



Emerging trends in infrastructure

2022 edition

KPMG International

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Foreword

This will be a year of setbacks and recoveries — and recoveries and setbacks. We see 2022 as a year of opportunity as the world learns from the past and works to rebuild with more resilience, sustainability and equity. Yet it will also be a year of uncertainty as new challenges emerge and social expectations continue to shift as we learn to live in a world with (not after) COVID. And infrastructure leaders have an opportunity to fundamentally change our collective path on the climate, social, and governance agenda.

Like it or not, the infrastructure decisions we make this year will set the stage for how the world will evolve over the next century. If we get it right, we have an unprecedented opportunity to catapult humanity forward into a cleaner, more productive and more equitable future. But if we get it wrong — if we allow our differences to supersede our collective interest — we will bequeath our children a very bleak future indeed.

Making the right decisions on infrastructure will require four things — insight, agility, collaboration and bravery. The insight tells us what we should expect in the future. The agility is there when our insight is wrong. Collaboration allows us to change things at speed. Bravery is the spark that lets leaders act.



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As suggested in this year's *Emerging trends in infrastructure*, **insights** (such as those gathered through data & analytics and publications like this one) will need to flow from a wide range of sources, leveraging multiple inputs, for infrastructure decision-makers to get a more holistic view of everything from individual needs through to system-level opportunities. **Agility** will be needed at every level of the infrastructure ecosystem — from individual assets right up to the system. It will be required by every actor (regulators, owners, management and workers, suppliers, technology providers and others). But if we try to operate in silos we will fail. Deeper **collaboration** must be embraced, including cross-sectoral approaches to understanding and addressing infrastructure needs. And **bravery** is needed, because time is running out to tackle challenges like climate change; infrastructure decisions will need to be made in years not decades.

We hope this edition of *Emerging trends in infrastructure* serves as a valuable input in that quest for insight. Over the past 10 years of making big predictions for the global infrastructure sector, this publication has been right much more often than it has been wrong. We hope to maintain that reputation.

To learn more about the trends raised in this edition of *Emerging trends in infrastructure* or to discuss your organization's unique opportunities and challenges, we encourage you to contact your local KPMG firm.



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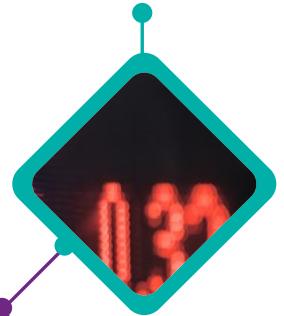
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Trend 1:

Moving from
talk to action



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Moving from talk to action

Infrastructure is central to addressing the climate crisis, with around 70 percent of the world's carbon emissions the result of infrastructure construction and use.¹ Happily, organizations in the industry are beginning to shoulder responsibility and move from words to deeds.

Even if politicians had achieved consensus at COP 26 (which they didn't) and agreed on practical goals (which they didn't), people have lost patience with talk; they are hankering for action. The annual COP negotiations are not without value. COP26 brought renewed global attention and a slew of new commitments. It forced politicians and nations a little bit closer to consensus. It reinforced the direction of travel for policy makers. But it also illustrated the limitations of global consensus-based decision making. What is needed, and what we are beginning to see, is leadership.

In 2021, the infrastructure sector began to convene around the actions that need to be taken to decarbonize the industry. We saw numerous initiatives in the industry attract huge support, like the Institution of Civil Engineers' Carbon Project. Many infrastructure owners published net zero strategies and growing numbers of start-ups are nurturing technology solutions on everything from direct air capture to the decarbonization of cement.

This year, the industry's focus on net zero will grow exponentially. It will become unacceptable for any company

in the sector to fail to engage. Suppliers will find themselves frozen-out of tenders if they cannot evidence their net zero efforts. Huge amounts of private capital is likely to flow into the most promising technology solutions, and businesses will compete aggressively for the best climate talent.

