

The future of global infrastructure

A survey of infrastructure trends



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The year 2022 marks a new beginning for infrastructure across the globe

THE PANDEMIC AND associated economic disruption are prompting new thinking about infrastructure. Governments around the world are investing in infrastructure to deal with this new reality and to help jump-start the recovery (see figure 1). These infrastructure funds are coming at a time when several larger trends are changing the way we think about infrastructure:

Economic stimulus for a postpandemic rebuild: The pandemic acted like a time-machine into the future, delivering massive changes faster than imaginable. Governments are investing in this new economy, which will require new—and different—infrastructure.

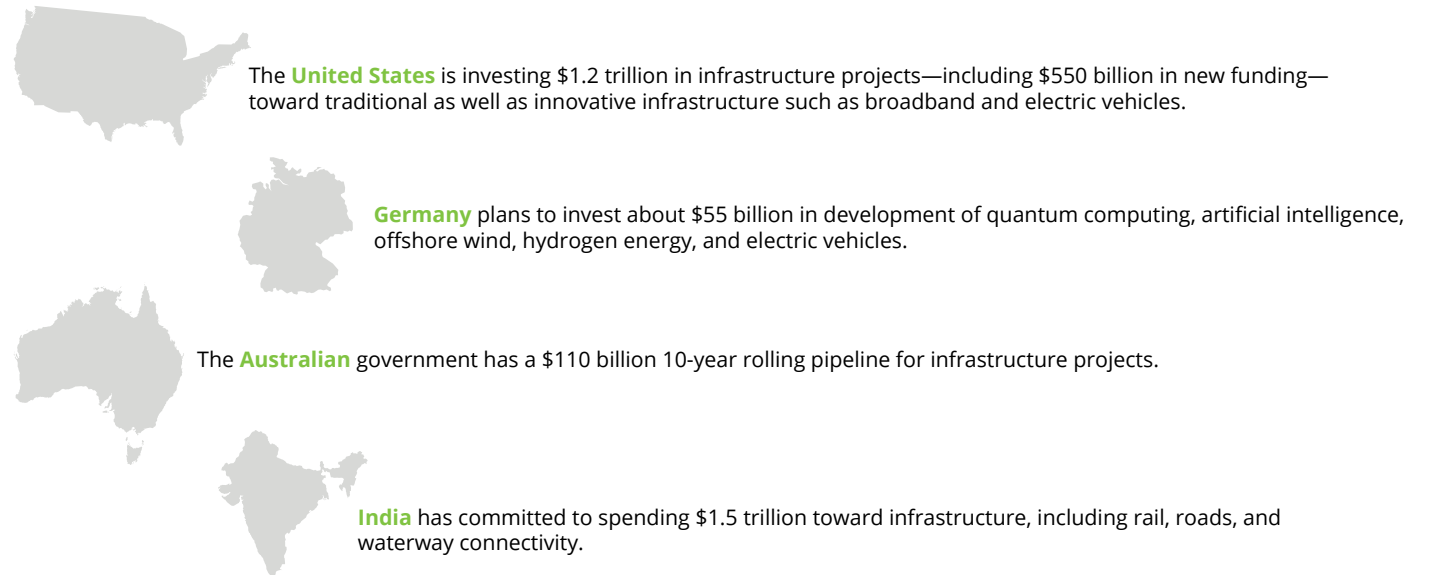
Focus on environmental sustainability: While green infrastructure has been on the radar for a while, many governments around the world are increasing commitment to environmental projects.

Emphasis on greater social equity: There is a strong focus on ensuring that new infrastructure meets the needs of all people.

Technology: The pandemic demonstrated the ever-increasing importance of technology. From broadband access to smart infrastructure, technology and cybersecurity are transforming infrastructure priorities.

FIGURE 1

Global investments for infrastructure projects



Note: All dollar amounts are in US dollars.

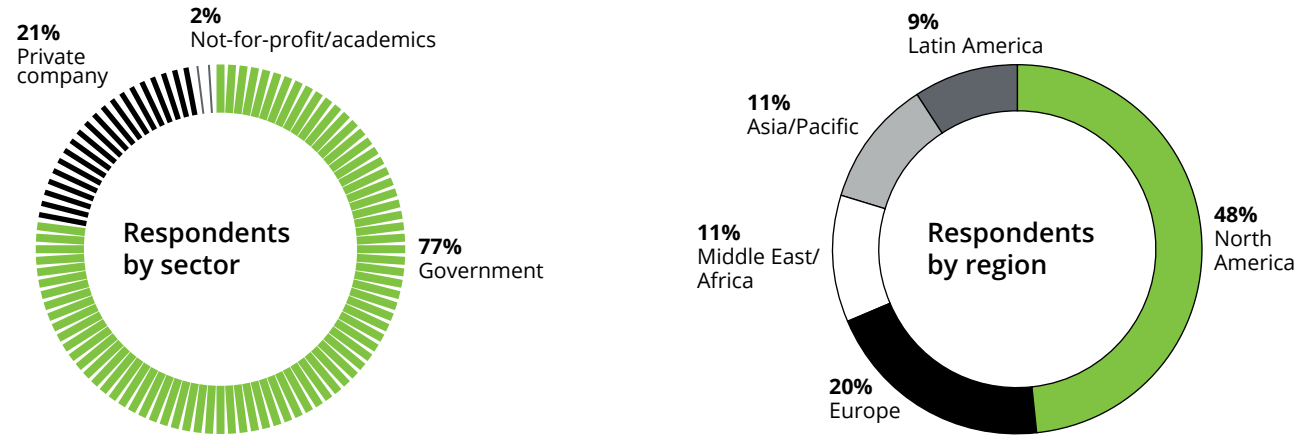
Sources: Cantwell.senate.gov, *Bipartisan Infrastructure Investment and Jobs Act summary: A road to stronger economic growth*, accessed January 24, 2022; Jonathan Ponciano, "Everything in the \$1.2 trillion infrastructure bill: New roads, electric school buses and more," *Forbes*, November 15, 2021; Éanna Kelly, "Germany unveils €50B stimulus for 'future-focused' technologies," *Science Business*, June 4, 2020; Australian Government, Budget Announcements (2021-22 budget) from the Department of Infrastructure, Transport, Regional Development and Communications; Matt Harris, "India commits 100 lakh crore to infrastructure in new budget," *GRI Hub*, July 25, 2019.

What does the future hold for infrastructure globally? We asked the specialists.

