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#InfraConnect

Connect to compete

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In today's world, those with the greatest connectivity reap the greatest rewards. It is true for people, cities, countries and infrastructure.

People are simply begging for more connectivity. The evidence is everywhere: it is in the continued adoption of social media; the recent boom in air travel; and the uptake of 4G networks and technologies. It is palpable — from the throngs that crowd the small internet shops in the shanty towns of Rio and Lagos through to the mobile smartphone addicts on the main streets of Hong Kong and New York, everyone is trying to connect to something.

Cities, too, are desperate to improve their connectivity. They are building massive new airports, encouraging greater competition in the ICT sectors and participating in regional rail and energy schemes. They are building 'smarter' versions of themselves by connecting their internal systems, technologies and data to drive massive efficiency at city-scale. And they are promoting these advancements to investors and potential employees around the world.

While recent media coverage may suggest that some countries are now starting to 'disconnect' in response to protectionist and populist pressures, the reality is that the vast majority of national governments are working very hard to improve their connectivity with other countries. Whether it is massive trade deals like the Trans-Pacific Partnership, collaborative investment vehicles like the Asia Infrastructure Investment Bank or even bilateral tie-ups like those currently blooming in ASPAC, it is clear that most countries are seeking more global connectivity, not less.

Infrastructure — arguably the foundation of all previous connectivity — is also becoming much more connected and much more focused on connectivity. At the asset level, we are seeing massive efforts to create more 'connected enterprises' that are able to leverage data and automation to drive significant performance enhancements. At the system level, we are seeing continued moves to integrate assets and services — whether that is encouraging multiple forms of electricity generation, creating multimodal transport or preparing for the introduction of automated vehicles.

Indeed, the value of infrastructure is no longer counted in the revenues it generates, but rather in the connectivity that it enables. The challenge for the infrastructure sector is that delivering connectivity is not the same as delivering assets.

Delivering connectivity requires infrastructure planners and owners to take a step back from their roles to view the bigger picture and to understand how their participation leads to greater connectivity. It requires designers, developers and operators to continuously innovate and adopt new technologies. It requires investors to rethink the value equation when assessing their return on investment. But, first, it will require a deeper understanding of what connectivity really means to people, cities, countries and infrastructure.

That is why, for this edition of *Insight Magazine*, we have approached the concept of 'connectivity' from multiple angles. We explore the challenges of delivering regional connectivity projects; the efforts to connect NGOs and multilateral institutions to infrastructure investment needs; protecting cities and interconnected infrastructure assets from cybercriminals on the dark web; Asia's massive regional initiatives; we even offer a futuristic view of what it might take to connect to a Mars colony.

Those seeking a better understanding of the bigger picture of how connectivity and infrastructure align will want to read our interview with Parag Khanna on page 6. Indeed, Parag sums up the current situation nicely when he notes, "Beneath the chaos of a world that appears to be falling apart is a new foundation pulling it together. And that is our collective connectivity."

This edition of *Insight Magazine* helps to explain why. ■

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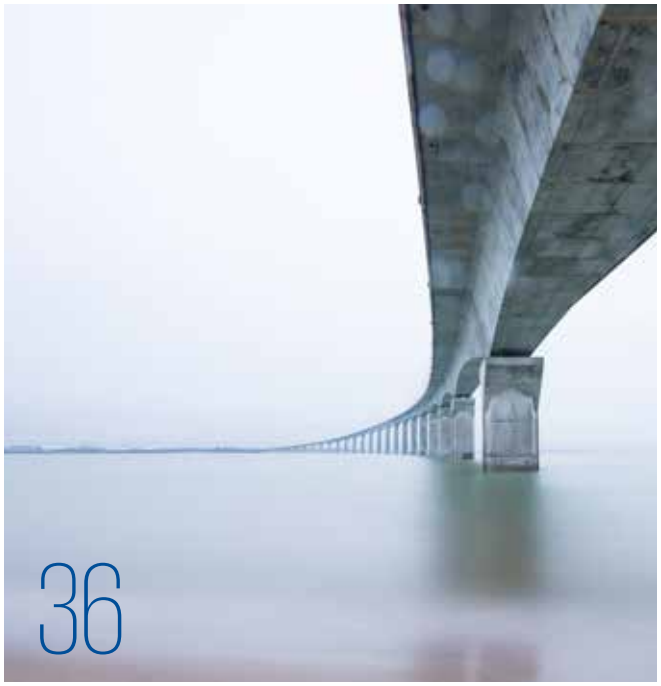

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*Parag Khanna believes that mankind has a new maxim — Connectivity is destiny — and the most connected powers, and people, will win. His vision of 'connectography' unlocks some of the great challenges of connectivity and provides a hopeful vision for the future. We sat down with **Parag Khanna**, leading global strategist, best-selling author and one of the World Economic Forum's Young Global Leaders, to learn more about his vision and its influence on infrastructure.*

Connectivity of the future: A new lens on infrastructure

Connectivity is destiny — and the most connected powers, and people, will win

Ed: In your opinion, why is connectivity so important today?

Parag Khanna (PK): I believe there are two main megatrends shaping the world we live in today: urbanization and connectivity. And, together, they dictate human behavior every bit as much as — maybe even more than — any other force or factor we've seen previously.

Connectivity really comes down to the enablement of supply chains, both physical and digital, which are now the conduits of our economies. What we have seen is that — in a very uncoordinated, unsynchronized yet simultaneous decision-making process — billions of people are gravitating toward infrastructure and the supply chains they enable.

That's why functional geography, what I call 'connectography', has become so critical today.

Ed: So is functional geography now more important than physical or political geography?

PK: Not at all. They are all layers through which we interact with the world around us. There is no more fundamental a layer than our natural or environmental geography. And, until now, our political geography has dictated geopolitics, economics and competitiveness. Today, we are entering a new era dictated by functional geography and its impact is influencing our decisions at a pace we have never seen before.

But if you want to truly appreciate the complexities we are facing today, you really need to take all of these layers into account at the same time. If your goal is to build a resilient society, for example, you need to consider the ecological uncertainties, the political realities and the functional geography that is available to that society when they need to cope with the various environmental scenarios they may face. Looking at the political geography alone certainly won't tell you whether this society will survive environmental disruption.

We really need to be able to appreciate all of these different layers if we want to peel back the challenges we face and understand the complexities we need to overcome in solving them.

Ed: The debate about the benefits of globalization continues. Is greater connectivity good for society?

PK: Absolutely. And, frankly, it's an unstoppable force that has been around since the dawn of time. Cobblestones in Roman roads were the first building blocks of connectivity, and we have been increasing our global connectivity ever since.

> "Connectivity really comes down to the enablement of supply chains, both physical and digital, which are now the conduits of our economies."

The problem isn't greater connectivity. It's the way governments are responding to the changes that connectivity brings. At some point, we have to be clear about where the responsibility for helping society cope with these universal phenomena like globalization and connectivity lies. And that is with government.

There are governments that have done a great job at helping their societies adjust and compensate for the rise in globalization and connectivity and there are governments that have not. If you ask me what the greatest risk facing our society is today, it's that governments will take a laissez-faire approach to managing connectivity.

Ed: Does that mean that connectivity is creating winners and losers?

PK: There is certainly a perception that it is. Connectivity is what allowed manufacturing jobs to be offshored to the Asian Tigers in the 1990s and that has led to the hollowing out of the manufacturing sector in some countries. Where governments have done a poor job managing that evolution, there have certainly been some losers.

Then there are places that have been without even basic infrastructure and, in many cases, digital connectivity can help them solve that. Platform solutions, energy-saving utilities, mobile broadband, telemedicine — these are all ways that governments can leverage connectivity to reduce the cost of their infrastructure while still delivering basic government services. And these would be the most obvious winners.

But I would argue that — particularly in today's political environment — there is far too much talk about who gains and who loses from connectivity. All evidence suggests that, when properly managed, everyone gains.

Ed: Are we seeing the rise of a new world order led by those with the best connectivity?

PK: I think we are seeing the rise of regions rather than nations. I always use the Trans-Pacific Partnership (TPP) and the Asian Infrastructure Investment Bank (AIIB) as two examples of regional connectivity. These initiatives involve dozens of countries working together to improve physical and social connectivity, to enhance supply chain integration, and to create trade and investment opportunities.

There are two ways you can look at these types of initiatives. On the one hand, you can take the functional perspective which would argue that more cross-border infrastructure and initiatives promotes national development and the fulfillment of competitive advantage, and this, in turn, makes the world a better and more secure place. On the other hand, you could take the national perspective and argue that these agreements weaken existing institutions and national borders and therefore pose a threat to society.

Yet I would suggest that organizations like the AIIB wouldn't exist today if our existing institutions hadn't dropped the ball on infrastructure investment and financing in the 1960s. Over 60 years of management by our existing institutions has led us to massive multi-decade market failures in infrastructure finance.

So I don't know if I'd classify it as a new world order. But I would argue that any initiatives that promote regional integration are inherently good.

Ed: Can you measure the value that connectivity adds to an economy or city?

PK: At a project or program level, it's often possible to calculate the return on investment for a specific piece of infrastructure and the value it creates for society and the economy. But at a macro level, it is almost impossible.

The reality is that our cities and our national economies are already so interconnected through trade, investment, supply chains and technology transfers that you simply can't separate what is endogenous economic value and what is a result of connectivity. You can't strip out all of the inputs and outputs, all of the movement of people, ideas and resources, all of the value of the physical and digital flows in and out of a city or a country.

You'd be better off studying quantum physics than economics if you want to try to untangle the intangible and pervasive role that connectivity plays in our world today.

Ed: So how can infrastructure decision-makers improve their chances of becoming winners in a connected world?

PK: I think infrastructure planners and owners need to be doing two things. First and foremost, they need to continue looking after the basics. They need to be investing, encouraging PPPs and maintaining their assets. Part of that is making sure that infrastructure assets are properly accounted for and that sufficient investment is being made into their renewal.

They also need to be thinking about their active strategy — what they want to achieve, what assets they need and how they plan to pay for them. But the goal shouldn't simply be to improve connectivity. You need to think carefully about how much connectivity you need, where you need it and what value it delivers.

Ed: What should developers, contractors and suppliers be doing to respond to the shift toward connectography?

PK: They are the real agents of connectivity. So they have no reason to rethink their value proposition in this equation. Particularly in this golden age of infrastructure.

There are certainly things that the industry could be doing to improve the value of connectivity. They could be thinking more about the longevity and adaptability of their assets and then creating bundles of assets that are as cost-effective as possible. But, overall, I think the industry — particularly the bigger global players — is at the center of connectivity today.

Ed: You seem very optimistic about connectivity and connectography. What is your vision for the future?

PK: As I say in my book, I see connectography as a hopeful vision for the future. I see a world where new energy discoveries and innovations have eliminated the need for resource wars, global financial assets are being deployed to build productive infrastructure that can reduce inequality, and frail regions such as Africa and the Middle East are unscrambling their fraught colonial borders through ambitious new transportation corridors and power grids.

Beneath the chaos of a world that appears to be falling apart is a new foundation pulling it together. And that is our collective connectivity. ■

Connected economies: The dark web challenges a 'new dawn' for infrastructure

An underworld of anonymous platforms and cryptocurrency dealing is placing new pressures on infrastructure stakeholders

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An exciting new dawn may be rising for global infrastructure, with governments sharpening their focus on infrastructure investment as a path to economic growth and new technologies forging innovative ways to accelerate development and control costs. But as the horizon brightens, there's little time to lose in confronting the unprecedented infrastructure threats emerging from beneath the cover of the dark web.

