caracas (city downtown), where it can more easily offer commuters the possibility to interchange with the Bogotá Metro and the SITP of Bogotá.

“... [this project will] stimulate the economy, generate competitiveness and alternatives for environmentally friendly mass transportation, and will be a great work of benefit, not only for the region but also as a national reference.” Cundinamarca Governor Nicolás García Bustos, August 2020.

Luis Niño, lead partner on the Regiotram de Occidente, Deloitte Colombia, explains, “This rail will be able to transport approximately 130,000 passengers per day at the beginning of its operation, or 40 million per year. In addition, it will connect the municipalities of Funza, Mosquera, Madrid and Facatativá with Bogotá, and reduce a conventional trip from three hours to only 45 minutes. Operations are expected to start in 2026,” says Luis.

FROM VISION TO IMPLEMENTATION

Making this bold vision a reality takes experienced teamwork across the private and public sectors. Deloitte has partnered with three expert companies in a consortium to advise the Government of Cundinamarca –

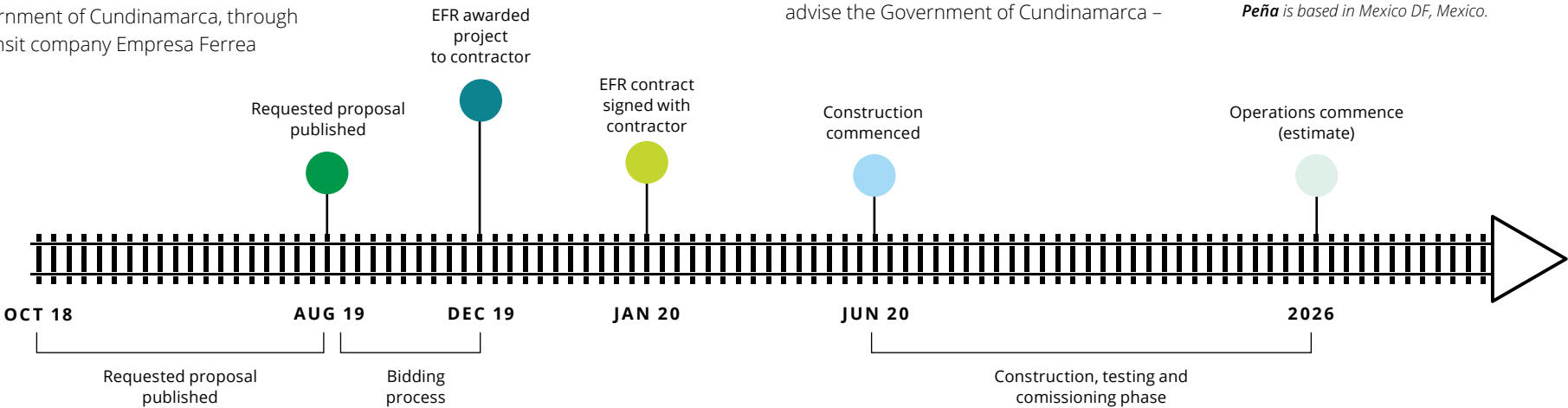
Duran & Osorio, a leading international law firm; Egis, local technical experts; and Sumatoria, a local investment bank.

“Deloitte’s main role is to financially structure the project to make sure it’s viable, including the financial modeling and a comprehensive financial feasibility study. Together, our consortium advises on all matters relating to the project so the Government of Cundinamarca can make confident decisions about next steps,” explains Luis.

With an approximate cost of US\$850 million, this private participation project, similar to a Public-Private Partnership (PPP), will be financed in two ways: by the state and the Government of Cundinamarca in the form of capex and rolling stock – and by the private sector, which will operate and maintain the trains for 21.5 years for the millions of citizens who will use them.

As highlighted by Eduardo de la Peña, lead partner, Infrastructure & Capital Projects, Deloitte Spanish Latin America, “Latin America needs to upgrade its infrastructure both in quality and quantity. Low competitiveness, population increase and urban concentration are some of the challenges we face as a region. Our Infrastructure & Capital Projects team is always looking to be part of projects that have the power to transform lives in a sustainable way.”

Luis Niño is based in Bogotá, Colombia and Eduardo de la Peña is based in Mexico DF, Mexico.



Making the new Regiotram de Occidente line a reality for Empresa Ferrea Regional (EFR).

FEATURE

Infrastructure megaprojects: What does it take?

EXPLORING MEGAPROJECTS WITH
ROB SCOPES – PARTNER, MAJOR PROGRAMS, DELOITTE UK

UK's first 'box slide' bridge - Marston Box M42 - preparation work. (Image: hs2.org.uk)

FROM REBUILDING ECONOMIES TO COPING WITH AGING POPULATIONS, TO REDUCING REGIONAL INEQUALITIES, TO TAKING CLIMATE ACTION ... SOCIETIES AT LARGE ARE FACING A NUMBER OF COMPETING, AT TIMES OVERWHELMING, CHALLENGES._____

Thankfully, major infrastructure programs are increasingly becoming a key delivery vehicle to help address these challenges – and will continue to do so – as long we can avoid going over budget, over time, over and over again. In fact, all major programs – infrastructure or otherwise – need to be set up with the right capability from the start to be successful over the course of their entire lifecycle.

Rob Scopes, partner in charge of leading major programs at Deloitte UK, says success is easier said than done, because every program is set up and delivered differently according to its size, scope, and ambition. Furthermore programs are dynamic, presenting the need to recognize their changing requirements as they move through the different phases from design to eventual construction and use. The UK Government's Major Projects Portfolio is case in point, demonstrating the full range and type of programs in play; each requires varying levels of financing and external support, and is dependent on the delivery model selected to execute the program. It's an interesting

dynamic that will directly impact the future of infrastructure. Rob says, "While on the surface each major program appears to be different, they're ultimately driven by three parallel lifecycles: funding and financing; capital program; and organizational (focusing on capability). Unfortunately, we have found that the organizational lifecycle doesn't always get the same attention as the other lifecycles, which creates challenges down the track.

"Each lifecycle is connected, but has unique objectives and characteristics that are influenced by a range of dynamic forces – as well as the knock-on effects of associated change between lifecycles. There may also be external factors that contribute to timing and scale of required capabilities," says Rob.

INSTILLING STAKEHOLDER CONFIDENCE TO STEP AHEAD_____

Needless to say, successfully delivering programs of work is complex, and much more than simply a capital project. It requires organizational capability development and change management, too. When you effectively manage the transition between lifecycles, you instill stakeholder confidence that the asset will deliver its intended benefits. And in doing so, that's when societal challenges are addressed, and the world runs more smoothly.

Projects that focus enough attention on the early stages are much more likely to achieve their intended outcomes later on and display world-class delivery standards.¹

For the last four years, Rob has been leading the firm's team of experts to work with High Speed 2 (HS2) Ltd. – a Government Arms' Length Body (ALB) – to deliver on its investment in a new high speed railway that will form the backbone of the investment in Britain's transport network. The team's focus has been on defining and developing the ALB's right capabilities and operating structures to demonstrate to the Department of Transport and HM Treasury that it can confidently manage multibillion-pound contracts – and effectively deliver on the large scale transformation required.

A START-UP MENTALITY WILL DRIVE LASTING CHANGE_____

Rob says, "ALBs created specifically to deliver megaprojects are like start-ups, but on steroids! In a capital project lifecycle, ALBs need to transform themselves on a number of occasions – like start-ups – as they transition to

the next lifecycle, from strategy and feasibility, to procurement and design, to construction and decommissioning."

Once operational, HS2 will be a state-of-the-art, high-speed line critical for the UK's low carbon transport future. It will provide much needed capacity and serve over 25 stations connecting around 30 million people. It will significantly improve connectivity in the North and Midlands and will also integrate the existing network serving stations into Scotland, creating 500,000 extra jobs and 90,000 homes around HS2 stations.²

This is a fantastic project for the firm to be involved in, and ticks every box in terms of making an impact that matters, proactively innovating and pushing the envelope, teamwork at speed and scale, and creating countless personal career highlights for all involved.

PLANNING NOW FOR THE LONG TERM

Ultimately, developing a clear understanding of the capability required throughout the lifecycle of a major program can both optimize efficiency and value in delivery, as well as support organizations to manage their program's dynamism and achieve broader organizational

objectives over the longer term. Rob concludes, "HS2 is all about creating capacity across the country while giving commuters a low carbon option for long distance travel. Over the next 12 months, having initially focused on Phase 1 between London and Birmingham, we're switching focus onto making sure everything is in place organizationally for Phase 2a to Crewe, and Phase 2b to Manchester. This extension

of the high speed network will free up capacity on the congested West Coast Main Line and deliver significant connectivity, reliability and journey time benefits for passengers. The work we have done, and the insights we have gained, will contribute to delivering on time, on budget."

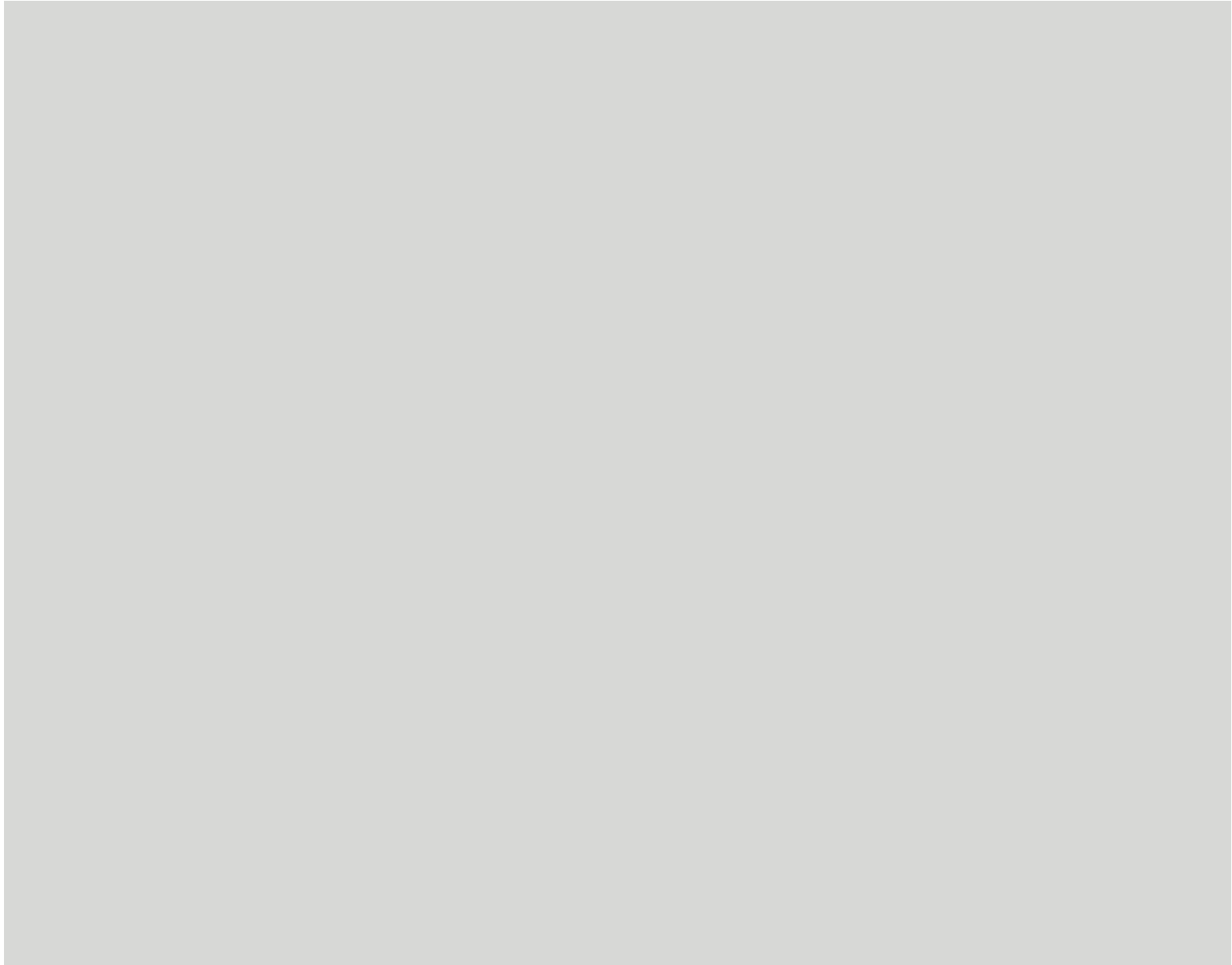
Rob Scopes is based in London, UK.

Sources:
1 Infrastructure and Projects Authority Project Routemap, Setting projects for success – Organisational Design and Development, 2021
2 www.hs2.org.uk

BLOCKCHAIN COLLABORATION SAVES MILLIONS

In late 2020 Deloitte met with the HS2 Innovation team to suggest innovations which could impact the infrastructure and construction sector – especially blockchain and how it could drive efficiencies in the commercial management of contracts. Meanwhile, Costain was bidding for funding from HS2's Innovation team to show blockchain's potential. The result? Deloitte and Costain teamed up to co-develop a proof of concept to demonstrate how this innovative technology could significantly improve the transparency, accountability and trust across all levels of the construction supply chain.

Hugh Dullage, partner, Financial Advisory, Deloitte UK, worked on the new proof of concept (POC) and says, "this collaboration was great. Our POC identified opportunities to reduce process steps and time required for processing timesheets and invoices; it's estimated this can reduce payment times by more than 50%. This will enable subcontractors to be paid faster and more consistently through increased automation, reducing their cost and the level of dispute associated with plant procurement. This platform has the potential to save millions for both HS2 and its supply chain. We're currently planning how to expand this POC into a production-ready platform."



