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McKinsey on Government

Reinvesting in America

Helping governments renew the sources of economic strength and deliver for their people

Compendium
December 2023

Contents

Introduction

As 2023 ends and we look ahead to 2024, our world and our country continue to face a broad range of challenges—including climate change, economic uncertainty, and continued geopolitical tensions. In the face of these challenges, the United States is investing trillions of dollars in public-sector capital via the Bipartisan Infrastructure Law, the Inflation Reduction Act, and the CHIPS and Science Act to bolster economic security, energy security, and national security. In aggregate, these new investments seek to accelerate technology and transform America's industrial policy and built environment. If implemented effectively, these policies may fundamentally alter the public- and private-sector landscape for the next several decades.

The year 2023 was one of planning. The US federal government drafted and issued guidance for a range of new programs. Many state governments designed, launched, and scaled central coordinating functions charged with winning competitive grants and deploying federal funding (competitive and noncompetitive, new and enduring) as efficiently and effectively as possible. Agency leaders have developed novel approaches to

deploying green financing, expanding broadband infrastructure, accelerating new technology, and building hydrogen hubs to ensure that the United States can keep pace with the demands of rapid modernization across industries.

We believe 2024 will be a year of transition from planning to implementation, with more shovels hitting the ground each day to build the future American economy. To make this happen, leaders at the federal, state, and local levels can work with industry counterparts to address a bevy of significant—but tractable—challenges, such as complex service procurement timelines, material and labor supply chain shortages, and permitting restrictions.

To inspire your efforts over the weeks and months ahead, we developed this compendium containing some of the most read perspectives from McKinsey's Reinvesting in America Initiative. We thank you for the time and energy you are investing in our country at this critical moment and wish you all the best in 2024 and beyond.

December 2023

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US government productivity: A more than $2,000 per resident opportunity

Government remains one of the biggest productivity improvement opportunities. Organizations must be given both the ability and motivation to improve.

by Nikhil Sahni, Vishnu Murale, David Cutler, Shubham Singhal, and Alan Gerber

This article is the first in a series on the US government's productivity improvement opportunity.

As the US economy has evolved, it has shifted from predominantly manufacturing to services. While some of these services industries have made productivity improvements, many lag behind the overall economy. For example, healthcare remains a growth engine for the US workforce but is one of the slowest in terms of labor productivity growth.[1] Government is also largely a services industry and offers one of the economy's largest productivity improvement opportunities.[2]

For nearly all countries, government represents the largest portion of the economy and is the biggest employer (Exhibit 1). For example, in the United States, government at all levels accounted for about 47 percent of GDP and about 17 percent of total employment in 2020.[3] Furthermore, government plays a critical role in society, ranging from building roads to educating youth. In many cases, when the government intervenes, it is necessary because there is no functioning competitive private counterpart.

Moreover, the imperative to capture the government productivity improvement opportunity has intensified. The COVID-19 pandemic put pressure on economies around the world, prompting governments to spend large amounts of money to distribute COVID-19 relief. As COVID-19 moves to an endemic phase, new macroeconomic issues have emerged, most notably a talent shortage, inflation, and high debt-servicing costs.[4] For example, in 2022, the US federal government spent the largest amount ever on debt interest, reaching nearly 2 percent of GDP.[5] Having to get by with both a smaller workforce and weaker government balance sheets suggest that the need for productivity improvements has increased.

In this article, we set out to estimate the size of the US government's productivity improvement opportunity. We defined productivity as operational efficiency; other researchers have focused on policy effectiveness (see sidebar "Why has it been difficult to measure government productivity?"). We quantified the US government productivity improvement opportunity by level—federal as well as state and local—and category, such as healthcare or road transport.

Overall, we found a $725 billion to $765 billion productivity improvement opportunity—that is, roughly $750 billion annually that could be saved while keeping government services operating just as effectively. This would be equivalent to more than $2,000 per resident. About 60 percent of the total was at the state and local level. Across categories, about 40 percent of the opportunity was in healthcare; 9 percent was in primary and secondary education.

We also converted this opportunity into an operational framework that could aid government organizations in determining what actions to take. Based on our experience with hundreds of public- and private-sector organizations, the framework suggests that operational challenges lie in an organization's *ability* and *motivation* to improve.

We recognize and acknowledge that a variety of civic compacts shape how governments set priorities, and thus governments have fundamentally different imperatives than those of the private and social sectors. Government organizations may make productivity trade-offs in service of those institutional imperatives. In this report, productivity is the focus, but it is just one way of evaluating government activity.

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[1] Nikhil Sahni, Pooja Kumar, Edward Levine, and Shubham Singhal, "The productivity imperative for healthcare delivery in the United States," McKinsey, February 27, 2019.
[2] *Government productivity: Unlocking the $3.5 trillion opportunity*, McKinsey Center for Government, April 2017.
[3] Data from OECD on general government spending, accessed on June 26, 2023; data from International Labour Organization on public employment by sectors of national accounts, accessed on June 26, 2023.
[4] Addie Fleron and Shubham Singhal, "The gathering storm in US healthcare: How leaders can respond and thrive," McKinsey, September 8, 2022.
[5] "What are interest costs on national debt," Peter G. Peterson Foundation, May 30, 2023.

Exhibit 1

In many countries, government spending and employment make up a sizable portion of GDP and total employment, respectively.

Breakdown of government spending and employment by country, 2020

	Government spending, % of GDP	Per capita government spending, current PPP,[1] $	**Government employment,** % of total employment	Total government employment, thousands
France	61.5	29,415	21.5	5,809
Greece	59.7	16,962	16.5	766
Belgium	58.9	32,127	18.5	904
Finland	57.2	29,907	24.1	635
Italy	56.8	24,506	15.5	3,352
Denmark	53.5	32,577	29.0	844
Canada	53.1	25,087	7.7	1,380
UK	52.4	24,037	16.4	5,343
Sweden	52.1	29,232	29.2	1,461
Spain	52.0	19,739	16.4	3,157
Iceland	51.2	27,790	19.4	49
Slovenia	51.2	20,906	25.0	178
Hungary	51.1	17,451	17.1	902
Germany	50.4	28,473	11.1	4,658
Portugal	49.2	17,212	14.9	719
Poland	48.3	16,838	12.0	1,649
Netherlands	47.8	28,613	10.0	1,146
US	47.3	30,033	17.1	22,633
Czech Republic	47.2	20,219	15.4	897
Austria	46.2	26,425	35.2	4,461
Israel	45.4	18,261	23.3	851
Estonia	44.9	17,706	21.7	153
Slovakia	44.8	14,728	19.0	456
Lithuania	42.6	8,671	24.3	311
Latvia	42.2	7,674	25.1	222
Korea	38.1	17,042	8.8	2,375
Türkiye	35.3	9,883	14.2	3,808
Mexico	31.0	5,732	13.4	5,539
Ireland	27.4	25,719	15.6	358

[1]Purchasing-power parity.
Source: International Labour Organization; OECD

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Why has it been difficult to measure government productivity?

The term "productivity" is used in many contexts with different intentions. For example, leaders want to talk to each other about productivity but may use conflicting definitions when they do so, leading to disagreements. For this article, we employed a definition of productivity that economists commonly use to conduct industry-level analyses.[1] This focuses on minimizing the inputs required to produce a set of outputs (exhibit).

To understand why it has been difficult to measure productivity in government, it is helpful to first look at how productivity is measured in the private sector. With respect to the equation in the exhibit, in industries such as manufacturing, input and output prices and volume produced are quantifiable. Inputs represent the cost of goods, sales, general administrative expenses, and other such operating costs for goods or services produced. Outputs are estimated by the price a consumer is willing to pay, which accounts for the quality of the good or service, multiplied by the volume. To measure productivity, it is critical to be able to separate price and volume.

When government is involved, inputs and outputs are much harder to measure. Researchers have tried to overcome this problem in a few ways. One approach has been to conduct international comparisons between governments; this offers insight into the productivity improvement opportunity at the national level.[2] For example, healthcare spending could be compared across countries, such as the United States and Canada. But these comparisons may be misleading because they do not easily take into account differences in how government delivers these goods or services, and the resulting need for more or less spending. Continuing with the example, the largely public, single-payer healthcare system in Canada may not need as much money as the market-based models in the United States. This approach also tends to exclude state- or local-level comparisons.

Another approach has been to dive deeply into a set of government organizations and develop specific metrics. For example, to examine the efficiency of public-health initiatives, some efforts have tracked microlevel operational metrics, such as

house visits by individual healthcare workers.[3] These can be helpful to the extent that the metrics are operationally focused. The challenge with this approach is that it is hard to aggregate up to the total opportunity across the government.

In our view, these two approaches are directionally correct but are each incomplete. Neither provides a comprehensive road map for the government to measure productivity improvement opportunities across the full range of functions it provides.

Further, when estimating productivity for government, it is important to separate efficiency from effectiveness. Productivity as defined in this article is related to the creation of goods and services; this is efficiency of production. The government also sets policy, the assessment of which concerns questions of effectiveness. While efficiency is tied to specific, measurable units (that is, detailed outputs and inputs), questions of effectiveness focus on how outputs translate into desired policy outcomes, such as shifts in wealth among population groups. Effectiveness is outside the scope of this article.

Exhibit

$$\text{Productivity} = \frac{\text{Total value of outputs}}{\text{Total value of inputs}} = \frac{\text{Output volume} \times \text{output prices}}{\text{Input volume} \times \text{input prices}}$$

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[1] Robert M. Solow, "Technical change and the aggregate production function," *The Review of Economics and Statistics*, August 1957, Volume 39, Number 3.
[2] Edwin Lau, Zsuzsanna Lonti, and Rebecca Schultz. "Challenges in the measurement of public sector productivity in OECD 180 countries," *International Productivity Monitor*, Centre for the Study of Living Standards, 2017, Volume 32.
[3] "Public-sector productivity (part 1): Why is it important and how can we measure it?," World Bank Group, February 2021.

The US government productivity improvement opportunity

To estimate the US government productivity improvement opportunity, we used a previously published approach by the McKinsey Global Institute and adapted it to conduct a country-specific analysis.[6] This approach accounts for both cost and quality and is applied to the federal level and the state and local level. We centered our analysis on five core government spending categories in which cost and quality data were readily available:
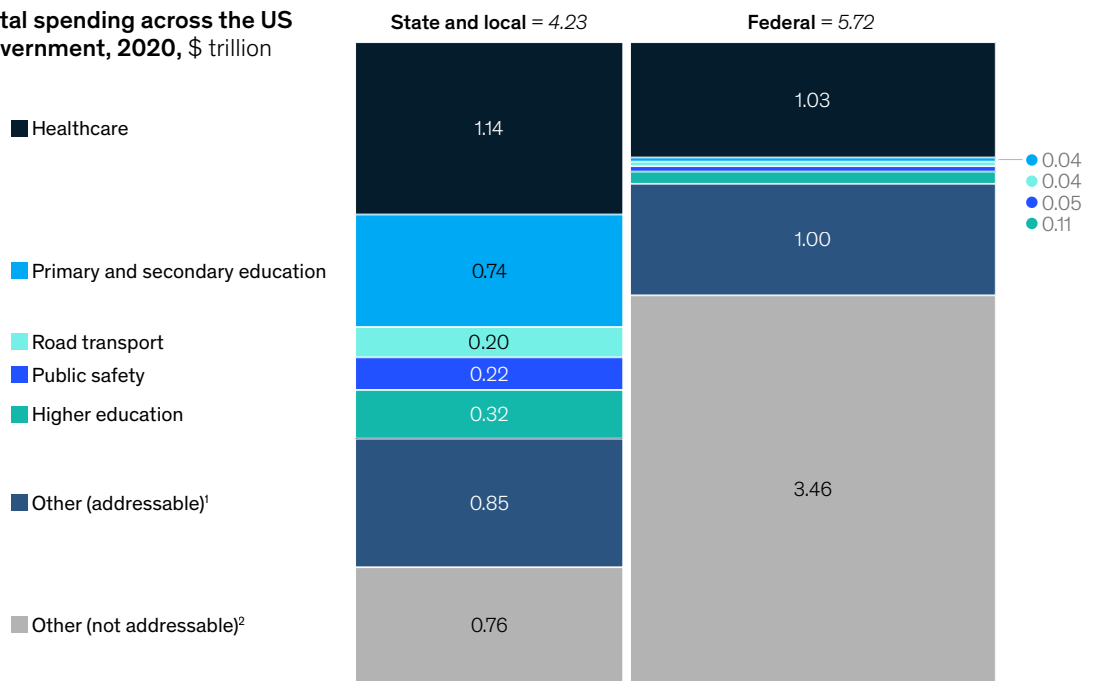
healthcare, road transport, primary and secondary education, higher education, and public safety. We then used these estimates to scale across the remaining categories of government spending.

We based our analysis on 2020 government spending data. That year, after accounting for intergovernmental transfers, governments in the United States spent $9.9 trillion, of which approximately 58 percent was at the federal level and the remaining 42 percent was at the state and local level (Exhibit 2).[7] Of this

Exhibit 2

For our analysis, we considered about 58 percent, or $5.8 trillion, of total US government spending in 2020.

Total spending across the US government, 2020, $ trillion

State and local = *4.23*   Federal = *5.72*

- Healthcare
- Primary and secondary education
- Road transport
- Public safety
- Higher education
- Other (addressable)[1]
- Other (not addressable)[2]

State and local column: Healthcare 1.14; Primary and secondary education 0.74; Road transport 0.20; Public safety 0.22; Higher education 0.32; Other (addressable) 0.85; Other (not addressable) 0.76

Federal column: Healthcare 1.03; 0.04; 0.04; 0.05; 0.11; 1.00; 3.46

Note: Figures may not sum, because of rounding. Numbers adjusted for intergovernmental transfers to reflect where the work is done.
[1]For state and local spending, other categories analyzed include community and regional development, international affairs, general government, and national defense. For federal spending, other categories analyzed include air transportation, financial administration, fire protection, judicial and legal, general government expenditure, general public buildings, libraries, other education, other governmental administration, parks and recreation, protective inspection and regulation, sewerage, solid-waste management, and utility expenditure.
[2]Spending that was unspecified or could not be further optimized in terms of operations was considered not addressable.
Source: Office of Management and Budget; US Census Bureau

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[6] *Government productivity*, April 2017.
[7] The intergovernmental transfers establish where the work is done versus where the work is funded. For example, Medicaid dollars are accounted for at the state and local level, though the funding is from the federal level. Due to data limitations, state and local spending could not be split.

total, about 42 percent was either unspecified or could not be further optimized in terms of operations, such as paying interest on debt or Social Security payments. This type of spending was excluded because it is not related to efficiency of production but is more commonly related to policy effectiveness, which was not in the scope of this article. As a result, our analysis focused on $2.3 trillion of government spending at the federal level and $3.5 trillion at the state and local level.

We then estimated that the US government productivity improvement opportunity is $725 billion to $765 billion, adjusting for wage differences across states (see sidebar "How we measured the US government

productivity improvement opportunity"). About 60 percent of the total was at the state and local level, with nearly a third of the opportunity in healthcare and about 15 percent in primary and secondary education. Of the remaining 40 percent at the federal level—$285 billion to $295 billion— about 50 percent of the opportunity was in healthcare (Exhibit 3).

From opportunity to action
We also sought to offer insight on how government leaders could capture the productivity improvement opportunity. To do so, we used a previously developed operational framework that lays out how the public sector could pursue productivity improvements (Exhibit 4).[8]

Exhibit 3

The US government productivity improvement opportunity is $725 billion to $765 billion.

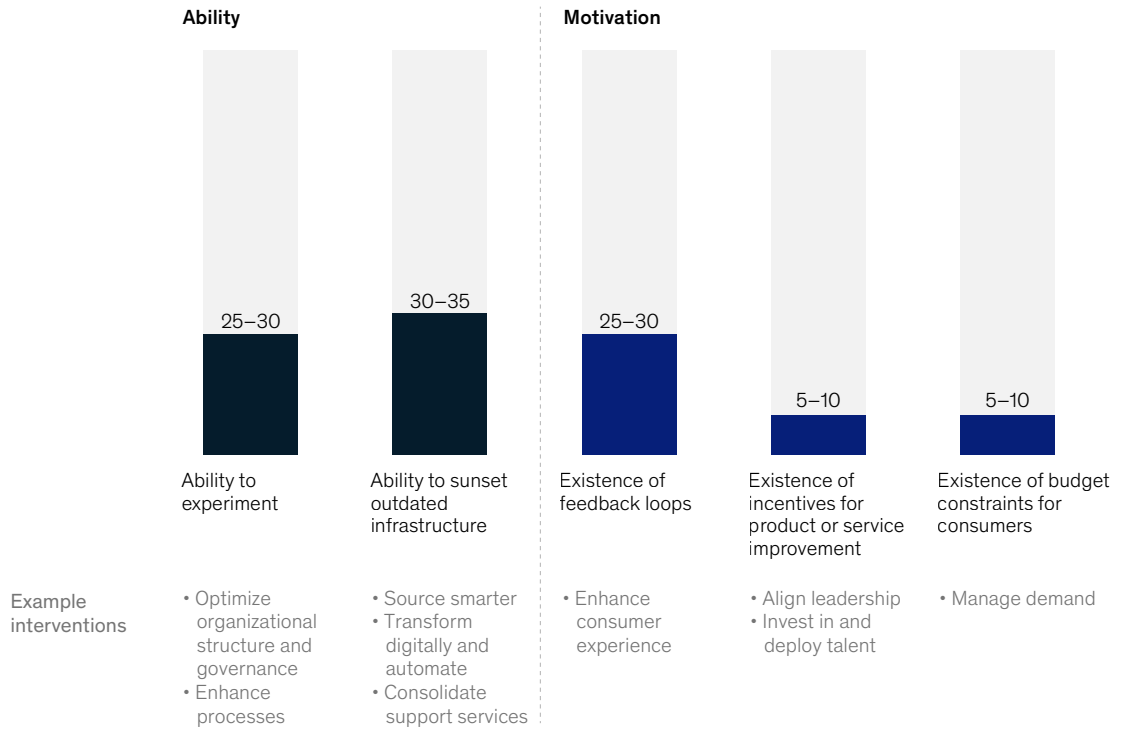**Productivity improvement opportunity by category,** $ billion
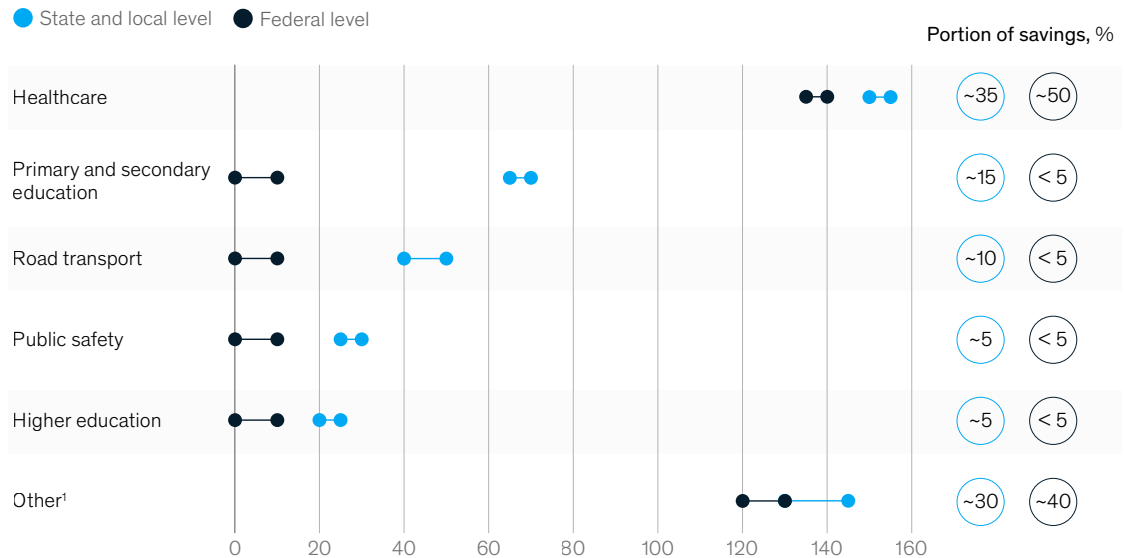
¹Spending that was unspecified or could not be further optimized in terms of operations was considered not addressable and excluded from "other" category.
Source: Centers for Disease Control and Prevention; Federal Bureau of Investigation; Federal Highway Association; National Center for Education Statistics; Office of Management and Budget; The Nation's Report Card; US Census Bureau

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[8] Nikhil R. Sahni, Maxwell Wessel, and Clayton M. Christensen, "Unleashing breakthrough innovation in government," *Stanford Social Innovation Review*, 2013, Volume 11, Number 3.