Hand-in-hand with the path to net zero will be the quest for infrastructure resilience. 2021 provided a catalogue of unhappy evidence (most notably ferocious wildfires in multiple regions around the world) that the effects of climate change will be severe regardless of the actions belatedly being taking today. Infrastructure is not only the most responsible for climate change and most accountable for its mitigation, but also most exposed to its effects. The costs of strengthening, protecting, relocating and rebuilding infrastructure are likely to rise inexorably through 2022 and beyond as governments and communities struggle to safeguard their essential services.

Happily, there is evidence that making new assets more sustainable or old assets more resilient does not need to cost more and in many cases, can improve bottom line results. But it does need to be done differently. A collective shift in mindset is needed and, thankfully, this is beginning to happen.

In 2022, expect to see the private sector redouble its investment and activity on the climate agenda. Infrastructure players with a clear path to net zero will thrive and the climate laggards will fail.

¹ <https://blogs.worldbank.org/ppps/low-carbon-infrastructure-essential-solution-climate-change>



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Trend 2:

Building long-term in
a short-term world



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Building long-term in a short-term world

Populism is raging. Work models are being disrupted. Shopping patterns are evolving. Technology companies are replacing traditional institutions. And massive debates that pit the right of the individual as opposed to the common good are exploding everywhere. It's becoming increasingly difficult to know what society will want in the next few days or years, let alone what it will need in the coming decades.

Now overlay some of the big macro trends that are changing the world around us. Demand for action on the climate agenda, growing pressure from economic and climate migration, intensifying trade issues, persistent supply chain challenges, political gamesmanship, and new strains of COVID-19 are all having massive short and long-term impacts on the world in which we operate.

Just consider how these trends are influencing the way people live, work and play. And what that means for the infrastructure that supports those activities and demands. What does that mean for future city and regional development plans? What does it mean for housing? What does it mean for that new metro system that is currently under construction?

The big question on every infrastructure player's mind, therefore, is which changes are temporary and which are indelible. The uncertainty is creating challenges for short-term decision making (do you sign that multi-year commercial property lease?). It's also creating massive problems for long-term planners (how do you know which technologies will still be relevant in just 10 or 20 years' time?). Nobody wants their investments to face technological obsolescence.

The only way to know (to some degree of certainty) what society will need in the future is by listening. And this means listening in

the broadest sense. Listening to both strong and weak signals and knowing the difference between them. That means more engagement with stakeholders and community groups. It means becoming more citizen/customer-focused instead of procurement-focused. It means no longer looking at planning as simple transactions, but rather as ecosystem enablers. It means thinking about the future rather than just repeating the successes (and failures) of the past.

Data and analytics will be key to conducting that listening, learning how society is actually changing and creating a greater understanding of future trends and needs. Making sense of society's stated preferences and their real preferences. But infrastructure planners will also need to embed a level of flexibility to mitigate those uncertainties that can't be analyzed away. Maintaining the trust of people, given our new power to listen, is also vital. Privacy continues to migrate up the priority list.

What we cannot do is retain the status quo, despite its comforting familiarity. The future may be opaque. But what is perfectly clear is that it is unlikely to look anything like yesterday. New ideas, new models and new approaches will be required — and are fast arriving. The way in which we deliver on the needs and demands of today while planning for the possibilities of tomorrow will set the stage for years to come.

Over the coming year, expect infrastructure planners to become much more focused on stakeholder engagement, data and analytics, and new technologies. And expect this to lead to greater certainty, flexibility and collaboration in future planning and investment.



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Trend 3:

Maintaining control
while encouraging
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Maintaining control while encouraging agility

Infrastructure requires governance, regulation and control. After all, these are big investments, with big impacts, made for the very long term. Consumers must remain protected; users must be served and kept safe; investors must be kept informed and there are already growing signals that the public is keen to see greater privacy protection in every sphere of their lives.