Apprentices pictured inside the tunnel portal at HS2's Long Itchington Wood site. (Image: hs2.org.uk)

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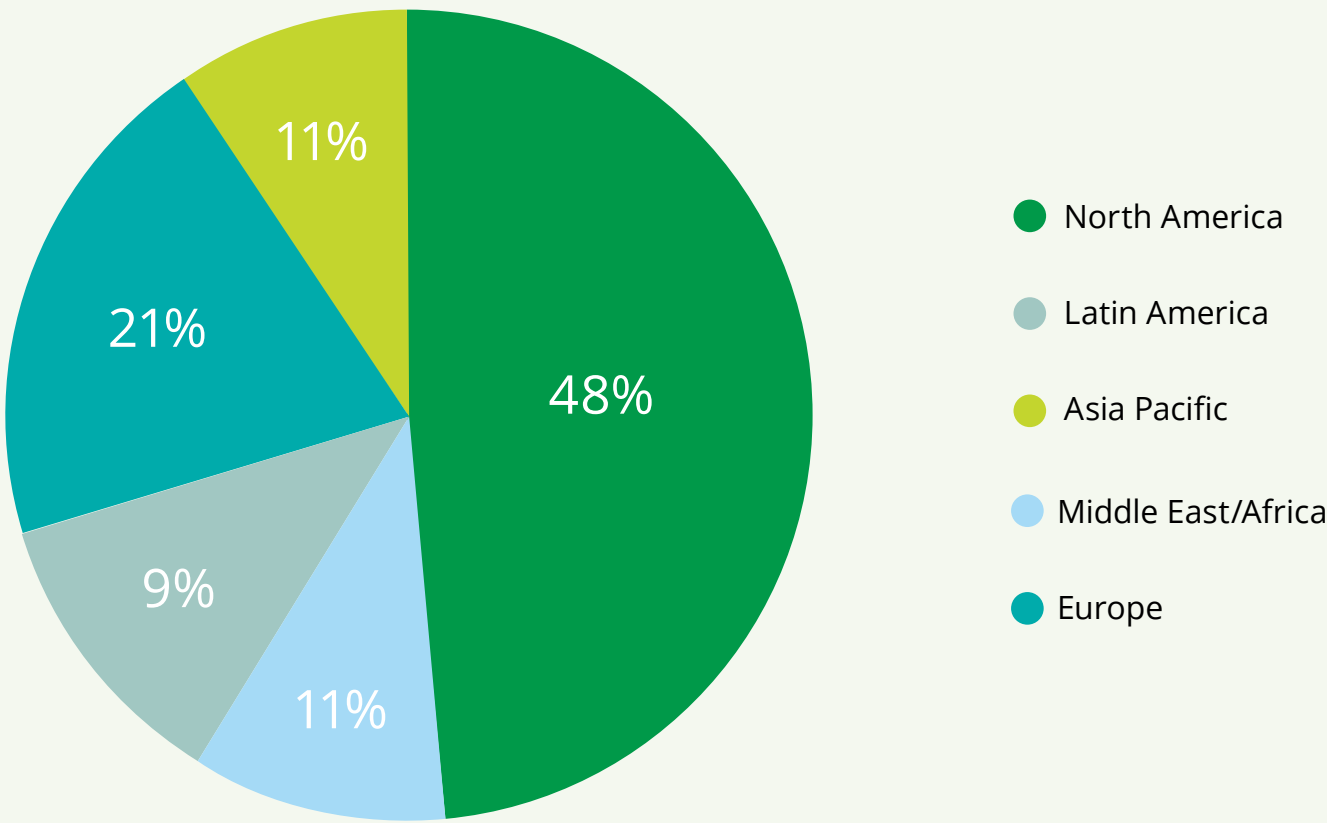


FEATURE

A survey of infrastructure trends

OVER 600 LEADERS SHARE THEIR VIEWS

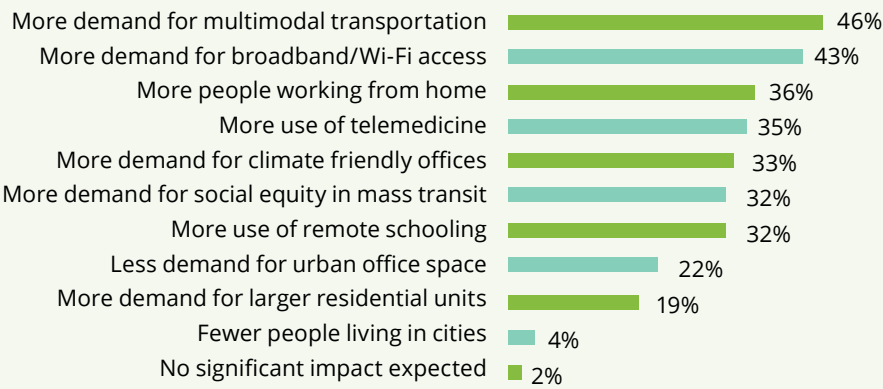
In late 2021, Deloitte surveyed 660 global leaders working in the infrastructure space to gauge their perspectives on the sector’s future. Key survey insights have been captured here. Survey respondents mostly included senior officials working in governments (77%), followed by private companies (21%) and nonprofits (2%).



COVID-19 WILL HAVE A LASTING IMPACT

1

Almost every participant (98%) believed that the COVID-19 pandemic will have a significant, lasting impact on infrastructure. Interestingly, the reasons cited for this impact covered a broad range of reasons, with almost half of respondents saying they thought COVID’s impact would create more demand for multimodal transportation:





PEOPLE STILL WANT TO WORK FROM HOME

2

Over one-third of respondents believe more people will be working from home, and people will also make greater use of telemedicine. Interestingly, although remote working will continue to increase, this isn't expected to translate to where and how people live.



GOVERNMENTS CAN MAKE CITIES MORE LIVEABLE

3

Interestingly, respondents don't expect people to flee cities. Only 4% of respondents believe that there will be fewer people living in cities, and only 1 in 5 believe that there will be more demand for larger residential units. The majority of respondents believed governments would achieve their post-pandemic social, environmental, and economic infrastructure agendas and meet citizen demand for more livable cities by investing in urban spaces and green transformation.

Steps to achieve post-pandemic agendas (increase a little or increase a lot)	Global (%)	Asia Pacific	Europe	Latin America	Middle East/ Africa	North America
Invest in urban public spaces for walking, cycling, socializing and eating	60%	57%	55%	53%	49%	68%

“TO IMPROVE THE CITY’S AIR QUALITY AND REDUCE CONGESTION, WE ARE INVESTING IN LOCAL STREET INFRASTRUCTURE TO PROMOTE COMMUTING BY WALKING, CYCLING AND TAKING PUBLIC TRANSPORT.”

- UK CITY OFFICIAL



TECHNOLOGY WILL SHAPE THE FUTURE OF INFRASTRUCTURE

4

Most respondents singled out AI/machine learning, cloud computing and cybersecurity technologies as the most likely ways to shape infrastructure development. But despite these advances in technologies, respondents believed execution challenges around starting projects would continue.

Technology	ALL	Developed*	Low and middle income countries**
AI/machine learning	55%	59%	43%
Cloud computing	53%	55%	50%
Cybersecurity technologies	49%	51%	41%



IN SOME REGIONS, INFRASTRUCTURE BACKLOGS CONTINUE

5

More than one-third of respondents said their region suffered from an infrastructure backlog, with that figure rising to 50 percent or more among respondents in Latin America, the Middle East and Africa.

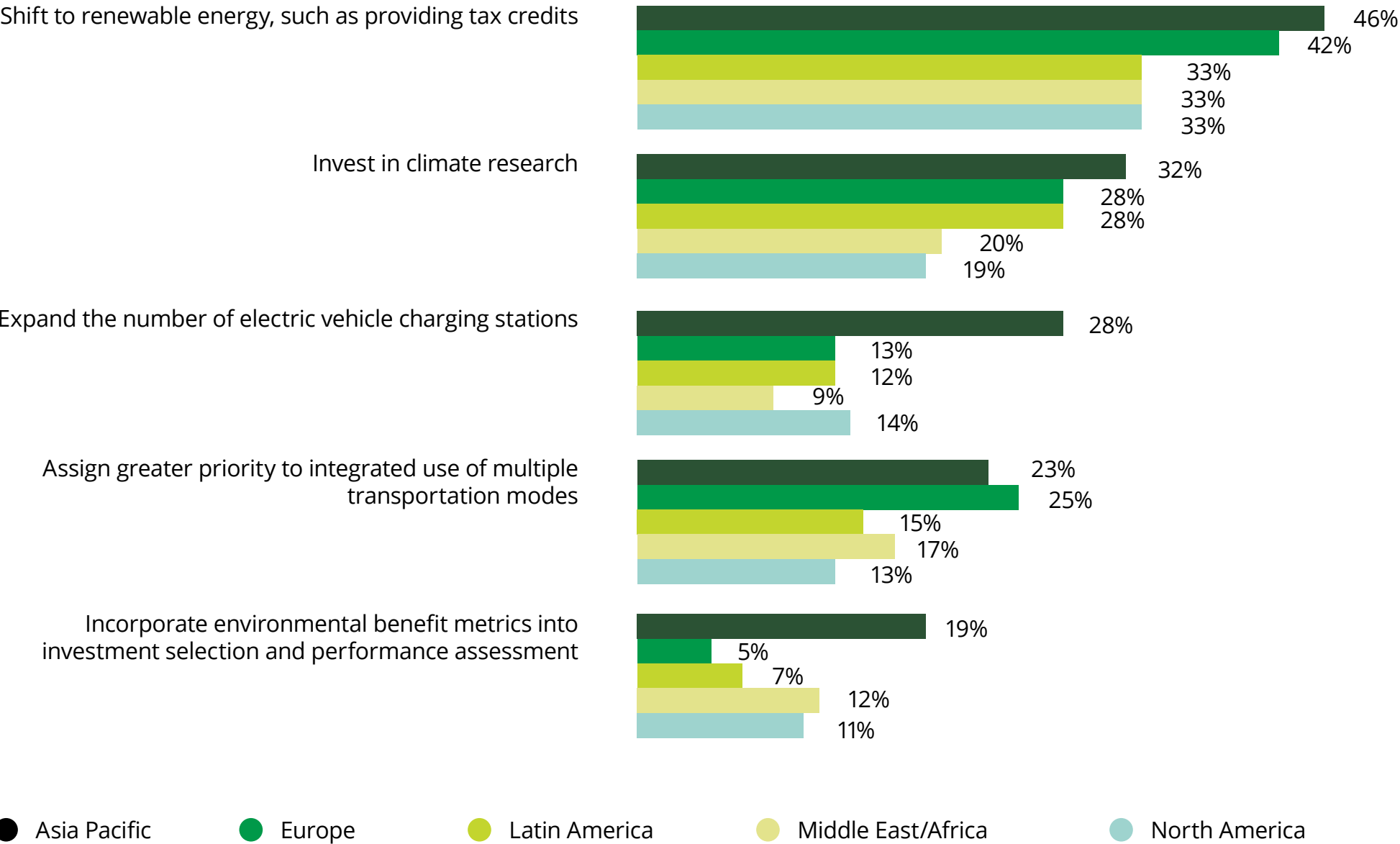


GOVERNMENTS ARE EXPECTED TO TAKE CLIMATE ACTION

6

Despite the infrastructure backlogs, respondents from the Latin America, Middle East and Africa regions felt that their governments would take specific steps to achieve their post-pandemic social, environmental, and economic infrastructure agendas. Survey responses are captured overleaf.

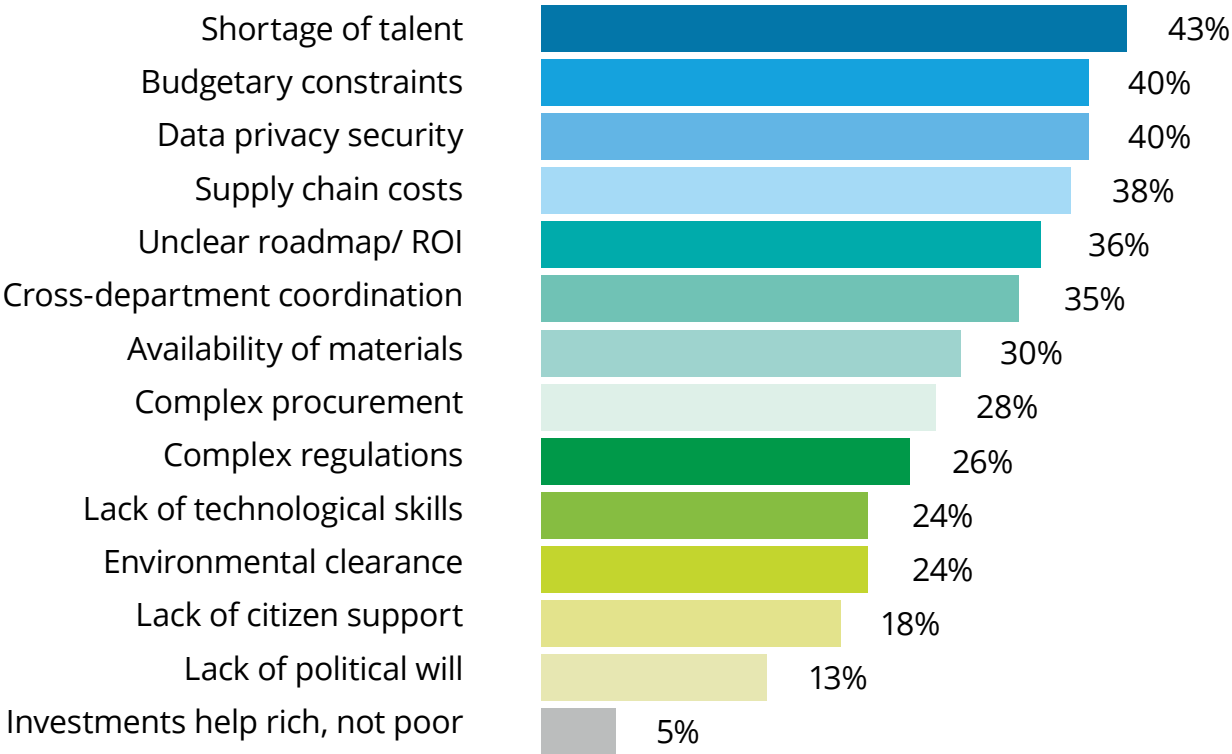
EFFORTS ARE EXPECTED TO INCREASE



THERE ARE MANY OBSTACLES TO INFRASTRUCTURE IMPLEMENTATION

7

In conclusion, survey respondents listed a vast range of reasons as to why infrastructure projects may not be implemented in the next three years. In particular, respondents cited talent shortage, budget constraints, data privacy risks and supply chain costs as the biggest expected obstacles.