Exhibit 4

Organizations must be given both the *ability* and the *motivation* to improve.

Breakdown of productivity improvement opportunity by operational focus area, %

	Ability		**Motivation**		
	Ability to experiment	Ability to sunset outdated infrastructure	Existence of feedback loops	Existence of incentives for product or service improvement	Existence of budget constraints for consumers
	25–30	30–35	25–30	5–10	5–10
Example interventions	• Optimize organizational structure and governance • Enhance processes	• Source smarter • Transform digitally and automate • Consolidate support services	• Enhance consumer experience	• Align leadership • Invest in and deploy talent	• Manage demand

Source: Clayton M. Christensen, Nikhil R. Sahni, and Maxwell Wessel, "Unleashing breakthrough innovation in government," *Stanford Social Innovation Review*, 2013, Volume 11, Number 3

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At its core, the framework seeks to identify challenges related to an organization's *ability* to improve compared with its *motivation* to improve in the government setting. We found that more than 60 percent of the opportunity was tied to an organization's ability to improve. There are two important operational focus areas. The first is an organization's ability to experiment, which allows organizations to implement interventions such as improving processes and optimizing governance. The second is the ability to sunset outdated infrastructure, a tactic that is being employed across industries today with tools such as artificial intelligence. The inability to do this can, for example, prevent the better use of IT and automation.

A government organization's motivation to improve accounts for the remaining 40 percent or so of the opportunity. The largest operational focus area, representing more than 60 percent of the motivation opportunity, is associated with feedback loops. This refers to organizations receiving feedback on their goods or services from consumers. Proven interventions include enhancing consumer experience, which is rapidly expanding in adoption across the public sector.[9]

9 Tony D'Emidio and Jonah Wagner, "Understanding the customer experience with government," McKinsey, April 20, 2018.

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How we measured the US government productivity improvement opportunity

Previous McKinsey research established an approach for estimating the government productivity improvement opportunity.[1] This approach focuses on operational efficiency and quantifies the opportunity based on variation in quality and cost per unit.[2] In this article, we adapted this approach for the United States, analyzing the opportunity at the federal level and at the state and local level.[3] We broke down spending into six categories: healthcare, road transport, primary and secondary education, higher education, public safety, and "other."[4] In 2020, the five core categories (excluding "other") represented 22 percent of federal spending and 62 percent of state and local spending.

We used two methods to estimate the productivity improvement opportunity related to operational efficiency for each core category. We began by estimating cost per unit, which was equal to spending divided by a given unit. For each state's costs, we normalized for wage differences. To do this, we first estimated the ratio of the state's average wage to the national average. Because the amount of labor for each category will differ (healthcare tends to use more labor, while transport likely uses less), we assumed labor was half of costs and therefore applied half of the wage difference. In addition, a different denominator unit was used for each core category, such as enrolled student body in higher education and total lane miles for road transport.[5]

For the second method, we added a quality metric to the output measure, such as six-year graduation rates for higher education or violent-crime rates for public safety.[6] For state and local spending, data constraints limited us to only state-level metrics, but we applied them to local spending as well.

The following are the methods we used to arrive at the estimates reported in Exhibit 3[7]:

— *Method one.* States were ranked based on their cost per unit. States above the median cost per unit were brought down to the median. The rationale for this method was that regardless of quality of the output, the lower-performing states could become more cost efficient (Exhibit A).

— *Method two.* States were ranked based on quality of the output and then broken into quartiles. Within a given quality quartile, states above the quartile's median cost per unit were brought down to the quartile's median. The rationale for this method was that states with similar quality could more realistically achieve a similar cost per unit (Exhibit B).

The "other" category accounted for 38 percent of state and local spending and 78 percent of federal spending. We excluded unspecified areas or areas that could not be further optimized in terms of operations. This represented 47 percent and 78 percent of the "other" category, respectively. Examples of this spending included state and local insurance trust expenditures and interest on debt.

For the remaining portion of the "other" category, we associated each subcategory with one of the five core categories based on how closely they might be related. Examples of these subcategories included utilities and sewerage.[8] The core category's productivity improvement opportunity percentage was then applied to the subcategory's spending.

To understand operational challenges the US government may be facing in capturing this opportunity, we used another published framework that addresses how to improve public-sector productivity across five operational focus areas: ability to experiment, ability to sunset outdated infrastructure, existence of feedback loops, existence of incentives for goods or services improvement, and

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[1] *Government productivity: Unlocking the $3.5 trillion opportunity*, McKinsey Center for Government, April 2017.

[2] All data used for spending, outcomes, and units was from 2020 with two exceptions due to availability: outcome data for the primary- and secondary-education and public-safety categories was from 2019.

[3] Due to data limitations, state and local spending could not be split.

[4] Centers for Disease Control and Prevention; Federal Bureau of Investigation; Federal Highway Association; National Center for Education Statistics; The Nation's Report Card; US Census; White House Office of Management and Budget.

[5] The unit used for each category was total population (healthcare), total lane miles (road transport), enrolled student body (primary and secondary education), enrolled study body (higher education), and total population (public safety).

[6] The quality metric used for each category was life expectancy (healthcare), road quality scores as defined by the Federal Highway Association (road transport), eighth-grade math and reading composites as defined by the Nation's Report Card (primary and secondary education), six-year graduation rates (higher education), and violent-crime rates as defined by the Federal Bureau of Investigation (public safety).

[7] To test the robustness of this approach, versions were run with 2018 data only, as well as a time lag between cost per unit and quality of the output. The results were marginally different (3 to 8 percent), and thus we reported 2020 data throughout for consistency.

[8] For state and local spending, the "other" categories for the analysis included utilities, other education, sewerage, waste management, fire protection, judicial and legal, financial administration, air transportation, public buildings, libraries, parks and recreation, and general government administration. For federal spending, the "other" categories for the analysis included national defense, community and regional development, international affairs, and general government administration.

How we measured the US government productivity improvement opportunity (continued)

existence of budget constraints for consumers.[9] For each operational focus area, there are several improvement interventions that government leaders can pursue based on our experience with public-sector organizations. For each intervention, we estimated net savings based on observed organizational results. Interventions were then grouped against operational focus areas, and the total net potential savings were estimated. This provided a perspective on the relative importance of a given operational focus area, based on the previously deployed operational framework that we used (Exhibit 4).
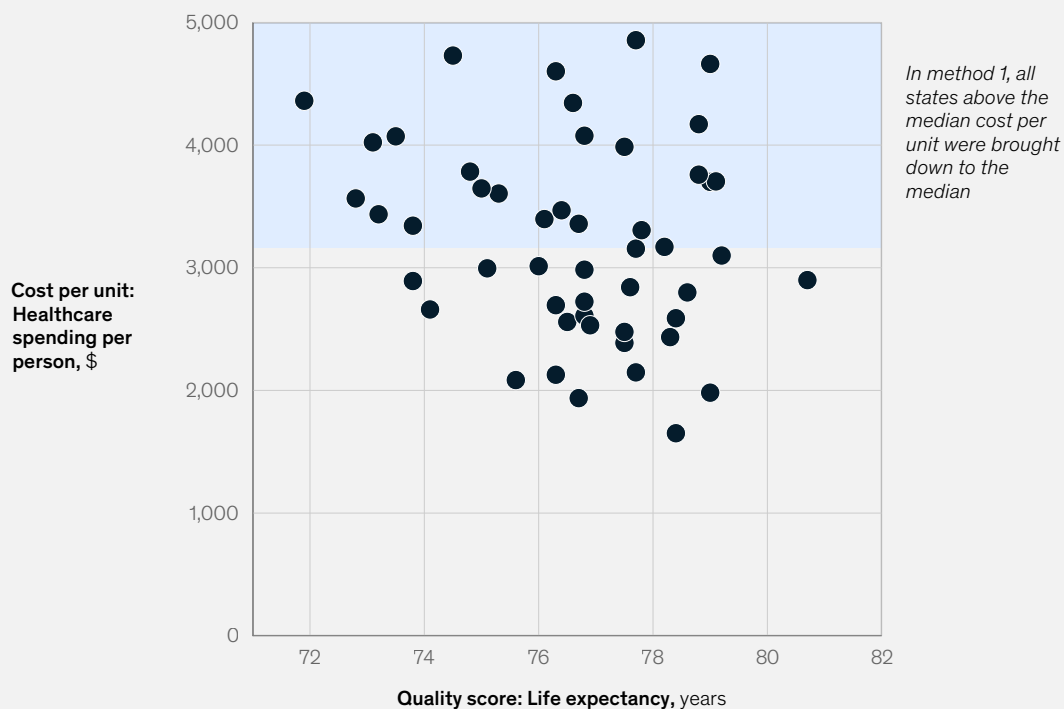
The methods used to measure the productivity improvement opportunity related to operational efficiency have limitations. First, the approach quantifies the opportunity based on variation due

Exhibit A

Our first method for estimating the productivity improvement opportunity ranked states by cost per unit.

Illustration of method 1: Healthcare example across all US states

In method 1, all states above the median cost per unit were brought down to the median

Cost per unit: Healthcare spending per person, $

Quality score: Life expectancy, years

Note: Spending was partially (50%) normalized for wages by state.
Source: Centers for Disease Control and Prevention; US Census Bureau

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[9] Nikhil R. Sahni, Maxwell Wessel, and Clayton M. Christensen, "Unleashing breakthrough innovation in government," *Stanford Social Innovation Review*, 2013, Volume 11, Number 3.

to efficiency of production, not need. For example, if two states have different rates of obesity, the need for healthcare spending will inherently be different. As a result, it may not estimate what the "appropriate" amount of spending should be. In addition, this approach does not account for structural differences between states. The approach assumes each state can reach the cost per unit of another state. However, if, for example, it costs more per lane mile for a rural location than an urban location, a state like Alaska may never reach the same level of efficiency as a state like Rhode Island. We attempted to adjust for part of this discrepancy through the wage index normalization. In the next article of this series, we will dig deeper into ways to address these limitations as we focus on how to operationalize interventions against the productivity improvement opportunity.

Exhibit B

Our second method for estimating the productivity improvement opportunity started by sorting states by quality into quartiles.

Illustration of method 2: Primary- and secondary-education example across all US states
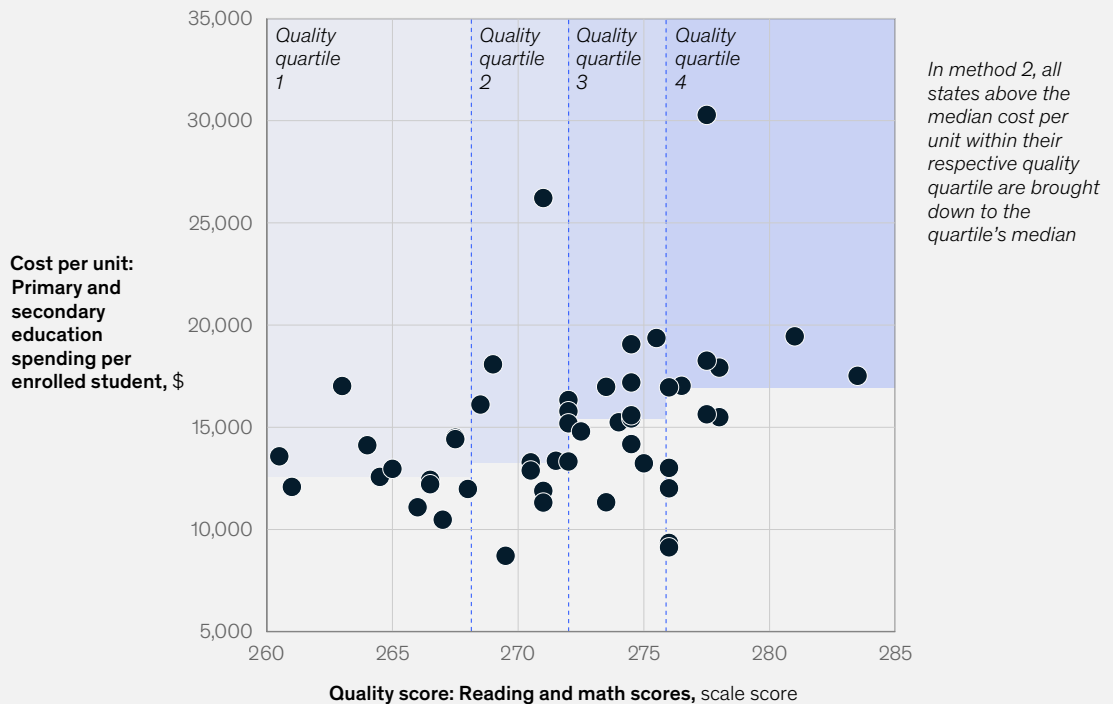
Note: Spending was partially (50%) normalized for wages by state.
Source: National Center For Education Statistics; The Nation's Report Card; US Census Bureau

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Another operational focus area related to motivation is the existence of incentives for goods or services improvement by employees. In this case, example interventions include hiring the right talent or aligning leadership on organizational outcomes.

A third motivation-related operational focus area is how to overcome a lack of budget constraints for consumers. In many cases, consumers have no choice but to deal with a government organization, such as when obtaining or renewing a driver's license. Unlike other purchasing choices, such as trading off between how much food or entertainment to purchase, these government products and services are necessities, creating no motivation to improve. Reframing the consumer's budget from cash to another metric, such as time, can generate this motivation, such as providing faster self-service options for renewing a driver's license.

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For many years, policy makers, organizational leaders, and researchers have discussed—and often largely dismissed—capturing productivity improvements in government. Using a definition and approach focused on operational efficiency, we estimated a potential $725 billion to $765 billion opportunity. We found that more than 60 percent of the opportunity could be captured by providing organizations with a greater *ability* to improve; the remainder could be captured from *motivation*. In the remaining articles in this series, we will break down the roles that government plays to better identify approaches on how to improve productivity at the organizational level.

This article is the first in a series on the US government's productivity improvement opportunity.

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Federal financial management: How governments can do more with the budgets they have

Tools that enable more agile and transparent financial management can help government leaders tie resources directly to mission outcomes, boosting the impact of taxpayer funds.

by Chris Griggs, Jihye Gyde, Chandru Krishnamurthy, and Megan McConnell

Throughout the world, people have been seeing higher prices at the grocery store, the gas pump, and elsewhere in their daily lives, and many are adjusting how they budget in response.[1] Costs are going up for federal governments too, yet agencies and departments may not register that decrease in buying power for months or even years, making it harder for them to deliver on missions and maximize the impact of taxpayer funds.

Although this current inflationary period will pass, it highlights a perennial question for government leaders: *How can we deliver more to the people we serve with the budget we have?* In our experience across the US federal government, we've heard agency heads and other leaders ask questions such as the following:

— Which costs are truly fixed and which ones are adjustable?

— What percentage of fiscal flexibility do we have in our budget and how can we double it?

— What are the true, fully loaded costs of our key outputs?

— What is driving costs up and what can we do to reduce them?

Building internal financial tools can help answer all these questions by boosting financial management agility and transparency. Government agencies have long sought to bring clarity and transparency to their large and complicated budgets; indeed, this was a major focus of congressional oversight and department-level regulations as early as the 1960s. In the 21st century, however, digital tools have opened up a new horizon of opportunity for the public sector. They can help leaders develop a "decision making" view of finances and automate reporting to "close the books" sooner, creating

more capacity for finance teams to partner with operations and tie financial resources directly to mission outcomes.

Enabling strategic decision making

For many federal agencies, the year-round activities of budgeting and ensuring legal and regulatory compliance typically absorb the bulk of the finance team's time, attention, and resources. That already considerable strain on capacity is often exacerbated by additional reporting requirements to senior, external government organizations.

However, narrowly focusing on financial compliance can obscure financial transparency, thwart agility, and stymie the potential for fruitful collaborations between the finance team and other parts of the organization. This is not to diminish the crucial role that financial transaction and process expertise play in federal agencies, but when federal finance teams are focused primarily on compliance and reporting, it's harder for them to support more strategic decision making.

To move beyond compliance, we've identified three best-practice solutions from the private sector that federal agencies and departments could consider utilizing to enhance strategic financial management.

1. *Boost internal transparency by developing a "decision making" view of finances.* Large, private-sector organizations often have robust internal reporting to build a more holistic view of funds and costs. The most ubiquitous of these tools is the "profit and loss statement," which is viewed and acted upon internally at least once a month. Other tools include budget portfolios for product and service lines, monthly spending plans, and monthly analysis comparing those plans to what was actually spent. Tools like these can foster greater financial transparency

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[1] *World economic outlook, October 2022: Countering the cost-of-living crisis*, International Monetary Fund, October 11, 2022.
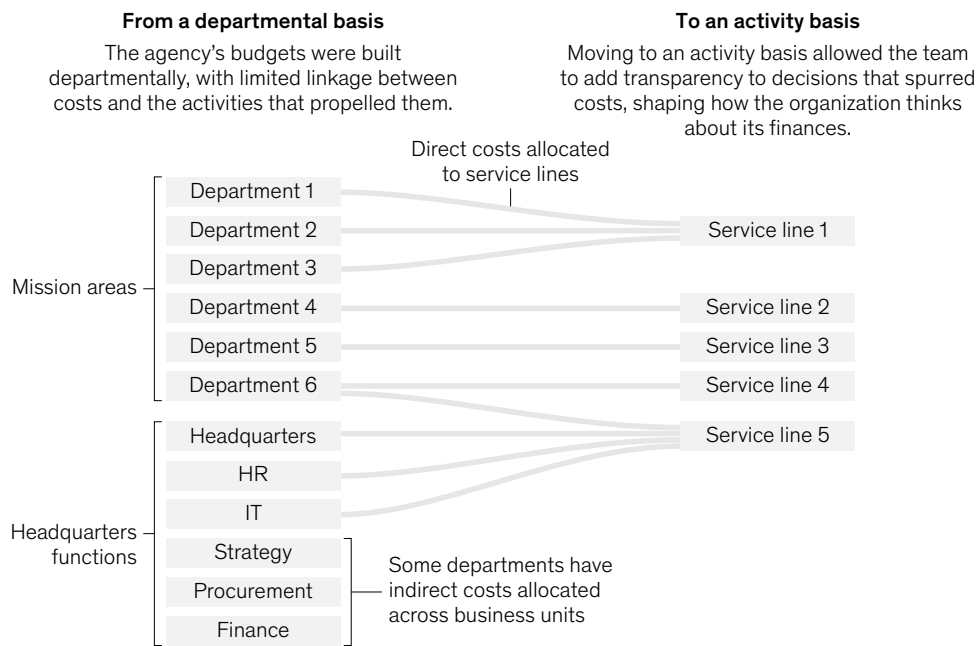
to help answer questions such as: How much additional funding will we have this year? How effective is our current spending plan? Does it match our priorities? How much is it truly costing to deliver this current product, service, or capability? These private-sector tools look and feel quite different than the reporting required of public-sector agencies for financial oversight, and given the resources required to maintain compliance with statute, it can feel difficult to add other reports and analyses to the finance team's plate. However, the strategic value of a decision-making view can begin to emerge quickly with a few key shifts.

Leaders can start building internal financial tools by organizing finances along core sets of program and mission priorities that are likely to endure as leadership, administrations, and fiscal priorities change (exhibit). These priorities can (and often are) distinct from the overarching organizational structure, but once they have been identified, financial resources can be directly linked and allocated to them to drive specific mission goals. Funding types and expenses can be segmented by program area—lines that are ideally high level enough to warrant engaging leadership, while providing enough detail to drive truly informed decision making. For example, the "revenue

Exhibit

Reorienting finances from an organizational basis to an activity basis can help federal agencies tie resources directly to mission outcomes.

Case study on reorienting finances

From a departmental basis
The agency's budgets were built departmentally, with limited linkage between costs and the activities that propelled them.

To an activity basis
Moving to an activity basis allowed the team to add transparency to decisions that spurred costs, shaping how the organization thinks about its finances.

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Automating financial reporting in full or in part helps private-sector organizations to close out their books every month, giving them near-real-time data to drive decisions.

line" could include four to seven funding types by category and source of funding. Costs can then be categorized as either "direct" or "indirect," and additional subcategories can be added that are relevant to specific organizations and program areas.

Though complex, federal agencies and departments could generate initial views of financials and start identifying opportunities within weeks. One military service organization recast its budget from a "source of funds" to "four stated missions," identified $400 million in contract savings, and improved internal discussions on balancing strategic portfolio decisions.

2. *Close the books sooner by automating data reporting.* Automating financial reporting in full or in part helps private-sector organizations to close out their books every month, giving them near-real-time data to drive decisions. Federal government agencies could do the same. Advanced tools can generate a near-real-time visualization of finances and enable deep dives to support categorization and reporting that is consistently correct.