The alarming reality is that, as the infrastructure world continues to embrace opportunities for remarkable 21st-century approaches and capabilities, the dark web is providing a covert, decentralized, unregulated 'black cybermarket' that's catapulting cybercrime — and the risk to global infrastructure — forward as well.

Today's infrastructure systems are becoming digitally interconnected and automated as never before. On the rise as well is their reliance on sophisticated, often remote, control-system architectures designed to manage infrastructure via networked computers and data communications. Sounds complex? It is.

Simply put, yesterday's individual targets are morphing into a far-reaching attack surface — an interconnected digital web controlling everything from transportation, telecommunications and power utilities to healthcare, financial systems and the internet itself. And a sordid array of anonymous hackers-for-hire, cybercrime syndicates and organized crime networks — operating far 'below the radar' of authorities — are busy trading information and attack methods aimed at exploiting any infrastructure vulnerability they can find.

The dark web's threat to critical infrastructure is real and rising. And the currency of choice that's keeping cyber-mercenaries in business is Bitcoin and countless other virtual currencies in circulation — each anonymously held and exchanged for illegal services rendered. Ransomware attacks illustrate just how well cryptocurrency serves as the ideal tool for dark web cybercrime to flourish, protecting perpetrators under a cover of complete anonymity as they demand these currencies from victims and then cash in the proceeds undetected.

"The ability of cybercriminals to trade information, collaborate on projects or pay for attacks is much greater than it used to be as a result of the dark web and the unregulated environment and anonymous transactions it provides today," says Talis Putnins, a professor of finance and co-author of *Sex, Drugs and Bitcoin: How much illegal activity is financed through cryptocurrencies?* "The exchange of information on how to engage

in illegal activity is greater than ever and allowing many kinds of illegal behavior and transactions to become a little more mainstream. It takes the threat beyond a handful of highly specialized, well-trained computer scientists to include many more players, dramatically broadening the pool of people engaged in cybercrime."

Putnins' team's findings suggest cryptocurrencies are transforming the way black markets operate by enabling 'black e-commerce'. The paper estimates that about half of all Bitcoin transactions are associated with illegal activity — or about US$72 billion per year. The total market capitalization of Bitcoin alone exceeds US$250 billion as of January 2018, with a further US$400 billion in over 1,000 other cryptocurrencies.

Authorities are scrambling to respond as threats advance

Should we view last year's WannaCry ransomware cyberattack — crippling hospitals, banks and businesses around the globe — as a harbinger of what's to come for infrastructure? Perhaps so when you consider, as just one example, the emerging potential for dark web cybercriminals to access today's rapidly advancing transportation infrastructure and turn autonomous vehicles into remote-controlled weapons. Authorities have already warned of this possibility. Or consider a scenario in which a major urban center — including emergency-response vehicles — is paralyzed by hackers disabling an entire network of traffic signals.

The possibilities are alarming, real and perhaps endless as the threat to interconnected infrastructure systems widens and advances. Witness recent terrorist attacks on so-called 'soft targets' in places like Canada, the UK, Spain, Sweden, Germany and France, forcing authorities to rethink how they secure today's mass transit, public spaces and heavily traveled pedestrian thoroughfares.

Unfortunately, no sooner do law enforcement and authorities marshal enough resources to train some light onto the dark web's cybercrime marketplace, organized cybercriminals are already pursuing sophisticated new methods and platforms. The problem becomes a rapidly moving target that authorities have struggled to keep up with so far.

The closure of the so-called Silk Road is a classic example. The online black market serving as a platform for illegal drug sales was shut down by the FBI in October 2013. And by early November 2013, Silk Road 2.0 came online, run by former administrators of Silk Road. It' too, was shut down, but that murky ecosystem's remarkably quick re-emergence illustrates the challenges facing law enforcement and authorities today — not to mention critical infrastructure owners, operators and stakeholders.

While a trend toward investment to improve cybersecurity and combat criminals targeting infrastructure is underway, efforts to illuminate new solutions are typically impeded by the fact that most infrastructure operators and owners involve private enterprises possessing many decades worth of major legacy systems. These are not easy to retrofit with modern cybersecurity requirements, and that's proving to be a major challenge in the face of increasing threats and risks.

We've moved quickly from yesterday's 'IT issues' — involving servers, networking gear, local IT infrastructure, PCs, laptops, tablets and smartphones — to today's digitally interconnected infrastructure ecosystems featuring new platforms such as autonomous vehicles, for example. And the risk of catastrophic disruption is multiplied when you consider how increasingly dependent societies and economies are becoming on the critical infrastructure web that surrounds us today.

Shining a bright new light on virtual currencies and the dark web

Regulators are driving hard to make progress, playing catch-up with intense focus amid the confusion that has reigned over the explosion of digital currencies in circulation globally and across the dark web.

"Regulators and governments have so far been bamboozled by digital currencies, unsure whether to treat them as personal assets, derivatives, shares or investment schemes," says Kate Allman, a multimedia journalist at the Law Society of New South Wales who authored an article titled *The Dark Side of Bitcoin*. "But there is definitely a sense of urgency to exert a greater level of control, and authorities and law enforcement are closing the gap, thanks to the focus they are placing on digital currencies and their illegal uses on the dark web."

The good news for authorities, and an increasing area of focus, is the simple fact cybercrime players always need to move back and forth between anonymous digital currency and real-world cash. So authorities are narrowing in on the points at which criminals are making those conversions between cryptocurrencies and real money — the so-called on-ramps and off-ramps to the dark web, where the virtual and the physical intersect.

It's at these key points, which are coming under increasing surveillance by authorities such as the FBI, where monitoring and tracing of activity can accelerate the prosecution of the players involved. Scrutinizing computer hardware — laptops, mobile phones, tablets — and software gateways into and out of the dark web will throw a new spotlight on hackers.

Meanwhile, the World Economic Forum has proposed global cryptocurrency strategies that include: enforceable new international rules; virtual currency providers verifying who their customers are; creation of an international e-forfeiture fund to combat money laundering; and modernizing existing authorities like the Financial Action Task Force (FATF).

The FATF is a global policy-making body whose stated objective is to set standards and promote implementation of legal, regulatory and operational measures for combating money laundering, terrorist financing and related threats to the integrity of the international financial system.

President Santiago Otamendi says that among the FATF's network of 204 countries and jurisdictions, all are committed "at the highest political level" to implementing FATF recommendations. He adds that financial innovation in the form of cryptocurrencies carries new risks that must be mitigated to ensure they are not abused.

"The cross-border nature of this new industry requires a global response," he says. "So far, there has been a wide range of government responses. This has resulted in a patchwork of regulatory approaches, which is increasing the risk of money laundering and terrorist financing. In the coming months, with the support of the G20, the FATF will review its guidance on virtual currencies — or crypto assets — and consider if changes to its recommendations are necessary."

In Europe, the NISD — Network and Information Security Directive — is just coming into law across the continent, placing new cybersecurity obligations and best practices on critical national infrastructure providers. It essentially introduces testing and breach-reporting obligations and includes requirements for emergency-response processes to manage a breach or major disruption.

The caveat on managing illegal use of digital currencies is to avoid a 'knee-jerk' response that cramps or crushes legitimate, productive, innovative uses for virtual currencies. While some nations are actively adopting cryptocurrencies and encouraging uptake as a stimulus to economies, others remain far more skeptical. But cryptocurrencies are here to stay and authorities are catching up in earnest to better monitor and manage their illegal use.

It's time for infrastructure stakeholders to raise their game

While regulators and law enforcement are zeroing in on organized cybercriminals and working to shrink their dark web playing field, it's time for infrastructure owners, operators and stakeholders to step up their game as well.

Unfortunately, we still see an alarming gap between the risk perception of regulators versus that of infrastructure players, many of whom seem unable to acknowledge the severity of today's threats from organized cybercriminals and nation states. In KPMG International's 2018 CEO Outlook,[1] we saw only 14 percent of 79 CEOs say that cybersecurity poses a threat to their organizations.

That's a serious disconnect that has authorities in many cases worried about the potential for catastrophic — and life-threatening — disruption of sprawling infrastructure systems. There's no more time to lose for infrastructure owners, operators, stakeholders and future investors to become better informed and more closely aligned, in order to respond strategically to today's and tomorrow's risk realities. A new way of thinking is needed now. A wait-and-see stance will only court disaster that puts public safety and lives at risk.

If we are to see infrastructure's full emergence into a bright new era of progress and advancement, an informed and strategic approach to security should be at the top of the agenda for everyone involved. ■

[1] https://home.kpmg.com/xx/en/home/insights/2018/05/ceo-outlook.html

Every infrastructure sector needs to take a more aggressive and strategic stance today to ensure that increasingly complex and interconnected infrastructure systems are adequately safeguarded. This includes:

01 Greater cooperation and collaboration among infrastructure owners, operators and investors with law enforcement and government to collectively tackle the growing threat to infrastructure in a strategic manner.

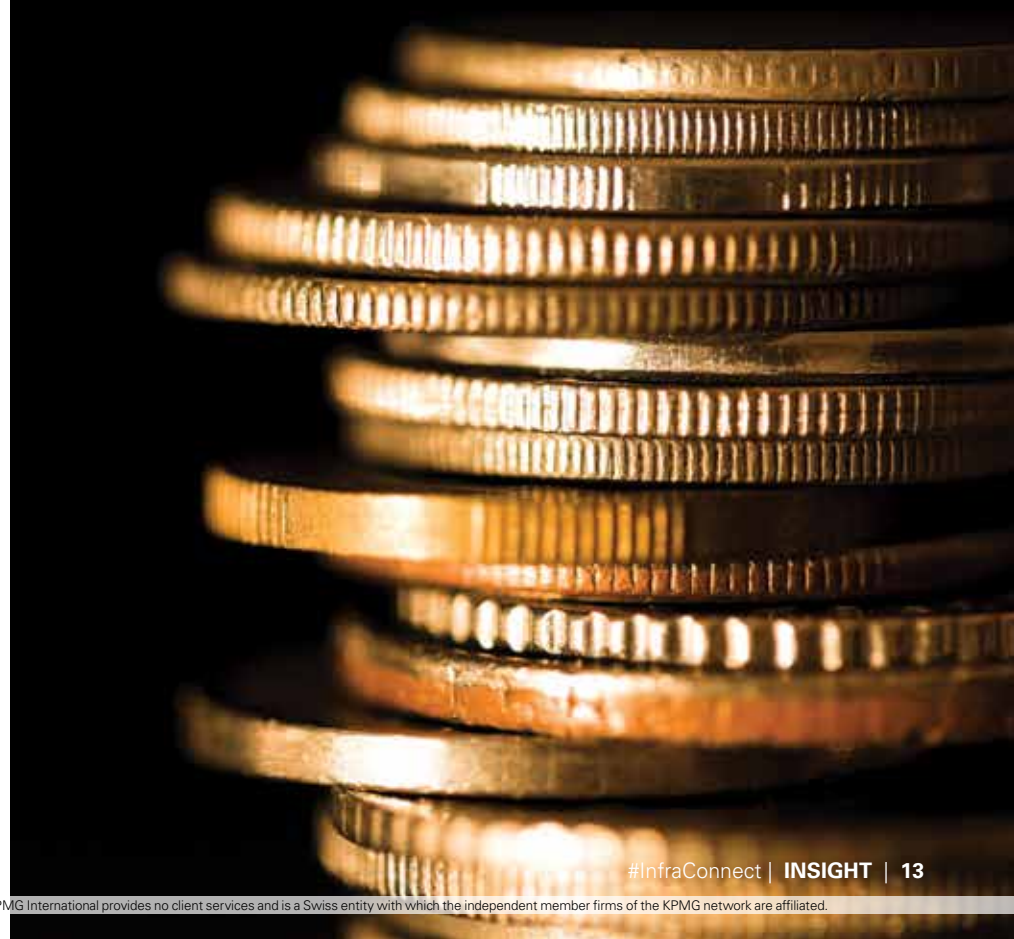
02 Better understanding of the growing threat from the perspective of today's ruthless, rational, organized and increasingly sophisticated cybercrime entrepreneurs. Know what is of value to attackers and take measures to fully protect those assets.