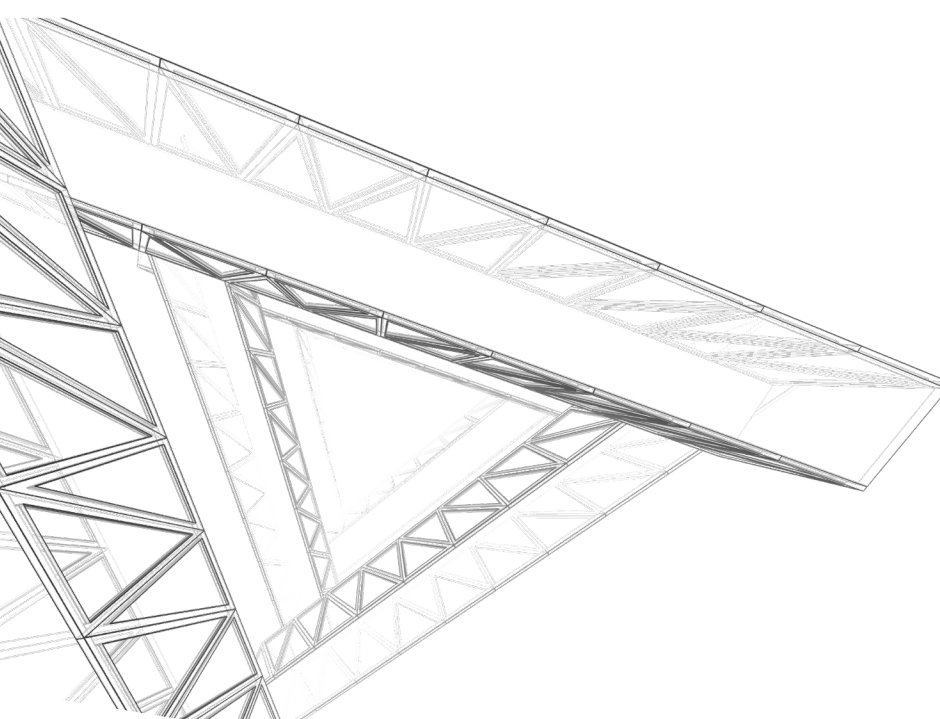
TO FIND OUT what's ahead, in September 2021, we surveyed more than 600 public officials and infrastructure executives worldwide. These were senior officials in the area of infrastructure, representing governments, private companies, and nonprofits including academics (figure 2). We surveyed public officials from national (17%), state (31%), and local (52%) governments, with a greater weighting on state and local governments since they are more responsible for the actual execution of infrastructure projects. Deloitte engaged an outside survey firm to conduct a “double blind” survey to promote unbiased participation. (For more information on the survey methodology, see the appendix.)

Our survey respondents also shared their comments and insights with us, and some of their quotes will be shared throughout the report.

FIGURE 2
Our survey respondents were spread across sectors and geographies



Note: Percentages may not add up to 100 due to rounding.
Source: Deloitte analysis.



Ninety-eight percent of respondents told us they expect that there will be significant, lasting impacts from the pandemic—including higher demand for multimodal transportation

The pandemic disrupted everything. What remains to be seen is which changes will be transient and which ones will be more enduring.

Importantly, an overwhelming majority of our survey respondents (98%) agree that the pandemic will have significant, lasting impact on infrastructure. However, there was disagreement about what that impact will be.

The biggest impacts expected by those surveyed are higher demand for multimodal transportation and broadband (figure 3). In Europe, demand for multimodal transportation is expected to be the largest with almost 60% of respondents saying there will be greater demand.

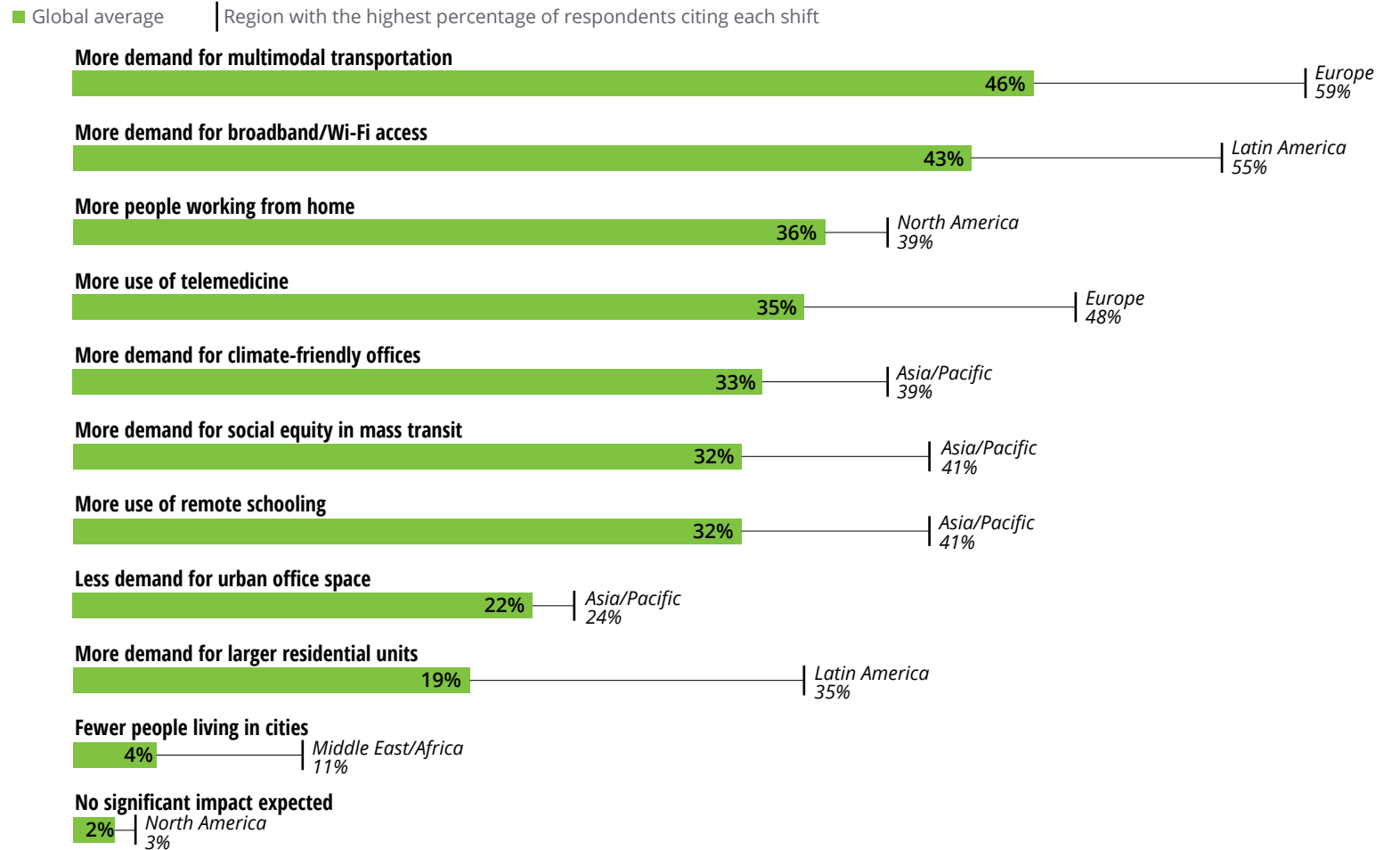
More than one-third of respondents also believe that there will be more people working from home and greater use of telemedicine. Interestingly, greater use of online modes of working or accessing services are not expected to translate to where and how people live. **Only 4% of respondents believe that there will be fewer people living in cities** and only 19% believe that there will be more demand for larger residential units.