As the appointed watch-dog of consumer protection, regulators need to take notice. In fact, regulatory systems everywhere are now being challenged to adjust for the new reality, new technologies and new approaches.

The problem is that — far too often — governance takes on a life of its own; call it momentum, or drift, or inertia. It becomes governance for the sake of governance. The consensus being that more governance and more control leads to better outcomes for citizens and consumers. But does it?

In some cases, an increase in redundant governance has led to good projects and ideas being drowned out in an endless loop of process and regulation. More often than not, governance tends to be focused on delivering on cost expectations rather than the specific benefits that were envisioned at the strategic planning phase. As a result, outcomes under-deliver on the needs of society.

One of the big challenges with regulation is that it is often designed to deal with historical challenges. It's retroactive. It's almost always a few steps behind, fighting the last war. So instead of helping to manage the risks of new technologies or new models and approaches, regulation tends to be more focused on ensuring the old risks are being mitigated.

It doesn't need to be like this. Well thought-through regulatory systems can be one of the most powerful drivers of infrastructure innovation and development. Take, for example, the way in which the UK has used regulation to help incubate the market for renewables (offshore wind in particular), driving a dramatic increase in the proportion of low carbon energy generation in just a few years.

In the future, expect governments, regulators and infrastructure players to embrace governance — not simply as a way to control costs and manage risks — but rather as an opportunity to ensure projects and programs are properly scoped, delivered and managed to address society's need. And, when that need changes or objectives are not being met, that the regulation is agile and flexible enough to allow the correct changes to be made.

Over the coming year, expect to see conventions related to regulation and control start to shift as regulators, governments and investors begin to take rapidly changing technologies into account and start focusing on creating governance for the sake of benefits, not just for the sake of governance.

This does not mean that regulation will start to recede or control will be loosened. Quite the opposite. In the coming year, expect regulators and governance bodies to take a much more central role — but with a view towards encouraging value (both in the way infrastructure is delivered and in the way it is governed). The speed of this could determine our future more than anything else.



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Trend 4:

Making digital real





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Making digital real

If the pandemic had lasted months (not years), perhaps many of the digital habits it spawned would have washed away as life quickly returned to normal. But the pandemic is not receding (setbacks and recoveries — and recoveries and setbacks). And the shift to digitization is only picking up speed. Simply put, COVID-19 has made digital real for the infrastructure sector. Predicted in last year's edition, the permanency of the changes we are witnessing are directly related to the depth and duration of the disruption being caused by COVID-19.

Over the past year, many infrastructure players are renewing their efforts to digitize. We are seeing data, analytics and new technologies being used to dramatically improve the planning cycle. We are seeing digital become deeply embedded into the development of new assets and services. And we are seeing infrastructure owners and operators starting to build digital into their operations — from integrated asset management systems through to new payment systems.

Some of the more advanced infrastructure players are now exploring opportunities to collect and manage data across multiple assets and throughout their supply chains to create even more value. This is good news, but the industry could go further. Consider, for example, how navigation apps provide users with a 'whole of system', multi-modal view of the options for their journey. The difficult question is why that data isn't already being used by city traffic planners and operations managers to make their cities more livable?

But it's not just about making the city more livable, it's also about making it greener and more affordable. Formula One pit teams are said to run more than a billion simulations during a race to keep the

car in optimal condition and plot competitive strategy. Consider how that type of insight might be applied to the power sector, for example, to provide operators with a range of real-time options for ensuring grids are optimized and carbon emissions reduced.

Yet, as infrastructure players rush to digitize everything from operations to customer experiences, challenges are starting to emerge. Whether it comes down to cost, comfort or capabilities, some users are unable to leap the digital divide as quickly as others. Infrastructure providers need to be sensitive to the needs of such users and find ways to ensure they are not excluded from access.

At the same time, as systems become more digitized and integrated, the threat of cyber attacks or catastrophic failures cascading across the system become more worrisome. That, in turn, is starting to challenge the acceptability of standardizing systems across multiple assets.