03 Taking ownership of the issue by being proactive rather than reactive to emerging threats and growing risk.

04 Striking a strategic balance between centralized versus decentralized infrastructure services and capabilities in order to mitigate risk.

05 Preparing for disaster scenarios via a comprehensive response-and-recovery program.

06 Raising awareness across the organization — from the C-level on down — encouraging organizational leaders to act as change agents dedicated to enhancing capabilities for infrastructure security.



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Connected energy: Super grids: making the right connections for a sustainable future

An attractive investment model for governments and private entities

Imagine a home in Sweden using low-cost electricity generated in part from solar panels in Spain. Or massive wind turbines in Mongolia helping to power a factory in Japan. Super grids could make these and other dreams a reality in the near future, providing ready access to affordable, reliable and sustainable energy for consumers around the world.

The idea of global decarbonization and the move away from fossil fuels toward renewable power generation will only become a reality through rapid acceleration of innovative technologies coupled with some visionary thinking. This is what makes the super grid idea so exciting.

A super grid is not just a "network of networks." Put simply, a super grid is a large scale transmission network that makes it possible to trade high volumes of electricity across great distances. Fossil fuel power plants are typically located in areas close to population centers, which makes it easy to distribute electricity. The same proximity between generation and consumption is often not the case for renewables. Yes, there is a treasure trove of offshore wind in Europe located in the North Sea and solar is in abundance around the Mediterranean Basin, but both are located away from high population centers.

The main issue is therefore trying to move that power from where it can be made cost effectively to where it can be consumed. This has led to the modern incarnation of the super grid and the idea is starting to gain real traction. For example, Greenpeace has released a report claiming that a European super grid could allow the European Union (EU) to reach a 45 percent renewable energy share by 2030.[1]

A key challenge for renewable energy generation is the ability to move that power across long distances. Existing regional grids use interconnectors that support the transmission of alternating current (AC) from power generation plants to local consumers. These grids require a significant amount of energy to move power long distances.Even for short distances, the movement of renewable power can overwhelm existing AC grids. The super grid, on the other hand, uses high voltage direct current (HVDC) that significantly reduces the loss of energy during transmission and helps to deal with the variability of renewable power. A key enabler is the super node. A super node is a piece of technology, or software, that will route power through a series of other super nodes to where it is most needed. It can best be compared to a router in IT systems. Super nodes will allow Europe, for example, to become one, interlinked network which will route power to where it is needed.

A super grid could support multi-directional power flows from multiple energy sources across very large regions.[2] As a result, super grids could improve energy reliability, permit the pooling of resources, and support greater economies of scale.[3] Super grids could also be connected with other super grids. Other benefits of super grids could include greater competition in energy markets, lower prices, and stronger energy security. Also, the Super grid can be a trading tool which will enhance the security of supply of all the countries of the EU.[4]

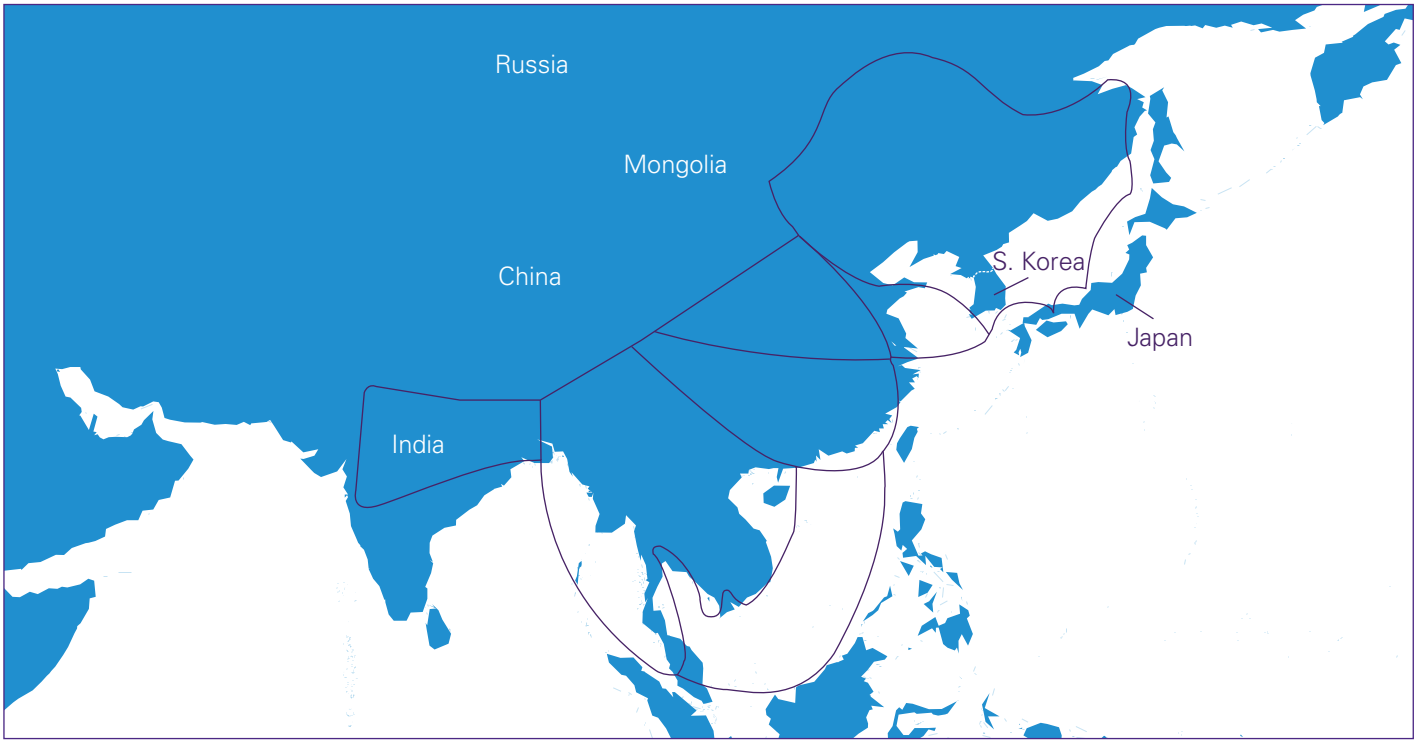
If Europe and the world are to meet the climate change targets set in the Paris Agreement, visionary concepts such as super grids can be a part of the ultimate solution.

Super grid concepts: Across Europe

Source: An engineering vision for a New Europe, Mainstream Renewable Power, http://mainstreamrp.com/an-engineering-vision-for-a-new-europe/

[1] Do we need to build a European supergrid to secure our energy supply?, The Guardian, 19 June 2014,
[2] Developing the Super-Grid, Energy Ireland, http://www.energyireland.ie/developing-the-super-grid/
[3] Technical Aspects of Grid Interconnection, UN, https://www.un.org/esa/sustdev/publications/energy/chapter2.pdf
[4] Friends of the Supergrid

Across Asia



Source: Renewable Energy Institute, https://www.renewable-ei.org/en/asg/about/

Critical challenges remain

As with any large, complex infrastructure project, implementing a super grid will involve finding ways to address a number of critical challenges.

Funding will invariably be a significant obstacle. Estimates for super grid development range well into the trillions of dollars, principally for the construction of the grid.[5] Given the scale of this cost, private capital will be essential in making the super grid happen.It also follows that creating the right regulatory and policy environment will be crucial in attracting private capital, and this brings its own challenges. However, lessons have already been learned from the private development of wind and solar energy. The goal will be to replicate this model on a much bigger scale.[6]

Geopolitical issues could also be a concern in different parts of the world, especially since super grids would almost invariably cross national boundaries. In terms of a European super grid, a coalition among governments in Europe will be required to make this a reality, although the momentum is already there in the context of the Paris Climate Agreement and the European Union (EU) 2020 Strategy.

In the same way, different regulatory and tax regimes involving multiple countries would have to be reconciled and possibly adjusted. Questions of ownership involving utilities, Governments and investors might also become an issue. Onshore battery storage will also be a key component in delivering this solution. In addition, the growing use of electric vehicles around the world could create a spike in demand for electricity that might change the location and scale of development.

What the experts say about renewable energy and super grids

Dr. Eddie O'Connor, Chairman of Mainstream Renewable Power

Founded in 2008 by Dr. Eddie O'Connor, Mainstream Renewable Power is an independent global developer that delivers large-scale wind and solar power plants to the world's emerging economies. Dr. O'Connor is the inventor of the European super grid concept.

How much renewable energy will Europe need in the future?

Quite a lot. Super grids will support our access to renewable energy, and that will be great because we are going to need higher levels of renewable energy in the future. One of the big movements in the European energy industry today is in the increased use of electric vehicles. It's safe to say that virtually all ground transport will be electrified by 2050. That means that you're going to have probably in the order of 1,000 terawatts hours a year of electricity just for ground transport.

So what does that mean in terms of additional demand? If we're going to replace the 50 percent of fossil fuels that we now use in Europe for electric generation, then look no further than wind and solar. In round numbers, we will need about 360,000 megawatts of wind energy to be built, and we will need about 360,000 megawatts of solar energy.

[5] Let's Build a Global Power Grid, IEEE Spectrum, 28 July 2015, https://spectrum.ieee.org/energy/the-smarter-grid/lets-build-a-global-power-grid
[6] Feasibility Study: Synchronous Interconnection of the IPS/UPS, UCTE Study Group, 7 December 2008

Where do you see the greatest source of renewable energy?

Very clearly, in the North Sea. It's the energy treasure trove for Europe. It has phenomenal wind speeds — 10 meters a second — and it's a huge area. We're getting a 55 percent capacity factor in the North Sea at the moment with current technology, which provides about eight megawatts. The North Sea is also quite shallow, so it's actually very cheap to build offshore wind farms. The other advantage is that relatively few people live in the area, so local objections to development are minimal.

What political regime is needed to allow the super grid to exist?

EU policy on energy is designed to ensure the functioning of the energy market; ensure security of supply; promote energy efficiency and energy saving and the development of new and renewable forms of energy; and promote the interconnection of energy networks.

Given that all electricity systems are national entities, individual nations would have to agree to a super grid proposal. For many of them this agreement would take into account the fact that much of a nation's generation would take place beyond its boundaries.