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FEATURE

The world's first energy islands will create clean power

SHOOTING THE BREEZE WITH
RIKKE BECKMANN DANIELSEN – PARTNER, FINANCIAL ADVISORY SERVICES, DELOITTE DENMARK

DENMARK HAS A LONG HISTORY OF EXPLOITING STRONG WINDS FROM THE SEA TO PRODUCE ELECTRICITY, STARTING IN 1991 WITH THE CONSTRUCTION OF THE WORLD'S FIRST OFFSHORE WIND FARM. MORE RECENTLY, IN JUNE 2020, THE MAJORITY OF DANISH PARLIAMENT AGREED ON EMBARKING ON ANOTHER AMBITIOUS WORLD FIRST: DEVELOPING TWO ENERGY ISLANDS.

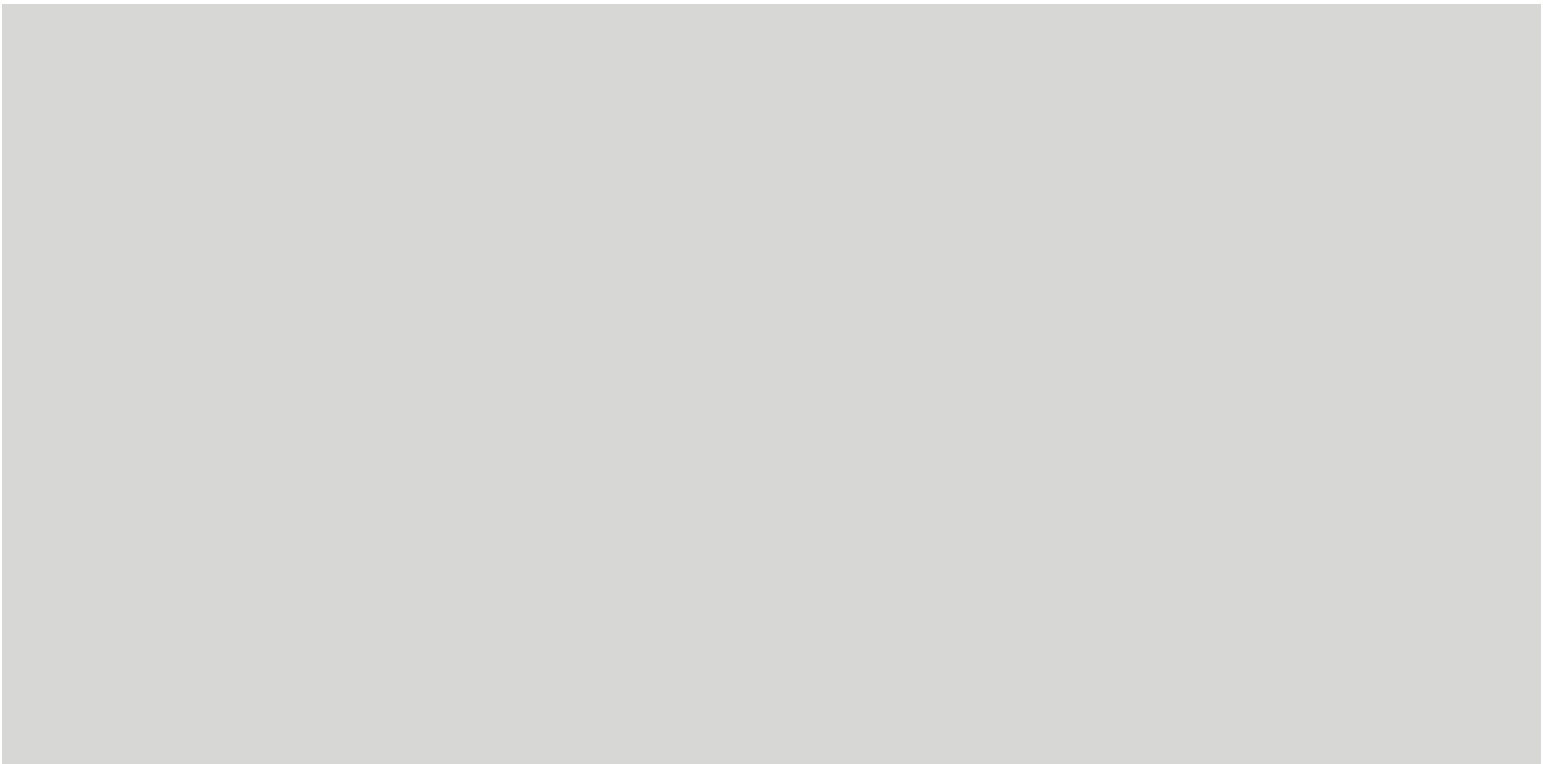
The business case was challenging – to accommodate offshore wind turbines and supply green electricity with a capacity to power at least five million households.

The Danish Energy Agency, part of the government's Ministry of Climate, Energy and Utilities, is in charge of monitoring and developing energy and supply sectors in Denmark. It is currently in market dialogue with private sector bidders for the government tenders to deliver on the islands, with results expected to be announced in early 2023.

The first energy island will be located west of Jutland in the North Sea, built from scratch as an artificial or caisson island. It will become Denmark's largest construction project and serve as a hub to connect and distribute the power generated by offshore wind farms. The initial minimum capacity will be 3GW – enough to cover the electricity needs of 3,000,000 European households – with the potential to expand to 10GW. The estimated cost of building the new island, and 10GW of capacity and required transmission grid, will amount to 210 billion Danish krone (US\$33.97 billion).

Bornholm island in the Baltic Sea will become the second energy island. Electrotechnical facilities on the island will serve as a hub for offshore wind farms off the coast, supplying an additional 2GW of green energy.

“By constructing the world’s first energy hub with a potential capacity of 10GW, Denmark significantly contributes to [the EU’s] ambitious [offshore wind] target. Not only by dramatically expanding renewable energy production, but also by supplying our European neighbors with an abundance of renewable energy. Only by inspiring others and developing new



Bornholm island in the Baltic Sea will become the second energy island. (Image: Getty Images)

DENMARK AND DANISH COMPANIES RANK AMONG THE BEST WHEN IT COMES TO DEVELOPMENT, PRODUCTION AND INSTALLATION OF WIND TURBINES WHICH TODAY PRODUCE MORE THAN A THIRD OF DANISH ELECTRICITY. EXPORT OF WIND TURBINES AND TECHNOLOGY FOR WIND ENERGY ARE ESSENTIAL CONTRIBUTORS TO THE DANISH ECONOMY, AND WILL ALSO ENSURE THAT DENMARK WILL NO LONGER BE DEPENDENT ON FOSSIL FUELS IN 2050.

green solutions they also want to use, can we really do something to combat climate change.” Dan Jørgensen, Minister for Climate and Energy and Public Utilities, said in early 2021.

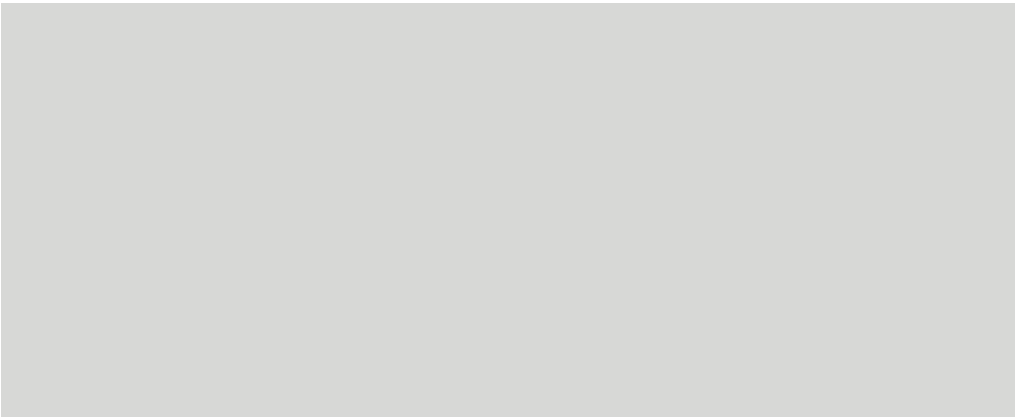
Rikke Beckmann Danielsen, partner, Deloitte Denmark specializes in advising on public private partnerships and says, “This is a really interesting, unique process to follow and a career highlight for me and my team – we’re working at the forefront of a green transition in the Nordics. The new islands will be considered as critical infrastructure, majority owned by the state, and made possible in collaboration with one or more innovative and expert private sector partners. The first phase will involve approximately 200 offshore wind turbines sending electricity to the hub, which will be

distributed to Denmark and nearby countries via the grid.”

According to the Danish Energy Agency, the energy islands mark the beginning of a new era for the generation of energy from offshore wind, aimed at creating a green energy supply for Danish and foreign electricity grids.

Operating as green power plants at sea, the islands are expected to play a major role in the phasing-out of fossil fuel energy sources in Denmark and Europe.

Rikke Beckmann Danielsen is based in Copenhagen, Denmark.



The world's first energy islands will create clean power. (Image: The Danish Energy Agency website, <https://ens.dk/en>)

Embracing ESG principles when delivering sustainable capital projects will uniquely impact climate change

THE BUILT ENVIRONMENT SECTOR ALONE CONTRIBUTES 45% OF UK GREENHOUSE GAS (GHG) EMISSIONS, SO IT CAN CONTRIBUTE SIGNIFICANTLY TO ACHIEVING OUR LOCAL AND GLOBAL NET-ZERO GOALS.



READ THIS RECENT BLOG BY DELOITTE UK COLLEAGUES

FEATURE

Tomorrow is already here today

A ROUNDTABLE WITH
DELOITTE'S GLOBAL INFRASTRUCTURE LEADERS

The year 2022 marks a new beginning for infrastructure across the globe. Post COVID-19, infrastructure will become even more central -to the economy, governments, businesses, communities and to the way we live - as infrastructure investment increasingly forms the backbone of fiscal stimulus programs.

GLOBALLY, TRILLIONS OF PUBLIC DOLLARS HAVE BEEN EARMARKED FOR INFRASTRUCTURE PROJECTS

Standard & Poor's estimates that infrastructure investments deliver returns of up to 2.7 times the initial outlay within a decade; and the projects launched today will support the livelihoods of millions in the future. But as infrastructure becomes more fundamental to our everyday lives, its nature is becoming more elusive. Once associated primarily with roads and bridges, "infrastructure" now encompasses intangible wireless networks and banks of data which are just as central to our lives as any local train station.

Every part of the ecosystem is changing – from the way we interact with infrastructure in the post-pandemic "new normal", to the impact new technologies are having on asset design and operation, to the growing emphasis on sustainability and social equity in every link of the project development chain.

Excitingly, the potential benefits of these changes are incredible. If policymakers, governments, and financiers play their cards right and prioritize the right projects at the right time in the right way, we will collectively lay the foundations for a more sustainable and equitable future; a world where all humans can flourish.

Some risks remain. For example, corruption or political considerations could unduly influence the sector, leading to suboptimal outcomes. There must be an emphasis on prioritising the right type of investments across diverse areas like broadband, smart travel, housing, health and energy while avoiding "shovel-ready" projects that can lead to short-term gain politically and long-term atrophy socially and economically.

Governments must think big and think globally, resisting the counterproductive urge to dial down public sector investment in infrastructure projects for budgetary reasons. They must also partner with private capital to finance the projects that can provide returns on a human level, as well as a monetary one.

The environmental impacts of new projects must always be considered. According to the World Bank, infrastructure construction and operations account for 70 percent of global emissions. It is imperative these decline over the coming years – through the sustainable design of new infrastructure projects, and the "greening" of existing assets.

There is also a risk that the infrastructure gap between developed and emerging economies may widen. The impacts of the global pandemic have constrained the ability of governments in the global south to finance necessary projects, while private capital seeks certainty in low-risk, "safe" brownfield assets in the global north. Inclusivity is good in and of itself. Concerted efforts are now being made to enhance diversity across gender, sexuality, and racial lines, with representation now a clear priority for industry leaders. But it has also been realized that it's impossible to meet tomorrow's infrastructure needs without input from a diverse range of voices who comprise the communities, cities, countries, and continents we are attempting to serve.

There is still a long way to go before the sector can be viewed as anything but "stale, male and pale", but progress is being made one step at a time.

The following interviews with four of Deloitte's most prominent infrastructure experts attempt to divine this new and exciting future. One thing is abundantly clear: Infrastructure will never be the same again.

“Infrastructure should exist to significantly benefit humans. To change lives. And to enable the provision of better services like healthcare, education and justice services.”

LUKE HOUGHTON

“There are risks that come with humans learning to trust machines and artificial intelligence, both on the user and designer end. If we don’t feel like we can fully embrace this technology, then we will leave a lot of potential benefits on the table.”

DR. KELLIE NUTTALL

“To achieve a carbon-free global economy requires everyone to do their part – it is the ultimate team sport. Collaboration among government, industry, and the community is key to responding effectively through climate mitigation and adaptation.”

BETH McGRATH

“New infrastructure needs to be digitally integrated, flexible enough to encompass changing mobility patterns, and be done on a climate and social basis so you can deliver what citizens are looking for.”