This year, expect to see infrastructure players start to take a much longer-term and holistic view of digital — from integrating data from the back office through to the front office, through to engaging with users and customers to drive digital literacy, access and acceptance.

As suggested in past editions, infrastructure CEOs will need to start thinking more like tech leaders. And they will need to stop seeing their CIOs as the "computer guy" and start integrating the expertise of their departments into the overall business strategy.

For the infrastructure sector, this is the year that digital becomes real. It will become embedded. And it will move to the core of the interaction between assets, operators and users.



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Trend 5:

Supply
infrastructure,
supply the world





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Supply infrastructure, supply the world

For years, businesses competed to reduce supply chain capital employed, while supply chain managers focused on saving cycle times (just-in-time). Now businesses are competing to improve resilience to COVID, extreme weather events, political gamesmanship, whatever. Indeed, the economic gyrations of the past 2 years have demonstrated to the world that modern supply chains are fragile, overstretched and vulnerable to a wide range of external and internal shocks.

The impacts of this supply chain fragility on the infrastructure sector are two-fold. First, infrastructure players are struggling with their own supply shortages, not only in material supply but also in talent, capabilities and equipment. The first big impact, therefore, is that infrastructure players will struggle to deliver on their objectives and social, economic and environmental opportunities will be lost.

The second impact is the response to increased supply chain risk. Significant investment will now flow into creating massive amounts of (perhaps ultimately redundant) infrastructure assets. Already, we are seeing fields of new distribution centers being developed around major cities in an attempt to reduce the risk of short-term supply shortages. As this mentality becomes more wide-spread, the related investment into infrastructure will be massive.

The constriction of infrastructure supply chains is a more serious issue than most people would recognize. Infrastructure supply constraints don't just slow down the rate of development, they also drive-up costs, reduce competition and restrict supply of

government services. Unlock the infrastructure supply chain and you'll help to unlock global supply chains.

If only it were that easy. Unfortunately, infrastructure supply chains are deeply influenced by macro-economic trends. The rise of resource nationalism, resistance to offshoring, increasing demand for local products and services, trade wars and even new tax incentives and schemes are all creating unwanted barriers to infrastructure supply.

The supply of talent may be even more constrained. COVID-19 has made some people reconsider their work and mobility choices (few want to get locked down on a remote construction site). Global mobility was already under stress as a result of political choices such as Brexit and immigration law changes. The pandemic only heightened the competition for good talent and human capital — the great resignation is real.

Of course, many of these supply challenges are increasingly intertwined and influenced by non-financial factors; the availability of good healthcare, for example, is now a key factor for some companies when deciding where to place their supply chains (a healthier workforce is a more resilient workforce).

In the year ahead, we hope to see some of the supply constraints currently plaguing the world economy to ease. One of the silver linings is that it may drive infrastructure players place increased focus on encouraging diversity in their organizations, both as a way to reduce talent supply constraints and as an opportunity to bring new perspectives into the sector.



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Trend 6:

Towards a new 'livable'





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Towards a new 'livable'

As governments and infrastructure planners are struggling to identify which pandemic-catalyzed trends are permanent and which are transient, one of the most important questions is where people will want to live, work and play both tomorrow and in 10 years' time. The answer will have significant impact on how cities evolve over the next 100 years.

Prior to the pandemic, a safe bet would have been a gradual shift towards 'work/live' communities in downtown cores or in sprawling suburbs. Weak signals already suggested people wanted to reduce their commute time and enjoy more work-life balance. City planners were seeking (often without much luck) to reduce the suburban sprawl and mix up the downtown core.

The pandemic created a sharp bifurcation in how people now expect to live, work and play. On the one side are those looking to take full advantage of the digitization of work. They are moving into smaller towns far outside of city centers. They are commuting into work a few days a week. And they tend to be keen on localization, both in the products and services they select, and the level of government control they expect.