Security of the transmission system would be an important consideration for nations. The current situation has almost all generation located within national boundaries, so security is not such a large issue. The concept of interdependency and trust, which originally drove the formation of the EU, would need to be re-affirmed in the case of electricity.

Teruyuki Ono, Executive Director of Renewable Energy Institute

Since its foundation in 2011, REI has worked to establish Asia Super Grid, a major initiative aimed at interconnecting electric power systems of Asian countries to enable mutual benefits by exchanging abundant natural renewable energy resources, such as wind, solar and hydropower.[7] Before joining REI, Mr. Ono served as a senior official of Tokyo Metropolitan Government, responsible for environmental policy.

What are your thoughts about an Asia Super Grid based on your experiences as a leader in environmental policy and in dealing with environmental problems?

The Japanese electric power industry has been reluctant to expand the use of renewable energy for a long time, and one of the excuses is — "Since Japan is a country of islands and has no international electricity transmission network like in Europe, we cannot introduce large volume of variable renewable energy. "The realization of the Asia Super Grid connecting Japan and South Korea, China, and Japan and Russia with subsea transmission lines will make such excuses impossible, enabling us to dramatically expand the use of renewable energy in Japan.

In your opinion, what is the biggest challenge for developing the Asia Super Grid?

The biggest challenge is the lack of political consensus among the governments of the concerned countries toward the realization of the Asia Super Grid, but all the countries other than Japan are positive. I think that the stance of the Japanese government would change as political tensions ease in East Asia.

What kind of future infrastructure plans will be necessary in order to ensure the success of the Asia Super Grid concept?

The infrastructure necessary to realize the Asia Super Grid is several international grids and several transformer substations. These are normally constructed in Europe and the United States, so no special infrastructure is required. The technical and business know-how already exists. The only thing we need is the will to make it a reality.

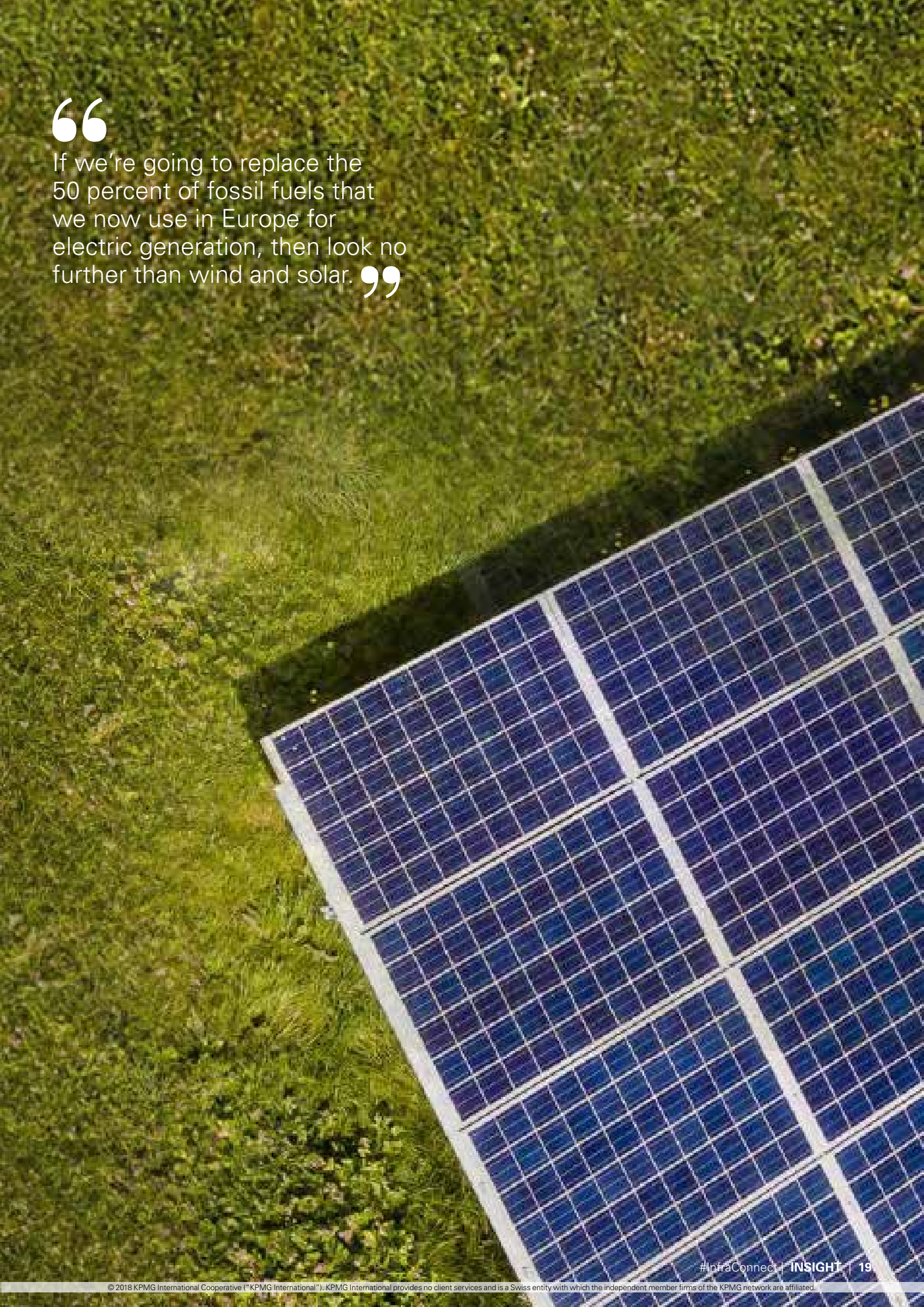
What is required of infrastructure planners, owners and operators for the Asia Super Grid to succeed?

Existing energy companies that own the domestic power grid in Japan might take the proposal of an international grid as a threat to their vested interests. However, when power production is separated from distribution in Japan in 2020, I believe that transmission companies will see the construction of an international grid as a new frontier for their business. I would like them to have a vision for investing in the future of the transmission business.

Conclusion

The future has arrived for super grids. The concept is technically sound, the investment model is feasible, and the imperative to develop and connect super grids into existing infrastructure for sustainability is now undeniable. A European super grid would play a key role in cutting carbon emissions and making the most efficient use of valuable renewable energy resources. The key challenges around ownership, regulation and cost are not insurmountable, particularly in an environment where the levels of interconnection are already increasing and the movement toward full decarbonization is gathering pace. Clearly, the infrastructure industry will be a major player in this arena. ■

[8] About Asia Super Grid (ASG), Renewable Energy, https://www.renewable-ei.org/en/asg/about/



> If we're going to replace the 50 percent of fossil fuels that we now use in Europe for electric generation, then look no further than wind and solar.

Connecting for good: At the confluence of development, investment and infrastructure

The future of partnerships to bridge the gap in developing worlds

To help bridge the developing world infrastructure gap, the development sector wants to build better connections between the private sector and developing world projects. To find out how they are doing this — and what more needs to be done — we sat down with three experts representing three different viewpoints: ***Mahmoud Mohieldin*** *is the World Bank Group Senior Vice President for the 2030 Development Agenda, UN Relations and Partnerships;* ***Jan Kellet*** *is the Special Advisor for External Engagement on climate, disaster and energy with UNDP;* ***Elizabeth Hausler*** *is the Founder and CEO of Build Change, an NGO focused on improving resilience in disaster-prone regions.*

Why are development agencies, multilateral institutions and NGOs so focused on catalyzing infrastructure investment?

Mahmoud Mohieldin (MM): I think infrastructure has always been at the very heart of development. But I think there is an increasing recognition that, in more ways than one, infrastructure gives people hope and stability; it serves more than just its function. If you consider water, basic sewer network facilities, access to electricity and, increasingly, access to communication — these are all key to driving the development agenda today.

Elizabeth Hausler (EH): For us, it comes down to the realities on the ground in these markets. We often say it's not the earthquake that kills a person, it's the collapse of a poorly built building. And in many cases, the challenges these markets face are a result of the quality and design of the infrastructure they either have or don't have. Infrastructure is the key to building a more resilient society.

Jan Kellet (JK): I absolutely agree. And, obviously, as the UN's Development Agency, we're guided by the UN's Sustainable Development Goals, and infrastructure plays a major role in the vast majority of those. The problem is that, for many of these countries, the targets are ambitious and require quite a lot of inward investment. And we tend to work in very vulnerable places where finding investment for infrastructure is very challenging. The conditions, or as we call it, the enabling environment for inward investment, are not always in place.

Why are partnerships with the private sector so important today?

JK: A large part of it is financial. The reality is that, between now and 2030, developing countries are going to need somewhere around US$2 trillion per year of annual investment to meet demand for infrastructure. At their best, global development assistance budgets amount to less than US$150 billion combined. And only a fraction of that is earmarked for catalyzing infrastructure investment. Tax revenues in many developing countries still remain weak. You look at those numbers and quickly realize that there is a massive need for private investment if we want to achieve our goals.

> "Challenges these markets face are a result of the quality and design of the infrastructure they either have or don't have."

MM: I agree that the amount of funding that countries can put in from public sources is very limited. So governments and development agencies really need to be pragmatic. They need to find ways to involve the private sector in those projects that are commercially feasible while keeping their public money for the areas that are unable to secure funding from the private sector. It's what we refer to as 'maximizing finance for development'.

EH: If we're talking about the wider private sector, it's also important to note the value of using development funding to catalyze local private sector growth. We predominantly work with small, local builders and construction materials companies with the intention of encouraging skills transfer and inspiring local builders to practice more resilient construction techniques. It's not just about spreading out the money. It's also about spreading around the knowledge.

How do you help connect developing world projects with private sector players?

MM: Besides the funding support the World Bank Group provides through our various funding arms — including the International Finance Corporation, the International Development Association or the Multilateral Investment Guarantee Agency — our focus is on helping governments make sure they have the right technical support to properly engage with the private sector. Even some of the most advanced economies we deal with currently lack the kind of in-house technical capabilities required to capture the attention of the private sector and then reach a good deal.

JK: A lack of capabilities is absolutely a challenge to attracting private investors. It also comes down to creating the right enabling environment — basic security, good governance, rule of law, representative legislation, transparency, good tax management and so on. I think one of the key roles for the UN organization is to help countries move to a more stable development and investment environment which, in turn, will help them attract more private in-flows to infrastructure projects.

EH: As a non-profit social enterprise, we spend a lot of time trying to mobilize private sector investment, both directly into our projects and into wider initiatives. For example, we have been working with some of the large reinsurers and financial institutions to think about how we can develop a financial instrument for governments that can be used to encourage or directly fund investments into housing stock retrofits in disaster-prone zones. I think part of the challenge is just helping private sector organizations and governments to think differently about the solution.

What types of projects are you hoping to help drive forward?

MM: The World Bank Group participates in a wide range of projects — from very large ones in the energy and renewables sectors to small road and sewage networks in rural and remote areas of low-income communities. We're involved in projects in more than 120 countries, so there is no end of opportunities at the project level. At the strategic level, however, our work is focused on helping client governments maximize their finance for development.