MICHAEL FLYNN



LUKE HOUGHTON
DELOITTE GLOBAL LEAD PARTNER,
INFRASTRUCTURE AND CAPITAL PROJECTS

**THINKING ABOUT 2025 AND 2050:
WHAT WILL BE DIFFERENT?**

Over the short term, I think infrastructure is going to continue to be seen as a key tool for delivering post-COVID economic recovery. Having said that, we'll still have continued pressure on supply chains.

We'll also see continued pressure on labor, and that's going to be exacerbated by the massive demand for infrastructure as part of the economic stimulus. For example, massive programs like the US Infrastructure Bill will consume resources at an unprecedented rate.

In the longer term, we'll see changes in construction techniques and changes in design – including much broader use of design for manufacture and assembly (DFMA), kit of parts and modular building.

HOW WILL THESE CHANGES IMPACT HUMANS, COMMUNITIES, CITIES AND BEYOND?

The social impact of infrastructure is becoming more and more critical, and I think that is going to be pivotal over the next 15 to 20 years.

In the past we focused too much on “what can we build?”, and not enough about what that build is trying to achieve. So I think it's most exciting to think about infrastructure from a service delivery point of view, and not an asset provision point of view. Otherwise we'll just build depreciating assets.

Infrastructure should exist to significantly benefit humans. To change lives. And to enable the provision of better services like healthcare, education and justice services.

ALL CHANGE COMES WITH RISKS. WHAT ARE THEY, AND CAN WE MITIGATE THEM?

The biggest long-term risk with infrastructure is building the wrong project, and building it in the wrong spot. Unfortunately, projects can become political decisions.

One of the ways to minimize that risk is for countries, governments and investors to have long-term strategic infrastructure plans in place – outlining clear priorities which citizens, shareholders and voters can use to hold them to account.

HOW CAN THE SECTOR EMBRACE DECARBONIZATION?

The World Bank estimates that 70 percent of global emissions are produced by infrastructure construction and operations. Having said that, I'm very confident the sector can reduce this. There are multiple sources of pressure pushing decarbonization of the entire economy.

Demand comes from several parties. From a real estate perspective, tenants are demanding it. From a shareholder perspective, shareholders and investors are demanding it. From a labor perspective, the future generations of workers, quite frankly, don't want to be associated with polluting or environmentally damaging the planet.

WILL FUTURE GENERATIONS CONTEST ANY POPULAR INFRASTRUCTURE TRENDS?

My one concern would be that some of the contracting models we see, especially for private finance, don't allow for easy incremental change or augmentation to a project.

All future funding models and financing trends need to allow for a level of incrementalism to deal with any trends or changes in requirements as they emerge.

HOW DOES THE SECTOR NEED TO DO THINGS DIFFERENTLY?

As an industry, we're doing better at embracing diversity, but we are still a bit “stale, male and pale”. We need to do more!

DR. KELLIE NUTTALL
DELOITTE AUSTRALIA
ARTIFICIAL INTELLIGENCE LEAD

WHAT ROLE IS TECHNOLOGY PLAYING IN CHANGING THE FUTURE OF INFRASTRUCTURE?

It's a business imperative! From a transport perspective, technologies like Artificial Intelligence (AI), cloud computing, and Internet of Things allow us to run scenarios and test new configurations of transport networks and service patterns faster than ever before.

When I would run modeling scenarios ten years ago, it would take us six months to build a scenario and 24 hours to run that scenario in a model.

Now, with modern technology, we can create what we call “digital twins” of an entire transport system or energy grid. In a few seconds, we can essentially run millions of permutations of how conditions on that network might play out. We can test different things. It's enabling trial and error without the error – allowing us to better predict things not only for future infrastructure planning, but also in operating that network in real time including better reliability, driving improved network efficiency and sustainability.

HOW WILL THESE CHANGES IMPACT HUMANS, COMMUNITIES, CITIES AND BEYOND?

The best travel demand moderation tool you have is giving consumers, or commuters if you like, more information. It will lead to less congestion and encourage people to use transport infrastructure in a more sustainable and environmentally friendly way.

In practical terms, we're moving to a world where the same information that is supporting transport operations centers to manage their assets can also be made accessible to consumers to support their journey planning. And that means a commuter can view traffic data and find out if they're better off staying at home for another five minutes (and having a coffee with the family) before leaving for work, because they can see that the road network is likely to free up in ten minutes' time.

ALL CHANGE COMES WITH RISKS. WHAT ARE THEY, AND CAN WE MITIGATE THEM?

Transport system planners and operations staff have not previously had access to the AI-enabled tools they do today, especially in the realm of real time operations. While traffic managers may have traditionally relied on their experience, they now have the potential to have this experience augmented with AI and more complex simulation tools, and that requires trust to embrace.

The effort required to drive effective adoption of these tools is not to be underestimated. Any AI solution or digital twin technology needs to be designed with the end user front of mind, making the use of these decision support tools easy and intuitive. The design and build of these tools should be done in collaboration with end users from day one, remembering we are designing for operations experts – not data scientists.

Technology is often the easy part. It's the change and adoption process that requires the real effort to maximize the true value these technologies enable – which is ultimately all about making better decisions.

WHAT INFRASTRUCTURE INNOVATION REALLY EXCITES YOU?

We have done a lot of prototyping around digital twin technology with a few government agencies, and this is showing great potential. Airservices Australia, the nation's air traffic controller, used our Optimal Reality digital twin solution to show significant benefits such as a 30 percent reduction in unplanned disruptions. What we are doing now is taking that same approach and bringing it to the ground transport system. That's really exciting to me. Ground transport systems are inherently complex, and these technologies are really enabling a new generation of intelligent transport system management.

Luke is Deloitte’s Global Infrastructure and Capital Projects Lead Partner. With over 25 years’ experience, he has built up an extensive and diverse skillset in structuring project financing. Luke has developed a passion for influencing infrastructure that creates better economic and social outcomes for citizens. He is based in Sydney, Australia.

Kellie is Deloitte Australia’s Artificial Intelligence Lead. Her work in both the public and private sectors has focused on the application of advanced analytics to support evidence-based decision making in transport infrastructure planning and operation. She is based in Brisbane, Australia.



MICHAEL FLYNN

DELOITTE GLOBAL LEADER PUBLIC SECTOR INFRASTRUCTURE,
TRANSPORT AND REGIONAL GOVERNMENT

**WHAT WILL INFRASTRUCTURE
LOOK LIKE IN 2050?**

Digital will become more prevalent across all assets, shifting how we interact with infrastructure. Citizens won't even realize they're using infrastructure; as they'll think of it as a service. For example, if we can use our phone to access information about bus and rail times and any congestion on the network, we can live our lives more conveniently and flexibly. This is made possible by having the latest data available at our fingertips.

Equally, infrastructure owners can use that same data to make informed decisions about projections and usage. This will require careful planning – cities will be different, people will do more remotely because they enjoy having more space, and the public realm will become more important in relation to wellness. Future infrastructure needs to support this.

**WHAT BIG CHANGES ARE YOU
SEEING?**

Definitely the increased fiscal stimulus flowing into the sector as a result of COVID-19. Every government around the world seems to have an infrastructure plan to stimulate the sector. How we think about and define “essential infrastructure” is also changing to include digital infrastructure like 5G and broadband, which are central to how we work, live and play.

Sustainability and climate concerns are also driving positive changes, and the “S” in ESG – or Environmental, Social, Governance – is becoming a more prominent consideration. Our clients, and the way we approach infrastructure solutions, are increasingly making sure everyone has equal access to infrastructure assets.

Any new infrastructure plans can't be just for “hard” infrastructure, because it will become more like a service supported by a digital backbone, with clear climate action and social equality priorities. Plans will need to be digitally integrated and flexible enough to address citizens' changing preferences and needs.

**HOW WILL THESE CHANGES IMPACT
HUMANS, COMMUNITIES, CITIES
AND BEYOND?**

A great example is in Saudi Arabia, where the world's first cognitive city is being built on the Red Sea. Known as NEOM, it will use world-class technology fueled with data and intelligence to interact seamlessly with its population.

By embracing flexible, digitally-integrated infrastructure from the ground up, NEOM will create a network of “5-minute communities”, where everything you need is quickly accessible; whether it's drones delivering food, or using lifts to access different parts of the city quickly. It won't be easy, but the lessons we learn can be applied to legacy cities to enhance sustainability and quality of life.

LET'S TALK ABOUT CHALLENGES ...

The OECD says US\$6.9 trillion in infrastructure investment is required annually to 2030 to support growth while meeting the UN's sustainable development goals. Realistically, governments can fund less than half of that, so the gap must be filled by the private sector. This is less likely to happen in developing economies due to higher perceived investment risks. This could mean mature economies will plow ahead, with their infrastructure priorities receiving both government stimulus and private capital. Meanwhile, emerging economies will do less and less, increasing the divide; and that's not good for the world.

Another challenge is our ability to fund and deliver future infrastructure plans, and making sure they generate their intended value and revenue. How do you plan amidst current supply chain issues? And the limited capacity and capability? What are the right margins for third party providers? Where is the direct and indirect value being generated? How can investors access some of the value they help to generate? Finding the best answers to these questions makes this a really exciting, complex industry to thrive in.

Michael leads Deloitte's Global Infrastructure, Transport and Regional Government offering. He works across the globe to focus on effective public sector investment in infrastructure, transport and mobility, cities and local government, and climate and environment. He is based in Dublin, Ireland.

BETH McGRATH

DELOITTE US MANAGING DIRECTOR
DELOITTE GLOBAL LEADER, GOVERNMENT
& PUBLIC SERVICES

**WHAT ARE THE MOST SIGNIFICANT
CHANGES SET TO OCCUR IN
INFRASTRUCTURE BY 2025 AND 2050?**

In my opinion, infrastructure is being redefined and the aperture is being expanded. Yes, it includes the traditional aspects such as roads, bridges, etc., but it also brings together other aspects such as climate and sustainability; and equitable and adequate access to services – all driven by a “smart”, tech-enabled approach.

In the coming years, the voice of the citizen/customer will continue to increase, driving the demand to incorporate features such as resiliency and sustainability into every aspect of the infrastructure design. Deliberate engagement of communities and citizens will be essential to achieving the intended outcomes – through community action groups, nonprofit organizations and crowdsourcing techniques.

**WHAT ROLE WILL MODERN
TECHNOLOGY PLAY IN DRIVING
THOSE CHANGES?**

Technology will play a tremendous role in meeting the demands of the expanded infrastructure ecosystem. 5G enabled network-connected devices will deliver services and data securely and quickly. The demand for data sharing will grow exponentially across the ecosystem, highlighting the need for stronger data protections, but also likely resulting in new business models.

HOW WILL HUMANS BE IMPACTED?

By adopting a human-centered design approach to infrastructure, the potential for positive impact on people is limitless. Green planning of public spaces, improving quality of life, alleviating issues such as crime, and smart “everything” enabling faster, more reliable information and services.

**ARE THERE ANY KEY RISKS
ASSOCIATED WITH THESE CHANGES?**

The first is time. Infrastructure transformation is more marathon than sprint – demanding a long-term vision and sustained tenacity. The

second is money; while initial budgets are generous, fiscal pressure never goes away, so it will be important to demonstrate progress and value quickly. And the third is change. Driving a more inclusive approach to infrastructure requires strong leadership, transparency, and buy-in at all levels.

**WHAT IS THE MOST EXCITING
INFRASTRUCTURE TREND FROM
YOUR PERSPECTIVE?**

I'm starting to see the convergence of “traditional” infrastructure modernization with human-centered design and smart, tech-enabled everything. Organizations are recognizing the importance of understanding the user perspective as they look to reduce CO2 emissions, create walkable communities and upgrade infrastructure. Taking a human-centered design approach that includes user experience, design, and user insights – coupled with technologies such as digital twins – enables organizations to save time and costs by designing the right solution from the beginning.

**THE WORLD BANK ESTIMATES THAT
INFRASTRUCTURE CONSTRUCTION
AND OPERATIONS ACCOUNT FOR 70
PERCENT OF GLOBAL EMISSIONS.
ARE YOU CONFIDENT THE SECTOR
CAN EMBRACE DECARBONIZATION?**

It must. It will require an integrated approach, a commitment to building resiliency and sustainability into the overall design to achieve net-zero, and transparency when measuring progress. To achieve a carbon-free global economy requires everyone to do their part – it is the ultimate team sport. Government regulators need to enact policies and ordinances that apply climate mitigation actions, oversee progress and hold people and organizations accountable. Industry players across all sectors need to “lean in” and be transformational in their design, building and adoption of net-zero practices.

Collaboration among government, industry, and the community is key to responding effectively through climate mitigation and adaptation.

Beth is Deloitte's Global Leader, Government & Public Services. Beth uses her unique experience and deep expertise to advise executives through their most complex organizational and operational changes, drawing on synergies across our member firms in over 150 countries. She is based in Arlington, Virginia, US.



**“NO MATTER HOW SMART YOU ARE AS AN INDIVIDUAL, YOU’LL
LEARN A LOT FASTER AND CREATE NEW KNOWLEDGE WHEN
YOU COME TOGETHER WITH OTHERS ... AND THAT’S PRECISELY
WHERE INFRASTRUCTURE PLAYS A KEY ROLE. INFRASTRUCTURE
NEEDS TO HELP PEOPLE LEARN FASTER, RATHER THAN JUST
CONNECTING THEM MORE EFFICIENTLY.”**

JOHN HAGEL III, FUTURIST

FEATURE

Unleashing exponential learning for a better future

AN INTERVIEW WITH
JOHN HAGEL III

“THE FUTURE ISN’T ABOUT DOING WHAT WE’VE ALWAYS DONE MORE EFFICIENTLY. WHERE IS THE PROGRESS IN THAT? INSTEAD, IT’S ABOUT MAKING SURE WE LEARN FASTER, SO THAT WE THRIVE MORE. WHEN WE’RE ALL THRIVING, WE’LL FREE UP OUR ENERGY AND TIME TO BE EVEN MORE MOTIVATED TO CREATE EVEN MORE VALUE TO OUR STAKEHOLDERS, SOCIETY AND THE WORLD WE LIVE IN.”