Federal agencies could start building this capability by creating a joint finance and IT/

digital team to build bespoke, automated tools that capture data across the organization. This team is ideally helmed by a senior leader who can champion its development and convey the impact of its efforts to other agency heads. Once the team is in place, it can align on developing tools to capture and visualize core program data through an automated process. It will likely require new ways of thinking and working for these tools to reflect all the financial nuances of the organization. Notably, the optimal level of precision and detail they yield entails weighing how much effort it would take to produce those granular findings, against the level of impact that information could deliver: for example, would it make sense to invest three months of effort to yield data that is accurate down to the exact dollar?

One $40 billion government agency that developed these tools dramatically reduced the time it took to close its books, from five weeks to three days. These tools enabled leaders to know almost in real time when they were approaching overruns or underruns. In 2020, this agency achieved a 5 percent reduction in annual costs, despite unpredictable demand for its services and in the face of extreme supply chain disruptions.

3. *Create an operations-finance partnership.*
   When finance teams have more bandwidth, they can think more strategically and gain a deeper understanding of how finances affect mission outcomes. For example, the extra time and resources recaptured from automated data collection can be invested in other efforts such as working more closely with operational leaders to enhance program resilience and shifting the focus of meetings from documentation and reporting to discussing trends, opportunities, and alternative courses of action.

   Greater bandwidth can be used to strengthen the operations-finance partnerships, shifting both mindsets and capabilities. Financial and operational leadership could work together to develop a joint decision-making view—one that achieves the optimal level of detail to drive informed decisions. They can review automated visualizations monthly to compare budgeted finances to actual finances, discuss actions to adjust for in-year cost overruns or underruns, determine where resources may need to be realigned to deliver on a priority program or mission, and make other data-driven decisions. They can also compare their agency's cost structure with other organizations to identify and address inefficiencies.

   This may require reskilling members of the finance team. The approach could also be rolled out as a pilot involving one program and one conversation between finance and operations leadership. Then, as the new ways of working unfold and feedback helps improve outcomes, more programs could be added.

One military service organization recast its budget along new "mission areas" to drive investment decisions and portfolio management within its operations organization. The new financial views enabled operational leaders to better understand portfolio trade-offs and the underlying resources needed to deliver on each mission. As a result, the finance team plays an integral role in portfolio-level decisions and shaping the "out years" (three- to five-year horizon) of the organization's budget.

Similarly, one federal law enforcement agency accounts for every single dollar that has been allocated to each of its mission areas in its end-of-year financial report. This allows the agency to view its portfolio based on mission outcomes over time and, if necessary, make trade-offs across and within each of them.

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Navigating a complex and ever-changing financial landscape is challenging, especially when organizational resources are not tied directly to desired outcomes. For many federal agencies, closing the gap between resourcing decisions and mission impacts could help them deliver more with the budgets they have. Building internal financial tools, automating capabilities, and creating a joint finance and operations team can serve as initial steps to guide their efforts, and help them achieve greater financial transparency, agility, and impact for the American people.

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Inclusive infrastructure investment: How to empower communities

With more than $2 trillion in federal funding entering the US economy, three steps can help governments meet the needs of communities previously excluded from federal funding implementation decisions.

This article is a collaborative effort by Henry Feldman, Danielle Hinton, Adi Kumar, Nehal Mehta, and Kunal Modi, representing views from McKinsey's Public Sector Practice.

Since November 2021, Congress has passed three landmark investment bills—the Bipartisan Infrastructure Law (BIL), the Inflation Reduction Act (IRA), and the CHIPS and Science Act (CHIPS)—directing more than $2 trillion in investment to bolster physical infrastructure, promote innovation and economic competitiveness, and shore up the domestic industrial base.[1] This suite of legislation also aims to redress long-standing inequalities by laying a stronger foundation for sustainable and inclusive growth. Two of these laws in particular—the BIL and the IRA—present a unique opportunity for public leaders to adopt a customer-centric approach to infrastructure strategy to ensure that communities and other stakeholders that historically had little to no say over large-scale projects are included in decision making and empowered to pursue funding opportunities.

While the BIL allocates a majority of its funding by applying a fixed formula, the law is distinct from past investments in that roughly 40 percent of all net new grant funding opportunities are available through competitive application processes.[2] These competitive opportunities encompass more than $180 billion in available grant money—a resource pool that can empower state and local governments to develop infrastructure strategies that address the needs of all residents, including marginalized communities. These opportunities are further amplified by an additional $80 billion in competitive grants from the IRA.

Government leaders can approach funding pursuit and deployment from a customer-centric perspective by engaging communities that have been underrepresented in shaping public works. Our recent State of the States research, which surveyed 80,000 Americans across all 50 states, found that residents' experiences with government services can vary significantly within states depending on their identity, location, and access to resources.[3] A relentless focus on customer experience could therefore help anchor state-level priorities in residents' core pain points and maximize the impact of federal dollars.[4]

State leaders may face significant challenges in engaging a diverse range of voices in making plans and decisions about public investment. Public-works projects with negative second- and third-order effects are seared into the collective memory, leading to mistrust and skepticism that these projects could have a positive impact on the lives and livelihoods of all residents.

There can also be resistance, with communities objecting to projects that are close to home and citing disruptions to neighborhoods and ecosystems.

To navigate these challenges and harness federal infrastructure funds in the service of sustainable, inclusive economic growth, state leaders could consider three actions: identifying a broad range of state-specific stakeholders, including those that represent marginalized groups; optimizing funding by providing targeted support to critical stakeholders as they pursue competitive grant opportunities; and considering proactive steps to promote transparency at each stage of the infrastructure investment journey.

Identifying and engaging stakeholders

State leaders could begin the infrastructure investment and delivery journey by gathering investment ideas from critical stakeholders and generating community buy-in. This approach could help build greater trust between policy makers and communities that have been historically left out of infrastructure decisions. State-specific stakeholders could include eligible recipients of funding (for example, municipal governments, public utilities, and federally recognized tribes) as well as the residents represented by these recipients.

[1] "The Inflation Reduction Act: Here's what's in it," McKinsey, October 24, 2022.
[2] "A new era of US infrastructure grants," McKinsey, May 20, 2022.
[3] Ashka Dave, Marcy Jacobs, Kunal Modi, and Sarah Tucker-Ray, "Governments can deliver exceptional customer experiences—here's how," McKinsey, November 16, 2022.
[4] "The call to rethink government customer experience," McKinsey, July 28, 2022.

To begin identifying and mapping these critical stakeholders, state leaders could blend a data-driven perspective—informed by publicly available sources—with qualitative insights. For example, the Council on Environmental Quality's Climate and Economic Justice Screening Tool collects data across eight categories (including climate change, energy, and health) to help policy makers identify underserved communities that could benefit from public infrastructure investment.[5] A data-driven approach can also help policy makers deliver on the federal government's Justice40 Initiative, which aims to have at least 40 percent of the benefits from major federal investments flow to disadvantaged communities.[6]

Another resource to consider is the Transportation Disadvantaged Census Tracts tool created by the US Department of Transportation.[7] The geospatial mapping tool uses American Community Survey and US Census data to identify disadvantaged census tracts across six key indicators (for example, transportation access disadvantage) and can help policy makers pinpoint areas in which infrastructure investment has not kept pace with more affluent communities.[8]

Once state leaders have built a data-driven perspective on underserved municipalities with pressing infrastructure needs, public affairs staff could collaborate with municipal governments to identify partners in these areas that are best positioned to represent their communities, including not-for-profits, civic organizations, small

businesses, and religious institutions. Recognizing the nuances and needs of specific communities could make outreach more effective and help states build trust-based relationships early in the infrastructure investment journey (see sidebar, "Engaging tribal nations").

Once infrastructure stakeholders have been identified, engaging them meaningfully could be informed by five key considerations:

— *Objectives.* First, leaders can clarify their objectives to inform selection of a particular engagement strategy. If a state is trying to reconcile competing investment priorities, an infrastructure task force with committees focused on specific asset classes (such as transportation, energy, or broadband) or broader thematic priorities (such as sustainability or equity) could help structure and accelerate decision making.

— *Trust.* Standard channels and formats for engaging communities could be insufficient, especially for groups with low trust in government. Leaders could consider partnering with trusted local organizations, including not-for-profits and other community anchor institutions, to facilitate meaningful engagement with marginalized communities. State and local leaders could ask key questions such as the following: Which organizations and leaders meaningfully serve and understand the needs and aspirations of communities? How can we

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[5] "Climate and Economic Justice Screening Tool," Council on Environmental Quality, updated November 22, 2022. The eight categories are climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.

[6] President Biden's executive order on tackling the climate crisis created the Justice40 initiative in 2021 to orient federal stakeholders toward a goal that 40 percent of the benefits of federal investments flow to disadvantaged communities. See "Justice40: A whole-of-government initiative," White House, accessed July 20, 2023; and "Executive order on tackling the climate crisis at home and abroad," White House, January 27, 2021.

[7] "Transportation Disadvantaged Census Tracts (Historically Disadvantaged Communities)," US Department of Transportation, accessed July 20, 2023.

[8] The six key indicators are transportation access disadvantage, health disadvantage, environmental disadvantage, economic disadvantage, resilience disadvantage, and equity disadvantage.

Engaging tribal nations

As state leaders begin reaching out to a diverse range of communities, it is important to create opportunities for meaningful engagement at each stage of the infrastructure investment and delivery journey. For example, tribal leaders have shared that they want to be engaged throughout the decision-making process and collaborate closely on capital planning and grant prioritization. To set the stage for a constructive partnership, state leaders could consider appointing a dedicated tribal infrastructure liaison to streamline communication and foster inclusive decision making. Going above and beyond existing approaches to tribal consultation could help build trust and convey a level of seriousness about the state's collaborative vision. The tribal infrastructure liaison may consider engaging with intertribal organizations as an intermediary between the state and federally recognized tribes, especially given frequent turnover in tribal leadership. Holding events in community spaces on tribal lands can also increase participation and awareness. Finally, beyond engaging tribes themselves, state leaders could build and maintain support for tribal projects by emphasizing that investments in tribal communities may confer benefits on all residents who commute through or work on tribal lands.

ensure that they have a seat at the table, that their voices are heard, and that they are included in decision making?

— *Communication.* How can state leaders reach critical stakeholder groups in the first place? What messages are most important to communicate to them? Is the format or channel conducive to conveying these messages?

— *Visibility.* Participation often hinges on awareness of outreach initiatives. A key factor for leaders to consider is what type of external attention this format or channel will draw.

— *Access.* Enabling community members to participate in outreach initiatives is another critical success factor. Leaders can consider the following questions: Are these outreach initiatives planned during a time of day when individuals from a range of socioeconomic backgrounds can participate? Could the event be held in a virtual or hybrid format? Could the organizers provide resources such as food and childcare to make the event more accessible? Could existing state programs that are effective in reaching target populations be leveraged to gather input?

Providing hands-on support to stakeholders

Because new federal funding allows a diverse range of entities (such as states, local governments, tribal governments, utilities, not-for-profits, and research institutions) to apply for competitive grants (both directly and as subgrantees), state leaders could help optimize the flow of funds into their state by providing hands-on support to critical stakeholders. For instance, the executive director of a digital equity not-for-profit told us that states could help

alleviate resource constraints for small not-for-profits by managing the administrative side of grant applications and providing support with reporting during project implementation. By taking a direct role in the application process, state leaders could help direct federal funds to grassroots organizations that are working directly with communities, increasing the overall flow of funds into the state's economy (that is, beyond grants that go directly to the state government).

When deciding how to structure support, state leaders could take stock of the common challenges that applicants face when pursuing competitive funding opportunities:

— *Access to information.* Keeping up to date with the latest eligibility requirements and funding deadlines can be challenging, given rapidly evolving funding environments.[9]

— *Technical expertise.* Creating compelling, data-supported applications with visual materials requires technical expertise. This expertise may vary considerably among applicants.

— *Capacity.* In-house grant writing staff may be overburdened, and capacity may be constrained. Additional project management resources may also be scarce, making it difficult to complete the large amounts of paperwork required for applications.

— *Credibility.* Getting approval from state governments through letters of support may be challenging for smaller entities. Without sponsorship from states, grant applications may struggle to attract attention from federal agencies.

State leaders could help optimize the flow of funds into their state by providing hands-on support to critical stakeholders.

9 "BIL Navigator," McKinsey, accessed July 20, 2023.

Three models, pursued together, could help support stakeholders to overcome these common grant application challenges:

1. Centralized assistance

States could centralize their technical-assistance services. For example, support centers with dedicated staff—grant writers, technical experts, and communications professionals—could help stakeholders secure funding for infrastructure projects (Exhibit 1). Support centers could be particularly helpful when federal support is lacking or when state officials want to play an active role in guiding the application process. They could also help stakeholders comply with eligibility requirements, establish performance management processes, and build credibility with federal agencies (for instance, through letters of support). To operationalize this approach, states could take inspiration from federal agencies with experience providing technical assistance. For example, the Environmental Protection Agency (EPA) has created 29 environmental finance centers to help disadvantaged communities access grants for clean water, clean air, and greenhouse-gas reduction; technical assistance includes hands-on support for project proposals and grant applications.[10]
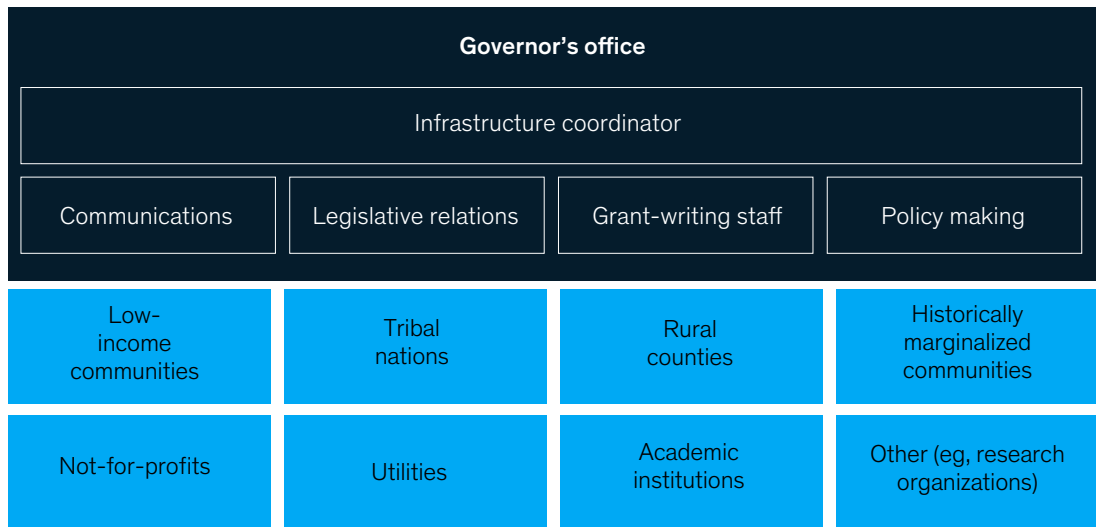
2. Convening stakeholders with shared interests

Without coordination, different groups within a state could end up applying for the same funding, potentially canceling each other out or missing opportunities that are more suited to their needs. By convening stakeholders with common or

Exhibit 1

Centralized technical assistance and support could help stakeholders secure funding for infrastructure projects.

Centralized technical assistance and support model

Governor's office			
Infrastructure coordinator			
Communications	Legislative relations	Grant-writing staff	Policy making

Low-income communities	Tribal nations	Rural counties	Historically marginalized communities
Not-for-profits	Utilities	Academic institutions	Other (eg, research organizations)

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[10]"Environmental finance centers," US EPA, updated June 21, 2023; "EPA selects 29 finance centers to receive grants, provide technical assistance," *Water Finance & Management*, November 14, 2022.

overlapping interests, state leaders could facilitate discussions about which projects to prioritize and even increase awareness of other funding opportunities (Exhibit 2).

For example, the Abandoned Mines Reclamation Program uses fees paid by currently operational coal mining companies to reclaim coal mines abandoned before 1977, making these areas safer for people and the environment. Bringing together groups that focus on watersheds, recreation, or conservation could enable state leaders to identify applications with the most impact and plan strategically to maximize the opportunity to reclaim coal mines. Convening critical stakeholders can also be an effective way to provide technical assistance at scale. For example, the Alabama Department of Economic and Community Affairs

(ADECA) is conducting a series of meetings across the state to help local governments and other stakeholders prepare for and access federal broadband grants (such as the Broadband Equity, Access, and Deployment Program or the Digital Equity Act).[11] Beyond promoting awareness, ADECA is supporting local stakeholders with mapping, planning, data collection, and overall strategy.

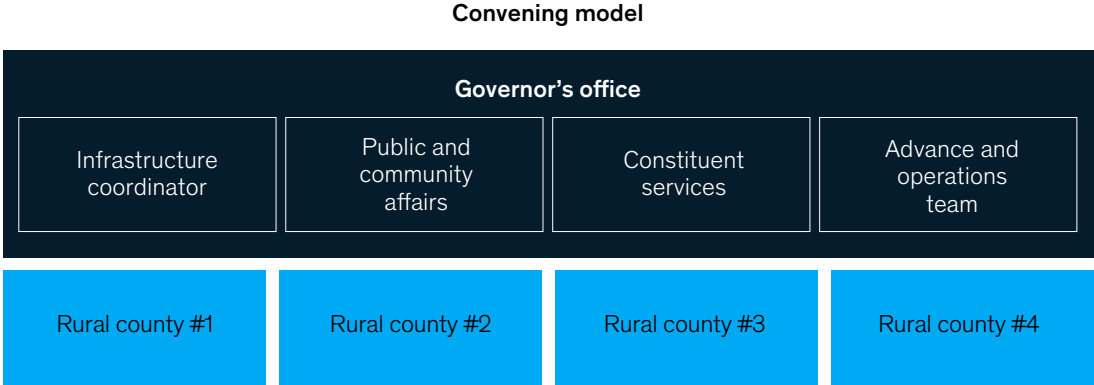### 3. Forming partnerships between states and stakeholders

States could also consider forming partnerships with a variety of stakeholders (Exhibit 3). These partnerships can take a number of forms:

State and critical stakeholder. When both the state and another critical stakeholder (such as an industry representative or a not-for-profit) are eligible for

Exhibit 2

State leaders could convene stakeholders to facilitate discussion and prevent missed opportunities.

■ Rural county with limited broadband infrastructure or access

Convening model

Governor's office			
Infrastructure coordinator	Public and community affairs	Constituent services	Advance and operations team

Rural county #1	Rural county #2	Rural county #3	Rural county #4

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[11] "Governor Ivey kicks off first of 67 county meetings to bring broadband to communities across the state," Office of Alabama Governor Kay Ivey, December 12, 2022.

Exhibit 3

States could consider forming partnerships with different stakeholders to pursue competitive funding opportunities.

State and critical stakeholder	State and subgrantee	State to state (regional)
State — Critical stake-holder	State / Subgrantee	State #1 — State #2 — State #3
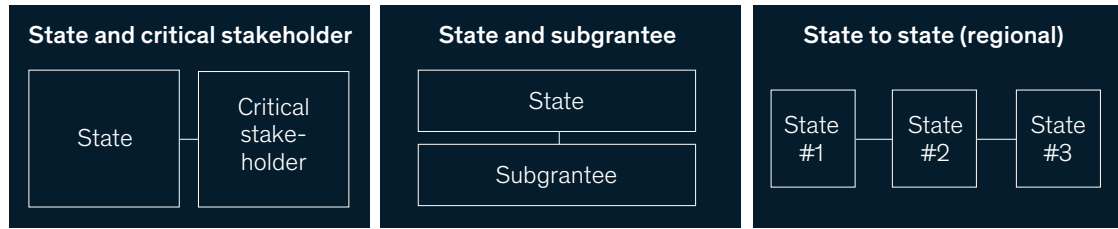
Source: US Senate H.R. 3684, Bipartisan Infrastructure Law

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a certain kind of funding, they could apply jointly. Depending on the grant program, the state may choose to form a partnership with multiple groups. For example, the Consolidated Rail Infrastructure and Safety Improvement grant program aims to improve the safety and efficiency of passenger and freight rail. States could partner with Amtrak, Class II or Class III railroads, rail equipment manufacturers, universities, and not-for-profits to support shared research, safety, or workforce development goals.[12]

State and subgrantee. This approach could allow states to gather input from potential subgrantees and applicants during the planning process, which can be required to unlock the state's competitive or formula infrastructure funding. States could start by identifying programs in which the state receives funds initially but is later responsible for providing grants to other entities. The Small, Underserved, and Disadvantaged Communities grant program of the Water Infrastructure Improvements for the Nation Act is one such

example. While this is not a competitive program, states are required to submit draft work plans to confirm that the eventual use of funds aligns with the requirements of the program.[13] Coordinating early and often with underserved communities can help ensure that these investments in water infrastructure address the most pressing contamination and water quality issues.