Respondents do not expect people to flee cities. But they do believe demand for multimodal transportation will increase.

FIGURE 3

Higher demand for multimodal transportation and broadband lead the list of the lasting impacts of the pandemic

Which of the following possible postpandemic shifts do you believe will have a significant impact on infrastructure over the next three years? (Select all that apply).



Source: Deloitte analysis.

Respondents expect infrastructure to become more digital, more cyber secure, and more ecofriendly

HOW WILL INFRASTRUCTURE investment look different in the postpandemic era? Our respondents sent several strong signals:

A big commitment to digital: Respondents indicated that digital investments will be one of governments’ top priorities. Almost 84% of respondents in Asia/Pacific (AP) expect digital infrastructure investments to increase, the highest percentage of any region.

Focus on cybersecurity: More digital activity brings more cybercrime. More than three-quarters of respondents expected greater focus on data security over the next three years.

Climate-friendly infrastructure: The environmental step respondents most expect is expansion in electric vehicle infrastructure followed by provision of incentives for renewable energy.

Today, even “hard” infrastructure increasingly entails a digital component.

FIGURE 4

Most respondents expect governments to focus more on data security, digital infrastructure, and electric vehicles

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?

| Steps to achieve postpandemic agendas (increase a little or increase a lot) | Global (%) | World region high | World region low |
|---|------------|-----------------------|-------------------|
| Invest to improve data security | 76% | Asia/Pacific 91% | North America 70% |
| Shift toward digital infrastructure investments | 70% | Asia/Pacific 84% | Latin America 65% |
| Expand the number of electric vehicle charging stations | 63% | Asia/Pacific 75% | MEA 60% |
| Assign greater priority to integrated use of multiple transportation modes | 63% | Europe 72% | MEA, NA 59% |
| Collaborate with the private sector | 62% | Asia/Pacific 71% | North America 56% |
| Ensure reliable and affordable internet connectivity to all | 62% | MEA 67% | Asia/Pacific 57% |
| Provide incentives for renewable energy | 61% | Asia/Pacific 71% | Europe, LA 58% |
| Invest in urban public spaces for walking, cycling, socializing, and eating | 60% | North America 67% | MEA 49% |
| Invest in infrastructure to boost economic growth and jobs | 58% | Asia/Pacific, MEA 67% | North America 54% |
| Provide equitable access to mass transit and other services in underserved areas | 56% | Asia/Pacific 67% | Latin America 53% |
| Invest in climate research | 54% | Asia/Pacific 68% | North America 47% |
| Use environmental metrics to select investments and assess performance | 52% | Asia/Pacific 64% | Europe, LA 48% |
| Change infrastructure plans to adapt to shifts in how people work, how they travel, and where they live | 50% | Asia/Pacific 57% | Latin America 42% |

Source: Deloitte analysis.

Urban spaces: Being transformed through green alternative transportation

AS MENTIONED EARLIER, one of the significant, lasting shifts respondents expect from the pandemic will be greater demand for multimodal transportation. Respondents did not expect people to leave cities but rather to look for better ways to live and travel within cities.

Helsinki has been a trendsetter in this area. It has been heavily focusing on the improvement of public transport and facilities for cycling, walking, and other alternative ways of mobility to reduce the usage of cars. There is also a service available for “mobility on demand” by meshing together a range of transportation options including buses, bikes, and driverless cars on one platform that can be used to order any trip through a smartphone.¹ Our survey suggests that other regions might be heading in this direction—about 60% of respondents globally said that they plan to invest in urban places for walking, cycling, socializing, and eating.

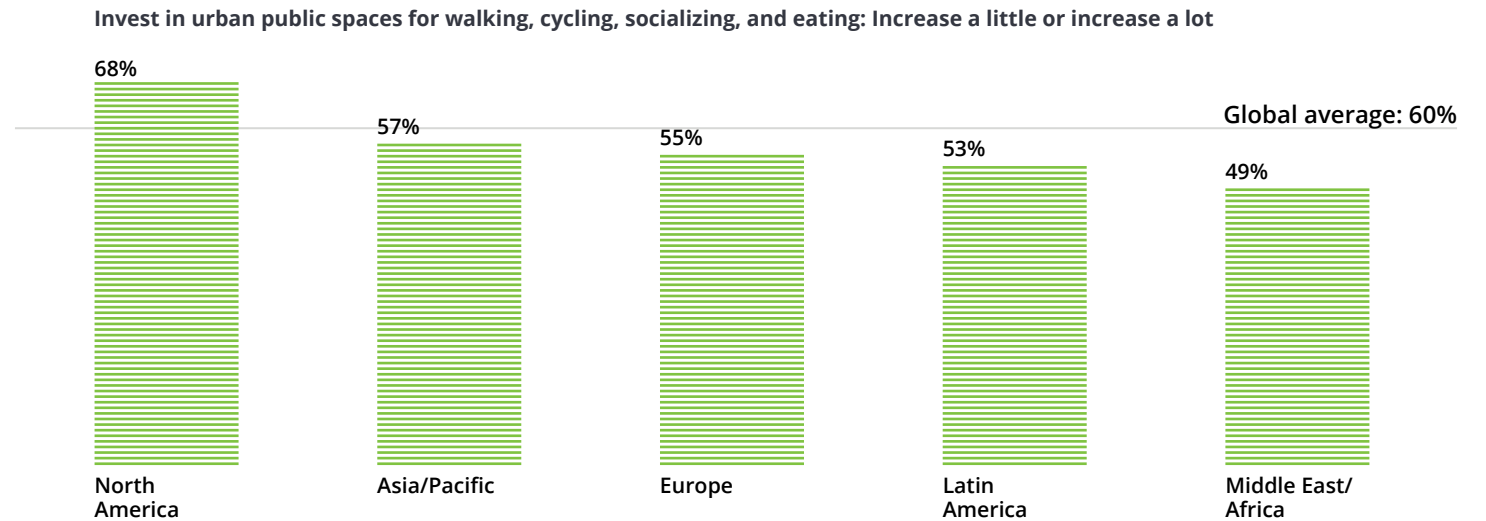
“To improve the city’s air quality and reduce congestion, we are investing in local street infrastructure to promote commuting by walk, cycle, and public transport.”