JOHN HAGEL III IS A HIGHLY REGARDED FUTURIST, MANAGEMENT CONSULTANT, ENTREPRENEUR, SPEAKER AND AUTHOR WHO HAS SPENT OVER 40 YEARS WORKING IN SILICON VALLEY

He is driven by a desire to help individuals and institutions to increase their impact in a rapidly changing world. His eighth book, *The Journey Beyond Fear*, addresses the psychology of fear and change, and how to navigate these.

It doesn’t matter what industry or sector we play in; many of us tend to focus on finding cheaper and faster ways to keep doing what we’ve always done. It’s human nature. In the case of infrastructure, the focus over the last century has generally been on increasing connectivity – finding ways to connect people faster, and more effectively. And that takes more data, and more technology. But is it enough?

We spoke with John to explore what infrastructure’s ultimate goal could – or should – be. What are we really trying to accomplish? Faster and cheaper efficiency? More flexibility? Or creating and delivering more value to those who matter to us? And if it’s the latter, how can we rethink our infrastructure from the ground up?

When reflecting on the future, John’s extensive research reveals that different institutional models in the global economy and society will evolve to shift from scalable efficiency to scalable learning. John says, “In a more rapidly changing world, the key imperative for all of us is to learn faster, so we can keep up with – and ideally ahead of – all the changes that are happening concurrently.”

Scalable learning isn’t just training modules or syllabuses, which focus on sharing existing knowledge more broadly. Rather, scalable learning is about finding new ways to help

everyone learn faster, creating new knowledge that never existed before. “This requires people to come together to interact with each other to explore different scenarios, iterate, learn together – have more and more impact,” John explains. “It’s all about coming together with others between and across ecosystems to co-create new knowledge and ideas.”

Cities and offices play a key role in bringing people together. While the past few years of the COVID-19 pandemic and the subsequent shift to working from home has shown us the power of technology, it won’t replace the value of a physical environment which, according to John, enriches the potential for learning.

“One of the great things about physical communities is that they encourage serendipity – those unexpected encounters with others who challenge our beliefs and comfort zones with different views and perspectives. This brings new ideas and insights to the problems we’re wrestling with! As a wonderful consequence, people see that opportunity to become better at what they do,” says John.

Technology can also do more to stimulate new ways of thinking. Rather than just suggesting “more of the same” content or topics for people to consume based on their preferences and history, it can do the opposite and pull us out of our comfort zones. John says, “To thrive, we need people with certain interests to be exposed to people with different interests – so their views collide, and these other people ask questions they’d never thought of and learn

something new. In the future, algorithms can do a better job of matching both shared and polar perspectives, so people can challenge each other to learn new things faster.”

Another enabler of a thriving future is ecosystems, especially dynamic ones. We know collaboration is key to share perspectives, capabilities and knowledge. So rather than creating static ecosystems driven by short-term transactions to access existing resources and knowledge, we can create dynamic ecosystems to enable people to come together and build deeper relationships – beyond mere transactions. That way we all learn faster together, accelerate our performance improvement as individual participants and as part of a dynamic ecosystem network.

Unfortunately, there are few examples of dynamic ecosystems where the primary goal is to help all participants to learn faster by acting together. One early example was the ecosystem created by a Silicon Valley start-up, PortalPlayer. The founders of PortalPlayer saw the potential for developing mass market consumer digital music players. Founded in 1999, the company orchestrated a global ecosystem of leading technology players to innovate in all the technology components required for these devices. The pace of innovation and learning was so rapid that, two years later, when Apple introduced the first iPod, it was built around the PortalPlayer technology platform.

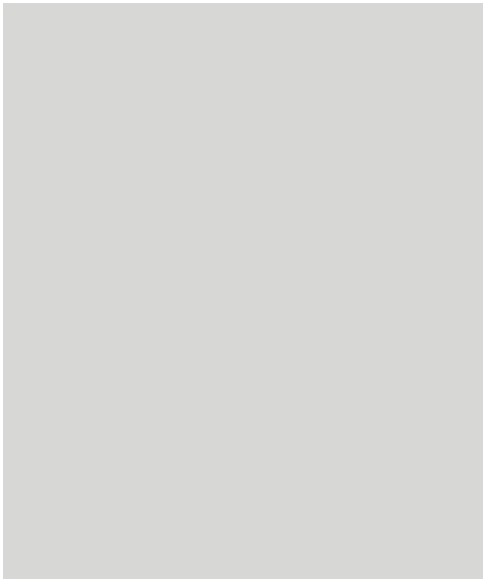
With all this new thinking, learning and ideas – enabled by technology and dynamic ecosystems – comes disruption. It also begs the question: Are incumbent infrastructure providers vulnerable to new entrants?

If infrastructure is found limiting, and emerging needs aren’t being met by that existing infrastructure, this will encourage new entrants. To counter that, infrastructure incumbents could introduce a new model and become more decentralized. For example, by focusing on

a local area, infrastructure could demonstrate its power to drive learning, then scale it over time in other areas.

“Imagine what we could accomplish if we could create infrastructure together, providing more value to users, so they can actively learn with others to create even more value to their community? Imagine how exciting it would be if everyone was flourishing and prospering, and making more impact? What an amazing world that would be! We don’t need to be driven by fear or be scared of the unknown, we need to welcome the opportunity to pursue a better future,” says John.

As an optimist, John is passionate about inspiring others to make small, smart moves – after all, it’s these small steps that set big things in motion. And it’s not about changing everything all at once. It’s about taking a specific sub-infrastructure asset at a time, or a community of participants, and exploring what its impact could be. It’s all about learning how to provide even more infrastructure over time to create similar value. “Imagine what a thriving future that would be,” concludes John.



John Hagel III is based in California, US.

KINGDOM OF SAUDI ARABIA

One ministry's ambition to improve over 71,064 km of roads and highways

TAKE A DEEP DIVE WITH OUR COLLEAGUES FROM DELOITTE MIDDLE EAST,
TAREK NAHLE – PARTNER AND **KARIM ZANTOUT** – DIRECTOR

“IN LINE WITH THE KINGDOM’S VISION 2030 AND WITH THE FAST TRANSFORMATION THAT THE KINGDOM IS GOING THROUGH, THE MINISTRY OF TRANSPORT & LOGISTICS SERVICES IS REORGANIZING ITSELF TO RESTRUCTURE AND REGULATE THE TRANSPORT SECTOR.”

TAREK ALSHAMI, DEPUTY MINISTER, MARCH 2022

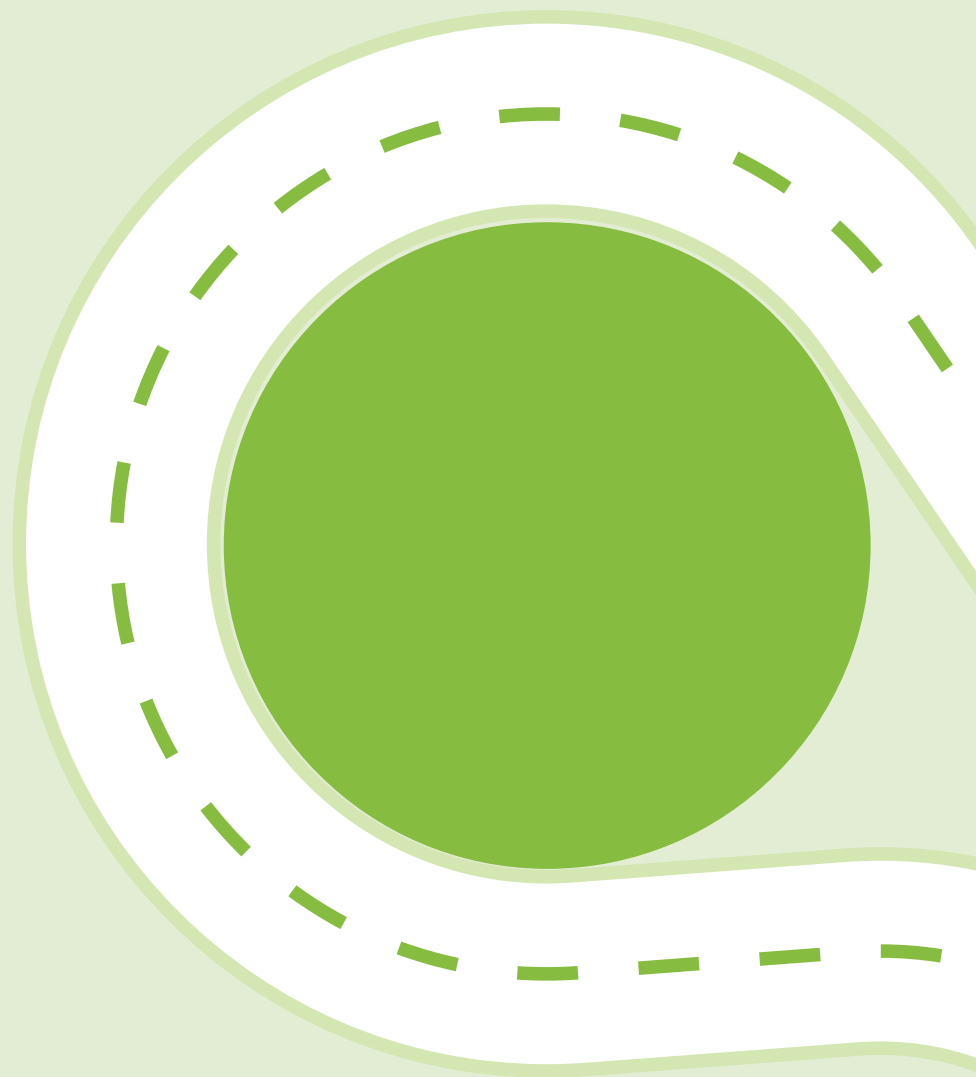
WITH A YOUNG, FAST GROWING POPULATION OF OVER 35 MILLION, THE KINGDOM OF SAUDI ARABIA IS THE THIRD-LARGEST COUNTRY ENTIRELY IN ASIA, THE SECOND LARGEST IN THE ARAB WORLD, AND THE LARGEST IN WESTERN ASIA

Its capital city, Riyadh, is home to about 8.5 million inhabitants and the Kingdom's various government departments – including the Ministry of Transport & Logistics Services.

In 2015, the Kingdom launched an ambitious **Saudi Vision 2030** built around three key themes: a vibrant society, a thriving economy and an ambitious nation. Providing world-class government services which effectively and efficiently meet citizens' needs is a fundamental piece of the puzzle, and the ministry plays a key

role in making this happen. Firstly, by evolving the Kingdom's transport system to create a thriving logistics center that critically links the three continents of Asia, Africa, and Europe. And secondly, by promoting sustainable economic development, underpinned by healthy competition.

The Ministry of Transport & Logistics Services' mission is to smoothly integrate all transport sectors – land, maritime and air – to meet the needs of the Kingdom; to raise the levels of safety and energy rationalization, and to enhance operational and performance efficiency to provide effective services to all beneficiaries. Its key departments focus on Planning Information, Road Affairs (Road Construction & Road Operation and Maintenance) and other core functions.



Tarek Nahle, Deloitte partner in charge of the firm's client relationship with the ministry, describes how the ministry is leading the transformation of the sector across all transport modes, while directing the development and the maintenance of the intercity road network. He says, "Its portfolio covers more than 51,000 km of single carriageways, 14,000 km of dual carriageways and more than 5,000 km of highways. It's also responsible for 5,496 bridges, 10 ports and the Kingdom's 28 airports. Efficiently and effectively managing and evolving this infrastructure is essential to the nation's future success."

This is a complex task, considering the numerous challenges the transport sector faces. These include the increased volumes of goods and people moving across the Kingdom and associated high congestion rates, limited usage of public transportation, reliance on government financing; and the need to reduce road fatalities and accidents.

SUPPORTING THE NATIONAL TRANSFORMATION AGENDA

As part of its major transformation in line with Vision 2030 and the National Transport Logistics Strategy, the ministry is focused on

reviewing regulatory activities and carving out its operational responsibilities. Deloitte is supporting this agenda by developing a new target operating model for the ministry's two deputyships: Road Construction (RC) – responsible for developing a comprehensive plan, design and technical specifications, budgets and implementation of new roads, bridges and tunnels; and Road Operations and Maintenance (ROM) – responsible for maintaining the intercity road network and ensuring its serviceability, safety and appearance.

The new operating model will help both deputyships adjust and develop their organizational capabilities – not only to respond to current challenges, but also to upgrade the quality and safety of the transport network while improving the financial sustainability of any construction and maintenance.

to interact seamlessly with headquarters, and introducing rigorous performance-based contracts for providers of road operations, safety and maintenance work, and asset management.

Another enhancement will be the introduction of the Stage Gate Management Office, which will facilitate the coordination and communication between all stakeholders involved in road construction, and minimize any handover issues. The office will oversee the end-to-end process and will have visibility of all project details, including approving the transition between the different construction lifecycle phases.

Karim Zantout, Deloitte director, is leading the delivery to address these challenges. He describes how the team has already helped the ministry in setting up and operating a strategic program management office to oversee the programs and projects required to deliver the transformation program. This includes the oversight of a bespoke Intelligent Transportation System (ITS) strategy, developing a new maintenance master action plan, establishing a crisis and risk management system for road operations and maintenance, and establishing an asset management practice. Karim says, "The operating models – developed together with the wider strategic changes being implemented – will transform how operations and maintenance occurs in the Kingdom on a day-to-day basis. This hasn't been seen on this scale in the Middle East previously. The change will impact contractor behaviors because they are expected to operate in a performance-based way compared to the current method-driven structure. This will ultimately lead to a better end-user experience."

"All improvement initiatives are designed to encourage public and private sector collaboration to transform the way roads, bridges and tunnels are designed, constructed, operated and maintained in future," says Tarek.