State to state. State-to-state relationships could allow states to collaborate on complex grant applications for which implementation will cross state borders, such as interstate highway projects. Another example is the $8 billion Regional Clean Hydrogen Hubs program. Under the BIL, the Department of Energy is offering grants to industry, utilities, state and local governments, and other entities to improve clean-hydrogen production, processing, delivery, storage, and end use. Given that Regional Clean Hydrogen Hubs grants will be awarded to different regions of the country, states could form partnerships or coalitions to capitalize

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[12]See "Consolidated Rail Infrastructure and Safety Improvement Grants" in *Building a better America: A guidebook to the Bipartisan Infrastructure Law for state, local, tribal, and territorial governments, and other partners*, White House, accessed July 20, 2023.
[13]"WIIN Grant: Small, Underserved, and Disadvantaged Communities Grant Program," US EPA, accessed July 20, 2023.

on each state's distinct advantages (for instance, talent, infrastructure, or feedstock diversity).[14] By working together, states could increase the overall competitiveness of applications and drive regional economic growth.

Communicating transparently during implementation

During project implementation, state leaders could take proactive steps to share information, promote transparency, and generate buy-in. Interactive, public-facing dashboards provide a high-impact way of engaging the public and could be linked to internal performance management infrastructure to create a single source of truth and minimize reporting friction. Public-facing dashboards could support transparency throughout the infrastructure investment and delivery journey by raising awareness of the following:

— *potential opportunities:* formula and competitive grant programs available to critical stakeholders across the state, along with key deadlines and eligibility requirements

— *intake:* formula and competitive grant money flowing into the state

— *expectations and progress:* timelines for project delivery, including delays and budgeting updates

— *disruptions:* major planned disruptions due to project delivery, and planned resolutions (for example, alternative routes during construction on a major highway)

— *impact:* how the state is tracking against key benchmarks and equity goals (for example, the percentage of residents who have gained broadband access or the number of lead pipes replaced)

Interactive, public-facing dashboards provide a high-impact way of engaging the public.

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[14]For example, see "Wisconsin, other Midwest states announce plans to form hydrogen coalition," WisBusiness.com, September 20, 2022.

To be sure, dashboards and other forms of digital engagement are not a substitute for traditional, nondigital channels, especially given the digital divide and its disproportional impact on marginalized communities.[15] However, by centralizing information and tracking progress, dashboards can help promote accountability and advance key equity goals. States looking to implement this approach could look to Utah's IIJA Opportunity Tracker for inspiration.[16]

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There is no single standard formula for engaging stakeholders successfully, but state leaders could draw on best practices in customer experience to ensure that infrastructure investments yield positive benefits for all residents. Taking a data-informed, human-centered approach to identifying stakeholders, choosing inclusive formats for engagement, providing hands-on support, and promoting transparency during project execution could help state leaders connect infrastructure investments to the lived experience of residents and set a new bar for effectively implementing federal programs.

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[15]"Closing the digital divide in Black America," McKinsey, January 18, 2023.
[16]See "IIJA Opportunity Tracker," Governor's Office of Planning & Budget, accessed July 20, 2023.

Building innovation ecosystems: Accelerating tech hub growth

Innovation ecosystems can generate economic, financial, and social benefits for all, and there's new federal funding to build them. A six-step playbook could help leaders get them right.

by Cameron Davis, Ben Safran, Rachel Schaff, and Lauren Yayboke

Across the United States, from urban to rural areas, public- and private-sector leaders are coming together to build innovation hubs. Relative upstarts such as the Indianapolis 16 Tech Innovation District and Tulsa Innovation Labs are positioning themselves as new centers of innovation, drawing inspiration from established ones such as Silicon Valley and Boston. Currently, the opportunity to launch new hubs is especially ripe given there is nearly $2 trillion in new federal funding designed to boost US innovation, competitiveness, and national security over the next decade.

Innovation hubs are geographic areas that bring together R&D institutions (such as tech-enabled corporations, universities, and medical facilities), as well as venture capital, incubators, and start-ups. They fall into three categories: smaller districts, midsize tech hubs, and larger cross-regional ecosystems, with the latter being by far the most complex but potentially impactful (see sidebar "Ecosystems, hubs, and districts: A short primer").

Think tanks and businesses have published papers defining the value proposition of innovation hubs and offering ways for companies to participate in the hubs that already exist. While these papers generally address the *what* and the *why*, this article builds on those perspectives to explore *how* public- and private-sector leaders could launch and scale an innovation ecosystem anchored in existing regional assets or accelerate efforts that are already underway.

Below, we outline the potential benefits of innovation hubs and offer six essential steps that leaders can consider for building and nurturing an ecosystem that promotes vibrancy, attracts top talent, and creates new and significant opportunities for economic and social development. The playbook we've created is based on our experience designing and developing best-in-class ecosystems and on our data analysis of more than 100 innovation districts and tech hubs. It addresses key elements of building an innovation hub including

Ecosystems, hubs, and districts: A short primer

When discussing how to build communities for innovation, it is useful to establish what we mean by these terms.

Innovation districts, the oldest of the three, were highlighted as a growing trend for much of the 2000s. The Brookings Institution, in 2014, defined them as "geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators and accelerators. They are also physically compact, transit-accessible, and technically wired [with] mixed-use housing, office, and retail."[1] The Global

Institute on Innovation Districts, which leads the analysis of innovation districts globally, was founded in 2018. It defines them as "new geographies of innovation emerging primarily in cities and urbanizing areas" and estimates that there are more than 100 of them around the world.[2]

Innovation hubs are somewhere between districts and ecosystems. *Nature* magazine, in its "Global Innovation Hubs Index" (2020), opened with this definition: "cities or metropolitan areas that can lead the flow of global innovation elements and influence the efficiency

of resource allocation, drawing on their unique advantages in science and technology innovation."[3]

Innovation ecosystems are the newest of the three tech hub archetypes. The *MIT Sloan Management Review* defined innovation ecosystems in 2022 as "places that engage five stakeholder types—research institutions, entrepreneurs, corporations, investors, and governments—linked by a strong social fabric of mutual interest, complementary needs and resources, and trust."[4]

[1] Bruce Katz and Julie Wagner, "The rise of innovation districts: A new geography of innovation in America," Brookings, May 2014.
[2] "The ambition," Global Institute on Innovation Districts, 2022.
[3] "Global innovation hubs index," *Nature*, 2020.
[4] Philip Budden and Fiona Murray, "Strategically engaging with innovation ecosystems," *MIT Sloan Management Review*, July 20, 2022.

Innovation hubs open new avenues for healthier, more diverse, and more connected communities.

prioritizing sectors, attracting talent and investment capital, mapping strengths and opportunities, and identifying ways to support the effort.

Creating an innovation ecosystem is a significant undertaking, and success often pivots on how well those who lead it build relationships with new and established companies and institutions, fill gaps in the business landscape through investment, and address the specific needs of workers and residents.

Why innovation hubs matter

Spanning high-value, research-oriented sectors from aerospace to life sciences to software, innovation hubs generate attention and investment for a reason. Annual productivity growth for US innovation industries has averaged 2.7 percent since 1980—nearly double the rate of all other sectors. These industries also claim 60 percent of US exports, boast 80 percent of US engineers and patents, and attract workers with above-average earnings—generating even more jobs for the communities where they are located.[1] Innovation hubs have higher commercial-rent growth rates than adjacent business districts: 5.3 percent from 2010 to 2020, compared with 4.8 percent, respectively.[2] They outperform other regions and business districts economically, financially, and

socially. In the most successful examples, the unifying, mission-driven spaces they create open new avenues for healthier, more diverse, and more connected communities.

There are compelling reasons to focus on innovation hubs now. In 2021 and 2022, the federal government passed a suite of legislation that aims to bolster the resilience of the US supply chain, promote the development of high-tech innovation clusters, and extend services and infrastructure to rural communities. Leaders can help finance and jump-start the development of an innovation ecosystem by taking advantage of competitive grants to regional innovation ecosystems and of legislation such as the CHIPS & Science Act, which creates incentives for domestic semiconductor manufacturing and authorizes funding for programs such as the National Science Foundation's Regional Innovation Engines.

Six essentials: The innovation ecosystem playbook

Innovation hubs typically fall into one of three categories—districts, tech hubs, and ecosystems—that vary according to scale, levels of collaboration, and reach. Ecosystems are the newest of these, and definitions are evolving (see sidebar "Categorizing innovation districts, tech hubs, and ecosystems").

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[1] David M. Hart, Siddharth Kulkarni, and Mark Muro, "America's advanced industries: New trends," Brookings, August 4, 2016.
[2] McKinsey analysis.

Categorizing innovation districts, tech hubs, and ecosystems

Innovation districts occupy a specific neighborhood or business districts within urban areas. Hubs are often similar in size but sometimes extend to multiple neighborhoods or the larger part of a city. Ecosystems are far more flexible but tend to be larger, enveloping whole cities or even crossing county and state lines. Given their size and conducive environment, ecosystems often give rise to (and ultimately house) hubs or districts with more defined mandates.

There's similar split in collaboration for scaling. To grow, districts and hubs must generally garner excitement and buy-in from employees, faculty, or neighborhood residents. Ecosystems usually also need governments to play a strong role—for example, through tax incentives or capital investment. Often, they require cross-institutional collaboration to support new technologies across the innovation funnel and to share facilities that catalyze innovation.

The leadership structure also differs. A single actor (for example, a real-estate developer, a university, or a large philanthropic foundation built for purpose) can often lead districts and hubs successfully because they tend to focus on just one or two industries or functions. An ecosystem's complexity calls for more diverse stakeholders (developers, education institutions, private companies, and governments) that take the reins together to generate ideas, solve problems, and enable something special.

Broadly speaking, in addition to prioritizing technology-centered R&D, investment, and growth, these ecosystems usually feature assets such as robust mobility options (including public transit), as well as a strong technological infrastructure and accessible spaces to play, connect, and live. All this promotes inclusive and equitable economic growth, innovation, and productivity (see sidebar "Research Triangle Park").

Public- and private-sector leaders could consider following a six-step approach to create and expand a thriving innovation ecosystem (Exhibit 1). A community-building program in a district will look quite different from one at an ecosystem, for example—but the playbook's essentials remain the same across the spectrum of innovation hubs.

1. Set the aspiration and a bold vision
Innovation ecosystems that struggle to succeed often underdeliver on the first playbook element:

a strong identity rooted in a clear aspiration and forward-looking goals that build broad stakeholder excitement and buy-in. Defining a unique, differentiated identity and brand crystallizes an ecosystem's intangibles, such as livability or regulatory stability. It establishes a value proposition for people and businesses alike. It also sets the stage for defining short- and long-term success metrics, helping to maintain the focus on why the ecosystem exists. It is the vision—backed by core competencies, specific strengths, and culturally consistent themes—that distinguishes one ecosystem from the others.

Aspirations can vary. Cortex, in St. Louis, aspires to be an "inclusive economic engine" for the region, linking success to outcomes beyond just financial returns,[3] while Virginia's Commonwealth Cyber Initiative is anchored in growing a specific sector. But when leaders establish an aspirational identity that resonates with employees and organizations,

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[3] "Accelerating inclusive economic growth in St. Louis," Cortex Innovation Community, July 13, 2022.

Exhibit 1

The innovation ecosystem playbook comprises six key actions.

Aspiration and bold vision setting
("North Star" that informs all other elements)

Cluster and partner strategy

Capital and funding[1]

Talent and community building

Real estate, infrastructure, and placemaking

Diversity, equity, and inclusion

[1]Eg, venture capital, business/academic R&D, federal funding.

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people become excited about pioneering new models for working, collaborating, and living.

Boston is a prime example of an ecosystem based on an ambitious goal: to define its "place, people, and purpose as the capital of scientific revolution."[4] Taking advantage of its wealth of universities (including Harvard and the Massachusetts Institute of Technology),

as well as leading institutions such as Mass General and Brigham and Women's Hospital, the city government set out to work closely with entrepreneurs, developers, and leaders across sectors to define its ambitions. In turn, the city as an ecosystem has been able to support smaller, more defined innovation districts within its sphere, including Seaport, South Station, Kendall Square, and Back Bay/South End (Exhibit 2).

Research Triangle Park

The ecosystem that quickly became the largest research park in the United States, Research Triangle Park (RTP), in North Carolina, started to develop in the 20th century. RTP harnessed its three academic anchor institutions—Duke University, the University of North Carolina at Chapel Hill, and North Carolina State University—to build a thriving innovation ecosystem in collaboration with local and state governments, business interests, and venture capital.

Although RTP began with a focus on biotechnology, life sciences, and microelectronics, it now has 300 companies across all sectors and more than 50,000 employees, who have collectively contributed to more than 3,000 patents. RTP also boasts apartment buildings that prioritize holistic living, efficient transit options, and even entire self-contained sports leagues. The ecosystem is supported by close collaboration among private-, social-,

and public-sector leaders. RTP companies and universities collectively spend $6 billion a year on research expenditures within the ecosystem. North Carolina's state government and the counties in the ecosystem support companies with competitive tax rates and incentive programs.

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[4] "The capital of scientific revolution," Massachusetts Life Sciences Center.

Exhibit 2

Greater Boston is a prime example of an innovation ecosystem supporting multiple smaller districts.

Boston area innovation hubs, nonexhaustive

● Cultural and entertainment facilities   ● Innovation centers   ⌁ 4,000 foot radius

● Education facilities   ● Hospital

CAMBRIDGE

Seaport district

BOSTON

Kendall Square district

Feet
0   2,000
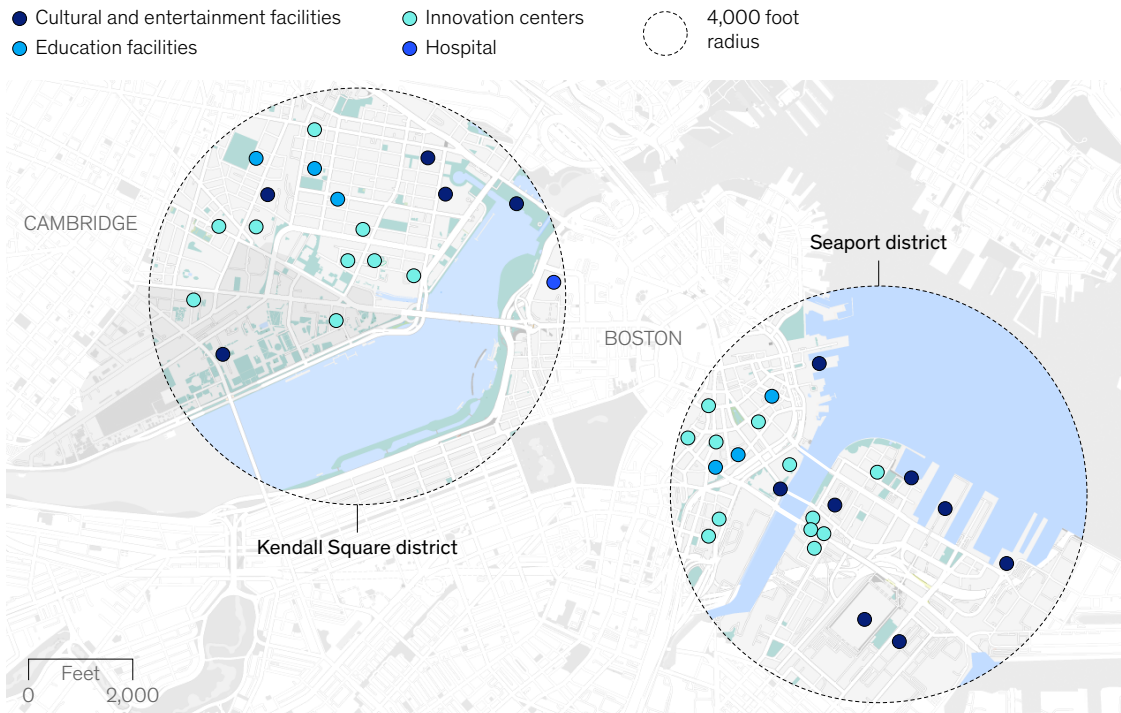
Source: *Place-based innovation ecosystems: Boston–Cambridge innovation districts*, Joint Research Centre, April 17, 2019

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2. Focus on specific sectors, partners, and anchor tenants

We've found that innovation ecosystems are more likely to thrive when local leaders and developers play to a region's existing skill base and institutional strengths. Ecosystems can focus on specific sectors and subsectors—for example, electric vehicles, advanced air mobility, or medical devices. Or they can focus on functions, such as artificial intelligence or the Internet of Things (IoT), across multiple sectors. Or they can live at the intersection of sectors and functions, as life science R&D and agricultural technology do.

Two questions can help leaders identify a region's value proposition and ideal anchor institutions: What unique areas of competitive advantage can the region pursue? And which universities, research institutions, incubators and investors, and businesses could be anchor institutions?

Some regions may be primed for a "right to win" approach, which builds off existing sector-based assets to anchor an ecosystem in an area of advantage. These existing assets could include areas of specialization, talent pipelines fed by higher-education and research institutions,

Innovation ecosystems are more likely to thrive when local leaders and developers play to a region's existing skill base and institutional strengths.

emerging venture capital (VC) capabilities, or infrastructure (such as proximity to farmland, specific transit options, or urban density).

Alternatively, leaders could pursue a "want to win" approach, which creates an area of advantage by leveraging current conditions and trends to drive investment. These conditions and trends can be identified by analyzing projected growth for a particular sector, function, or intersection; major disrupters; and other factors that could influence growth trajectories (such as technology trends, supply chain disruptions, or federal funding). It can be tempting to zero in on hot industries, regardless of an area's assets and strengths, but leaders could benefit from thinking like creators of coherent economic clusters—interconnected and intentional groups of employees, tenants, firms, and institutions.[5]

The approach used to identify a unique value proposition can also be applied to anchor institutions. One of them may already exist in the region. But such an institution could also be attracted to it—for example, a large company that's looking to tap into local start-ups for new capabilities and paid pilots, or a university that

wants to expand its teaching and research facilities. The range of options may seem overwhelming, but large-scale developers can home in on an ideal candidate by considering factors such as revenues, growth, the total number of employees, and private versus nonprofit status. The process can be both iterative and opportunistic—testing multiple value propositions in the market to see where interest sparks and then refining the results.

Such intentionality in cluster and subsector design is evident in some of the largest innovation ecosystems currently being developed. National Landing, for example, is a 17-million-square-foot development spanning multiple Arlington County neighborhoods (including Pentagon City, Crystal City, and Potomac Yard) just outside Washington, DC. The ecosystem has secured the location for Amazon's HQ2 campus. National Landing clearly focuses on technology and the region's related expertise—including IoT, cybersecurity, and cloud computing. By building on two newly attracted anchor tenants (Amazon and Virginia Tech), National Landing has expanded its technology-focused footprint considerably. It has created enough space to accommodate 25,000 new employees and the follow-on economic growth.[6]

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[5] Smaller-scale initiatives, such as neighborhood innovation districts, often require greater refinement—for example, an on-campus research center rather than a broader life sciences regional ecosystem.

[6] "National Landing bid releases study, new data defining the region as one of the nation's leading innovation districts," National Landing, April 11, 2022.

3. Catalyze a critical mass of VC capital and start-ups through a strong innovation backbone

Start-ups and early-stage companies often develop cutting-edge ideas with the potential for real financial and economic returns. Innovation ecosystems can boost their chances of success if they catalyze a critical mass of start-ups and VC funding by developing a "backbone" across the four key areas of the integrated innovation funnel—the generation of ideas and R&D, commercialization, start-up and early-stage development, and growth (Exhibit 3).

Scaling up R&D, both academic and private, can help ensure that innovation remains robust. Those ideas can then be translated into start-ups by attracting entrepreneurs, fostering tech transfers, and building out IP assets. Seed, angel, and broader venture capital funding nurtures start-ups so that they survive and scale up past infancy. Early-stage companies—part of the integrated innovation funnel and value that the ecosystem promises—also need access to capital and structured support.

Assessing strengths and opportunities across the innovation funnel and making tailored plans to bolster strengths and fill gaps are key ingredients of a successful ecosystem. Understanding the root cause of gaps can help target effective solutions
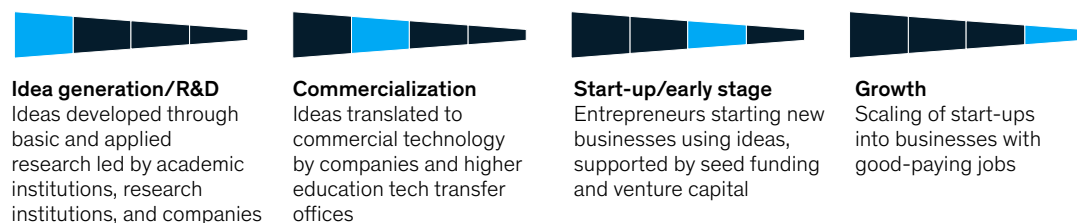
for bridging them. If a location has low VC funding, for example, either a lack of investment vehicles or of funding opportunities in the region could be responsible. These distinct challenges would require distinct solutions.