— UK city official

FIGURE 5

Investments in green transportation in cities are expected to increase, as per respondents

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?



Source: Deloitte analysis.

Which technologies will reshape infrastructure over the next three years?

INFRASTRUCTURE OFFICIALS IN our survey were clear about their top technology picks expected to reshape infrastructure—artificial intelligence (AI), cloud computing, and cybersecurity.

These technology choices highlight the shift from purely physical infrastructure to a hybrid of physical and digital. From power grids to roads, infrastructure is getting “smarter.” This also means that it will likely hold more personal data and be more vulnerable to cybercrime.

The increasing use of AI, cloud, and digital technologies means public officials should strengthen their privacy and ethical use of data protocols. In the United States, at least eight states have appointed chief privacy officers, and in 2021, Georgia became the first state to name a chief cloud officer.²

“Our goal is to increase growth by incorporating new technology, such as artificial intelligence, to build climate-friendly city infrastructure.”

— *City manager, UK city*

FIGURE 6

AI, cloud computing, and cybersecurity technologies are expected to have the most impact on infrastructure projects, according to respondents

From your perspective, which of the following technologies will have the largest impact on infrastructure plans over the next three years? Select up to five.

| Technology | All | Developed countries | Low- and middle-income countries |
|---|-----|---------------------|----------------------------------|
| AI/machine learning | 55% | 59% | 43% |
| Cloud computing | 53% | 55% | 50% |
| Cybersecurity technologies | 49% | 51% | 41% |
| IoT/sensors/RFID technology | 45% | 46% | 41% |
| Autonomous/electric vehicles | 37% | 41% | 27% |
| Batteries and energy storage | 34% | 38% | 23% |
| Distributed energy resources/smart grid | 33% | 36% | 24% |
| Robotics and drones | 33% | 34% | 31% |
| Biometrics | 30% | 32% | 23% |
| Predictive analytics | 30% | 31% | 27% |
| Blockchain | 26% | 28% | 20% |
| 5G | 24% | 25% | 21% |
| Edge computing | 18% | 21% | 9% |
| Digital twins | 14% | 15% | 10% |

Notes: Developed countries include Australia, Canada, Germany, Japan, Singapore, the United Kingdom, and the United States. Low- and middle-income countries include Brazil, Chile, Colombia, India, Indonesia, Kenya, Mexico, Qatar, Saudi Arabia, United Arab Emirates, and Uganda.

Source: Deloitte analysis.

Globally, infrastructure is not adequately protected from cyberattacks

CYBERATTACKS ON CRITICAL infrastructure can be dangerous and costly. From San Francisco’s MUNI light rail system in 2016,³ to the shutdown of the Colonial Pipeline in 2021,⁴ attacks on essential infrastructure are rightly a big concern for many public officials.

Even in the most economically advanced countries, about one in five respondents told us infrastructure is not adequately protected from cyberattacks.

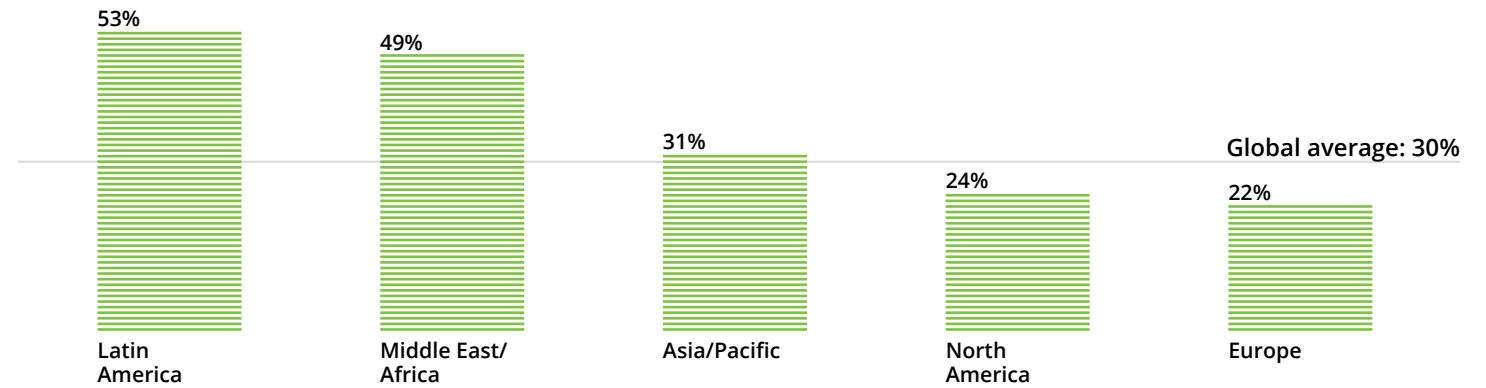
“Priority must be given to the digital infrastructure that will help with device connectivity, protocol translation, data filtering and processing, and security and management matters.”

— Senior IT department official, Middle East

FIGURE 7

Many respondents across geographies expressed concerns around infrastructure safety from cyberattacks

Do you agree with the following statement? *Our infrastructure is not adequately protected from cyberattacks.*



Source: Deloitte analysis.



What do respondents say isn't going to change?

The (sometimes burdensome) *process* of building infrastructure

OUR RESPONDENTS INDICATED that they don't expect the way governments oversee the building of infrastructure to change much—meaning some of the execution challenges around infrastructure projects are likely to continue.

Complex regulations and associated court challenges can significantly increase the costs and create long delays in the execution of infrastructure projects. Yet less than 8% respondents across regions said they expect regulations to be loosened a lot to make it easier to execute on projects.

Similarly, few respondents expect significant changes to contracting methods or a substantial increase in the involvement of the public in infrastructure decisions.