The overarching transformation focus is on enabling the deputyships to better plan, prioritize, monitor and maintain their assets efficiently and effectively, establishing a standardized approach for regional branches

"This work is not just about enhancing the effectiveness and efficiency of maintaining the thousands of kilometers of roads and highways, but also about reducing fatalities and improving citizens' experience of the Kingdom's vast road networks. Better roads will keep citizens safe, attract tourism and help the Kingdom become the core logistics hub for the region," says Karim.

The ministry is also looking into innovative financial models to fund and finance future road construction and maintenance, and will establish new road companies with responsibility for the road assets – from ownership to operations. With all these improvements, the ministry is on the right track to achieve its objectives as part of the wider Saudi Vision 2030 strategy.

Tarek Nahle and **Karim Zantout** are both currently working in Riyadh in the Kingdom of Saudi Arabia.



COP26

Futures we want: Listening to inform built environments in 2050

AS PART OF COP26, WHICH WAS HELD IN GLASGOW IN LATE 2021, WE ASKED EXPERTS AND CITIZENS FROM SIX REGIONS – THE ARABIAN PENINSULA, BRAZIL, JAMAICA, KENYA, INDIA AND THE UNITED KINGDOM – TO IMAGINE A GLOBALLY NET-ZERO, CLIMATE-RESILIENT FUTURE. THE PROJECT WAS DELIVERED FOR THE UK DEPARTMENT FOR BUSINESS ENERGY AND INDUSTRIAL STRATEGY BY A CONSORTIUM LED BY DELOITTE AND INCLUDING AECOM, THE UNIVERSITY OF CAMBRIDGE, ONE YOUNG WORLD AND RADLEY YELDAR.

“WE NEED A MORE ENERGY-EFFICIENT WAY TO IMPROVE COOLING CAPACITY AND WITHSTAND HEAT STRESS.”

– WORKSHOP PARTICIPANT, JAMAICA

BUILDING OUT A PICTURE OF THE FUTURE

We asked Liselore Kolff, risk advisory manager at Deloitte UK, what the team focused on for this research project with global citizens. “Specifically, we were asked to focus on building out four themes – water, energy, food and land, and the built environment. As part of this we started to develop a picture of built environments in 2050, based on what was desirable and feasible. People from all walks of life shared their hopes and desires for what their homes and buildings will be like, and reflected on the critical role homes, buildings and cities will play in protecting people globally

from the effects of climate change. We also looked at how technology, design and urban planning can reduce greenhouse gas emissions and change the way we live,” she says.

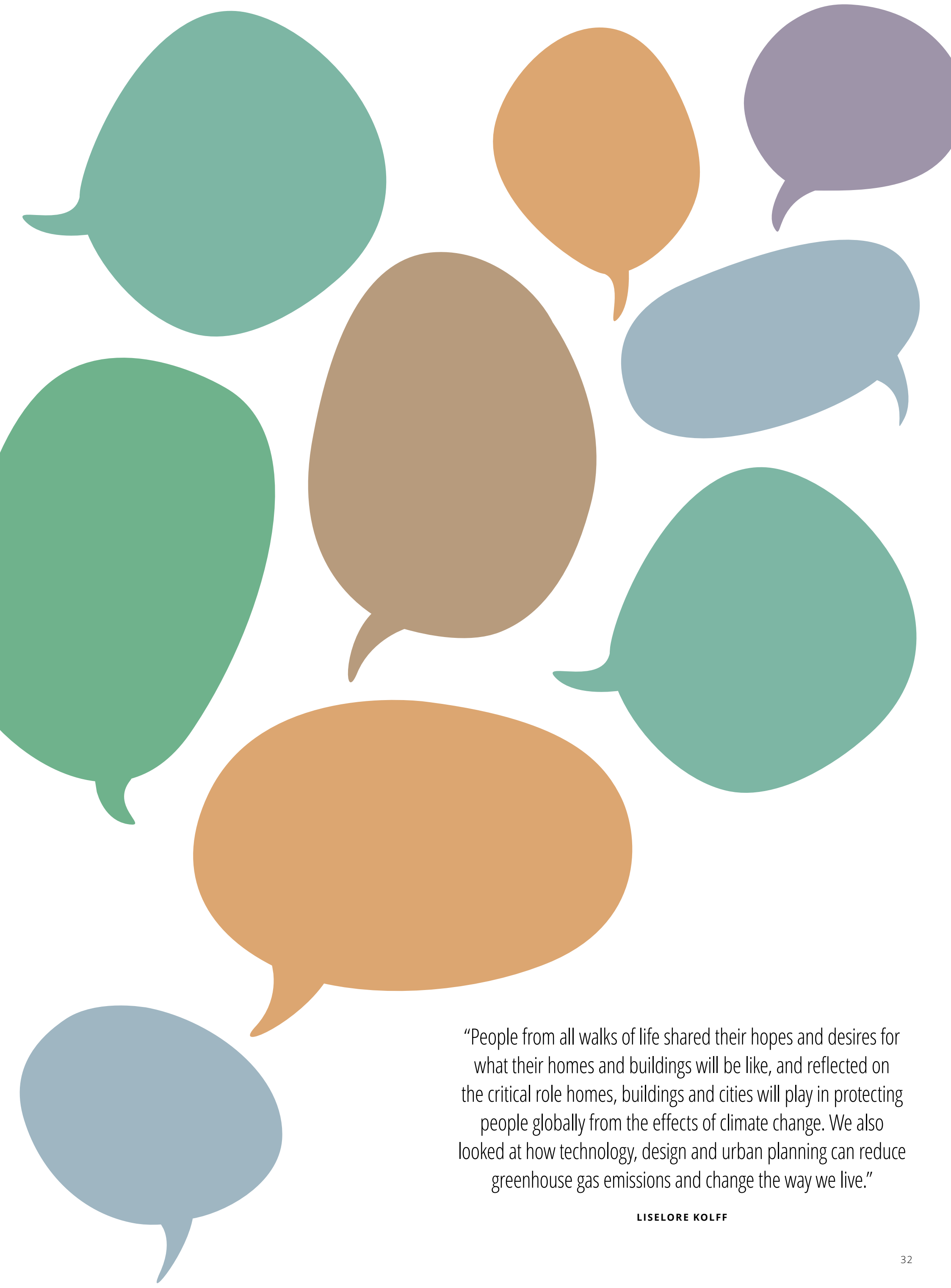
The team found that the built environment is intrinsically linked to the climate: its carbon footprint, its ability to withstand more challenging and unpredictable weather, and its ability to help people lead low-carbon lives. Its design plays a large role in informing a climate-resilient 2050; by then, our built environment might look and feel very different. From greener cities that are designed to create cool, comfortable streets, to smart technologies that reduce the energy consumption of homes,

a range of innovations and interventions will become the norm by then. When combined, they will not only help to give people a sense of safety and security in the face of a changing climate, but will also enable more sustainable lifestyles.

Workshops for the project showed that people want to see the benefits of a better built environment – from new economic opportunities to enhanced biodiversity.

There is also a desire to make sure that developing countries and marginalized communities can engage with the transition in an equitable way.

As temperatures rise, both old and new technologies can help keep buildings comfortable. In the Arabian Peninsula and Africa, traditional architecture designs including cooling wind towers can provide an alternative, or a supplement, to active cooling, helping to protect against the intense heat. Increasingly, air conditioning systems will be powered by local renewable energy sources such as rooftop solar. In places like India and Brazil, where rural populations and those living in informal settlements currently have limited access to power grids, this may be essential for livability by 2050 as global warming increases.



“People from all walks of life shared their hopes and desires for what their homes and buildings will be like, and reflected on the critical role homes, buildings and cities will play in protecting people globally from the effects of climate change. We also looked at how technology, design and urban planning can reduce greenhouse gas emissions and change the way we live.”

LISELORE KOLFF

RESILIENCE AGAINST WEATHER

By 2050, homes will need to provide resilient and sustainable protection against tropical storms, floods, heatwaves and other extreme weather events. For example, in India, increasingly severe storms (especially cyclones) will cause more damage to infrastructure and livelihoods, and further intensify saltwater intrusions in storm surges.

Meanwhile, in Jamaica, which is already highly vulnerable to tropical storms, affordable and sustainable building materials like bamboo may be used in storm-proof building designs to provide protection against the elements. Protection will also come from the restoration and preservation of natural storm barriers, such as mangrove swamps and sand dunes.

“RIGHT NOW WE LIVE IN FEAR EVERY HURRICANE SEASON AS WE DON’T KNOW WHAT IS GOING TO COME. IF WE HAD A MORE CLIMATE RESILIENT ECONOMY WE COULD BE LESS FEARFUL, WITH A GREATER SENSE OF WELLBEING.”

– WORKSHOP PARTICIPANT, JAMAICA

“I HOPE THAT GREEN INFRASTRUCTURE IS PART OF CITY PLANNING TO HELP PURIFY THE AIR AND PROTECT FROM HEAT WAVES AND FLOODING.”

– WORKSHOP PARTICIPANT, INDIA

“BY 2050 I EXPECT TO HAVE INSTALLED LOTS OF NEW LOW-CARBON TECHNOLOGIES INTO MY HOME.”

– WORKSHOP PARTICIPANT, UK

NEW TECHNOLOGIES, NEW MATERIALS

The built environment is responsible for a big percentage of direct and indirect greenhouse gas emissions in many regions – 40% in the UK, for instance – and thereby holds significant potential for contributing to the net-zero transition. Smart, energy-saving technologies in our homes are likely to become increasingly important as we approach 2050.

The choice of methods and materials used in home construction, and the built environment more broadly, also need to be reconsidered. Technologies to decarbonize the manufacture of a construction material like cement, which underpins much of the world’s built environment and is responsible for 5% of global emissions, must be applied and scaled well before 2050. In tandem, local, sustainable timbers and recycled materials will also play an important role.

Some nations will need to renew or replace large portions of their built environment – for example, informal settlements, which may become increasingly uninhabitable in a changing climate. The energy efficiency and embodied carbon of any replacement stock must be considered from the outset if new buildings are to be compatible with a globally net-zero, climate-resilient future.

“I HOPE THAT MORE GREEN SPACES WILL HELP MAKE LIFE HEALTHIER, COOLER AND MORE PLEASANT IN THE UK.”

– WORKSHOP PARTICIPANT, UK

“I’D LIKE TO SEE GREEN CITIES, WITH MORE USE OF RENEWABLE RESOURCES – ESPECIALLY IN THE TRANSPORT INDUSTRY.”

– WORKSHOP PARTICIPANT, INDIA

RETHINKING THE CITY

Simple interventions can make existing cities and built environments more livable. Urban tree planting reduces street temperatures, both by providing more shade and through transpiration cooling. Enhanced infrastructure may also make active transport, such as walking and cycling, more popular and more viable.

The concept of a “15-minute neighborhood” – where daily essentials are within easy reach by foot or bike, thus encouraging more sustainable behavior – might also become more commonplace by 2050. In some parts of the world, planned city developments demonstrate a perspective on one possible future of sustainable urban development.

“I’D LIKE TO SEE AN ECONOMY THAT IS SOCIALLY FAIRER AND MORE ENVIRONMENTALLY SUSTAINABLE.”

– WORKSHOP PARTICIPANT, BRAZIL

BUILDING A JUST TRANSITION

Globally, access to comfortable and safe living environments is currently unequal, as well as within countries and regions. On top of this, the immediate impact of climate change will vary hugely around the world: low-lying coastal regions in the tropics, for example, will be at a much higher risk of storm damage.

A globally net-zero, climate-resilient world will need to address these problems, facilitating the transition to more resilient and more sustainable built environments globally, and particularly in poorer and developing countries.

RETHINKING WASTE

Goodbye waste,
hello opportunity

RETHINKING WASTE WITH DELOITTE AUSTRALIA PARTNERS
DANNY REZEK, GEORGINE ROODENRYS AND PHIL DAVIES

IN A WORLD OF FINITE RESOURCES, TODAY’S “TAKE-MAKE-WASTE” APPROACH TO PRODUCTION IS NO LONGER AN OPTION. TO CHANGE THIS, WE NEED A TOTAL RETHINK OF HOW WE LIVE – AND IT STARTS IN OUR CITIES

Look to the outskirts of Sydney’s West and you’ll see the familiar sight of construction. As Sydney swells and residents struggle to find – and afford – a slice of Australia to call their own, the city’s housing is increasingly pushing out to its fringes.

The area spells opportunity to a lot of Sydneysiders – but for Danny Rezek, Deloitte partner, it’s for a very particular reason. “We’re about to build a whole new city,” he says. “It makes sense to build it using best practice – so it is more sustainable, more resilient. We have the technology – it doesn’t need to be invented; it needs to be adopted. That’s the opportunity: to look at best practice and bring it together in a precinct.”

While Australia’s east coast will have a raft of climate change impacts, Western Sydney will have its own challenges. The area already experiences blisteringly hot weather, and the recognizable black roofs of newly built estates can give rise to the heat island effect.

But addressing it will take more than just technology – it requires a new way to think about resilience and a new way to think about waste. For Deloitte partner Georgine Roodenrys, the answer is obvious: a more “circular economy” is the way of the future. She points to other cities, like Helsinki – where these practices are already gaining currency as

a way to meet climate change goals, create new jobs and business opportunities, and provide more efficient services.

“In a world where the environmental footprint of our current economic practices is becoming clearer by the day, the traditional consumption model of “take-make-waste” is not only inefficient but it’s not sustainable,” says Georgine.

The vision of a circular economy is exciting – businesses can create value and jobs by using sustainable materials, minimizing waste, creating new business practices, and expanding the way we recycle and reuse.

A SYSTEMATIC APPROACH

But what does this mean for our cities? Georgine says that the built environment uses almost half of all material extracted globally every year. By using a circular scenario, we could reduce global CO2 emissions from building materials by 38% by 2050.

“It’s good for the planet and good for business. Not only would these measures further reduce the impact of human activity on the planet, they will also introduce sharper and more financially enduring businesses practices. It’s a win-win,” says Georgine.