JK: One initiative that I'm particularly keen on is a resilient infrastructure investment mechanism targeted toward insurance investors. Working with KPMG,

BlackRock and others, we are really at an advanced stage of development; if it all comes together, we will have something significant to offer developing countries but still plenty of work to do. As Elizabeth said, we need to be thinking about different ways to use our capital to tackle the big problems. And these types of partnerships with the private sector are one way to do that.

EH: I absolutely agree, Jan. Our focus is very much on the development of resilient housing and schools in disaster-prone areas, so we're focused at both the tactical level — working on projects in places like Mexico, the Philippines, Indonesia, China, Haiti, Nepal, Guatemala and Colombia — and at the strategic level advocating for greater emphasis on social housing from development banks, policy makers and private sector participants.

Why is collaboration so important to achieving your goals?

EH: I think we need to start looking at development from a much more holistic standpoint. It's about more than just bricks and funding. It's also about technology and people. We need to overcome barriers to development that are financial, technical, social and cultural. And if you just look at infrastructure in terms of developing a building without looking at it in the wider context, you're probably not creating much value.

MM: I agree we need to move forward with an integrated approach that prioritizes inclusiveness, sustainability, culture, and social requirements. We can no longer continue to fix one part of the problem and neglect the rest of it, assuming it will be resolved automatically. We need integrated approaches that put people first in the sustainable development agenda.

JK: That is certainly an increasingly important theme in development circles. We can't continue to just look at issues in silos — infrastructure in one silo, healthcare in another, conflicts in another. We need to help countries look at this holistically and help them find ways to wisely utilize investments so they can create the right conditions for investment. And that takes great collaboration. ■

> We need to be thinking about different ways to use our capital to tackle the big problems.

Connecting markets: Asia and 21st-century opportunities

New infrastructure will catapult the region into the future, but challenges on funding and private investment demand solutions

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Living standards are rising, a new middle class with disposable income is emerging, consumerism is growing and demand for enhanced lifestyles, modern technology and digital capabilities is soaring. Asia's time has come for dramatic infrastructure investment, planning and long-term commitment that will catapult economic and social development into the 21st century and beyond.

Almost 650 million people live in the Association of Southeast Asian Nations (ASEAN) region alone, making it one of the largest markets on the globe, while the 45 nations of 'developing Asia' have a combined population of 1.7 billion, according to the Organisation for Economic Co-operation and Development (OECD).

A colossal paradigm shift on infrastructure development has begun over the last few years, with several countries undertaking or announcing projects to increase land-, air- and sea-based connectivity within and between borders. The entire region, as well as China, has launched unprecedented national and transnational initiatives and megaprojects to develop hundreds upon hundreds of new highways, airports, railways, ports, utilities and telecommunications capabilities.

Thailand, Southeast Asia's second-largest economy, recently approved legislation to attract investment for its US$45 billion Thai Eastern Economic Corridor — a plan to transform three provinces into an economic zone of futuristic 'smart' cities, technological manufacturing and transportation links to its ASEAN neighbors. Another US$5 billion initiative calls for Thailand to build a 1,200-kilometer high-speed rail network connecting it to China.

The 4,500-kilometer Kunming–Singapore high-speed railway will erect three new rail routes from China to Singapore, Thailand, Vietnam and Cambodia.

Airport projects are equally massive and many are abandoning the traditional airport model in favor of modern aerotropolis concepts — destination *cities* featuring retail, entertainment and business centers catering to travelers and non-travelers alike. China has invested about US$12 billion toward its five-year plan to build 66 airports. Japan, in anticipation of Tokyo's 2020 Olympics and future tourism numbering 60 million visitors annually by 2030, is racing ahead with massive transportation infrastructure projects including a recent US$18 billion privatization and development initiative for two Osaka airports.

China's Pearl River Delta region — 'the factory of the world' with almost 70 million people and combined 2016 GDP of US$1.38 trillion — is the center of the Greater Bay Area initiative to forge a gigantic economic zone among Hong Kong, Macau and Guangdong province cities. The development envisions an interconnected technology and innovation 'megacity' generating GDP of US$4.6 trillion by 2030 and serving as a gateway to the world for Chinese companies seeking global expansion.

As KPMG's 2018 report *A lens on the Greater Bay Area* notes: "The GBA has the potential to become the most-diversified city cluster in the world by leveraging its wide range of industries and strengths across its cities, such as financial and professional services, high-tech manufacturing, and technology and innovation. This unique combination provides significant opportunities for companies that are looking to enter or build on their existing presence in China."

Governments do the heavy lifting on funding — for now

The Greater Bay Area and other projects underway or planned in Asia and beyond are, in many cases, components of China's staggering vision for transnational infrastructure known as the Belt and Road Initiative (BRI). A project of historic proportions, it will eventually interconnect more than 70 countries in Asia, the Middle East and Europe to forge immense new global opportunities for economic and social development, trade and investment. When complete, some observers say it will transform the face of global trade.

The BRI plan envisions countless new highways, airports, railways, ports, telecommunications capabilities and more. Launched in 2013, the BRI is a 21st-century version of the iconic Silk Road trading routes, a trade and infrastructure web across Asia and into Western Europe and the Middle East. The initiative comes with an estimated cost of up to US$8 trillion.

China is not alone as a major international investor in Asian infrastructure.

Significant investment to support the transformation projects in ASEAN, for example, has already been made and continues to come from Japan and South Korea, as well as other nations, plus multilateral development agencies and policy banks.

But the capacity of governments, private banking and multilateral banks will only go so far, leaving enormous and inevitable funding gaps to fill. Worth noting is the Asian Development Bank's (ADB) estimate that the developing Asia region — representing the ADB's 45 member nations — will need to invest up to US$26 trillion between 2016 and 2030 or about US$1.7 trillion annually just to *maintain* its growth momentum. The ADB notes in its 2017 *Meeting Asia's Infrastructure Needs* report that, despite dramatic growth in recent decades, about 400 million people still lack electricity and 300 million lack access to safe drinking water.

Private investment will require improved structuring of projects

The availability of future financing, however, is not the primary challenge for Asia's infrastructure transformation. Huge sums of private capital seeking infrastructure projects are poised on the global sidelines. The bigger issue is that few of these futuristic infrastructure projects or pipelines are structured to attract private capital from international investors, who expect and require prioritized and financially feasible projects, institutional stability, and confidence in the rule of law and contract certainty.

These investors, unfortunately, have little choice but to view most emerging markets and their grand plans as high-risk due to regulatory uncertainty, weak institutional capacity, lack of procurement transparency and inadequate project prioritization and preparation. Some countries — like the Philippines and Thailand — possess the economic profile to attract at least some private financing for future infrastructure. But overall, the challenge of getting projects off the ground — and sustained for the long term — remains a major issue.

For now, certainly, a number of big projects are proceeding rapidly enough as the various governments place their bets. But still unanswered are looming questions concerning the risk profile and structuring of projects, the capacity of countries to continually fund their projects, compliance issues, sustainability and more.

Will foreign governments eventually take up some of the slack? Infrastructure investment company InfraCo Asia, for example, is backed by a group of governments — including the UK, Australia, the Netherlands, Switzerland and Sweden — and funds pre-financial close, early-stage, high-risk infrastructure projects. Taking an equity stake in infrastructure projects that contribute to economic growth, social development and poverty reduction, InfraCo Asia steps in where the private sector is initially unable or unwilling to invest. By mitigating early-stage development risks, it facilitates private-sector participation.

Five fundamentals for enticing private funding

For now, Asia's governments will continue to do the heavy lifting on financing. But emerging-market governments will clearly need to sharpen their focus on five key fundamentals if there's hope of enticing private investment that's critical to bringing their grand infrastructure visions to life:

1. **Create institutional capacity** by improving regulatory systems, forging equitable dispute-resolution mechanisms and developing transparent procurement processes.

2. **Prioritize projects and selection** based on economic and social priorities, allowing investors to focus on projects delivering the most in benefits.
3. **Improve project preparation** at national, local and agency levels to optimize their structure prior to procurement, including assessment of financial feasibility and risk.
4. **Mobilize private capital** by MDBs and other public financing institutions developing mechanisms to support the provision of private finance to projects.
5. **Promote international cooperation** by partnering with global institutions and companies, emerging-market governments and infrastructure investors.

Asia is poised at the threshold of an exciting and truly historic new golden era of economic and social development. But it will be up to the regional governments of its emerging markets to kick open the door to the vast benefits of globalization that await. ■

Multilaterals to the rescue?

Asia's dramatic flurry of infrastructure planning and development comes with a remarkably hefty price tag. China's Belt and Road Initiative is estimated to cost US$8 trillion. Beyond that, the Asian Development Bank estimates that the developing Asia and Pacific region will need to invest up to US$26 trillion between 2016 and 2030 — or about US$1.7 trillion annually — just to maintain its growth momentum, compared to annual current investment in infrastructure estimated at US$881 billion.

Multilateral banks will have a significant role to play if Asia hopes to bring its infrastructure visions to life within any given time frame. But how effectively can the world's multilateral banks — as they currently pursue strategies to change their own ways — position themselves to perform and capitalize on Asia's historic initiatives? The reality is that Asia's infrastructure transformation comes at a time when traditional multilateral models are failing, prompting most to pursue dramatic reforms and new approaches.

Amid significantly weaker returns in the low-interest environment — and an inability to keep up with demand as global infrastructure projects proliferate in number and soar in size — many of the world's multilaterals are pursuing a new role, one that's more about *mobilizing* and *facilitating* private capital versus lending stakeholder capital. They are exploring opportunities to 'open up' markets for private investment and looking for new ways to move deals out of the pipeline.

So far, however, most are responding slowly to today's rapidly evolving global environment amid the challenges they face. These include the required change in culture toward *mobilizing* money instead of *lending* it; a lack of skills to sustain a new model; the need to provide innovative new products that offer simplicity rather than complexity; and the lingering preference among stakeholders for straight loans with clear structures.

These are significant challenges in a world where megaprojects, the new normal in developed and developing markets, are creating unprecedented demand for massive amounts of funding. It remains to be seen if multilaterals can innovate capabilities and offerings in time to capitalize on Asia's ambitious journey into the future.

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Connecting citizens: Digital makeovers envision 'smart' urban centers

Redefining how we interact with the city services we rely on

Governments training a sharp lens on the future are harnessing the power and potential of digital infrastructure to create 'smart' urban centers that promise unprecedented connectivity between people and the physical worlds of business and government services.

The future-oriented *Sidewalk Toronto* plan in Canada's largest city, and Singapore's Digital Economy framework for action, are two current examples of how governments today, in partnership with private enterprise, are taking a new approach to developing digital infrastructure capabilities that will redefine how we access and use services in every sector.

Toronto's forward-looking transformation plan aims to combine modern urban design with the latest in digital technology and infrastructure, creating what Toronto calls 'people-centered neighborhoods' that are designed to provide unprecedented levels of sustainability, affordability, mobility and economic opportunity.[1]

Sidewalk Toronto will feature the creation of a futuristic downtown lakefront neighborhood called Quayside, future home to an estimated 5,000 people and an array of businesses.

Singapore, meanwhile, has launched its own digital makeover and that journey begins with plans to bring the historic Kampong Glam shopping district into the 21st century. The government is collaborating with an array of businesses and organizations to transform Kampong Glam into the first retail neighborhood in Singapore that's digitally enabled. Hundreds of merchants are adopting digital solutions to collectively transform their businesses and customer experiences via capabilities that include cashless and contactless payment systems for everything from products to parking fees and bus tickets; real-time inventory tracking; product-delivery management; and automated invoicing and financial accounting.