FIGURE 8

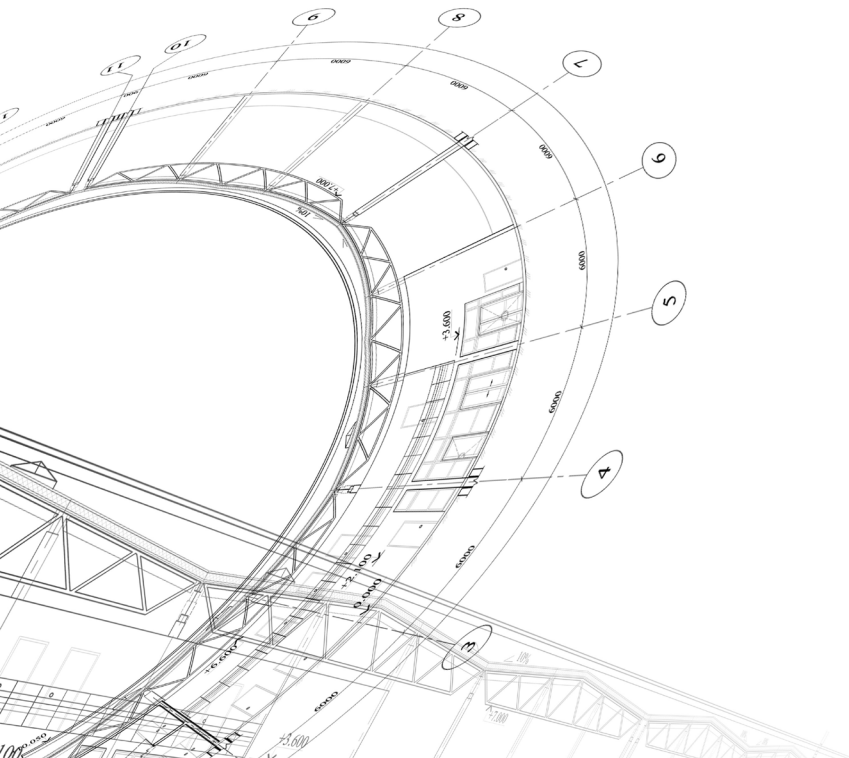
Respondents don't expect big changes in infrastructure execution

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?

| Efforts expected to increase a lot | Asia/Pacific | Europe | Latin America | Middle East/ Africa | North America |
|---|--------------|--------|---------------|---------------------|---------------|
| Use alternative contracting methods for infrastructure construction | 11% | 4% | 3% | 3% | 8% |
| Involve the public in infrastructure decisions | 9% | 5% | 7% | 5% | 5% |
| Loosen regulations to make it easier to execute on projects | 8% | 3% | 5% | 5% | 3% |

Source: Deloitte analysis.

Less than 8% across regions expect regulations to be loosened.



There is a backlog of infrastructure needs, especially in Middle East/Africa

ALMOST FOUR IN 10 respondents say their localities have a backlog of investments needed to bring infrastructure to a good condition—a large proportion of world infrastructure. Middle East/Africa had the highest percentage of respondents reporting investment backlogs.

Investment backlogs can corrode existing assets leading to higher maintenance costs and higher chances of infrastructure failure. While new infrastructure projects tend to garner much media attention, governments should prioritize and publicize infrastructure maintenance efforts that can improve valuable infrastructure assets and lead to higher efficiency by avoiding future costs.

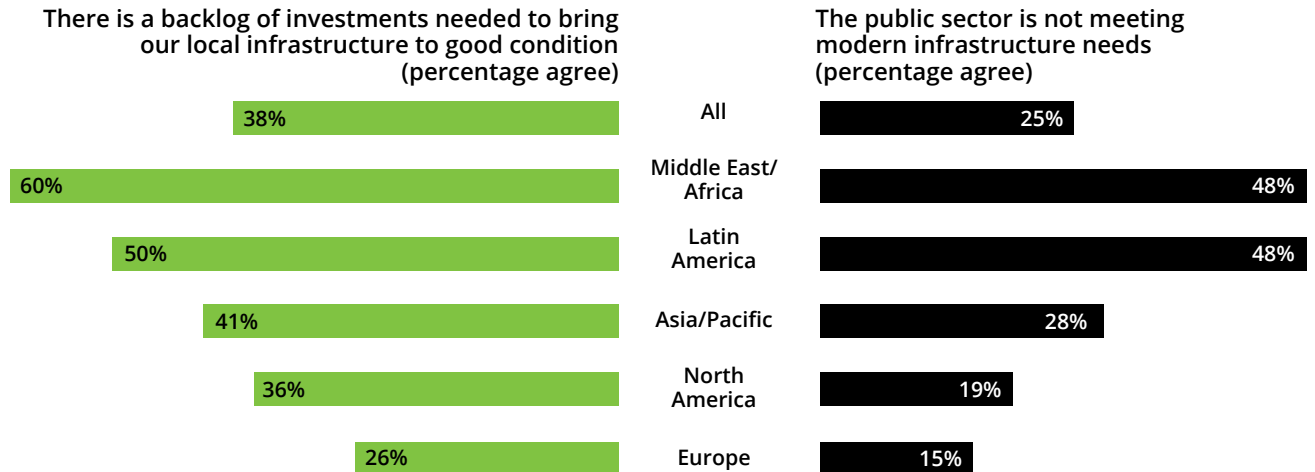
Almost 50% of respondents in Latin America and Middle East/Africa said the public sector is not meeting modern infrastructure needs compared with 28% of respondents in AP and less than 20% of respondents in Europe and North America.

Almost 50% of respondents in Latin America and Middle East/Africa said the public sector is not meeting modern infrastructure needs.

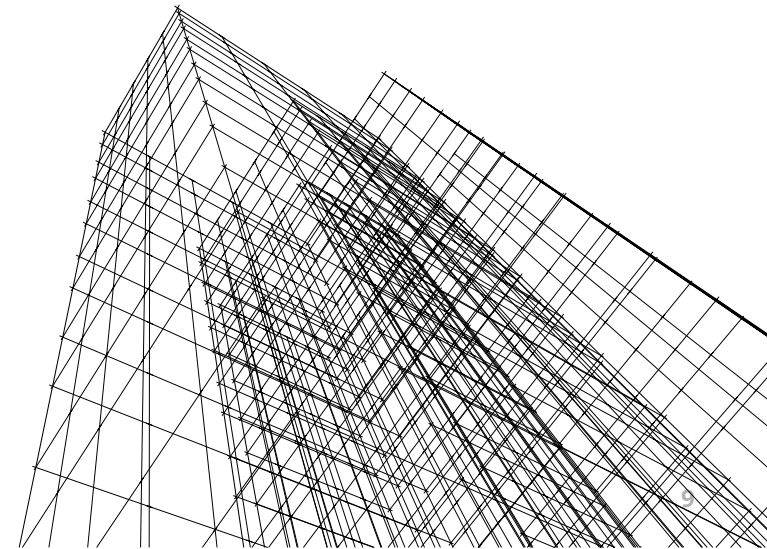
FIGURE 9

Middle East/Africa had the highest percentage of respondents reporting investment backlogs

Do you agree with the following statements?



Source: Deloitte analysis.



Talent shortages were cited as the biggest obstacle to infrastructure over the next three years

OUR SURVEY REVEALED an interesting finding: Respondents told us that a shortage of talent would be the biggest obstacle to implementing infrastructure projects—more than budget constraints or regulatory challenges.

When thinking of infrastructure talent, it is easy to think of construction workers. But today’s infrastructure encompasses many more elements which require a far more diverse range of skills. Engineering and cyber skills could increasingly play a critical role in building infrastructure.

Budget constraints and data privacy risks are also big challenges to implementing infrastructure projects, survey respondents indicated. Recent events, including the Colonial Pipeline hack in the United States, have highlighted security vulnerabilities of infrastructure.