A robust mix of companies is also essential for building a healthy innovation funnel because it allows start-ups to improve their ideas—from applied research through the commercialization of a finalized product or service—by working together with large R&D anchor institutions and established talent. Boosting private investment in some higher-risk early-stage companies can help achieve better balance between start-ups, more mature companies, and established but slower-growing anchor institutions.

Ecosystems can support activities across the integrated innovation funnel in several ways. University anchors can empower tech transfer offices to scout and support developing technologies more proactively. Incubators and accelerators can help entrepreneurs on their journeys. Ecosystem leaders can coordinate start-up showcases by building out physical hubs that allow VC firms to interact with the ecosystem organically. The right mix of activities will probably depend on the scale of the hub and its strengths and challenges across the pipeline: the ASU

Exhibit 3

The integrated innovation funnel spans four key areas.

Idea generation/R&D
Ideas developed through basic and applied research led by academic institutions, research institutions, and companies

Commercialization
Ideas translated to commercial technology by companies and higher education tech transfer offices

Start-up/early stage
Entrepreneurs starting new businesses using ideas, supported by seed funding and venture capital

Growth
Scaling of start-ups into businesses with good-paying jobs

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Scottsdale Innovation Center,[7] for instance, has fostered $1.3 billion a year in economic activity by incubating and funding student start-ups.[8] The St. Louis Cortex, meanwhile, has prioritized regulatory and infrastructural policies to generate $2.1 billion[9] in single-year economic impacts (see sidebar "Cortex (St. Louis)").

4. Develop an ecosystem talent and workforce strategy

Another critical component of successful ecosystems is a coordinated talent strategy. A scarcity of talent can severely constrain an ecosystem's growth. For knowledge-based industries, location decisions often hinge on the available talent pool and the ability to develop and attract qualified candidates.

Economic development organizations and local leaders have historically relied on businesses and schools to attract talent. But large-scale ecosystems can have their own strategies to convince employers that they are environments where people want to work, play, and live—and would willingly relocate to.

To that end, the talent pipeline can be expansive and can focus on development across a spectrum of occupations and skill levels aligned to priority sectors. Public- and private-sector leaders can create partnerships and collaborations with a range of institutions, including four- and two-year universities, training providers, and community-based organizations that support greater access. Standing up an ecosystem can be an opportunity for leaders to work together to tear down the "paper ceiling" by incentivizing and helping employers to rethink degree requirements and consider candidates with two-year degrees or other certifications of skills—an approach that emphasizes reskilling existing talent pools, uplifting the entire community.

Cortex (St. Louis)

In 2002, St. Louis approved a master plan to develop a 200-acre area of industrial legacy land adjacent to anchor institutions, including Washington University's medical campus, St. Louis University, and Barnes–Jewish Hospital, in an area that became known as Cortex. Leaders made sure that supporting start-ups in all stages of growth was part of the mission. The steps they took to promote that goal included building spaces for coworking, incubators, accelerators, and labs, as well as providing specialized prototyping, pilot, and scale-up equipment.

By considering needs beyond traditional corporate office spaces and by establishing the right balance to create a vibrant space ripe for early-stage investment, Cortex fostered innovation and investment side by side. To attract venture capital, it developed infrastructure, including a new MetroLink station to provide connectivity to the region. Tax abatements and incremental financing were regulatory mechanisms to attract venture investment. Altogether, Cortex has been credited with generating $500 million of investment across nearly 400 companies—85 percent of them small businesses—that have together created 3,800 technology jobs and made the broader St. Louis community a successful innovation ecosystem.[1]

[1] McKinsey analysis.

[7] Arizona State University.
[8] Darren Higgs, "SkySong expected to generate $58.2 billion In economic impact over next 30 years," ASU Scottsdale Innovation Center, January 19, 2021.
[9] "The regional impact of the Cortex Innovation Community," Cortex Innovation Community, May 2019.

Helping ecosystems tailor specific programs to the needs of a sector or even an individual company can also create direct pathways into family sustaining jobs. Leaders can look at K–12 education to maintain a high-quality talent pipeline over the longer term. Such novel strategies helped the economic development organization JobsOhio attract companies and capital investment to the state, creating tens of thousands of new jobs.

Attracting talented workers to an ecosystem and then retaining and developing them often hinge on creating a relatable aspiration and appealing anchor institutions. To ensure that the ecosystem's universities, research institutions, and companies have a robust talent pipeline, leaders could consider developing a coordinated and cross-sector regional workforce strategy that translates the ecosystem's brand, goal, and aspiration into a tangible pitch. They can also work with all participating organizations to ensure that employers have access to qualified applicants and that employees have access to exciting and competitive opportunities. Other ways to increase the retention rates of local graduates include launching new or expanded degree programs, loan forgiveness for graduates staying within the region, coding bootcamps, university satellite campuses, and working with ecosystem companies to offer internships and apprenticeships.

5. Design high-quality real estate, infrastructure, and livability

Say that sufficient talent has been attracted to an area and that large anchor tenants are coexisting with accelerators, incubators, start-ups, and academic entities. But to be sustainable, an ecosystem needs to remain attractive to businesses, institutions, and workers. That enduring appeal is anchored in two types of infrastructure: first, the physical and virtual infrastructure aligned to the specific needs of the prioritized sectors (for example, wet-lab space for life sciences), and second, the "placemaking" infrastructure that informs quality of life. Leaders typically focus on the physical and virtual, which are crucial, but placemaking is also key for facilitating an inclusive community, vibrant and successful start-ups, collaboration, ideas, and growth, as well as making people who live and work in the ecosystem happier and more productive (see sidebar "Boston and Kendall Square").

Boston and Kendall Square

Boston is a prime example of an ecosystem based on the ambitious goal to define its "place, people, and purpose as the capital of scientific revolution."[1] Over the years, the city as an ecosystem has been able to support smaller, more defined innovation districts within its sphere, including the Seaport, South Station, and Kendall Square. Kendall Square, called "the most innovative square mile on the planet," provides an example of how to use innovative infrastructure to improve the experience of anchors and tenants. It has long prioritized the infrastructure needed to help its residents lead connected, efficient lives—for example, by taking the latest R&D thinking from its anchor tenant, MIT.[2]

The area also takes advantage of innovations from the broader Boston community—for example, in public transit and open-access technology. Most recently, MIT unveiled its plans for the new Volpe redevelopment of a central parcel of land in the district. The plans prioritize research community space, transit improvements, inclusivity, and cutting-edge energy efficiency, all designed to take advantage of new technology to attract both tenants and residents.[3]

[1] "The capital of scientific revolution," Massachusetts Life Sciences Center.
[2] Lita Nelsen, "Help America's universities keep transforming the world," *Boston Herald*, August 17, 2022.
[3] "Volpe project prepares for design phase," MIT News on Campus and Around the World, October 7, 2021.

Real-estate investments and spatial decisions involve more than glossy new buildings or flavor-of-the-month technologies. Economic development organizations should prioritize investments in physical and digital infrastructure aligned with an ecosystem's sector needs, from research facilities and prototyping equipment to co-working spaces and incubators. Even in a postpandemic world, physical spaces such as offices and storefronts are important. Retail, residential, and commercial real estate that complements new ways of working can provide the right alchemy for attracting and retaining the best talent and businesses. Quality-of-life investments—such as highway interchanges, light rail stations, and public parks and open spaces—can create an appealing atmosphere for ecosystem residents, commuters, and businesses alike. Finally, a sufficient supply of housing is critical to ensure community affordability and vibrancy.

Each of these components—infrastructure to live, work, and play—can be designed to avoid the negative externalities that come from growth. Transportation and transit systems can use demand forecasting and load planning to get people from place to place without adding to congestion; land use and housing plans can account for pricing and affordability to avoid pricing people out of existing homes.

6. Cultivate a vibrant, diverse community and a sense of place

Innovation industries have long been notable for their lack of diversity and inclusion. Less than 20 percent of the people employed in engineering jobs are women, for example, even though they earn a majority of undergraduate and advanced STEM degrees.[10] Black workers make up 11 percent of total US employment across all sectors but only 9 percent of STEM workers, and the gap is even more pronounced for Hispanic workers.[11] Closing that divide will depend largely on the enrollment of members of historically marginalized communities in STEM education, and progress is currently poised to move slowly. Our research found that at current rates of change, racial and ethnic parity in higher education is still 70 years away.[12]

To redress the imbalance, successful ecosystems can catalyze diverse, inclusive community building and shared prosperity—"inclusive growth." Leaders can begin with a firm understanding of their starting point to promote equity goals and then develop initiatives, together with community anchors and education institutions, to ensure that the voices of residents are included in the ecosystem's development and that opportunities benefit everyone, not just transplants to the area. Partnerships with community-based organizations are also critical to ensure that existing residents are not displaced as rents rise and new public spaces are created. Ecosystem leaders can even steer investment to create opportunities for disadvantaged communities and company founders from underrepresented groups (see sidebar "University City Science Center").

This last component of the playbook begins in the planning phase, when leaders are well-positioned to promote inclusion as they consider urban-design, health equity, or other initiatives that bring together a diversity of stakeholders. They can commit themselves publicly to the goal of inclusive growth by setting SMART[13] goals for diversity, equity, and inclusion and by announcing them transparently. They can also create performance incentives linked to these goals and share updates through annual progress reports on diversity, equity, and inclusion.

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[10] Richard Fry, Cary Funk, and Brian Kennedy, "STEM jobs see uneven progress in increasing gender, racial and ethnic diversity," Pew Research Center, April 1, 2021.
[11] Ibid.
[12] Diana Ellsworth, Erin Harding, Jonathan Law, and Duwain Pinder, "Racial and ethnic equity in US higher education," McKinsey, July 18, 2022.
[13] Specific, measurable, achievable, relevant, and time-bound.

University City Science Center

University City Science Center (UCSC), an urban research park in Philadelphia's University City innovation ecosystem, provides tech commercialization curricula and convenes innovation programs for the broader area. In 2020, it held more than 400 programs and events for 15,000 participants, 44 percent of them non-White. Moreover, the initiative supported 94 start-ups, and nearly half of its overall funding went to company founders from underrepresented groups. UCSC's development and risk capital helps underserved members of the wider innovation community, too. Additional UCSC-led real-estate developments, started in 2020 in the innovation ecosystem, have created a new commercial lab, a public park, and a STEM-focused middle school on a campus currently being leased to Philadelphia public schools.

To capitalize on the promise of innovation ecosystems, government and private-sector leaders can consider a few critical shifts in their community-building approach. Instead of doing business as usual, these leaders can not only cultivate a community of anchor institutions but also support tenants that enhance one another's businesses within specialized segments. Instead of just helping to shape infrastructure with public authorities and creating common residential amenities, economic development leaders in the public, private, and social sectors can work together to assist anchor tenants and cluster businesses. And instead of looking at financial returns in isolation, leaders across sectors can capture the value for all shareholders and stakeholders. The potential returns—for communities, organization leaders, and residents alike—are worth the effort.

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Rural rising: Economic development strategies for America's heartland

There is no one-size-fits-all economic development strategy for rural communities. How can local leaders—including governments, businesses, and individuals—put rural regions on track to thrive?

by Mike Kerlin, Neil O'Farrell, Rachel Riley, and Rachel Schaff

In downtown Clarksdale, Mississippi, in a repurposed freight depot built in 1918 for the Yazoo and Mississippi Valley Railroad, sits the Delta Blues Museum. The state's oldest music museum, it is central to the growing tourism industry in the Mississippi Delta, "the land where the blues began"—once home to John Lee Hooker and Muddy Waters. Yet on March 18, 2020, as the COVID-19 crisis escalated across the United States, the museum was forced to temporarily close its doors. Tourism across the country slowed to a trickle, and Clarksdale's Coahoma County—85 miles from Memphis, 77 percent Black, and with 35 percent of its population living in poverty as of 2019—suddenly lost one of its main sources of income and employment.[1] By April 2020, the county's unemployment rate had reached about 20 percent.[2]

Meanwhile, about 1,000 miles northwest, in rural Chase County, Nebraska, the unemployment rate in April 2020 was only 2.2 percent. Businesses struggled to fill positions and attract workers; the poverty rate in Chase County was lower than the US average and remains so today.[3]

As these stories show, rural America is not one geographical unit but a mosaic of different landscapes, people, and economic realities.[4] It includes agricultural powerhouses, postindustrial towns, and popular tourism enclaves. Some rural communities are relatively close to major cities, while others are hundreds of miles from the nearest urban hub. Some have thriving workforces and a handful of economic anchors, while others face declining populations and some of the lowest living standards in the country. Some benefit from endowments such as energy resources and beautiful landscapes, while others have few natural amenities.

Below, we examine the types of rural communities in the United States and suggest that attention to three foundational elements—sectors, workforce, and community and connectivity—can promote economic success. We then outline a data-driven approach to economic development that can be tailored to meet the needs of different communities and share examples of initiatives that have led to positive outcomes in rural communities throughout North America.

Rural America is not one geographical unit but a mosaic of different landscapes, people, and economic realities.

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[1] "S1701: Poverty status in the past 12 months," American Community Survey, US Census Bureau, 2019.
[2] "Unemployment rate in Coahoma County, MS," retrieved from Federal Reserve Economic Data (FRED), Federal Reserve Bank of St. Louis, March 8, 2022.
[3] Ibid.
[4] *America at work: A national mosaic and roadmap for tomorrow*, Walmart, February 2019.

Tracking growth across rural America's five community archetypes

In collaboration with Walmart, we've identified five archetypes of rural American communities (Exhibit 1).[5]

Americana. The largest rural community archetype, comprising 879 counties and 40 million Americans, Americana counties have slightly lower GDP and educational outcomes than urban areas. They are relatively close to major cities and often include several major employers.

Distressed Americana. Distressed Americana communities comprise 18 million people living in 973 counties (many in the South) facing high levels of poverty, low labor force participation, and low educational attainment. Historically, these communities have been hubs for agriculture, extractive industries, and manufacturing. Their decline has mirrored the struggles in these sectors.

Rural Service Hubs. Rural Service Hubs are so named because the areas (often close to highways or railways) are home to manufacturing and service industries. Because these hub communities typically serve surrounding counties that are more rural, they tend to specialize in industries such as retail and healthcare.

Great Escapes. Great Escapes are the smallest but most well off of the rural archetypes, home to wealthy enclaves and tourist destinations. They comprise 14 counties and 300,000 people. While

Exhibit 1

The contiguous United States is a complex mosaic of local economies, with five distinct rural community archetypes.

Cluster segmentation
- Resource-Rich Regions
- Great Escapes
- Rural Service Hubs
- Distressed Americana
- Americana

- Smaller Independent Economies
- Urban Periphery
- Urban Centers and Core Suburbs
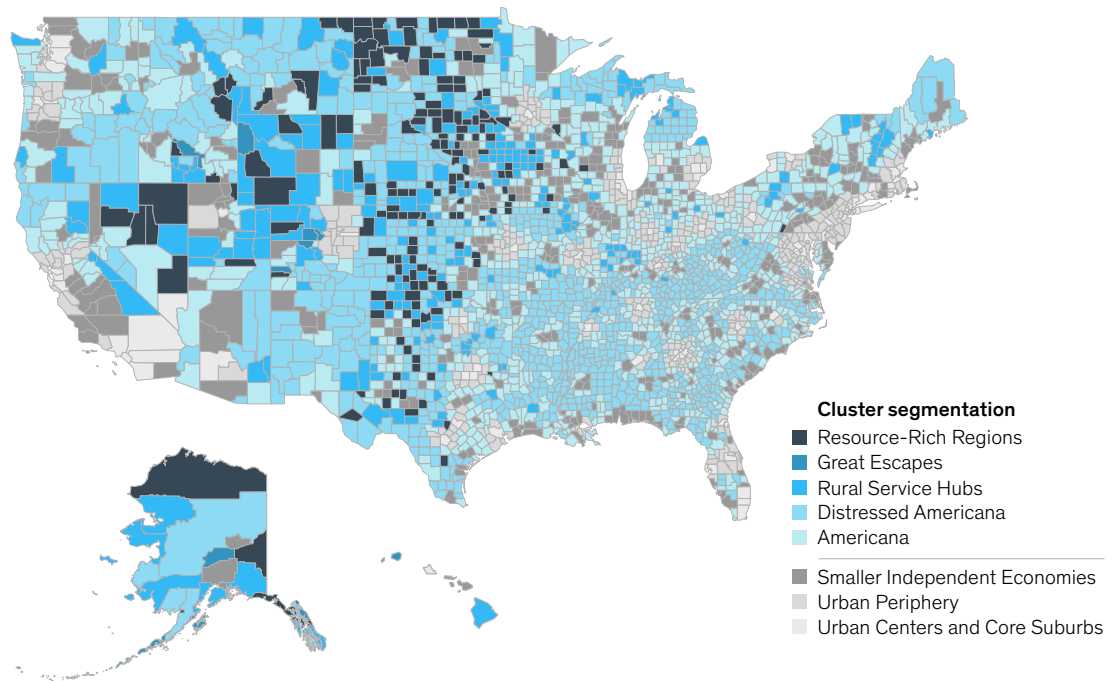
Source: *America at work: A national mosaic and roadmap for tomorrow*, Walmart, February 2019

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[5] Ibid.

the focus on tourism in Great Escapes communities results in many low-paying service jobs, their GDP, household income, and educational attainment outpace their rural peers.

Resource-Rich Regions. This category comprises 177 counties that are home to almost one million people. As the name suggests, these communities are defined by economic reliance on oil and gas or mining, often alongside high rates of agricultural production. Due in part to the value of the resources, household income, GDP per capita, and educational attainment in Resource-Rich Regions tend to be higher than average.

Over the past ten years, the populations of all archetypes except for Distressed Americana have grown (Exhibit 2). Resource-Rich Regions in places such as West Texas and North Dakota have seen some of the fastest growth. For example, since 2010, the populations of McKenzie County, North Dakota, and Loving County, Texas, have grown by
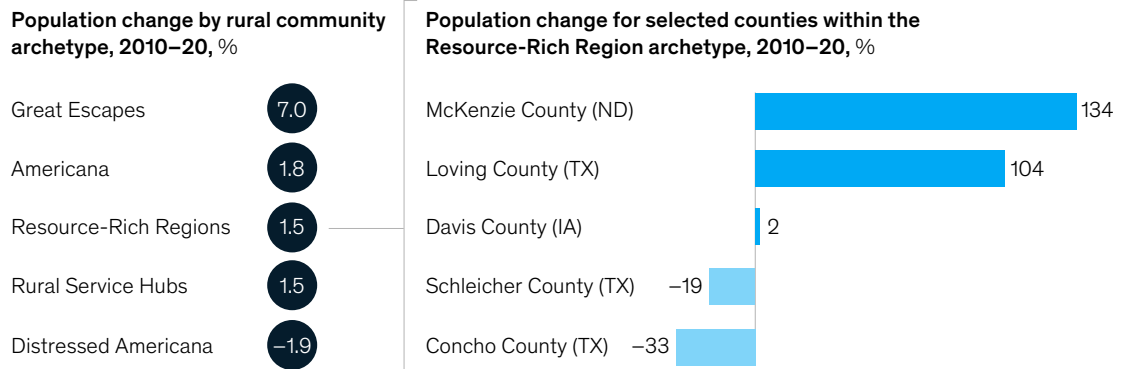
134 percent and 104 percent respectively, while median household incomes have increased by nearly half in nominal terms.[6]

Yet while the population of Loving County soared, Concho County, Texas, another Resource-Rich Region, witnessed a 33 percent decline in population over the past decade. Approximately two-thirds of Resource-Rich Region counties faced similar, though often less precipitous, declines.[7]

Counties where residents typically have access to world-class natural amenities, which are often among the Great Escapes, have been among the most uniformly successful since 2010. The appropriately named Summit County, Colorado, is home to one of the greatest concentrations of ski resorts in the world, featuring Breckenridge, Copper Mountain, Keystone, and Arapahoe Basin. Over the past decade, the county's population has grown by 11 percent and median household income has increased by 54 percent.[8]

Exhibit 2

In aggregate, all archetypes except Distressed Americana saw population growth in the past decade, yet these numbers mask significant differences within archetypes.

Population change by rural community archetype, 2010–20, %

Great Escapes	7.0
Americana	1.8
Resource-Rich Regions	1.5
Rural Service Hubs	1.5
Distressed Americana	−1.9

Population change for selected counties within the Resource-Rich Region archetype, 2010–20, %

McKenzie County (ND)	134
Loving County (TX)	104
Davis County (IA)	2
Schleicher County (TX)	−19
Concho County (TX)	−33

Source: US census data retrieved via Moody's Analytics

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[6] Data Buffet, Moody's Analytics.
[7] Ibid.
[8] Ibid.