Taxi-bots, intelligent traffic signals, automated energy management

Toronto's initiative features an innovative collaboration between various government agencies and Alphabet Inc.-owned Sidewalk Labs, which will invest US$50 million in the planning process for Quayside, its first such urban project. Sidewalk Toronto's vision includes:

— Streets served by autonomous vehicles, including 'taxi-bots' controlled by app-based services such as Lyft, plus self-driving buses;

— Freight-moving robots and trash-collecting robots that traverse a network of underground tunnels;

— Areas featuring narrow streets designed on a 'human scale' and catering to pedestrians over vehicles;

— Intelligent signals to manage traffic plus digital tools to track, analyze and optimize the movement of people, vehicles and goods;

— What Sidewalk Labs calls a 'radical' mix of office, retail, residential and startup spaces, featuring modular office, retail and residential buildings that are manufactured locally and designed for quick assembly;

— A centralized energy system designed to monitor and sustain the efficient transfer and use of energy by homes and businesses.

Toronto's plan ultimately envisions the city becoming the global hub for a new 'urban innovation' industry that's focused on improving the quality, efficiency and affordability of city life. Sidewalk Toronto hopes to ultimately serve as a model for other neighborhoods in the city and indeed for other cities around the world.

Robotics in healthcare, a cashless society, smart homes and vehicles

Like Toronto's long-term vision to keep its bold smart-city journey expanding beyond the initial Quayside neighborhood, Singapore's Kampong Glam retail-area project is part of the much larger digital economy plan — a vision to create a competitive, interconnected global region whose businesses, workforce and citizens are ready for the digital age.

> "Digital infrastructure is blurring traditional boundaries and borders that have long divided or 'siloed' physical businesses, sectors and the marketplaces they serve."

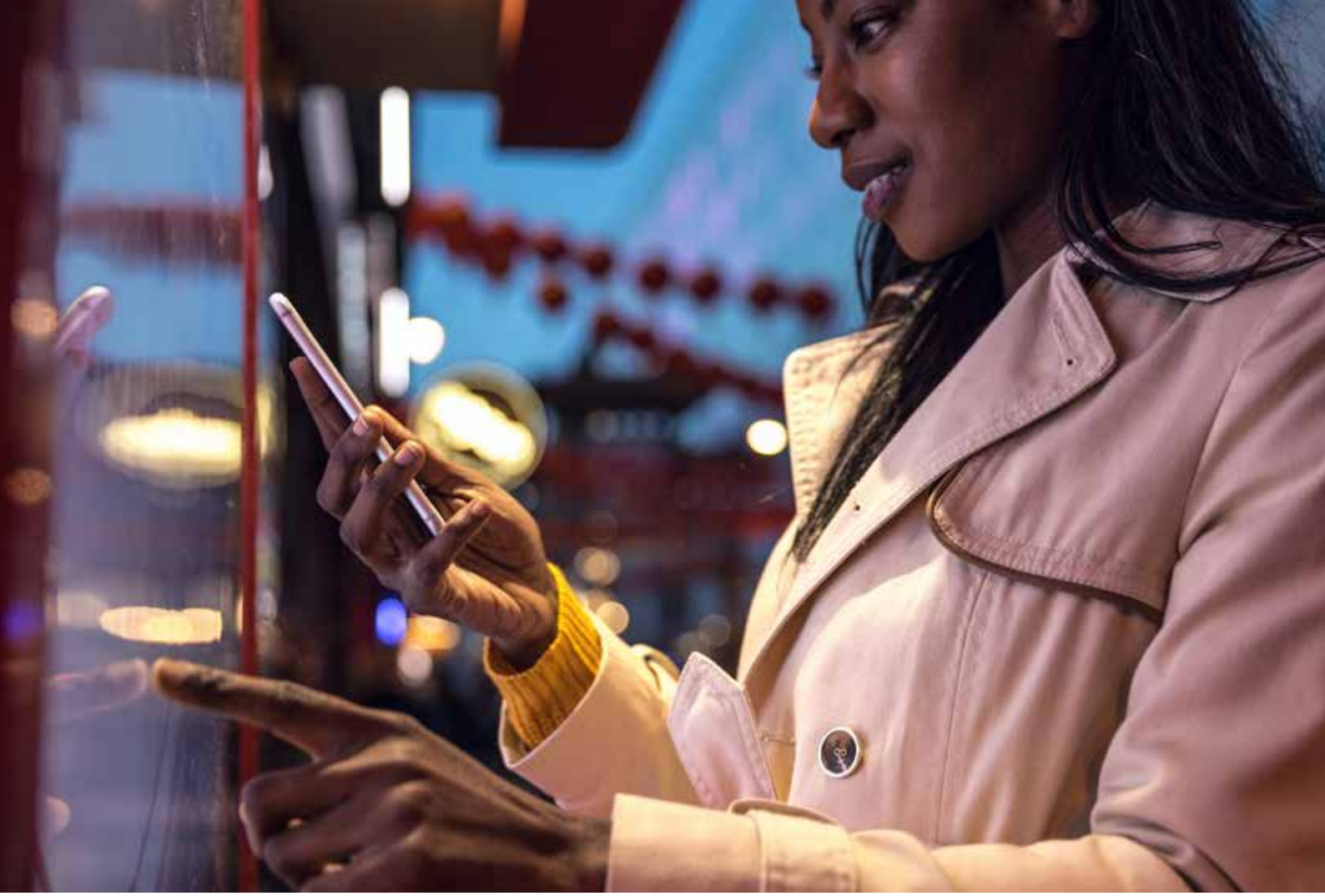
To ensure the public's readiness for self-driving vehicles, robotics in healthcare, telehealth for the elderly, a cashless society, transportation-on-demand, smart homes, government e-services, artificial intelligence and more, the plan includes a 'digital readiness blueprint.' It is designed to empower the public by promoting: digital access and the means to transact digitally; digital literacy and skills; digital participation; and the ability to make use of technology to improve daily life.

Singapore's move into a digital economy highlights four key 'frontier technology' areas targeted for investment and rapid development: data analytics and artificial intelligence; the Internet of Things (IoT); cybersecurity; and immersive media.

A new International Data Corporation study commissioned by Microsoft notes that 98 percent of organizations in Singapore are already in the midst of digital transformation.

The study estimates that the digital economy — including mobile and cloud technology, the Internet of Things (IoT) and artificial intelligence — could contribute US$10 billion to Singapore's GDP by 2021[2] and account for about 60 percent of GDP by then — compared with 10 percent in 2017. Survey respondents said they expect 93 percent of Singapore's jobs to be transformed in the next 3 years alone by digital innovation.

[1] https://sidewalktoronto.ca/
https://www.theglobeandmail.com/news/toronto/google-sidewalk-toronto-waterfront/article36612387/
[2] https://news.microsoft.com/en-sg/2018/02/21/digital-transformation-contribute-us10-billion-singapore-gdp-2021/
https://www.opengovasia.com/articles/singapores-abc-approach-to-grow-its-digital-economy-and-enhance-digital-readiness



Government partnerships with private enterprise play a key role

Like Toronto, private-enterprise collaboration aimed at bringing futuristic visions to life are playing a key role in Singapore as well. While Toronto has partnered with Alphabet Inc.-owned Sidewalk Labs, the Infocomm Media Development Authority (IMDA) in Singapore has joined forces with many industry partners such as Microsoft on several fronts to support its journey toward a digital economy. That includes close collaboration on a program to help local tech companies scale up and build new digital capabilities and applications. Singapore's government is also bringing together start-up accelerators, venture capitalists, industry mentors, SMEs and 'technopreneurs' across the entire range of industries to create new bridges between innovation, enterprise, government and the public.

"Digital infrastructure is blurring traditional boundaries and borders that have long divided or 'siloed' physical businesses, sectors and the marketplaces they serve," says Philip Heah, Senior Director, Technology & Infrastructure, IMDA, which is driving Singapore's leap toward a digital economy. "We see a growing trend with companies in one industry —whether transportation, communications, healthcare, you name it — now calling themselves digital enterprises as they transform and reinvent themselves through digital infrastructure."

Singapore-based Grab — Southeast Asia's popular ride-sharing firm — is one example of how a company delivering *transportation* and *logistics* services can more accurately be considered a *digital* company that's changing traditional sector and infrastructure boundaries using the power of digital infrastructure. Grab recently announced a joint venture with Japan's Credit Saison to form Grab Financial Services, as well as a new partnership with insurance giant Chubb for app-based insurance solutions.[3]

Meanwhile, on-demand services platform Go-Jek recently announced a US$500 million plan to introduce to Singapore and other Southeast Asian countries its super-app offering a remarkable array of services — everything from rides and meal delivery to massage and home-cleaning services.[4]

The ongoing emergence of smart cities holds the promise of unprecedented opportunities for the public, their urban lifestyles and the businesses that serve them. It will be up to forward-looking governments to stay focused on driving innovative initiatives that generate new economic benefits and positive social and environmental advancements that ensure a better future for everyone. ■

[3] https://www.cnbc.com/2018/04/02/grab-co-founder-and-ceo-anthony-tan-on-uber-deal-fintech-indonesia.html
[4] https://www.channelnewsasia.com/news/commentary/commentary-when-go-jek-enters-singapore-what-to-expect-10395436
http://www.scmp.com/tech/article/2149640/singapore-preview-how-grab-and-go-jek-will-likely-face-across-southeast-asia

Interplanetary connectivity:

Building a life — and infrastructure — on Mars

What does it take to physically build a colony on the red planet?

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If visionaries like Elon Musk have their way, interplanetary connectivity will soon become an important topic for the human race. So, for this article, ***KPMG International's Richard Threlfall*** *takes a trip into the future and off the planet to try to see what a Mars colony might mean for people, companies and infrastructure providers in an interplanetary society.*

A dream realized

I won't say there wasn't great surprise when the four BFR Space X rockets made a near-perfect landing on Mars in 2022. Yes, the cargo — a rudimentary kit designed with no real knowledge of Mars' atmosphere — was fairly useless. But a rapid succession of other landings over the next two years resulted in a small, yet habitable, series of 'pods' spread across a small area of the planet. It was a real foothold. And it was ready for human habitation.

For the first two years, those 'living' on Mars were entirely dependent on dispatches from Earth. Everything — from water and oxygen through to building materials and technologies — was shipped in increasingly massive rockets. But that meant that the potential for any real growth was severely limited.

The issue of governance also came to a boil in those first two years. After finally building consensus around the need for the colony to be 'non-aligned' politically or nationally, world leaders (both political and business) agreed on the formation of an independent body — the Mars Development Corp or MDC — that would hold responsibility for making the key infrastructure investment decisions for the new colony.

Made up of some of the most brilliant minds on Earth — and representing nearly every region of the world — the MDC's mandate was to develop and then execute a viable, practical and yet, importantly, equitable development plan for the new planet. While the MDC was structured into distinct 'working groups', each member was required to sit on two working group teams to ensure maximum interoperability and collaboration between teams.