Another shortage that might impact infrastructure construction? Supplies. Supply chain costs (38%) and availability of materials (30%) were both cited by those surveyed as significant potential obstacles.

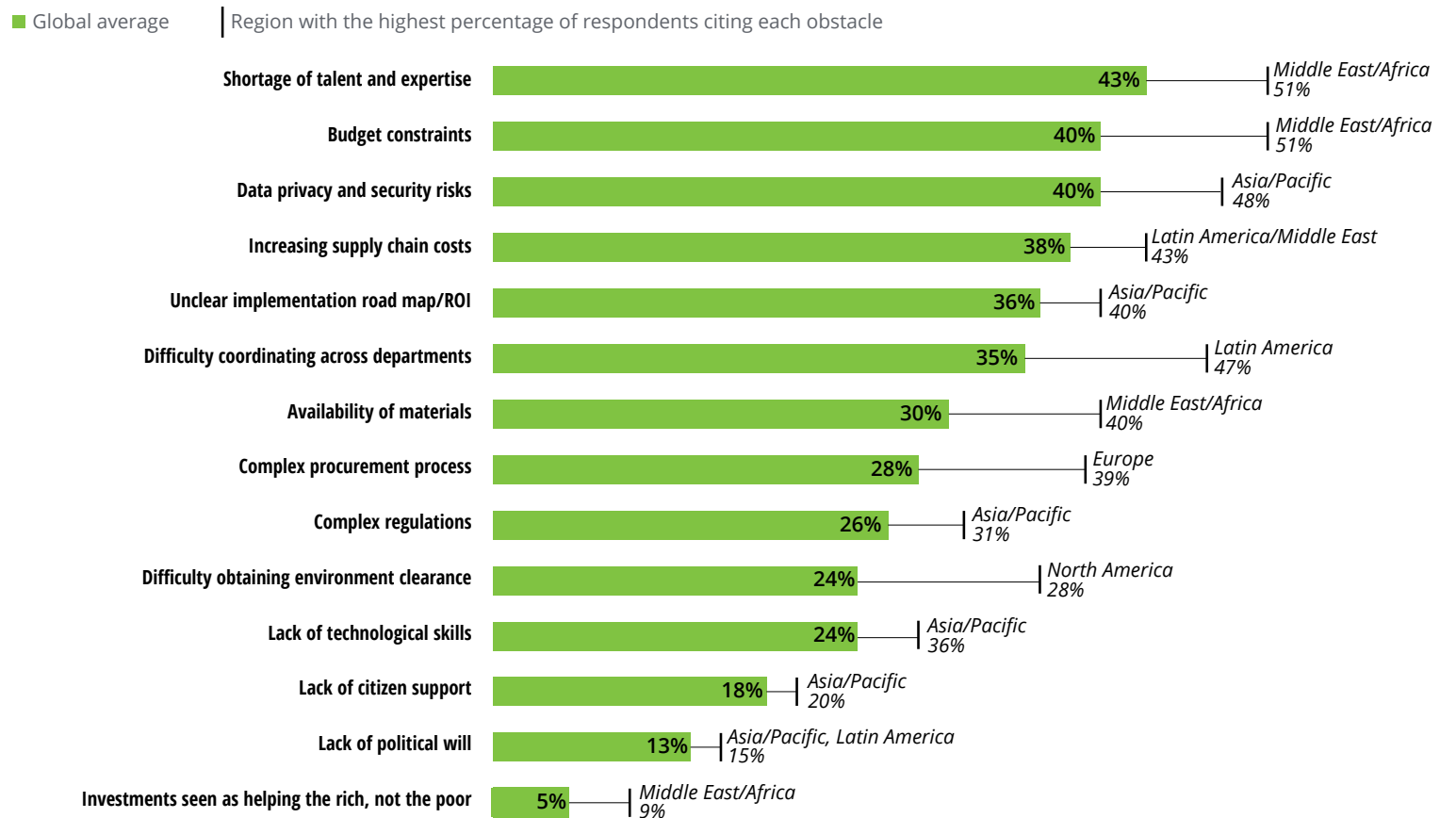
“Certified cybersecurity professionals should be trained to meet the shortage of cybersecurity advisers.”

— CEO, New York-based telecoms company

FIGURE 10

Respondents cited talent shortage, budget constraints, data privacy risks, and supply chain costs as the biggest obstacles

Over the next three years, what do you expect to be the greatest obstacles in implementing the infrastructure projects that you are involved in? Select up to five.



Source: Deloitte analysis.

Major measures to meet equity goals are not expected on the ground

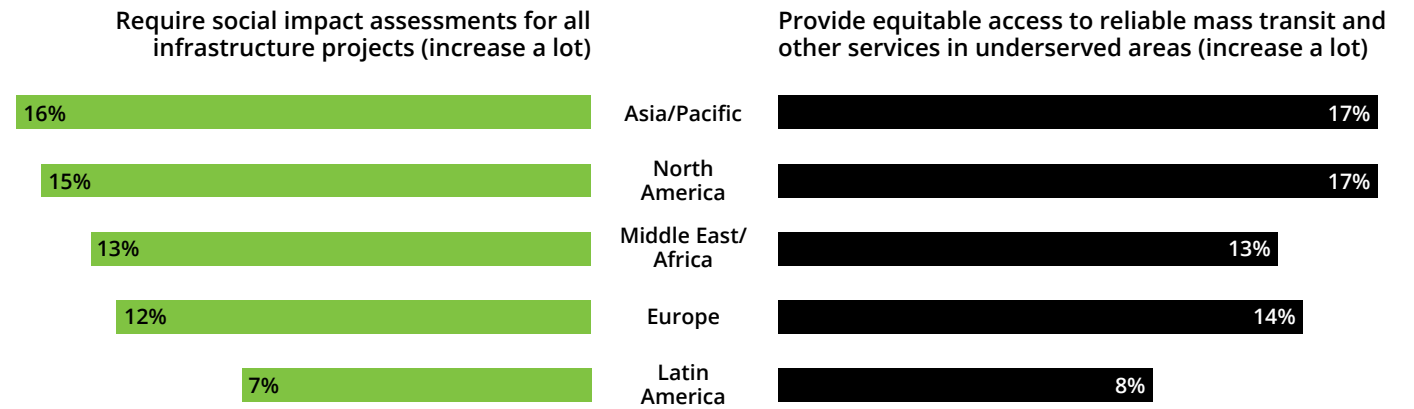
OUR SURVEY RESPONDENTS did not reveal a strong consensus that significant steps will be taken to meet various equity goals. For example, respondents do not see a significant change in social impact assessments. Globally just 14% of respondents on average across regions said that social impact assessments will increase a lot, 35% said it will increase a little, and 49% expect it to stay the same.