Finland, for example, is aiming to become a global leader in the circular economy by 2025. While the initiatives being undertaken by the country range from urban food markets to food waste reduction projects, a large portion of work so far has been focused on construction and urban planning. This includes projects to enhance green construction procurement such as using recycled materials for the renovation

of Helsinki’s Laakso Hospital and a considered focus on land occupation and zoning.

But in Australia, this has historically been different. Phil Davies, partner, Deloitte, says that for the last 30 years, Australia’s planning and infrastructure approach has been reactive to population growth. Rather than thinking in systems and understanding how to optimize over the long-term, there has been a frantic need to build housing and transport for the masses.

According to Phil, the creation of Bradfield city around the new Nancy Bird Walton Airport in Western Sydney provides a clear opportunity for change. “Because we’re playing catch up, it makes it hard to think in a systematic way. There are so many barriers that make transformation hard – it requires real leadership. The creation of Bradfield city is an opportunity to provide real leadership,” says Phil.

BUILDING CIRCULAR CITIES

Importantly, Georgine stresses, circular practices are not the work of science fiction or utopia. Many are available today. Phil agrees – we have the technology to embed more sustainable, circular practices. He cites the example of University of New South Wales Professor Veena Shajwalla, who is inventing new production processes which reuse products. This includes using recycled glass as kitchen benchtops, which Mirvac is using as part of its apartment complexes.

For Danny, the COVID-19 pandemic represents a moment in time where we can embed these practices in our community. He says, “COVID-19 has made most people appreciate

Infinity symbol with creative ideas. (Image: Getty Images)

their local community more. This is creating the foundation of a smart city – in the sense that we’re much more aware and knowledgeable of the impact we make as individuals in our local communities – and how we can make a lasting difference.”

MAKING A CITY MORE CIRCULAR TAKES:

- Increased utilization – better use of the shared economy to get more use out of the buildings we have
- Reduced raw materials – using recycled materials and improved design that minimizes materials used
- Eliminated construction waste – pre-fabrication, modular design, 3D printing and better planning for eliminating construction waste
- Extended asset lifetimes – refurbishing and re-purposing existing buildings
- Improved urban planning – to allow effective re-use, collection and redistribution of resources.

Danny Rezek and Phil Davies are based in Western Sydney and Georgine Roodenrys is based in Brisbane, Australia.

FEATURE

A continental soup of smart cities

IN THE SPIRIT OF CELEBRATING SOME CITIES THAT ARE PUSHING THE ENVELOPE IN SUSTAINABILITY AND LIVABILITY, WE TOOK A WHISTLE-STOP TOUR OF OUR SEVEN CONTINENTS TO CREATE A UNIQUE “CONTINENTAL SOUP”.

When you search “smart cities” on Google, a plethora of results compete for your attention. But the various blogs, reports, criteria and rankings are all a little different and change each year (also a good sign, because cities constantly evolve). But it’s also confusing – because no one list appears to be definitive.

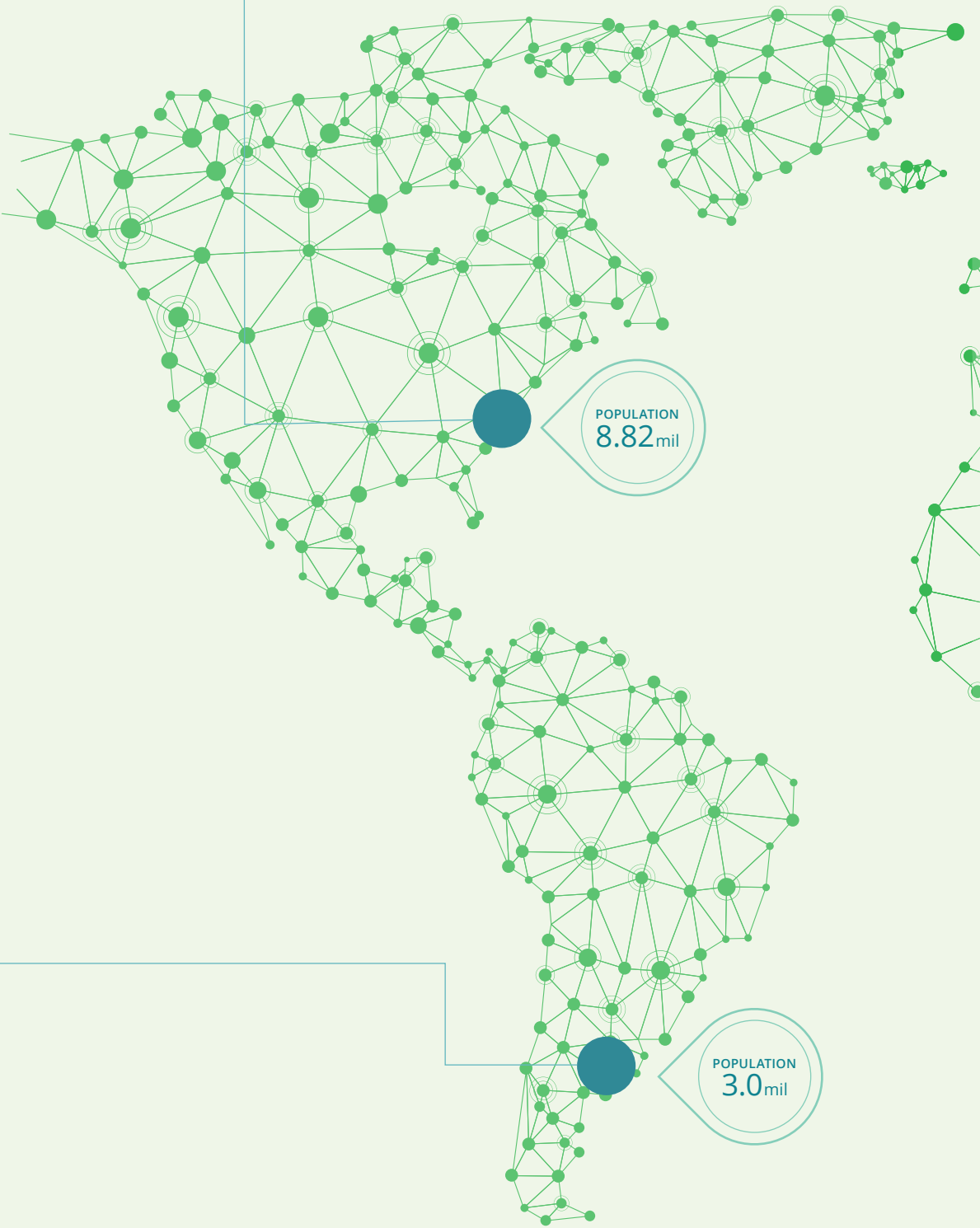
There are some hard facts though. According to UN Habitat, cities consume 78 percent of the world’s energy and produce more than 60 percent of greenhouse gas emissions – yet they account for less than two percent of the Earth’s surface. City populations are only set to soar, making it more important than ever that cities continue to improve.

**A HINT OF SOUTH AMERICA ...
BUENOS AIRES, ARGENTINA
FOUNDED: 1580**

This “Paris of South America” boasts a high-tech public transport system with automated traffic lights and digitalized local administrative networks. However, its smartest asset is its modern and sophisticated waste management program, which was launched in 2012 by the city government. It has transformed Buenos Aires into one of the world’s most advanced cities for waste management and effective reuse in energy production. Circular economy principles have also been put into practice – citizens are encouraged to cut back on personal waste and the government facilitates waste separation and grants public access to a series of plants designed to treat different types of waste.

**A PINCH OF NORTH AMERICA ...
NEW YORK CITY
FOUNDED: 1275**

The “Big Apple” is this continent’s most densely populated and smartest city, with hundreds of smart sensors and technologies situated right across the city, busily amassing data to help make services like waste management and collection more efficient. Phone booths were first replaced by smart hubs with contactless technology, Wi-Fi capabilities and online charging stations – and now many of these will be replaced by new 5G-enabled Wi-Fi kiosks. Car sharing services are also popular and help reduce total emissions and traffic, and an Automated Meter Reading system keeps track of the city’s vast water usage – 1 billion gallons a day – to give city residents a clear snapshot of their water consumption.



A DASH OF EUROPE ...
ZURICH, SWITZERLAND
FOUNDED: 1218

This Swiss city started its smart city program with a streetlight project that focused on using sensors to respond to traffic levels with varying levels of brightness – an initiative that saved up to 70% in energy. Since then, Zurich has expanded the smart streetlights across the city, and established a greater range of sensory technologies to collect environmental data, measure the flow of traffic, and act as a public Wi-Fi antenna.

ANOTHER SPOONFUL FROM ASIA ...
SEOUL, KOREA
FOUNDED: 1394

It's also worth taking a quick look at Seoul, with its huge population of almost 10 million people. Data is at the heart of the Korean capital's smart city projects, and it is one of the first cities to use 5G technology in mobility and transportation. Urban patterns are accumulated and analyzed to determine traffic flow, speed and air quality – all measured by sensors and CCTVs deployed across the city. Home to Songdo, the world's first smart city, Seoul's smart technology campaigns have gone from strength to strength since launching in 2014.

A BOWL FROM ASIA ...
SINGAPORE, REPUBLIC OF SINGAPORE
FOUNDED: 1819

The “Lion City” launched its Smart Nation initiative in 2014. Since then, smart-tech-like contactless payments have been introduced to drive efficiencies – like helping 7.5 million citizens commute seamlessly on the national public transport network. To overcome the pressures of an aging population, Singapore has introduced a digital health system with video consultations and wearable Internet of Things devices so patients can be advised and monitored remotely. By the end of 2022, the government will introduce energy-efficient lighting on all public roads, and solar panels on the rooftops of at least 6,000 buildings.

AND SOME SPLASHES FROM AUSTRALIA ...
ADELAIDE, SOUTH AUSTRALIA
FOUNDED: 1836

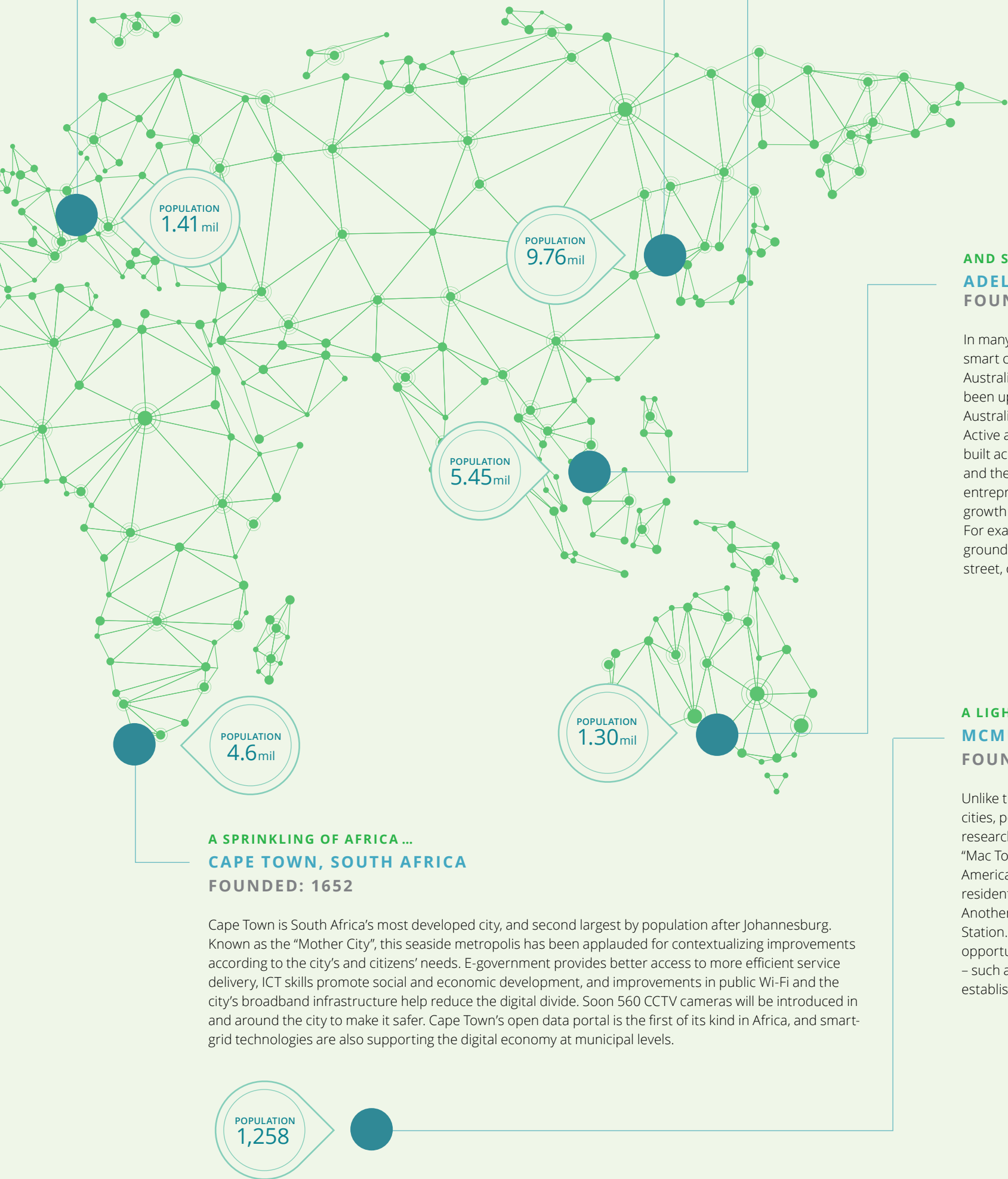
In many ways, this South Australian city started its smart city journey in 2005 when it became the first Australian city to offer free public Wi-Fi. This has since been upgraded with Ten Gigabit Adelaide – a new, Australian first, ten gigabit-per-second data network. Active and collaborative relationships have been built across all levels of government, universities, and the private sector to support innovation and entrepreneurship, fuelling investment and economic growth to make the city a great place to live and work. For example, the Park Adelaide App links 2,800 in-ground sensors to a mobile app, so visitors can find street, or long-stay parking, options at their fingertips.