Finding new approaches

Recognizing that our infrastructure challenges on Earth were largely a result of incrementalism and a piecemeal approach to planning, great emphasis was placed on developing the Mars Infrastructure Plan (MIP). All new ideas were welcomed and encouraged. And this led to amazing innovations and models that — ultimately — unlocked the growth potential of the new Mars colony. Prioritization was driven by establishing the long-run, whole-life value for money of alternative investments, which may have cost a bit more at first, but ultimately delivered services to Mars residents at a fraction of the cost they were on Earth.

The Climate, Energy and Water working groups, for example, spearheaded the development of a massive organic 'climate envelope' that would keep temperatures within optimal levels for human and plant life, generate energy from geothermal sources and deliver sustainable fresh water through the development of a mini 'water cycle', similar to that on Earth.

The Infrastructure and the New Resources Development working groups collaborated to identify elements on Mars that could be adapted for use in 3-D printers. The stronger-than-steel compounds can last up to 500 years without decaying but can also be dissolved and reused when no longer required, giving infrastructure on Mars the flexibility it always lacked on earth. Buildings, technologies, appliances and consumer goods are now all fabricated using locally sourced materials and power.

The Transportation working group and the Aviation working group agreed that solar-charged drones (of various sizes depending on their role) would be used to transport everything on Mars. "I traveled in a rocket ship for 55 million kilometers to get here; I'm not about to go back to driving a car," noted the head of one of the working groups. With no need for roads, rails or other hard transport infrastructure, the two working groups eventually combined.

New planet, same problems

In retrospect, those were some of the easy problems facing the MDC at the time. The bigger challenge (no surprise here) was how all of this development was going to be funded and who was going to 'profit' from it.

In the early days, a wide variety of traditional financing and funding options were suggested and then rejected: government-/taxpayer-funded (too political); user pays (too unaffordable); investor-led (too many risks and little guarantee of returns); developer-led (too unequitable).

What eventually evolved was a hybrid between a Special Economic Zone (initially funded by government grants, investors and 'founding' corporate tenants) and a consumption tax-funded system. Corporations pay for the operation and maintenance of their own infrastructure — though costs are extremely low due to easy access to distributed solar and thermal energy, extraordinarily high levels of automation, and new self-contained water and waste treatment and management systems. Consumption taxes are used to pay for 'shared infrastructure' such as the Space Port and the climate envelope.

The profit question was a bit more sensitive. Given their mandate for equitable growth on Mars, the MDC was keen to ensure that all of the benefits — financial, social and economic — would flow to the human population on both planets. Deep social concerns that Mars would become an 'elitist' society sparked a number of protests on Earth; tensions ran high. Ultimately, a quasi-'sovereign wealth fund' structure was developed to invest a certain proportion of the surplus on Mars back into infrastructure and development projects on Earth. And, for now, the agreement has helped reduce tensions.

Meanwhile, back on Earth…

What about Earth? It, too, has found ways to leverage the Mars project to improve its own sustainability and prosperity. New technologies — many of which were by-products of the Mars Innovation Initiative — have been developed and implemented to better manage a range of pernicious earthly challenges: climate change, energy security, resource management and natural disasters, to name but a few.

Like other space programs before it, the Mars project catalyzed a massive surge in innovation and innovative thinking across Earth. Entirely new service areas and revenue streams were created almost overnight. The benefits of automation — used so efficiently on Mars — were warmly welcomed by humans who quickly lost their rather archaic fear of machines.

Interestingly, connectivity between the 'blue marble' (i.e. Earth) and the red planet has become less of an issue. Both planets

Great story, Richard, but what's the point?

The point is that we are now living in an era of massive disruption. And while most of these disruptive forces will be incremental and somewhat predictable, there will also be disruptions that — from today's educated viewpoint — seem wholly unlikely or implausible.

But what if they are not? What if just a small portion of the above story came true? How would that impact your current business models, your forecasts and your long-term vision as a company? How would it influence your planning and investment into new technologies? And, more importantly, how can you start planning for the shifts that you can currently see disrupting your markets?

While he should never be counted out, Mr. Musk's vision of landing humans on Mars by 2024 seems far-fetched. But what if it isn't? What's your plan for the interplanetary era?

are now (relatively) self-sustaining; any commerce or interaction between the two planets is largely digital. Dozens of low-cost and luxury 'spaceliners' ply the route between Mars and Earth, bringing millions of tourists, business people and new colonists to the planet every year.

Not yet Utopia

Things may be going very well on Mars, but there are still a number of difficult challenges looming on the horizon for humankind. You can almost guarantee that the Mars — Earth Equity debate will once again reappear, most likely once most of the major corporations have relocated to Mars and human jobs on Earth are 'hollowed out'.

Demand for Colonization Permits (largely from retirees seeking a new adventure rather than young families) will soon require the MDC to develop a new spatial planning strategy for the planet — one that will guide development for the next 1,000 years or more. New technologies will also need to be developed and commercialized to deal with a human population at a larger scale.

No doubt there will be other challenges. But, given the massive steps we took and the difficult challenges we overcame in the first few years of the project, I have no doubt that we will solve them with collaboration, innovation and human ingenuity.

As the Secretary General of the UN said when he opened the new terminal at the Mars Space Port, "We set out to Mars to escape the problems of Earth. But, in the end, it was our journey to Mars that helped us solve them." ■

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Cooperation and compromise: Building regional connectivity

Reinforcing a commitment to regional connectivity

While some markets around the world may be ramping up the protectionist and isolationist rhetoric, countries in Asia Pacific are reinforcing their commitment to regional connectivity. But — even when geo-political visions align — the reality is that building infrastructure across borders is a daunting task. In this article, ***KPMG in Malaysia's QingLin Fang*** *zooms in on Malaysia to find out how this booming South East Asian market is overcoming obstacles to improve its electricity and transport connectivity.*

Last July — as talk of walls and tariff wars filled the international news cycles — the ten states that make up the Association of Southeast Asian Nations (ASEAN) community were meeting to work towards a remarkably different outcome: regional connectivity. Sitting down together in Manila to discuss the Master Plan on ASEAN Connectivity (MPAC) 2025, delegates from each country worked in cooperation to find and explore mutually beneficial outcomes.

What the ASEAN member states recognize is that regional connectivity is key to delivering on their policy objectives. Better transport connectivity between nations leads to improved economic growth and trade. Improved regional ICT infrastructure unlocks innovation, new competition and huge social benefits. Greater energy connectivity allows for better resource planning, energy pooling and fuel source diversification.

However, unlike the European Union, the ASEAN community has no 'Central Commission' with authority to bind governments together around an investment plan. There is no 'Junker Plan' option for the ASEAN community. And that means that each new connection must be negotiated — often on a case-by-case basis — between the countries involved. Progress is often slow.

As a Founding Member of the ASEAN community, Malaysia has long been focused on improving connectivity between its neighbors and within the region. Air connectivity is already very strong — in fact, the Kuala Lumpur to Singapore route recently became the world's busiest, the Kuala Lumpur to Jakarta route is the world's fifth busiest. The country has also enjoyed significant success improving regional (largely bilateral) connectivity in other sectors, particularly energy.

So what have Malaysia's infrastructure leaders learned about creating, designing and executing cross border integration projects? I recently sat down with Abdul Razib Bin Dawood, COO of Energy Commission Malaysia and Megat Khairulazhar Khairodin, Chief Strategy and Transformation Officer of Prasarana Malaysia Berhad to talk about their experiences. Here are the five lessons I took from our conversations:

1. **Shared Vision:** "Aspiring to, sharing and working towards a common objective are essentially integral components

to establishing a strong foundation for mutually beneficial cooperation between two or more nations," noted Megat Khairulazhar. "Ideally, the social, infrastructural and economic returns are equally beneficial to participating nations that it merits expediting the implementation of such projects."

Governments need to recognize that infrastructure development is not a winner-take-all process; sometimes governments find themselves holding little more risk than they would like in order to make sure the project gets delivered but this is a decision that is often precipitated by the benefits and positive impact the project is expected to have on their respective citizens and economies.

2. **Get governments talking:** "You really need a strong commitment from each of the governments involved to overcome some of the big harmonization challenges that must be faced when building and operating infrastructure across jurisdictions. There are different regulatory regimes, different laws and commissions, different sovereign debt ratings and different procurement practices. It takes strong government-to-government initiative to achieve that," noted Abdul Razib.

   Megat Khairulazhar added that stakeholders also need to consider differences in culture, as well as reward and compensation packages between the different countries.

   Most cross-border projects start with a political announcement from governments. But, shortly after the media walk away, the project gets handed off to the bureaucrats to manage. The problem is that many of the big challenges that need to be overcome when developing cross-border connectivity projects are political in nature. Solving them will require leadership at the highest levels.

   Experience also suggests that governments need to be talking not only to other governments but also to their citizens about the benefits and impacts of their cross-border connectivity projects. Without sufficient transparency these projects have a tendency to become highly politicized.

3. **Have a strong business case:** "Even if the project is majority or fully funded by government, it is vital and imperative to embark on a strong business case. We have the responsibility to make sure the project is financially, socially and economically viable, that it is warranted at that particular time, that we are able to keep costs competitive and in check, and that we are optimizing the procurement process — doing everything we can to anticipate and address any commercial risks that may surface over the entire lifecycle of the project," added Megat Khairulazhar.

   Far too often, cross-border connectivity projects are evaluated with a heavy weighting on symbolism. In some cases, projects may not have been thoroughly thought out, vetted or opportunities for additional revenue generation could have been overlooked. In other cases, project plans are adapted or changed in order to serve some higher political purpose, thereby risking driving up costs and reducing the overall value of the project. Long term business cases and plans must be evidently clear on the commercial and economic value that could be generated by the project.

4. **Understand the wider benefits:** "It's often the case that you only see the real benefits once the project is complete. When Thailand experienced electricity shortages a few years ago, we were able to quickly supply emergency exchange. It's also changed our planning assumptions — due to time-zone differences, we experience peak electricity usage at different times than our neighbors – better integration will allow us to balance those peaks in a much better way which, in turn, impacts our investment requirements," noted Abdul Razib.

   As many of the articles in this edition of *Insight Magazine* illustrate, improved connectivity can drive a wide range of social, economic and commercial benefits that are not always quantifiable for the purposes of a business case. A certain amount of value must be assumed on faith.

   But that does not mean that infrastructure planners and cross-border project owners should not be thinking about and planning for those benefits. That may mean spending a bit more today to allow for anticipated improvements in the future. Or it may mean working with other groups and commercial interests to identify new ways to generate value from the project. The first step, however, is identifying the wider benefits that could be achieved.

5. **Expect some political reconsideration:** The current situation in Malaysia illustrates this point perfectly. When I sat down with Mr. Abdul Razib and Mr. Megat Khairulazhar, Malaysia had just voted in parliamentary elections. By the time of writing a few weeks later, several of Malaysia's existing international projects had already been revisited by the new government. While this move is understandable given the new governments' priority to balance the books (and therefore desire to sort out debt issues as quickly as possible), we expect that this government, like those before, will return to an agenda of greater regional connectivity.

The challenges ASEAN needs to steer clear of however, are those born out of the move towards increased protectionism and territorialism. As we have seen in a number of developed and emerging markets, the recent shift towards these more populist agendas has led to the undoing of a number of planned cross-border projects.

This, unfortunately, can become a cyclical phenomenon. Protectionism generally leads to reduced economic trade which, in turn, undermines the value of cross-border connectivity projects. The more uncertainty politicians create around the changing world order, the more difficult these types of projects will become. And the less valuable they will seem to citizens and politicians alike.