Respondents don't expect significant changes to equitable access to mass transit, either. Just 15% on average expect efforts to provide equitable access to mass transit to increase a lot, 41% said it will increase a little, and 40% expect it to stay the same.

FIGURE 11

Few respondents expect a major increase in social impact assessment and changes to equitable mass transit

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?



Source: Deloitte analysis.

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Eco-infrastructure: Respondents anticipate uptick in tax credits for renewables

THE SURVEY FOUND that a high percentage of respondents are expecting sizable increases in incentives for renewables, with more than 33% expecting that area to increase a lot in each region: on average 37% across regions expect tax credits to increase a lot.

However, our survey indicates that other actions are deemed less likely.

For example, although respondents expect *demand* for multimodal transportation to increase (see figure 3), they expect a limited response from government in this area. Just 13% in North America and 17% in Middle East/Africa expect a significant shift ahead in terms of prioritizing mixed transportation modes (such as train to bus to bike).

On average, only 10% of respondents across regions expect efforts to incorporate environmental benefit metrics into investment selection to increase a lot. However, some banks are considering environmental compliance when making lending decisions—which means environmentally sustainable projects may have an easier time accessing private capital.

“Given the environmental consequences, renewable energy and digitization should be prioritized.”

— *Senior official, department of energy/ environment, Canadian province*

FIGURE 12

Respondents largely expect governments to increase incentives for renewables

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?

| Efforts expected to increase a lot | Asia/Pacific | Europe | Latin America | Middle East/ Africa | North America |
|--|--------------|--------|---------------|---------------------|---------------|
| Shift to renewable energy, such as providing tax credits | 45% | 42% | 33% | 33% | 33% |
| Invest in climate research | 32% | 28% | 28% | 20% | 19% |
| Expand the number of electric vehicle charging stations | 28% | 13% | 12% | 9% | 14% |
| Assign greater priority to integrated use of multiple transportation modes | 23% | 25% | 15% | 17% | 13% |
| Incorporate environmental benefit metrics into investment selection and performance assessment | 19% | 5% | 7% | 12% | 11% |

Source: Deloitte analysis.

Infrastructure funding: Privatization and national government funding are leading global trends

HOW WILL INFRASTRUCTURE be funded going forward? The short answer, seems to be “More of everything!” Respondents expect a wide array of funding approaches to increase in the next three years.

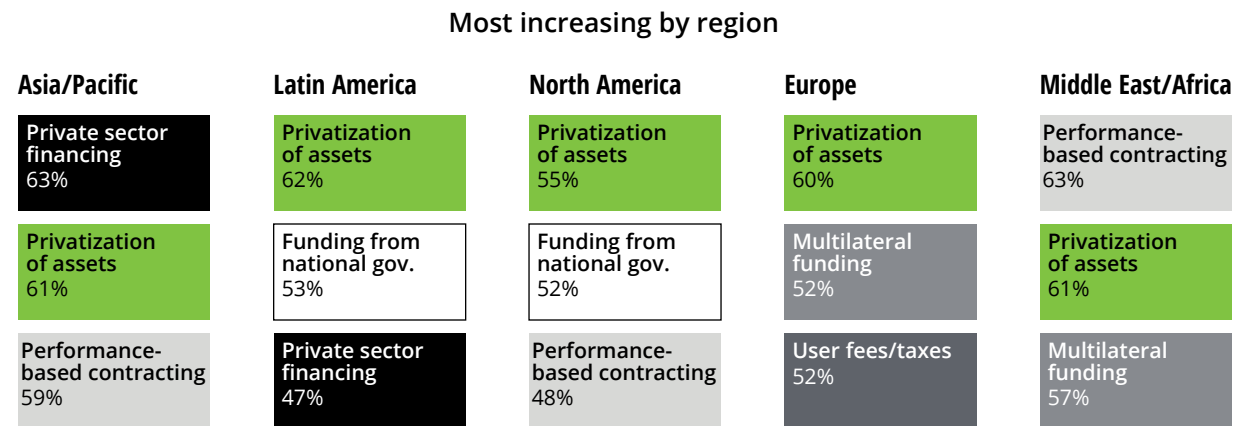
The approach most expected to increase across the globe, is privatization of assets.

Other financing techniques expected to rise include performance-based contracting, user fees, and multilateral and development funding.

FIGURE 13

Most respondents expect more infrastructure funding through privatization of assets and national government funds

For infrastructure projects you are involved with, do you think the following financing techniques will increase, decrease, or stay about the same over the next three years?



All financing techniques (globally)

- 58%** Privatization of assets
- 52%** Funding from national government
- 51%** Performance-based contracting
- 46%** Multilateral funding
- 45%** User fees/taxes
- 42%** Private sector equity
- 42%** Private sector financing
- 42%** Funding from local government
- 42%** Funding from state/regional government
- 39%** Government borrowing
- 38%** Crowdfunding
- 37%** Vendor financing
- 26%** Philanthropic support

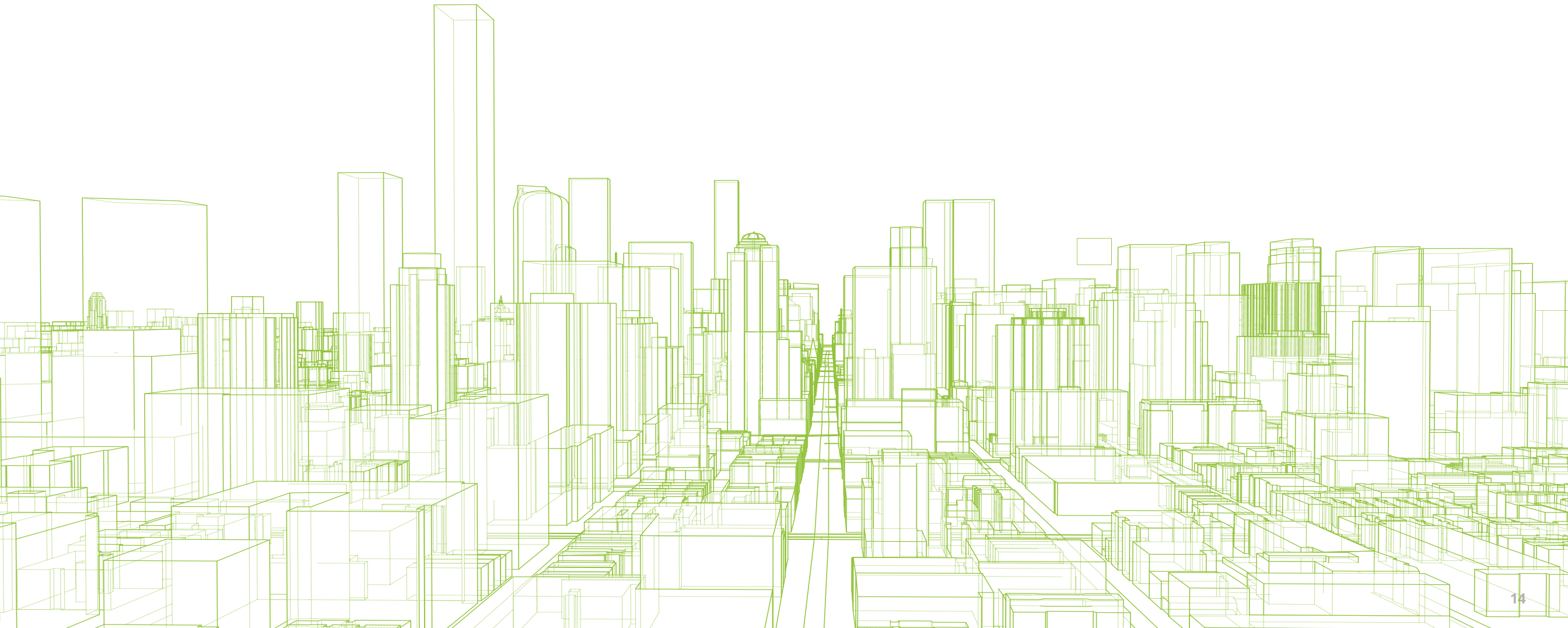
Source: Deloitte analysis.