Gallatin County, Montana, home to Bozeman, is a Rural Service Hub, though it also features the world-class natural amenities common to Great Escapes. It contains Big Sky Resort and is one of the gateways to Yellowstone National Park. The county, particularly the city of Bozeman, has seen a significant influx of remote workers during the pandemic, which may have contributed to a jump in housing prices of more than one-third since the beginning of 2020.[9]

Meanwhile, Pender County, an Americana region on the southern coast of North Carolina, achieved 22 percent population growth from 2010 to 2020 while positioning itself as a logistics hub. Pender Commerce Park, a 450-acre industrial center developed as part of a partnership between Pender County and Wilmington Business Development, attracted FedEx Freight in 2018.[10]

Rural counties' wide range of economic performance over the past decade reinforces that there is no one-size-fits-all playbook for growth. Instead, we have identified some of the fundamental characteristics that thriving counties tend to share, even as the appearance or impact of the characteristics varies from place to place.

Elements of a thriving rural community

Rural communities require three interconnected, baseline elements to thrive: sectors, workforce, and community and connectivity (Exhibit 3). Rural economic development initiatives typically tie into one or more of these key elements.

Sectors. Sectors refer to stable or growing tradable industries that bring wealth into communities, create employment opportunities, and carry strong multiplier effects that support the overall economy. Thriving rural communities play to their region's strengths, supporting sectors such as agriculture, manufacturing, energy, tourism, and postsecondary education.

Workforce. People are the lifeblood of any community. A healthy, skilled workforce is the most important factor in attracting and retaining employers in key sectors.[11] In addition, workers spread wealth and create additional jobs by buying goods and services within their communities.

Community and connectivity. The most intangible element, community and connectivity includes services and amenities critical to quality of life, such as transportation infrastructure and access to broadband, healthcare, childcare, and arts and culture. Because these assets support the workforce, they are essential to developing thriving sectors.

While thriving communities are succeeding across all three elements, more narrow or focused efforts can still catalyze economic growth. For example, even if job creation is low or GDP growth has plateaued in a community, improving residents' quality of life can slow outmigration and attract thriving sectors in the future.

Creating an economic development strategy

Creating an economic development strategy for a rural area is similar to doing so in other places. It is a multistep process that requires assessing the current state of the region, identifying the value proposition, evaluating existing programs, and establishing partnerships and rural hubs. When those steps have been taken, communities will be in a position to prioritize specific initiatives.

Assess the current state of the region
Before engaging in an economic development strategy, it is important to understand the current state of a region, its competitive position, and its strengths and challenges. This requires using quantitative data from sources such as the US Census Bureau, the Bureau of Labor Statistics, as well as the National Center for Education Statistics and qualitative data from sources such as stakeholder interviews to assess regional

[9] "Gallatin County home values," Zillow, updated on January 31, 2022.
[10] "FedEx Freight coming to Pender Commerce Park," Pender County, North Carolina, February 5, 2018.
[11] Ron Starner, "More than some like it hot," *Site Selection*, January 2018.

performance across a variety of metrics. The framework in Exhibit 3 provides a starting point. Regions can be assessed by sector, including factors such as employment rate, GDP, specialization, and growth by industry; workforce, including a demographic breakdown, employment by occupation, and educational attainment; and community and connectivity, including factors such as transportation infrastructure and access to broadband, childcare, and healthcare.

With these data, policy makers can understand their region's strengths and challenges relative to other regions and begin to focus on assets, or competitive advantage, and potential barriers to development.

Identify the value proposition

After the diagnostic phase has resulted in a picture of a region's strengths and challenges, the next step is formulating the value proposition, which is part of a strengths-based approach to economic development. The value proposition is about creating a regional story line that answers questions such as: Why would someone live here? 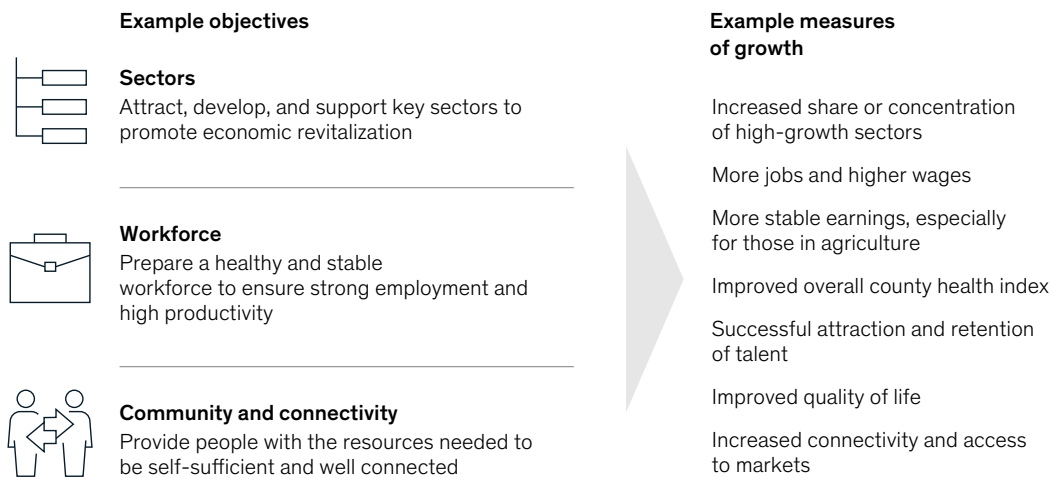Why would a company locate here? Why would someone visit? The value proposition can take many forms across sectors, the workforce, and community and connectivity. For instance, it may be a high-performing local talent pool, a knack for retaining and growing local businesses, an ability to build partnerships to attract investment, or distinctive industry clusters. The value proposition for residents might include a strong local community, a high quality of life, or access to natural amenities. The most effective economic development strategies leverage and develop a region's strengths and reinforce its value proposition.

Evaluate existing programs and initiatives

Any one region can be affected by multiple programs and initiatives, including those from federal, state, and local governments and from groups such as chambers of commerce and business improvement districts. Policy makers may want to take stock of existing programs before developing new initiatives to avoid reinventing the wheel. Key questions to ask include: What does this program cover? What are its strengths and weaknesses? Can it be improved? Is it possible to increase engagement? Successful economic development strategies often leverage existing

Exhibit 3

Rural communities can focus their growth on three interconnected areas: sectors, the workforce, and community and connectivity.

Example objectives

Sectors
Attract, develop, and support key sectors to promote economic revitalization

Workforce
Prepare a healthy and stable workforce to ensure strong employment and high productivity

Community and connectivity
Provide people with the resources needed to be self-sufficient and well connected

Example measures of growth

Increased share or concentration of high-growth sectors

More jobs and higher wages

More stable earnings, especially for those in agriculture

Improved overall county health index

Successful attraction and retention of talent

Improved quality of life

Increased connectivity and access to markets

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efforts or improve them incrementally by updating programs or increasing participation. An analysis of a region's current programs also reveals genuine gaps that can be addressed with new initiatives.

Establish partnerships and rural hubs

Rural regions often include multiple stakeholders, such as governments, nonprofits, and educational institutions, that have a—sometimes overlapping—hand in the three foundational elements of economic development noted above. In addition, multiple communities within a broader region may have shared economic needs. Partnerships in rural areas can therefore allow communities to direct limited resources and expertise to shared initiatives. When regions and institutions band together, they create economies of scale, also called rural hubs.

Designing rural economic development initiatives

Rural regions are not monoliths, so rural economic development strategies will vary. The approach outlined above will help leaders identify their region's unique strengths, challenges, and assets that can be formed into cohesive value propositions. That said, many broad economic development initiatives can be tailored to meet the needs of different regions. Below is a nonexhaustive list of initiatives that may apply to rural regions, based on their specific assets and needs.

Launch 'big push' investment

The idea of the "big push" is to funnel a significant amount of investment into a particular area of need to create a sustainable, long-term, virtuous cycle of economic growth. This can take many forms but is most frequently associated with the attraction of a major employer or the construction of large-scale infrastructure. Due to its size, big-push investment usually requires involvement and funding from an overarching government body, such as the state or federal government.

An example of big-push investment in electric vehicles can be found in Tennessee. The state has offered Ford Motors and its partner, South Korea–based SK Innovation, hundreds of millions of dollars in incentives to develop BlueOval City, a site for the production of electric pickup trucks and advanced batteries. Leaders expect the project to create nearly 6,000 jobs in Stanton, Tennessee, a town within Distressed Americana Haywood County.[12]

Embrace placemaking

Residents want to live in communities that are safe, interesting, and attractive. Placemaking means creating those environments. It is, by one definition, "the process of creating quality places that people want to live, work, play, and learn in."[13]

Funding for placemaking efforts can come from a variety of sources, including private groups and local, state, or federal governments. For instance, the US Department of Agriculture's Rural Placemaking Innovation Challenge made available $3 million (with a maximum grant of $250,000) to rural areas for technical assistance related to placemaking.[14] Like their urban counterparts, many rural cities and towns have seen success in creating business improvement districts (BIDs), small-scale economic development organizations often funded by local stakeholders, such as businesses. BIDs deliver services in a particular area, often at the neighborhood or "Main Street" level. The services might include street cleaning, public safety, beautification, or events.

One example of placemaking comes from Douglas, Georgia, a city of roughly 12,000 people about 115 miles northwest of Jacksonville, Florida. It is the county seat of Coffee County, characterized as Distressed Americana.[15] In the late 1980s, Douglas faced downtown vacancy rates of about 25 percent.

[12] Morgan Watkins, "Here are the incentives Kentucky and Tennessee used to lure Ford's new factories," *Louisville Courier Journal*, October 11, 2021; "Ford to lead America's shift to electric vehicles with new mega campus in Tennessee and twin battery plants in Kentucky; $11.4B investment to create 11,000 new jobs and power new lineup of advanced EVs," Ford Motor Company, September 27, 2021.

[13] Robert Steuteville, "Four types of placemaking," Better Cities & Towns, October 2014.

[14] "Rural Placemaking Innovation Challenge," US Department of Agriculture, updated on July 26, 2021.

[15] *How small towns and cities can use local assets to rebuild their economies: Lessons from successful places*, US Environmental Protection Agency, May 2015.

In response, the city restored historic facades (funded by an initial $10,000 from the city and the local industrial development authority), replaced sidewalks, and added lighting. Today, Douglas's downtown is a community gathering place where festivals take place regularly. Walking paths connect the downtown area to local community colleges. By 2012, the vacancy rate had dropped to 6 percent, thanks in part to 12 newly opened businesses downtown. Surrounding areas of the county gained nearly 8,000 new residents between 1990 and 2000, increasing the county's growth rate to 26 percent—up from 11 percent between 1980 and 1990.[16]

Develop tourism infrastructure

Tourism is technically an export sector—it draws in spending from outside the region to generate economic growth. Some rural communities can leverage existing assets, such as state or national parks, to capture tourism value. Others can use their environment or location to create a reason for tourists to visit.

Crosby, Minnesota, is 125 miles north of Minneapolis and home to just shy of 3,000 people. The town was a hub for iron ore mining until the industry collapsed a half-century ago. In the 1980s, leaders from Cuyuna Range Economic Development Inc., a regional economic development organization, and other stakeholders petitioned the state to create a recreation area on the former mine sites and surrounding land.[17] The Cuyuna Country State Recreation Area was officially established in 1993. In 2011, it became the state's first mountain bike park, featuring 25 miles of trails. Since 2011, 15 new businesses—including a brewery, a yoga studio, and a farm-to-table restaurant—have opened in Crosby, largely

serving the tens of thousands of annual visitors to the trail system. Once the trails reach completion at 75 miles, leaders anticipate a local economic impact of $21 million.[18]

Attract, retain, and expand small and medium-size businesses

Sixty-five percent of workers in nonmetropolitan areas are employed by small and medium-size enterprises (SMEs), a higher share than in the nation as a whole.[19] These companies provide benefits to communities beyond direct employment. SMEs generate local wealth, because profits go to the owner, who is more likely to live and spend locally than shareholders of a large corporation.[20] Rural communities with a relatively high share of SMEs also tend to have better health outcomes.[21]

While attracting new businesses generates local excitement, expanding and retaining SMEs has a higher return on investment, in part because existing businesses do not require tax incentives to move to the area. Local businesses are stalwarts of the community, paying economic dividends through local taxes and job creation. Leaders can initiate a business retention and expansion strategy by collecting qualitative data from interviews with entrepreneurs about expansion plans and business challenges. In addition, economic development practitioners can support SMEs by helping them access loans and grants, navigate regulatory requirements, write business plans, plan for succession, and connect to large companies doing procurement in the region.

Northern Development Initiative Trust, an economic development agency representing rural Northern British Columbia, has made SME support a core part of its mission. The agency offers programs

[16] US Census Bureau, "Resident population in Coffee County, GA," retrieved from Federal Reserve Economic Data (FRED), Federal Reserve Bank of St. Louis, updated on May 5, 2021.

[17] Dan Kraker, "From mining to biking: How Minnesota's Cuyuna Range became an off-road cycling destination," Minnesota Public Radio, October 7, 2016.

[18] Nicholas Hunt, "How biking is saving small-town USA," *Outside*, May 15, 2017.

[19] Hanna Love and Mike Powe, "Rural small businesses need local solutions to survive," Brookings Institution, December 1, 2020.

[20] Devra Gartenstein, "Reasons why small businesses are important," *Houston Chronicle*, January 28, 2019.

[21] Troy Blanchard, Carson Mencken, and Charles Tolbert, "The health and wealth of US counties: How the small business environment impacts alternative measures of development," *Cambridge Journal of Regions*, *Economy and Society*, March 2012, Volume 5, Number 1.

such as the Competitiveness Consulting Rebate, which helps SMEs recover up to 50 percent of costs (to a yearly maximum of CA $30,000 [US $23,400])[22] for external business consulting on services such as website creation, marketing strategy, and workplace health and safety plans. Thus far, the program has allotted more than CA $5.5 million (US $4.3 million) to SMEs across 552 projects. A complementary program, the Northern Industries Innovation Fund, supports regional SMEs' innovation projects, such as providing funds to develop a technical process to adapt forestry equipment for drilling.[23]

Attract remote workers

Many companies have adopted long-term remote work strategies prompted by the COVID-19 pandemic and employees' desire for flexibility. These strategies primarily affect knowledge workers, who tend to be highly educated and high earning. Historically, remote workers have flocked to smaller communities with natural amenities. A 2018 Gallup poll showed that 27 percent of Americans would prefer to live in a rural area.[24] This presents an opportunity for rural communities to make strategic investments to attract remote workers. Some investments, such as strong broadband infrastructure, may be a requirement. Others, such as assets related to quality of life or outdoor recreation, may carry varying weight depending on the region.

Some regions offer direct financial incentives to remote workers who relocate. For example, the Shoals region includes Lauderdale and Colbert Counties in rural Northwest Alabama. Remote Shoals, a partnership launched in 2019 between the Shoals Chamber of Commerce and the Shoals Economic Development Authority, offers participants a stipend of up to $10,000 to move to the region and work remotely for at least 12 months.[25] The program received more than 200 applications from 33 states in 2019 and 500 applications in 2020.[26] By March 2021, the total payroll of those in the program was $1.8 million.[27]

Increase access to healthcare

According to the Centers for Disease Control and Prevention, significant disparities in health outcomes exist between urban and rural America, with residents of rural communities more likely to die from ailments such as heart disease and cancer.[28] Limited access to healthcare in rural

Local businesses are stalwarts of the community, paying economic dividends through local taxes and job creation.

[22] Converted on March 7, 2022; "Competitiveness Consulting Rebate," Northern Development Initiative Trust, accessed December 15, 2021.
[23] "Northern Industries Innovation Fund," Northern Development Initiative Trust, accessed December 15, 2021.
[24] Frank Newport, "Americans big on idea of living in the country," Gallup News, December 7, 2018.
[25] "Work remotely? Get $10,000 to do your job from the Shoals," Shoals Economic Development Authority, accessed December 15, 2021.
[26] Jared Lindzon, "Cities offer cash as they compete for new residents amid remote work boom," *Fast Company*, June 22, 2020; Anna Eubanks, "Remote work possibilities draw traffic to the Shoals," Shoals Chamber of Commerce, January 22, 2021.
[27] DeAndria Turner, "Remote Shoals thriving in the midst of COVID-19," WAFF 48 News, March 24, 2021.
[28] "About Rural Health," Centers for Disease Control and Prevention, updated on August 2, 2017.

regions is one of the drivers of this imbalance.[29] However, many rural regions are working to address this challenge by making it easier for patients to access care—virtually or in person—and by training the next generation of rural healthcare workers.

Project ECHO, based at the University of New Mexico, uses a combination of telemedicine, case-based learning, and web-based disease management tools to offer treatment for people with chronic diseases at more than 250 sites across the state.[30] The program saves many rural residents from long trips to hospitals in more urban areas to receive specialized care. In Alabama, the University of Alabama at Birmingham and Tuskegee University, in partnership with rural community clinics, train registered nurses in three

identified areas of health professional shortages. The effort became particularly relevant during the COVID-19 crisis.[31]

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Rural America is indeed a mosaic. From a distance, it is often idealized but misrepresented. Upon closer examination, it reveals a diversity of colors and images. It is not one place but thousands—each community with its own identity, culture, strengths, and challenges. Some rural regions are thriving, while others have yet to fully capture their potential value. But all rural areas could benefit from an economic development plan that strengthens sectors, the workforce, and community and connectivity.

[29] "Rural health disparities," Rural Health Information Hub, updated on April 22, 2019.
[30] Martha Hostetter, "Case study: Project ECHO expands access to specialty care for rural patients," Commonwealth Fund, accessed December 15, 2021.
[31] Jennifer Lollar, "$2.8M grant will establish primary care RN workforce," University of Alabama at Birmingham, August 29, 2018.

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Will a labor crunch derail plans to upgrade US infrastructure?

There's a historic and widening labor shortfall in the US construction sector. Yet it extends far beyond jobsites and varies by location, demanding tailored solutions.

by Garo Hovnanian, Adi Kumar, and Ryan Luby

The United States has a construction labor shortage that will likely get worse. In April, the US construction industry had roughly 440,000 job openings, and the US manufacturing industry had more than one million—the highest levels recorded since industry-level jobs data were first collected. This prompts the question: Who will fill the hundreds of thousands of additional jobs we estimate the Bipartisan Infrastructure Law (BIL) will create each year (peaking above 300,000 in 2027 and 2028) across the construction value chain in the next decade?[1]

The answer to this question is critical, and not just for the construction sector. The BIL is poised to escalate labor demand, starting with outlays flowing to states, agencies, and authorities to fund portfolios of projects. Because each project relies on a chain of companies spanning engineering, materials fabrication, distribution, freight, and construction, any shortage of materials or labor at any point along the chain may cause delays, drive up costs, and result in projects being scaled back or scrapped.[2] In short, a labor shortage may affect much more than just the construction sector—it could have far-reaching economic ramifications.

Closing the widening gap between labor demand and supply is critical. Our latest research shows that labor strains are expected to manifest differently across US states, sectors, and occupations, arguing for a comprehensive strategy filled with solutions that can scale to address this wave of labor demand. Without such a strategy, the United States may not only be deprived of urgent upgrades to aging infrastructure but also miss the opportunity to set itself up for increased economic success over the balance of the 21st century.

A persistent labor shortfall

Today's labor mismatch has multiple root causes,[3] from baby boomers leaving the workforce to record quit rates as workers reevaluate priorities to a shrinking pipeline of new construction workers amid stalled training and low net migration.[4]

But whatever the reasons, the net result is the same: there are too few workers for the jobs currently available, and certainly not enough for the jobs expected to be created in the years ahead.

In the current constrained environment, industry wages are growing at the fastest rates since the run-up to the 2008 financial crisis.[5] And demand is unlikely to materially slacken irrespective of economic conditions, in large part because private- and public-sector infrastructure investment is locking in multiyear capital outlays (Exhibit 1). These outlays are less sensitive to cyclical pressures than the residential and business-to-consumer commercial sectors (such as retail and hospitality).

Getting granular: Insights by sector, occupation, and geography

The disconnect between jobs available today— and those set to be created in the years ahead— and the number of qualified people to fill them is significant. But when we looked beneath those top-level numbers, we found the strain varies by geography, sector, and occupation (for more on our methodology, see sidebar, "Model scope and assumptions").