The good news is that, even with the recent reconsideration of some projects, both Abdul Razib and Megat Khairulazhar are optimists. "In principle, all member countries have envisioned what is to become an integrated ASEAN community by 2025 and I am convinced that all member states and parties recognize the exponential benefits that will bring to the entire region as an emerging world economy," argued Abdul Razib. ■

Creating urban connectivity:

New planning models to build 'connected cities' within Greater Sydney

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To help Greater Sydney prepare for population growth over the next 40 years, the New South Wales (NSW) government is applying innovative new models of urban planning and partnerships to create connected '30-minute cities' within the sprawling metropolis.

*To learn how they developed this vision, **Paul Low**, Head of the Infrastructure, Government and Healthcare practice at KPMG Australia, talked with members of the leadership team behind the Greater Sydney regional and district plans and the Future Transport 2056 strategy.*

Making Greater Sydney a 'metropolis of three cities'

In March 2018, Australia's New South Wales (NSW) government finalized bold, integrated plans for Greater Sydney's future growth over the next 20–40 years: the *Greater Sydney Region Plan,* the *Future Transport 2056,* and the *State Infrastructure Strategy.*

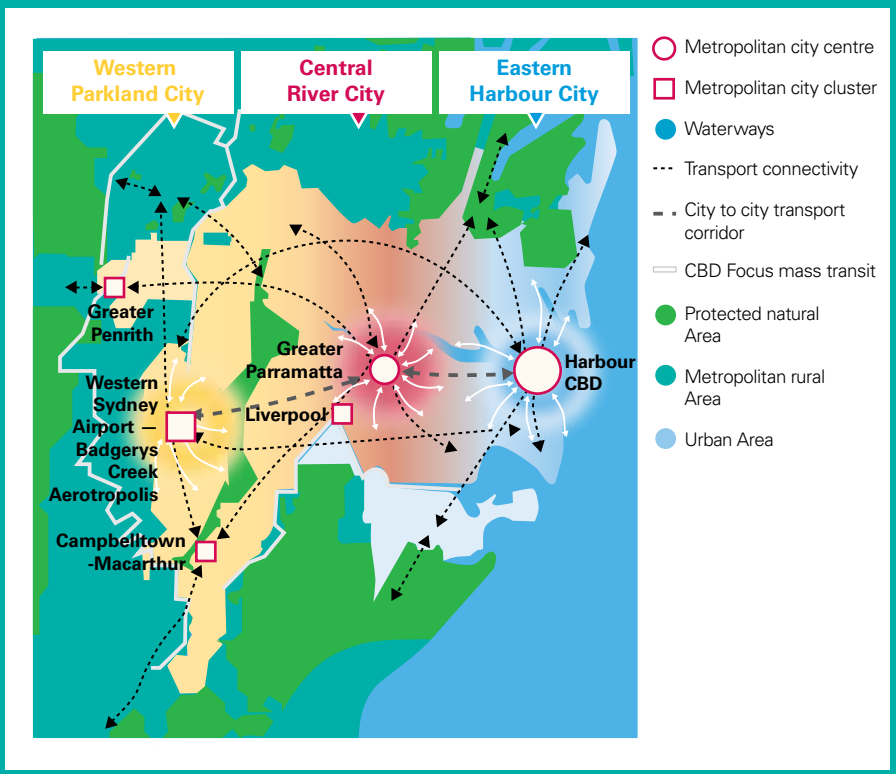
These plans will help NSW prepare for future population growth and economic, technology and lifestyle trends that will impact the people who live, work and visit Greater Sydney. With the metropolis forecasted to grow to 8 million people by 2056 — and almost half of that population expected to reside in outlying, western areas — the NSW government plans aim to spread the benefits equally and equitably across Greater Sydney.

The planning for Greater Sydney reflects an emerging national agenda of more connected urban policy to drive the global competitiveness of Australian cities and their capacity to attract and retain talented human capital.

The three plans, prepared concurrently for the first time, align land use, transport and infrastructure planning to reshape Greater Sydney as three distinct but connected cities: the Eastern Harbour City, the Central River City and the Western Parkland City.

Implementation of the plans is underway, notably in the Western Parkland City, where the federal and NSW governments and eight local councils recently signed the Western Sydney City Deal, a 20-year agreement to transform this community around the Commonwealth government's $5.3 billion investment in a new Western Sydney Airport.

The plans are the result of collaborative partnerships across the NSW government. Together, The Greater Sydney Commission (GSC), Infrastructure NSW and Transport for NSW, which established co-located teams and adopted common planning assumptions and agile ways of working. The result of this partnership has changed the way that government works and will deliver better outcomes for customers, visitors and residents. This represents a comprehensive shift in the culture and as Jim Betts, CEO of Infrastructure NSW, describes it, "I've never seen collaboration on this scale between government agencies."



Source: Our Greater Sydney 2056, A metropolis of three cities — connecting people by, Greater Sydney Commission

Can you describe the Greater Sydney Region Plan and how it will shape the future for residents?

Geoff Roberts (GR): It's as a vision with a practical set of policies that lays out an innovative process for investing in infrastructure over the next 40 years. Greater Sydney is one of the world's fastest growing cities and we needed to give residents a clear narrative about what the city was becoming. We've laid out a plan for a metropolis composed of three, '30-minute cities' in which most residents can live within 30 minutes of their jobs, education, health, services and great places. Right away, 'Sydney-siders' began to connect with the idea since it inherently makes sense.

Clare Gardiner-Barnes (CG-B): Yes, we now have a strategic framework for our future direction that responds to all the changes going on around us. For example, within the Transport realm we see new technologies impacting freight movement around cities, connected and automated cars and trains, and new requirements for roads and rail systems — smarter systems and infrastructure that address changes in customer expectations and behaviours. To plan for these disruptive forces, we really had to push ourselves into that visionary space and not approach planning the same way we did in the past. Ultimately, we were able to create a vision that engages the community and is shared across the NSW government and supported at the local and federal levels. Our new approach means that we will be able to plan future services and cities in a flexible, but integrated way, which is what the community expects. We have also been proactive with changing the legislative and regulatory frameworks in NSW, to ensure that we don't inhibit change as it arrives.

What does 'urban connectivity' mean to you in relation to this plan?

GR: On the most basic level, we are creating three highly connected 30-minute cities, but I also look at urban connectivity in terms of access to jobs and the economy of the city. We've seen how most cities are becoming less equitable and, for me, there is no such thing as urban connectivity if people have to travel two hours each way to get to work. That's urban 'dis-connectivity'. So, our three cities logic is about creating equitable access to jobs wherever you live.

In our case, we have magnificent fortune that the federal government committed to constructing the Western Sydney Airport, which will be an economic driver and confidence builder for our western city.

CG-B: There are many different layers to connectivity including how the three cities and 30-minute city concept creates a vision for all of us to embrace alongside our partners in other agencies, local councils and Commonwealth government. Under the guidance of the GSC, we've come together to carefully plan and implement projects in a staged way that they complement one another. We've also enhanced connectivity between individual projects and the communities, and this translates into a very different approach to planning. In the past, transport planning was driven by isolated projects that were not always connected to the people they were intended to serve. Often, the dots were not joined between transport, land use planning and even essential services like schools and healthcare. Now, we are ensuring that planning is about connecting with the local community. That's a very different approach to how priorities are set and how budgets are allocated. It's not all going to happen overnight, but this more connected approach will have much better outcomes for the broader community.

Does this departure from traditional planning processes require a culture change?

CG-B: Yes, it requires a culture change starting at the top from leaders who expect a new culture and reinforce it along the way. For example, we were fortunate that Government empowered the public sector with the space and freedom to do what we needed to do. Then, at the senior public service and planning levels, we embraced a very different way of working together between agencies so that we didn't let existing boundaries or blockages prevent us from moving ahead. We were determined to focus on good outcomes, robust engagement and cooperation at all levels. We shared consultation materials, we co-located our team in one office, and we really enforced a culture of transparency, collegiality and co-design so that we all saw this as a shared project from day one.

GR: This culture change was definitely enabled by our senior leadership, including Sarah Hill, CEO of the GSC, Lucy Turnbull, Chief Commissioner of the GSC, and Tim Reardon, Secretary of Transport at that time and now Secretary of the Premier's Department. They set the tone for the 'one team' approach, gave us the rights we needed to develop the plan in a new way and helped us break through the siloed-approaches that can exist. Today, there is much emphasis in the planning space on technology, data and data-assisted decision-making — and technology was a big part of what we have just done — but you never achieve culture change through data, you can only achieve it by leadership. You definitely need technology and automation of what we are doing but, in that process, the need for human leadership becomes more important.

What other factors contributed to the plan's success?

GR: One of the reasons we've ended up with the great outcome we have today is the structure of the legislation that created the GSC. The NSW government established a very pluralistic body through its enabling legislation, by which the Secretaries of Transport, Treasury, Planning, and others are on the GSC Board, along with various ministerial-appointees. This really forced a high level of collaboration and it has also resulted in a planning-oriented, versus development-focused, organization, to deliver the best outcomes for the city.

CG-B: I'd add the importance of the human element in bringing the suite of plans to life. We've collaborated across our organizations and we will continue to engage everyone in the process — community, government and industry. In doing so, we are giving them plans that they can feel they have contributed to and can own. In the case of Transport for NSW, we have some 27,000 employees, and our view is that everyone should understand the impact their job has on the delivery of Future Transport 2056, whether they are a line marker on a regional road or a financial analyst. Typically, people work in their own silo but this is about everyone taking responsibility, joining the dots, and thinking about the greater planning outcomes we are trying to achieve. It's not infrastructure for the sake of infrastructure, but rather it's thinking about the community and emerging technologies first, and that's a very different mindset to where we've been. I'd also like to highlight that at Transport we have shifted to a culture that accepts that we don't have all the answers, so we partner with industry, academia and private sector experts.

How will you ensure the continuity of the vision in the years ahead?

CG-B: I think it's important that we've embedded flexibility into Future Transport 2056 so that we can continue to engage with the community and iterate the plans as customer needs and technologies change. This is not a 40-year vision that sits on a shelf, but rather it is an evolving guide that will respond to change and ensure we're on the front-foot with our planning and project prioritization. In addition, the partnerships we have formed across levels of government will help keep the big picture plan on track. The Commonwealth government is an absolute partner in this and it is essential that all layers of government are on board. With all levels of government and the community engaged in this, even as governments change, everyone will recognize that we can't afford to throw this vision away and start again. We have future-proofed them for good reason — to ensure the best possible outcomes across NSW for generations to come.

GR: The key lies in continuing the collaborative model that has been created but also making adjustments and adding the necessary supports and structures to keep the plans moving forward. For example, the NSW government recently announced it was setting up a Western Sydney Development Authority with the Commonwealth Government to work jointly on the delivery of utilities and other infrastructure. Implementation will be driven by the Western Sydney City Deal Implementation Board, and the Western Sydney City Deal Coordination Committee. We've come so far with this integrated and collaborative one team approach and it doesn't get any better than that in my experience.

The final message?

What we're seeing coming out of the Greater Sydney experience, is that connected urban strategy and policy only comes from connected leaders, collaborative cultures and a truly integrated focus on visionary outcomes that are connected to the community and industry through a clear, common narrative. ■

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