A fresh future for infrastructure

THE PANDEMIC HAS put a spotlight on infrastructure around the globe. It prompted new behaviors, including a substitution of online interaction instead of in-person. Remote work, telehealth, and online education are impacting infrastructure needs. Other global trends include:

- Increased investing from national governments
- Pandemic impacts to global travel and global supply chains
- A continued focus on environmentally sustainable, climate-sensitive infrastructure

Infrastructure will never be the same again. Every part of the infrastructure ecosystem—national and local governments, as well as private sector partners—will need to adjust.



Appendix on survey methodology

TO HELP ILLUMINATE the future of infrastructure, in September 2021, Deloitte conducted a survey of 660 respondents from 18 countries across five regions, with the largest sample, 300, from the United States. These 660 total respondents included government officials and infrastructure executives, as well as a small sample of nonprofit and academic representatives (see figure 15 for respondents by sector).

Qualifying responses came from respondents who indicated that they are “very knowledgeable” or “knowledgeable” about infrastructure plans and investments in their geographic area. The respondents were focused on three broad areas—mobility and transportation; energy, water, and utilities; and digital infrastructure.

FIGURE 14

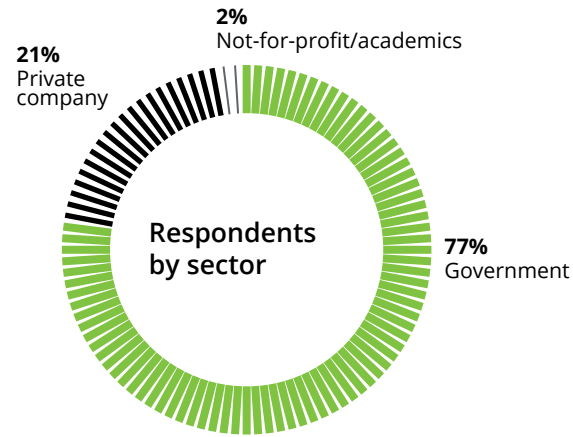
Countries surveyed

| | | |
|---------------------------|--|------------|
| North America | 3% Canada 45% United States | 48% |
| Europe | 7% Germany 13% United Kingdom | 20% |
| Asia/Pacific | 2% Australia 2% India 2% Indonesia 2% Japan 2% Singapore | 11% |
| Middle East/Africa | 3% Kenya 2% Saudi Arabia 2% Qatar 2% UAE 2% Uganda | 11% |
| Latin America | 2% Brazil 2% Colombia 2% Chile 2% Mexico | 9% |

Source: Deloitte analysis.

FIGURE 15

Our survey respondents were spread across sectors



Source: Deloitte analysis.

FIGURE 16

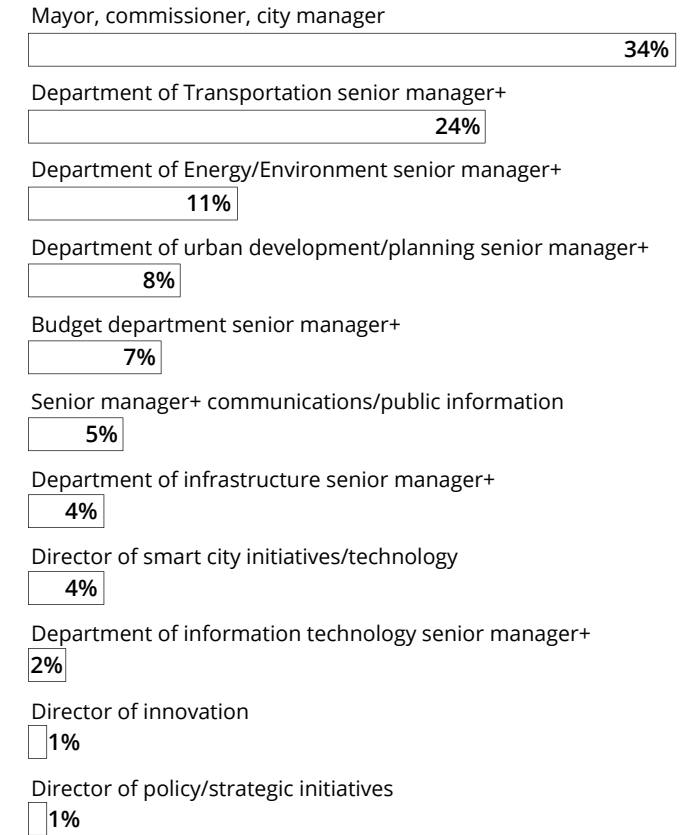
Global respondents by infrastructure focus

| | |
|-------------------------------------|------------|
| Mobility and transportation | 55% |
| Energy, water, and utilities | 44% |
| Digital infrastructure | 26% |
| Multiple/overall policy | 5% |

Source: Deloitte analysis.

FIGURE 17

Global public sector respondents by title



Note: The "+" symbol denotes senior-level designations (including commissioner, director, and senior manager).

Source: Deloitte analysis.

Endnotes

1. Randy Rieland, "Helsinki has a plan to get people to stop owning cars," *Smithsonian Magazine*, September 30, 2014.
2. Jenni Bergal, "More states appoint 'chief privacy officers' to protect people's data," Stateline, May 14, 2021.
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4. David E. Sanger, Clifford Krauss, and Nicole Perloth, "Cyberattack forces a shutdown of a top US pipeline," *New York Times*, May 8, 2021.

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