The challenges introduced by the BIL and their possible solutions require a local, nuanced perspective. Industries that hold their collective breath to see what happens do so at their

[1] "The US Bipartisan Infrastructure Law: Breaking it down," McKinsey, November 12, 2021.
[2] Garo Hovnanian, Ryan Luby, and Shannon Peloquin, "Bridging the labor mismatch in US construction," McKinsey, March 28, 2022.
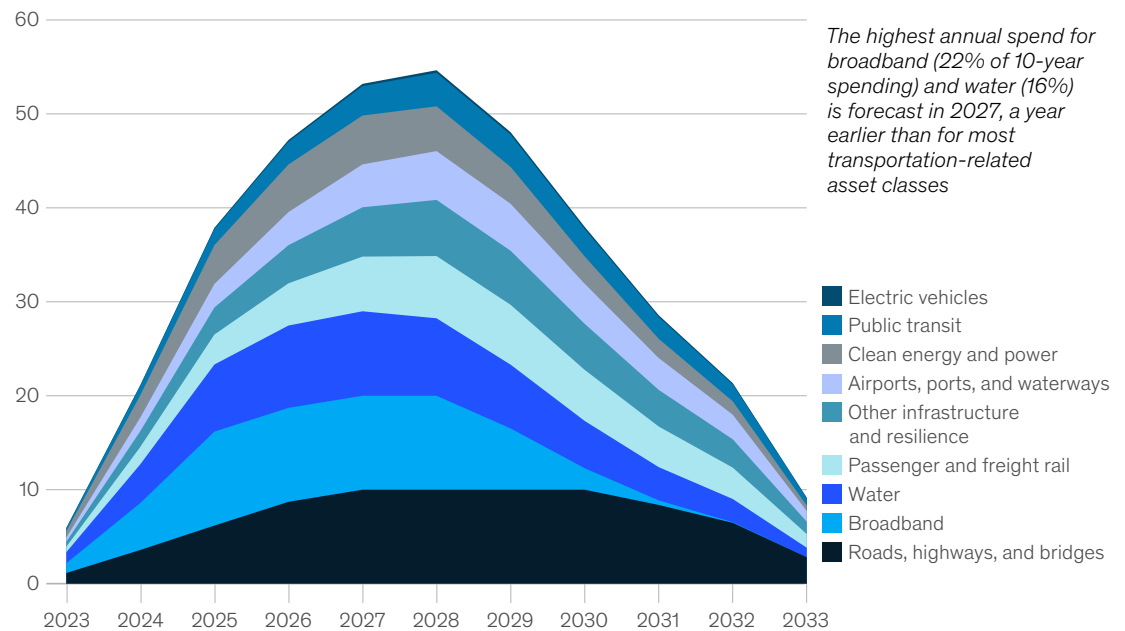[3] Ibid.
[4] Aaron De Smet, Bonnie Dowling, Marino Mugayar-Baldocchi, and Bill Schaninger, "'Great Attrition' or 'Great Attraction'? The choice is yours," *McKinsey Quarterly*, September 8, 2021.
[5] "Job openings: Construction," US Bureau of Labor Statistics, accessed from Federal Reserve Bank of St. Louis (FRED) on August 30, 2022.

Exhibit 1

Incremental Bipartisan Infrastructure Law spending and subsequent workforce needs could peak around 2027–28.

Estimated new capital construction expenditures, by year and asset class, $ billions

The highest annual spend for broadband (22% of 10-year spending) and water (16%) is forecast in 2027, a year earlier than for most transportation-related asset classes

- Electric vehicles
- Public transit
- Clean energy and power
- Airports, ports, and waterways
- Other infrastructure and resilience
- Passenger and freight rail
- Water
- Broadband
- Roads, highways, and bridges

Source: Expert interviews; Lightcast, 2022; US Bureau of Economic Analysis; Bernard Yaros and Mark Zandi, "Macroeconomic consequences of the Infrastructure Investment and Jobs Act and Build Back Better framework," Moody's Analytics, November 4, 2021; McKinsey preliminary estimates based on Bipartisan Infrastructure Law, H.R. 3684, and White House state-specific information

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peril, because this is unlikely to be a transient, near-term issue. BIL spending is expected to start in 2023 and persist through 2033, with funding peaking across asset classes in 2027 and 2028. For example, in the year of peak demand, we estimate a shortfall attributable to the BIL of more than 160,000 workers in the contractor and subcontractor sector, 145,000 workers in the materials sector, and 40,000 workers in the engineering and technical-services sector. Again, that's a shortfall just for the year in which demand peaks, not over the lifetime of the BIL's effect.

In addition, the risks of the labor shortage are more acute in the short term. In the run-up to those peaks in 2027 and 2028, every year in which the

market fails to meet demand for labor creates a backlog that will both extend and delay the peak while driving up costs and eroding the BIL's purchasing power. At the same time, BIL investment is occurring alongside other public-sector outlays (such as the Creating Helpful Incentives to Produce Semiconductors and Science Act of 2022 [CHIPS Act] and the Inflation Reduction Act) and as the private sector makes generational bets on the future of the economy. In that sense, our modeling should be treated as a lower bound of the collective strain facing the construction value chain over the next decade.

The sector view
The $383 billion in BIL expenditure—comprising $90 billion in competitive funding and $292 billion

Model scope and assumptions

Our economic modeling covers $383 billion in expenditure from the US Bipartisan Infrastructure Law (BIL). We arrived at this figure by examining only the $1.2 trillion in BIL funds (private-sector spending is not included), and then excluding expenditure already in the pipeline, nonconstruction capital expenditure (for example, rolling stock), and funds that may not clearly translate into a representative set of construction projects, such as safety and environmental-remediation funding and competitive energy grants (exhibit).
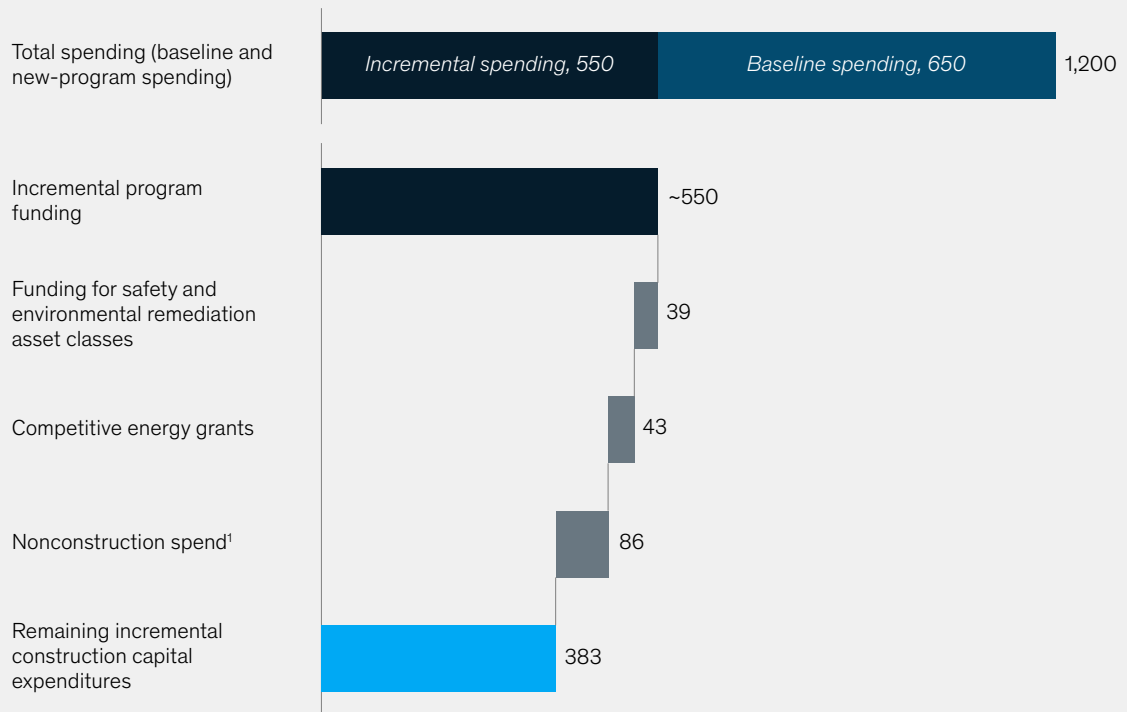
The analysis is grounded in a multiplier model, in which BIL dollars across asset classes are mapped to sectors at the state level. Sector-specific job multipliers—which are taken from Lightcast, a labor economics data provider—are applied to BIL dollars to estimate the number of jobs created by sector and by state due to incremental BIL expenditure (examples of sectors include highway, street, and bridge construction and ready-mix concrete manufacturing). Generated jobs by sector are then distributed across occupations using Lightcast's state-level staffing-patterns matrices (including, for example, civil engineers and electricians).

This economic analysis—which spans all 50 states and nine asset classes within a set of roughly 900 occupational codes—helps identify the occupations most likely to present workforce challenges from incremental construction capital expenditure and the timing of these challenges. It does not include all funds that can increase demand for workers from the BIL, nor is it tied to granular job titles at a level of specificity below 900 occupational codes. Our analysis is also not fully adjusted to reflect the specific nature of BIL investments that may differ from historic construction infrastructure.

Exhibit

Modeling job gains from the Bipartisan Infrastructure Law focuses on $383 billion of incremental construction capital expenditures.

Analyzed funding, $ billions

Total spending (baseline and new-program spending)	*Incremental spending, 550* / *Baseline spending, 650* — 1,200
Incremental program funding	~550
Funding for safety and environmental remediation asset classes	39
Competitive energy grants	43
Nonconstruction spend[1]	86
Remaining incremental construction capital expenditures	383

[1]Nonconstruction spend includes operating expenses, nonconstruction capital expenditures, and funds allocated to territories or Tribal Nations.
Source: Expert interviews; McKinsey preliminary estimates based on Bipartisan Infrastructure Law, H.R. 3684, and White House state-specific information

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in formula-driven investment—will engage the entire construction value chain, including engineering, design, manufacturing, distribution, and construction. This means labor strains will be felt in areas other than jobsites, which aligns with what we heard prior to the outlay of BIL funds. In a November 2021 McKinsey survey, for example, executives cited a labor shortage of 80–83 percent in distribution roles, compared with a shortage of 50–64 percent in contracting.
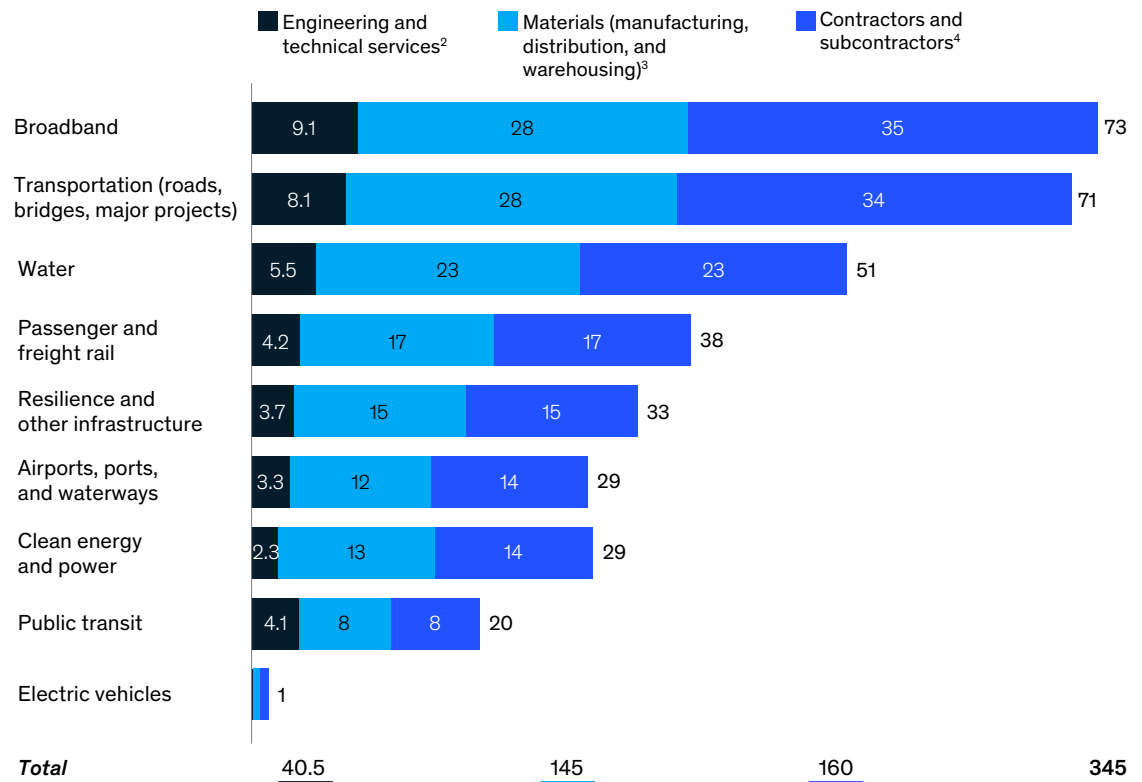
Indeed, of the estimated 345,000 jobs created in that year of peak demand, only 46 percent will come from contractor roles within the construction industry (Exhibit 2). About 42 percent of the jobs will be concentrated in the materials sector, which combines manufacturing, distribution, and warehousing.

Each of these areas poses sector-specific challenges. In materials manufacturing, new

Exhibit 2

Jobs from new Bipartisan Infrastructure Law capital expenditures for construction will span sectors across the construction value chain.

Jobs created in year of peak demand across construction value chain,[1] thousands

	Engineering and technical services[2]	Materials (manufacturing, distribution, and warehousing)[3]	Contractors and subcontractors[4]	Total
Broadband	9.1	28	35	73
Transportation (roads, bridges, major projects)	8.1	28	34	71
Water	5.5	23	23	51
Passenger and freight rail	4.2	17	17	38
Resilience and other infrastructure	3.7	15	15	33
Airports, ports, and waterways	3.3	12	14	29
Clean energy and power	2.3	13	14	29
Public transit	4.1	8	8	20
Electric vehicles				1
Total	**40.5**	**145**	**160**	**345**

Note: Figures may not sum, because of rounding. Does not include safety and environmental remediation asset classes or competitive energy grants, collectively accounting for $82 billion in new spending.
[1] Peak demand is defined as the year between 2023 and 2033 in which an asset class has the highest number of jobs required from spending (typically, 2027 or 2028); estimates above do not include the ~78,000 jobs generated during peak demand through supply chain effects outside of the construction value chain.
[2] Eg, civil engineer, architectural drafter, electrical engineer.
[3] Eg, welder, truck driver, supervisor of production workers.
[4] Eg, construction laborer, operating engineers, supervisor of trades workers.
Source: Expert interviews; Lightcast, 2022; US Bureau of Economic Analysis; Bernard Yaros and Mark Zandi, "Macroeconomic consequences of the Infrastructure Investment and Jobs Act and Build Back Better framework," Moody's Analytics, November 4, 2021; McKinsey preliminary estimates based on Bipartisan Infrastructure Law, H.R. 3684, and White House state-specific information

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A labor shortage may affect much more than just the construction sector—it could have far-reaching economic ramifications.

jobs are often far from the jobsite, meaning local demand may strain labor markets in other parts of the country. This lack of visibility may create a price pressure that feels disconnected from local labor markets where manufacturing is concentrated. For example, North Carolina is likely to see a jump in demand for the manufacturing workforce needed to produce fiber-optic cable that will be laid across the United States. In the warehousing and transportation space, on the other hand, the construction value chain will compete with other sectors that are driving the expansion of short- and long-haul logistics networks. While just 12 percent of the project job gap is in engineering and technical services, these positions can bottleneck project- and industry-wide growth because of the upstream gating role they play in individual projects. In addition, due to the education and licensing requirements for this segment (for example, civil engineers), the lead time required to address shortages in these sectors is particularly long.

The occupation view

The influx of investment and corresponding shortage of qualified labor are expected to strain a specific set of occupations across each sector. These "crucible" occupations may vary across sectors, influenced by two core drivers: the "momentum" rate at which jobs were expected to grow (or decline) without the BIL and what's expected to happen as a result of the BIL.

Several occupations required for metal and plastic manufacturing are expected to shrink but are needed to propel implementation of the

BIL (Exhibit 3). Within construction contracting, line installers—who are driving the buildout of broadband internet access—are poised to be in particular demand, along with construction laborers, construction managers, equipment operators, and electricians. Within engineering and technical services, civil engineers are the crucible occupation.

If left unaddressed, several occupational-demand challenges could spur inflation. For instance, most construction companies are competing for the same talent. Welders, for example, will be required at scale for manufacturing in addition to their role in the construction process—meaning without cooperation, manufacturers will compete with contractors for the same limited set of welders.
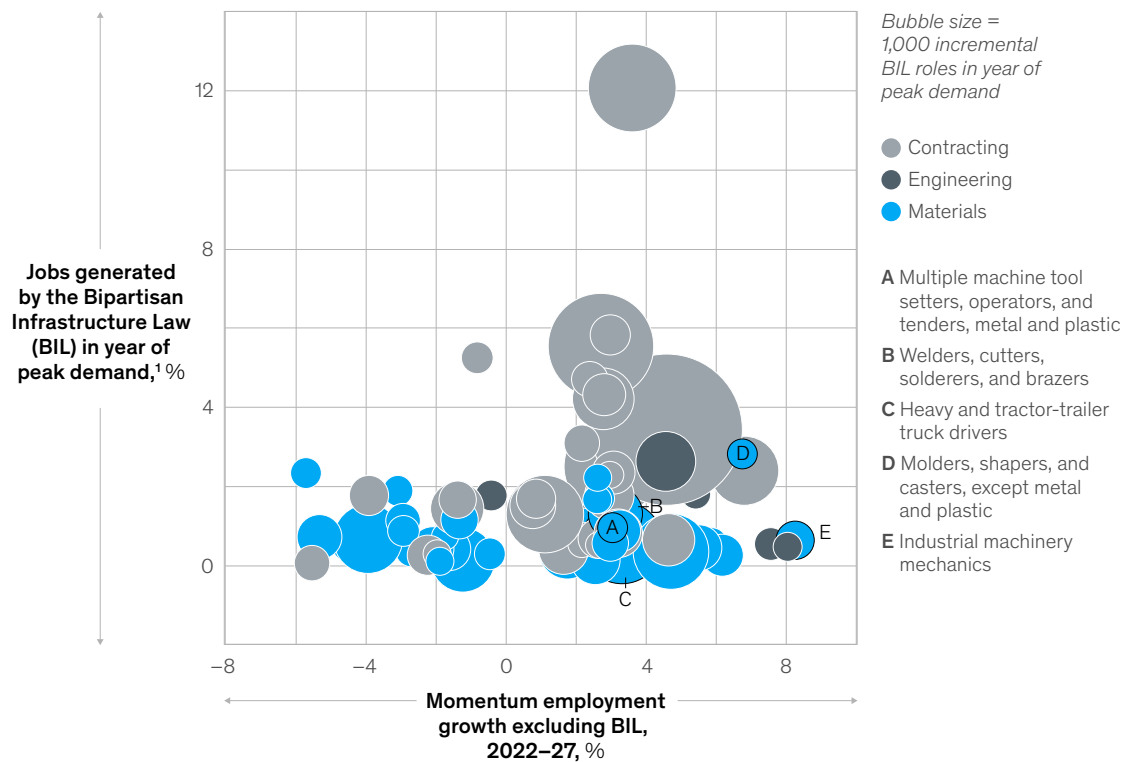
And indeed, people with skills crucial to the construction industry aren't beholden to working in the industry. The distribution sector could feel this strain severely, as truck drivers and freight movers, who were already in short supply, are drawn to short- and long-haul logistics companies driving B2C and B2B transformation across the economy. And regardless of their place in the value chain, construction companies eyeing digital transformation will need software developers, which is an entirely new capability for many small and midsize firms.

The geographic view

A few occupations, such as operating engineers, truck drivers, and freight movers, are in high demand across most US states—and construction laborers are the most in-demand jobs across the

Exhibit 3

Overall, the occupations that contractors typically employ are likely to face the most strain, but there are crucial roles across the value chain.