On the other side are those gravitating towards the downtown core. They want to cut the commute, but also see value in the interconnectedness that can only be found in vibrant city centers. Many live within walking distance of their offices, coffee shops and favorite restaurants. While localization is increasingly important, convenience, connectivity and cost remain key factors.

The problem for infrastructure planners is that both paths require different investments, assets and priorities. And not everyone is going to choose one path or the other; the future will likely include a varying mix of the two. The challenge, therefore, is how to develop assets that serve both camps. And to do so while also tackling big issues like housing affordability, environmental sustainability and development planning.

In part, the answer will flow from the current ongoing shift from mass production assets (factories) to mass customization ones (food home delivery). In the past, we would focus on building monolithic assets that would serve the masses. Now we are building smaller, tailored assets that users can optimize to meet their unique needs.

Flexibility will also be key. Indeed, new assets will need to be planned and delivered with sufficient flexibility to allow for change of use over time. Residential assets are being created in ways that would allow them to quickly pivot from hotel to apartment, apartment to student housing, and from student housing to hotel — as local demand changes.

Over the coming year, expect to see city planners and policy makers start to place bigger bets on how their populations will want to live, work and play. Don't expect any radical changes in investment priorities for the time being. But do expect to see increased prioritization on those assets that support a range of different lifestyles. Many of the short term changes will remain on paper until it becomes clearer how/if these issues will sort themselves out.



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Trend 7:

Paying for it all



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Paying for it all

Government spending remains at record levels. Material scarcity is driving up costs. Yet governments still want to deliver a massive pipeline of infrastructure projects over the next few years (the US plans to spend more than 1.2 trillion over the next decade).² So where is all the money going to come from?

Some will come from higher taxation. The US hopes changes to its tax code will result in \$2.15 trillion in new tax revenues.³ Many governments are considering shifting their tax brackets or implementing new capital gains taxes in order to place more of the burden onto the uber-rich.

At the same time, we are also seeing growing clarity around the need to introduce, broaden and better align user-pay funding options. It's not a topic many politicians like to raise. And there are many markets where infrastructure services like water provision, healthcare and power are either provided free to residents or at highly subsidized rates. This can lead to a misallocation of resources and significant waste.

The interesting change is that the topic is now broadening. People in some markets are asking why — in an age of digital work — drivers aren't shouldering a greater share of the road costs. If governments were to then apply variable fee rates (like the City of LA does on its

high occupancy lanes), travel behaviors could be influenced and costs could be directly funded by those who use it.

Governments everywhere are under pressure to pass more of the cost of infrastructure to users, but they are worried about the political backlash. In the UK, for example, the energy regulator has been supported by the Government in its refusal to lift the energy price cap even in the face of dozens of energy firms collapsing. No one wants to pay more for something they regard as essential, like power, water or the drive to work. But greater alignment between users and payers will need to be found if governments are to deliver on their infrastructure agendas and in particular their net zero commitments.

Not everyone will be able to do that. Indeed, despite both higher taxation and higher user charges, there is already some scaling back of ambition. The Belt and Road initiative, for example, has been significantly scaled back. The UK recently cancelled the Eastern Leg of HighSpeed 2 and the Northern Powerhouse Rail.

This year, expect to hear governments having more articulate and persuasive conversations about how they will fund their infrastructure plans over the long-term. Taxation will likely rise and expand. And serious conversations about user fees will come to the front page.

² https://www.washingtonpost.com/politics/biden-poised-to-sign-12-trillion-infrastructure-bill-fulfilling-campaign-promise-and-notching-achievement-that-eluded-trump/2021/11/15/1b69f9a6-4638-11ec-b8d9-232f4afe4d9b_story.html

³ US Department of the Treasury (<https://home.treasury.gov/news/featured-stories/preliminary-estimates-show-build-back-better-legislation-will-reduce-deficits>)



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