A LIGHT DUSTING OF ANTARCTICA ...
MCMURDO STATION, ROSS ISLAND
FOUNDED: 1955

Unlike the other continents, Antarctica doesn't have cities, per se. Instead, it has a scattering of remote research stations. McMurdo Station, nicknamed “Mac Town” by its residents, operates as the hub for American activities on the continent, and has seasonal residents who are mostly focused on research. Another sizeable station is Amundsen-Scott South Pole Station. Interestingly, Antarctica represents incredible opportunities for collaboration between countries – such as the large marine protected area recently established in the Ross Sea in East Antarctica.

A SPRINKLING OF AFRICA ...
CAPE TOWN, SOUTH AFRICA
FOUNDED: 1652

Cape Town is South Africa's most developed city, and second largest by population after Johannesburg. Known as the “Mother City”, this seaside metropolis has been applauded for contextualizing improvements according to the city's and citizens' needs. E-government provides better access to more efficient service delivery, ICT skills promote social and economic development, and improvements in public Wi-Fi and the city's broadband infrastructure help reduce the digital divide. Soon 560 CCTV cameras will be introduced in and around the city to make it safer. Cape Town's open data portal is the first of its kind in Africa, and smart-grid technologies are also supporting the digital economy at municipal levels.



FEATURE

The Great White North: Canada's 8 transport infrastructure priorities

SHARED PERSPECTIVES WITH THREE DELOITTE CANADA PARTNERS
ANDREW PAU – NATIONAL PUBLIC SECTOR TRANSPORTATION LEADER
SIMA GUPTA – INFRASTRUCTURE & CAPITAL PROJECTS ADVISORY
AND RICHARD NOBLE – CAPITAL PROJECTS GROUP



With ten provinces and three territories that extend from the Atlantic to the Pacific and northward into the Arctic Ocean, Canada covers 9.98 million square kilometers, making it the world's second-largest country – and is home to over 38 million citizens. It's been coined the "Great White North" given its great size, white Arctic frozen tundra and snow, and being north of the US.

WE “VIRTUALLY” SAT DOWN WITH THREE DELOITTE CANADA PARTNERS TO FIND OUT MORE ABOUT THEIR CLIENTS’ PRIORITIES, AND THE BIGGEST CHALLENGES AND OPPORTUNITIES THE GREAT WHITE NORTH’S TRANSPORT SECTOR WILL FACE IN THE YEARS AHEAD.

1 ENCOURAGING PEOPLE TO START TAKING PUBLIC TRANSIT AGAIN

TransLink in Vancouver recently asked Deloitte to better articulate the mindset and motivations of public transit riders. We deliberately chose not to describe commuters based on a persona or identity, but instead focused on what unique driving factors motivated a person to choose public transit over other modes. This included looking at commuters’ different mindsets for any particular trip. This work has helped TransLink’s Customer and Marketing team think more strategically about how it targets both marketing and employer programs to increase ridership (which has dramatically reduced since COVID-19). Metrolinx in Toronto is also working with our team for recommendations on incentives to restimulate ridership on the rail and bus network, including conducting “return to work” employee workshops and encouraging corporates to rethink employee car parking arrangements.

3 MAKING CANADA’S TRANSPORT NETWORK MORE EQUITABLE AND ACCESSIBLE

The future of mobility extends well beyond the major urban centers, and needs to be relevant to all communities across Canada. Infrastructure enhancements need to accommodate a wide range of needs and preferences. We collaborated with the Toronto Regional Board of Trade to produce a report on what must be true to build universal transit access. **Scan the QR Code to view the full report.**

5 CONTINUING TO EMBRACE TECHNOLOGY TO TRANSFORM TRANSPORTATION

Increasingly, modern technology is being used to improve data transparency and inform quicker, better decisions. For example, we’re helping NAV Canada to develop a digital twin to better forecast and manage air traffic control personnel. Additionally, we’re working in partnership with AWS to help the Port of Vancouver utilize computer vision pilot technology to track container movements from terminal to inspection facility, identifying those that require further inspection.

7 DIVERSIFYING AIRPORT OPERATIONS TO RECOVER FROM COVID-19

To respond to COVID-19, and capture new market share, several Canadian airports are enhancing their logistics capabilities and facilities to replace reduced passenger air travel. Air Canada has also been affected and is looking at different loads to transport.

2 IMPROVING CONNECTIONS TO VANCOUVER’S CORE TRANSIT SYSTEM

Metro Vancouver has a high concentration of “can’t work from home/flex work” workforce members – including healthcare workers, and workers engaged in industrial and distribution centers. We’re looking at ways to tailor transit programs and services – like shuttles – to provide better service and connectivity to the core transit system.

4 MOVING TOWARDS MORE COLLABORATIVE CONTRACTING MODELS

When it comes to procurement of construction projects, industry participants are moving away from Public Private Partnerships to more Collaborative Contracting models, including alliance models or Progressive Design-Build delivery models. While these new contracting methods are already playing out in the private sector, government bodies are also following suit.

6 TAKING CLIMATE ACTION IS A NATIONAL IMPERATIVE

To help turn the tide on emissions, Deloitte is developing a Canadian roadmap for sustainable aviation fuel production and is in early discussions with clients and industry partners about the potential of biodiesel and synthetic fuel.

8 BEING FLEXIBLE AND AGILE IS ESSENTIAL WHEN DEVELOPING SUCCESSFUL TRANSPORT INFRASTRUCTURE

Being able to plan infrastructure assets in a flexible way is more important than ever. This is enabled by modern approaches to the engineering, procurement, and construction management using a) Systems Engineering methodologies to manage scale and complexity; and b) digital twin and simulation technologies to strengthen and accelerate design, enable trade-offs and reduce design risk. These need to be augmented by innovative delivery models including progressive, collaborative and alliance models for contracting.

GET READY FOR THE FUTURE

How can Optimal Reality solve for real-time operational excellence?

A DIGITAL DISCUSSION WITH DELOITTE AUSTRALIA EXPERTS
SEAN McCLOWRY – PARTNER AND **CALEB SAWADE** – PRINCIPAL

ANSWERING THIS QUESTION GETS TWO MELBOURNE COLLEAGUES, DELOITTE PARTNER SEAN McCLOWRY AND DELOITTE PRINCIPAL CALEB SAWADE, OUT OF BED EVERY DAY. BECAUSE THEY KNOW THE ANSWER IS A GAME CHANGER FOR THE FUTURE OF INFRASTRUCTURE_____

Their key focus? Digitization, and how it can help transport operators, despite, and in response to, COVID-19. The transport sector has seen some welcome trends emerging, ranging from electric vehicles to self-driving cars, smart cities, and improved sustainability. But what problems will it face in 50 years' time? And how can we best prepare ourselves?

Caleb Sawade, a machine learning expert, explains there are three areas in which transport operators can excel to thrive in an uncertain future.

"Firstly, prediction. This means being able to map what's going to happen in a given transport network – like a motorway, bridge, or ambulance route – in a confidence-based way. Secondly, collaboration across partners. We need to encourage people to solve problems inside and between departments, ranging from with, and across, ambulance services, to police and other organizations to create an ecosystem of collaboration. And lastly, integrated data. Data sources don't need to be bottlenecks, or cumbersome, anymore. When you bring these three areas together, it provides one unified view of all the data types, including that wonderful ability to make predictions, in one spot."

Sean McClowry, digital twin and simulations expert, agrees. "It's all about optimizing decisions, supported by what we refer to as 'mission control', as shown in the image. "Imagine having all the right information at your

fingertips, predicting what will happen in your transport network – what do you do next? Make the best decisions, of course! But let's not stop there. Then you track that decision, making sure everyone acts on it. Testing and planning for dynamic scenarios is also important: we can explore what could happen in three years' time, right now, in as little as three minutes. This is everything," says Sean.

This is where digital twins come to play. They can provide a way for us to change complex systems with more confidence than ever before. By creating digital versions of physical systems, organizations can make better, faster, and more optimal decisions for their business operations and performance in the physical world.

Optimal Reality is Deloitte's digital twin capability, based on simulation techniques pioneered in Formula 1 racing. Sean explains, "We help organizations run millions of permutations on a digital replica of their network to drive optimal decision making within seconds. By harnessing Formula 1 simulation modeling and scaled cloud computing, Optimal Reality is tackling our built environment's greatest challenges."

Caleb adds, "We have seen some wonderful results for our clients, where the digital twin of their transport networks – ranging from air traffic control to a state's entire transport network – has enabled more robust decisions to be made, improving not just citizen safety, but also minimizing congestion and time delays. Decision-making processes differ for every organization: if you close a motorway, it could mean congestion will dissipate somewhere else. But if there is a car crash which blocks the route you're diverting traffic to, your decision has resulted in two blocked routes. This isn't robust: digital twins can help inform decisions to avoid this from happening."

"For example, for Airservices, we were asked to improve network planning to reduce disruption. The result? Reducing airborne delays by a forecasted 33% when applying our simulator as a disruption management tool to foresee unexpected events; and a new portal for transparent and agile collaborative decision making between Airservices and its airline partners," says Caleb.

Transport operators have traditionally solved congestion issues with more infrastructure, but with Optimal Reality we're talking about digitizing the infrastructure that already exists, so it works better. Sean says, "We can solve congestion by optimizing how things move in existing infrastructure – this is complementary,

Mission control. (Image: provided by Sean McClowry)

or as an alternative to building more infrastructure. Either way, it's about improving your confidence in the asset's ability to deliver what it's intended to."

It is still early, but it is wonderful to see an increasing number of public sector transport operators embrace the opportunity to digitize their networks and improve the services they provide to citizens. Mission control operations can make both small and large impacts, from turning lights green at just the right time, to avoiding major network disruptions.

Scan this code to find out more about Deloitte's Optimal Reality

Scan this code to watch the Airservices case study video

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Solving the world's most wicked problems with our innovative digital twin solution by fusing physical and digital worlds in real time. Running millions of permutations to drive optimal AI-powered decision making within seconds. Solving tomorrow's problems today for a safer, smarter and more sustainable way to live.



Deloitte.

PUBLIC AND PRIVATE PARTNERSHIPS

Bridging the gap for a better future

CROSSING BRIDGES WITH
RYO TSUJIMOTO – PARTNER, INFRASTRUCTURE & CAPITAL PROJECTS,
DELOITTE VIETNAM AND JAPAN

Addis Ababa, Ethiopia – The Japan International Corporate Agency provides financial support here for start-up companies to create business innovations. (Image: Getty Images)

WE’VE ALL SEEN THE DIVIDE BETWEEN EMERGING AND DEVELOPED COUNTRIES AND ECONOMIES, BUT HOW ARE WE BRIDGING THAT GAP? AND WHAT ROLE CAN PRIVATE AND PUBLIC SECTOR ORGANIZATIONS PLAY?_____

One government entity that is actively forging new bonds of trust around the globe is the Japan International Corporate Agency (JICA), one of the largest bilateral international donor organizations (IDO) in the world. Based in Tokyo, JICA has a diverse track record of successfully embracing Public-Private Partnerships (PPPs) in developing countries – to improve the business environment, support infrastructure development, and enhance public services.

Ryo Tsujimoto, Deloitte’s partner for Infrastructure & Capital Projects in Vietnam and Japan, explains the important role government agencies like JICA play in funding critical infrastructure improvements. He shares some recent examples of how the firm is helping JICA make an impact that matters in developing countries.

“It’s an honor to help JICA achieve its objectives, which primarily focus on encouraging private sector investment and participation in making local infrastructure improvements. For example, in Africa we’re establishing policy recommendations to make it more attractive for the private sector to get involved with Ethiopian PPPs, have conducted surveys to better understand the food value chain in central-west Africa, explored measures to

promote renewable energy investment, and helped JICA provide financial support for start-up companies to create business innovations,” says Ryo.

Further afield in Indonesia, JICA and its partners were recently approached by the Indonesian government to help with an ambitious plan to develop 1,000 km of roads through PPPs. Based on an official request, a new joint venture of private sector experts is providing support and a capacity development program for strategic PPP applications to make sure that the new roads – and importantly their tolls – will improve transportation options and boost local economic development.

“These kinds of projects serve as a ‘showcase’ of successful PPP capacity development – ranging from planning, procurement, and monitoring – by an international donor to drive infrastructure and economic improvements by focusing on assets that will generate revenue and improve ways of life,” says Ryo.

Another great JICA investment drive is in Kenya, where it is supporting SMEs’ access to finance – a key bottleneck to their growth in the region. A new survey project identified exactly

which countermeasures need to be taken to overcome this challenge. Ryo says, “Deloitte conducted a thorough survey of the Kenyan financial sector to analyze the major issues in SME finance and explore potential solutions, including fintech. We are currently preparing for pilot projects to measure the effectiveness and efficiency of potential solutions.”

Traditional international development has tended to focus on helping to develop public sector services provided by developing countries’ governments. However, it’s important to enhance the role of the private sector as well, with the collaboration between public and private sectors largely recognized among IDOs. JICA’s initiative for PPP and private sector support is in line with this trend and this is where Deloitte and its extensive experience and knowledge is helping to work with private enterprises throughout the world to add significant value.



It's time to revitalize, rebuild and reimagine the future

Construction projects have grown larger, riskier and more complex. And capital projects have a uniquely long-lasting impact on climate change. Given the urgent need to accelerate economic recovery, it's clear that well-planned infrastructure investments are critical.

Deloitte takes pride in our legacy of helping clients integrate capital projects into economic recovery and delivering first class infrastructure projects around the world, supported by our global network of Infrastructure & Capital Projects professionals with deep expertise across sectors, services and geographies.

We are driven by purpose: to make an impact that matters, and an industry-centric belief that infrastructure must be designed and used to enhance outcomes and services for citizens.

Working extensively in the public, private, and capital investment sectors and powered by collaboration, innovation and transformation, we find solutions to the most pressing issues facing our clients and communities.

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