Jobs generated vs employment growth

Bubble size = 1,000 incremental BIL roles in year of peak demand

- Contracting
- Engineering
- Materials

A Multiple machine tool setters, operators, and tenders, metal and plastic

B Welders, cutters, solderers, and brazers

C Heavy and tractor-trailer truck drivers

D Molders, shapers, and casters, except metal and plastic

E Industrial machinery mechanics

Note: BIL stands for Bipartisan Infrastructure Law; occupations are limited to those requiring at least 1,000 new workers based on BIL spending in the year of peak demand within a given sector.
[1]Calculated as the number of jobs generated in year of peak demand from new BIL construction capital expenditures spending, divided by 2027 employment based on momentum growth that excludes BIL.
Source: Expert interviews; Lightcast, 2022; US Bureau of Economic Analysis; Bernard Yaros and Mark Zandi, "Macroeconomic consequences of the Infrastructure Investment and Jobs Act and Build Back Better framework," Moody's Analytics, November 4, 2021; McKinsey preliminary estimates based on Bipartisan Infrastructure Law, H.R. 3684, and White House state-specific information

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value chain in every US state except South Dakota. But the mix of sector and occupation constraints manifests differently across states.
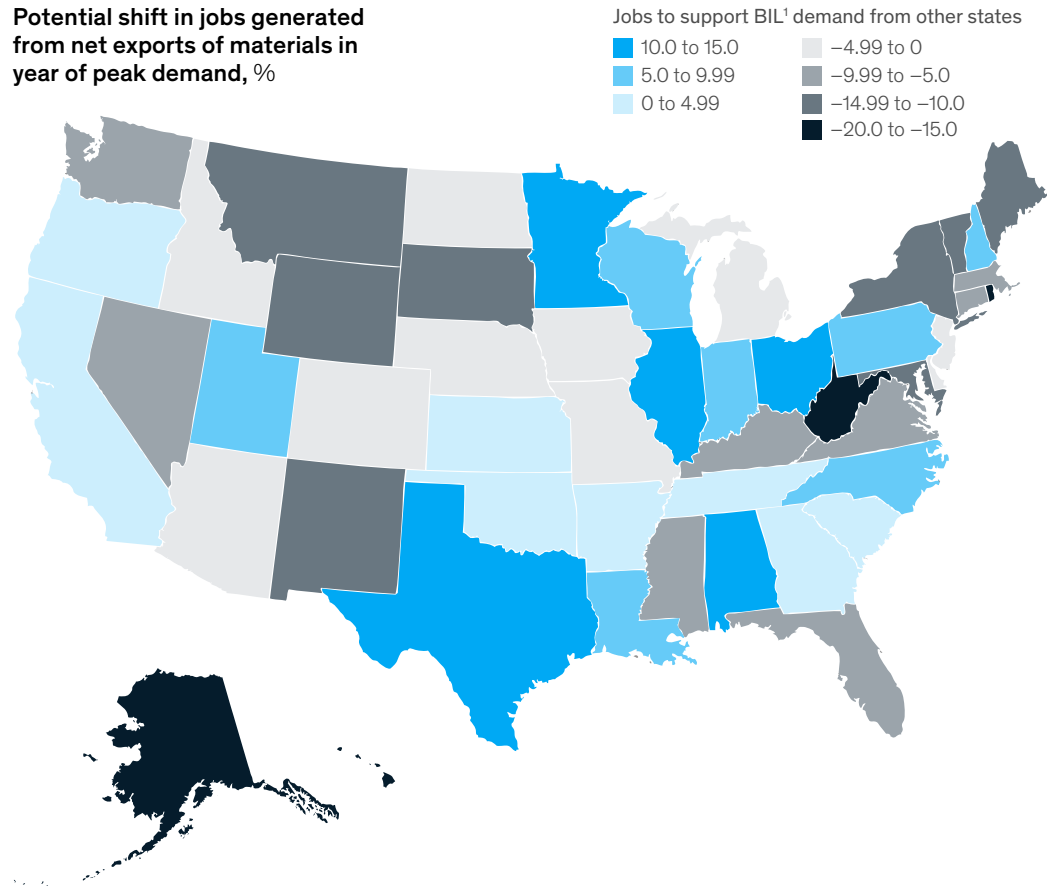
The potential labor strain caused by the BIL could be disproportionately concentrated in states that manufacture and export materials to states with limited manufacturing capacity (Exhibit 4). These manufacturing-heavy states will likely see demand for more jobs (and thus face additional labor

strain) than those required to build out their own infrastructure.

In North Carolina and Pennsylvania, for example, 46 percent of projected jobs are in the materials value chain, including manufacturing and distribution—in part reflecting the concentration of fiber-optic cable and steel-manufacturing production capacity in those states, respectively. In contrast, just 31 percent of projected jobs in Rhode Island are generated in the materials value chain.

Exhibit 4

Twenty-one states that are net exporters of materials may see incremental labor market strain.

Potential shift in jobs generated from net exports of materials in year of peak demand, %

Jobs to support BIL[1] demand from other states

■ 10.0 to 15.0	■ −4.99 to 0
■ 5.0 to 9.99	■ −9.99 to −5.0
■ 0 to 4.99	■ −14.99 to −10.0
	■ −20.0 to −15.0

[1]Bipartisan Infrastructure Law.
Source: Expert interviews; Lightcast, 2022; US Bureau of Economic Analysis; Bernard Yaros and Mark Zandi, "Macroeconomic consequences of the Infrastructure Investment and Jobs Act and Build Back Better framework," Moody's Analytics, November 4, 2021; McKinsey preliminary estimates based on Bipartisan Infrastructure Law, H.R. 3684, and White House state-specific information

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This dynamic could have three diverse implications: projects in states with limited manufacturing capacity may have increased risks associated with getting materials from other states, driving further price increases; companies in states with concentrated production capacity may feel incremental pressure to create capacity to address potential shortages; and states with less capacity may feel pressure to develop in-state manufacturing capacity to reduce potential delivery risks for their public projects.

Four actions to address the potential labor shortage

The potential labor challenge created by the BIL's historic investment transcends any individual sector, occupation, and geography. Delivering on this generational opportunity to drive national and global economic growth would benefit from the combined and coordinated efforts of the private, public, and social sectors working across the entire construction value chain.

Given the cross-cutting nature of the challenge, some of the most interesting solutions to date have involved partnerships across groups of stakeholders. We've identified four broad actions that may help the United States capitalize on this transformational moment.

1. Increase the supply of construction labor

To address the need for labor both in the aggregate and for a targeted set of bottleneck roles, companies could focus on reskilling and upskilling existing workers, attracting new people, and pulling people currently on the sidelines back into the labor force.

Upskill and reskill the workforce to fill targeted roles. McKinsey's recent American Opportunity Survey underscores the depth of appetite for reskilling in the industry.[6] Fifty-eight percent of workers across the construction value chain plan to pursue future training, education, or credentialing opportunities, 17 percentage points higher than the national average. Three examples illustrate the breadth and diversity of partnership approaches available to meet this demand, which involve a combination of employers, educational institutions, and the public sector. First, the Departments of Transportation (DOT) in Arizona and California require that DOT-funded projects meet minimum targets for on-the-job training. Second, UpSkill Houston links employers, educators, and applicants by providing a platform that connects candidates with potential job opportunities.[7] Third, shifting to a skills-based rather than credential-based view of hiring will provide further relief. The Rework America Alliance, a Markle-led coalition that includes McKinsey, has demonstrated the power of this approach, particularly for those without college degrees.[8]

Hire workers from nontraditional segments. These can include formerly incarcerated individuals, veterans, and others. Homeboy Industries provides an example of the local impact, effectiveness, and potential of working with formerly incarcerated individuals.[9] Stable employment is especially critical for this segment. Our American Opportunity Survey found 53 percent of previously incarcerated workers reported concern about the stability of their current employment, 1.4 times higher than those not previously incarcerated.[10] Helmets to Hardhats supports veterans transitioning into civilian roles.[11]

Attract new workers through a variety of approaches. First, nonwage benefits could open segments of the labor market. For example, some employers have started to offer housing and other benefits,[12] and Oregon introduced a $100 million childcare investment package to encourage entry into the workforce.[13]

Second, taking a more expansive view of the nonwage value proposition could also help employers access younger, more diverse talent. McKinsey's research emphasizes the importance of supportive management, purpose and values, and a flexible working schedule.[14] In a sector that is critical for building out the next-generation infrastructure required to propel American and global economic growth, there's an opportunity to frame such employment as deeply meaningful and compelling.

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[6] McKinsey American Opportunity Survey, 2022.
[7] For more, see the UpSkill Houston website.
[8] For more, see the Markle website.
[9] For more, see the Homeboy Industries website.
[10] McKinsey American Opportunity Survey, 2022.
[11] For more, see the Helmets to Hardhats website.
[12] Chip Cutter and Lauren Weber, "In battle for workers, companies build houses," *Wall Street Journal*, May 22, 2022.
[13] "House Bill 4005," Oregon Legislative Assembly, March 9, 2022.
[14] Aaron De Smet, Bonnie Dowling, Marino Mugayar-Baldocchi, and Bill Schaninger, "Gone for now, or gone for good? How to play the new talent game and win back workers," *McKinsey Quarterly*, March 9, 2022.

The industry has an opportunity to redefine what it means to be a construction worker.

Third, apprenticeships can start at younger ages, and the time between completion of school and integration into industry can be reduced. Ohio's High School Tech Internship Pilot program, for example, brings awareness to priority industries by allowing employers to hire high school interns.[15]

Finally, the industry could band together to showcase its wide variety of job opportunities. For people who want to work in an office, construction and manufacturing companies offer engineering and office jobs. For those who prefer operating machinery, roles are available on jobsites, in factories, and in distribution centers. And for individuals who like variety and want to work outside, construction laborers are in demand everywhere. The industry has an opportunity to redefine what it means to be a construction worker.

2. Improve productivity across the entire value chain

Improving productivity will involve upstream design, manufacturing, and distribution and downstream activities at the jobsite. While technology enablement is a core pillar of these activities, it's not a silver bullet to solve all problems.

Upstream productivity. Construction has been slow to adopt technology, despite its promise of productivity gains and proven value. When McKinsey surveyed construction executives in 2022 about the trends they expect to have the most impact over the next five to ten years, two of the top three trends involved upstream technological adoption: digital design (for example, digital twins) and automation of material production processes.[16] The industry could accelerate its slow adoption to offset the workforce challenge, and modernizing the industry's tech stack would have the added benefit of attracting a new demographic of skilled talent. In addition to technology, executives also cited transparency of material performance, earlier decision making, and professionalization of procurement among trends with the most impact. Past McKinsey research has highlighted the productivity and project cost gains available from off-site manufacturing.[17] Uptake in US markets has been limited, particularly compared with the Nordic countries, where there is a virtuous cycle among consumer preferences, demand, and the industry's supply chain.

Downstream productivity. The second most influential trend cited by executives in our 2022 survey involved downstream digital construction tools, including jobsite management. This is part of the lean construction ecosystem,

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[15] "High School Tech Internship," Ohio Department of Education, updated April 5, 2022.
[16] "Building products in the digital age: It's hard to 'get smart,'" McKinsey, June 6, 2022.
[17] "Modular construction: From projects to products," McKinsey, June 18, 2019.

which we described in a March 2022 article as "another proven way to drive significant and sustainable productivity improvements."[18] For instance, establishing a centralized continuous-improvement engine may enhance on-site execution through integrated planning, performance management, and waste elimination. Because key stakeholders across the project work with a common, agreed-upon set of KPIs, they can address issues in real time and better collaborate to reduce waste and variability of work. In addition, capability building across the planning and construction teams may help team members understand and adopt lean construction practices.

3. Revisit how owners work with contractors and suppliers

Most statutes that govern state and local agency procurement rely on lump-sum, fixed-price contracting in which the lowest price wins. In a world of rising inflation and increased macroeconomic uncertainty, this approach has already caused many agencies to receive inflated bids grounded in risk falling entirely on contractors that price for uncertain scenarios of inflation linked to material and labor shortages. A handful of alternative contracting options may reduce the burdens of the lump-sum, fixed-price status quo:

— At a strategic level, engage procurement, legal, and capital-programs departments in listening sessions with contractors in their market to understand the risks they are currently bearing and how existing procurement guidelines could be adapted to share those risks in a labor-scarce environment.

— Adopt models that allow contractors to execute over a flexible time horizon and optimize their resources accordingly, as some DOTs have done.

— Scale up the use of full collaborative contracting, especially on larger, complex projects, early in the design phase.[19]

— Revisit other terms and conditions affecting how much risk the market bears (for example, bonding requirements, payment terms, and change-order processes) to make contracts as appealing as possible to the market.

— Add room in the project procurement process to take feedback from the market on scope, bundling, timing expectations, and other elements that could improve the cost, schedule, and risk equation of a project. This approach—in which owners actively solicit feedback to determine ways to make a project better—is typically not accounted for in hard-bid procurement processes.

4. Coordinate more effectively

BIL projects across asset classes that are not coordinated and effectively compete are likely to inflate the cost of materials and reduce the real volume of infrastructure delivered. A variety of different types of coordination might address this issue.

First, across infrastructure projects and geographies, there's a need to prioritize and sequence spending across asset classes to smooth the flow of demand, with a link to centralized procurement planning (many states, including Michigan and New Jersey, are establishing infrastructure coordinator offices for this purpose[20]). In the same vein, there are potential benefits to coordinating at the regional or federal level.

Second, there's an opportunity to introduce efficiencies by combining particular types of

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[18] "Bridging the labor mismatch in US construction," McKinsey, March 28, 2022.
[19] "Collaborative contracting: Moving from pilot to scale-up," McKinsey, January 17, 2020.
[20] "Impact officer in chief: The state infrastructure coordinator's role," McKinsey, April 20, 2022.

investments to only "dig once."[21] For example, agencies that are installing fiber and repairing water mains in the same municipality could tackle both projects at once if they had visibility into each other's planning and sequencing of their broader capital programs.

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We've noted before that the US construction sector could power inclusive growth and set up the country's economy for success in the 21st century.[22] Yet the labor challenges are not easing. Thoroughly assessing the mismatch between worker demand and supply and implementing collaborative, creative approaches could help us embrace this generational opportunity to the fullest. Failing to do so may rob the United States of tens of thousands of miles of roads, thousands of bridges, and miles of water and electrical infrastructure that could have been funded by this bipartisan investment and made our lives better for years to come.

[21] "'Dig once' could help states manage material and worker shortages," McKinsey, August 24, 2022.
[22] "Bridging the labor mismatch in US construction," March 28, 2022.

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Transforming public sector hiring with data-enabled talent 'win rooms'

These talent hubs can expedite and streamline government hiring processes—and they can also close critical labor gaps.

by Anita Dutta, Nora Gardner, Megan McConnell, and Angela Sinisterra-Woods

The need for public sector workers has steadily increased over the past several years due to expanded government mandates and funding, including the American Rescue Plan[1] and the Bipartisan Infrastructure Law.[2] These and other initiatives have resulted in a rapid rise in the number of government jobs needing to be filled. In March 2023, there were 1.05 million government job openings—compared with fewer than 700,000 at the end of 2020[3]—accounting for more than 10 percent of open jobs in the United States.[4]

However, employers across sectors are struggling to balance competing hiring priorities as they contend with an uncommon combination of economic uncertainty and a persistently tight labor market.[5] In the context of these trends, the public sector can transform its traditional hiring practices and close its growing labor gap by optimizing four key hiring steps and deploying data-enabled talent 'win rooms' to rapidly fill in-demand positions.

A data-enabled talent win room is a central, cross-functional team that uses internal and external data to address talent attraction needs and rapidly recruit in-demand talent. A win room can be a catalyst for recruiting and hiring transformations: critically, it quickly and effectively lends focus, transparency, and structure to implement essential steps for improving recruiting and hiring. It also allows for dedicated attention across stakeholders to solve the organization's most crucial talent attraction and hiring problems.

The challenges affecting public sector hiring

The government's talent attraction challenges are apparent in its hiring data: the public sector has had the lowest overall hiring rate of the ten major economic sectors tracked by the Bureau of Labor Statistics for the past several years, hovering at about half the rate of the private sector.[6]

Because economic uncertainty and tight labor markets have historically existed in isolation, employers do not have a playbook for managing hiring amid these dueling forces. Many leaders are therefore balancing on a "talent tightrope" as they carefully and simultaneously trim budgets, retain key talent, and protect the business in the near term while also setting it up for success in the long term. Government employers have fewer options for effectively navigating these difficulties because of the rigorous hiring processes many government roles require.[7]

The public sector's struggle to fill its vacancies increasingly endangers the United States' efforts to serve the public,[8] including major initiatives to upgrade infrastructure, bolster supply chain resilience, educate children, and respond to the complex geopolitical environment.

To overcome these challenges, leading organizations are taking four crucial steps to modernize traditional hiring practices and fill critical positions quickly.

[1] "Fact sheet: The impact of the American Rescue Plan after one year," US Department of the Treasury, March 9, 2022.

[2] "Fact sheet: One year into implementation of Bipartisan Infrastructure Law, Biden-Harris Administration celebrates major progress in building a better America," The White House, November 15, 2022.

[3] "Job openings, hires, and separations levels, seasonally adjusted," US Bureau of Labor Statistics, accessed June 7, 2023.

[4] Ibid. Excludes farming jobs.

[5] *People & Organization Blog*, "Shorter for longer: Navigating the taut talent tightrope amid economic uncertainty," blog entry by Bryan Hancock and Asutosh Padhi, McKinsey, January 3, 2023.

[6] "Table 1. Job openings levels and rates by industry and region, seasonally adjusted," US Bureau of Labor Statistics, updated May 31, 2023.

[7] Isabella Bennett, Sarah Kleinman, and Megan McConnell, "Mission critical: Improving government workforce planning," McKinsey, September 14, 2022.

[8] Danny Clark, Marcy Jacobs, Megan McConnell, and Sarah Tucker-Ray "Transforming the US government's approach to hiring digital talent," McKinsey, September 9, 2020.

How leading organizations win the race for talent

Many leading organizations have been able to rapidly attract and hire needed talent by focusing on four critical components of the hiring process: expanding the candidate pipeline, sharpening job descriptions and employer branding, streamlining the hiring process, and enabling data-based decision making.

Each of these actions can help close talent gaps, but they are especially effective when used together.

Expanding the candidate pipeline

Creatively reassessing and changing candidate screening criteria can expand sourcing pipelines, ultimately increasing the number of qualified potential candidates who may be considered for a role. These changes could include strategically seeking out new types of candidates, such as those switching jobs midcareer or reentering the workforce after time away; candidates from different geographic locations or remote workers; candidates from diverse demographics or back-grounds; or skilled-through-alternative-routes (STAR) candidates, who are adults in the workforce over the age of 25 who have high school diplomas but do not have bachelor's degrees.[9]

There are nearly 70 million STAR candidates in the United States, composing approximately 50 percent of the workforce. Despite not holding bachelor's degrees, these individuals have developed skills through workforce training, boot camps or certificate programs, military service, or on-the-job experiences. Because a résumé screener may automatically exclude these candidates due to their lack of formal educational credentials, expanding screening criteria to include STAR candidates could vastly expand the pool of qualified job applicants. This is an especially potent way for organizations to close labor gaps for critical roles more quickly,

especially during a time when many organizations are struggling with a perceived skills gap in the talent market.[10] In addition, the public sector is uniquely poised to provide employment opportunities to underserved groups, such as refugees and formerly incarcerated individuals, by expanding its talent pipeline to include more STAR candidates.

The impact of expanding the candidate pipeline is of heightened importance for addressing public sector talent shortages: between April 2020 and April 2022, 72 percent of public and social sector or not-for-profit workers who left did not return to the same industries or left the workforce entirely,[11] indicating a growing need to seek out new sources of talent. This is underscored by ongoing research by McKinsey and the National Association of State Chief Administrators (NASCA), which has demonstrated that ongoing talent challenges have resulted in critical resource shortages that have restricted various government services, particularly those related to areas with acute shortages such as healthcare and engineering.[12] The benefits of expanding the candidate pipeline are therefore especially potent for public sector entities.

Sharpening job descriptions and employer branding

Highlighting favorable aspects of a role to job seekers can also greatly attract talent. This is particularly critical for government roles: in a recent McKinsey survey of 1,500 public sector employees, more than 40 percent of respondents cited meaningful work as one of the top reasons why they wanted to stay in their current position.[13] Organizations could develop and implement surveys or hold focus groups for potential job candidates as well as for current employees to understand what these groups value in their roles and employers. This information can then be used to redesign job descriptions and employer branding to crystallize and clearly communicate

[9] For more information, see tearthepaperceiling.org.
[10] *McKinsey Blog*, "Tearing the 'paper ceiling': McKinsey supports effort driving upward mobility for millions of workers," September 23, 2022.
[11] Aaron De Smet, Bonnie Dowling, Bryan Hancock, and Bill Schaninger, "The Great Attrition is making hiring harder. Are you searching the right talent pools?," *McKinsey Quarterly*, July 13, 2022.
[12] Richard Choi, Sameer Chowdhary, Drew Erdmann, and Tim Ward, "Bridging the talent gap in state government postpandemic," McKinsey, March 17, 2023.
[13] "What workers want is changing. That could be good for government," McKinsey, October 26, 2022.

Four steps can significantly transform the efficacy of hiring. But implementing them is not easy for any organization.

aspects of a role that candidates care about, thereby attracting more applicants.

Streamlining the hiring process
In recent years, the average time from a candidate applying to a public sector job to receiving a job offer was about 119 days—more than triple the private-sector average.[14] To condense this lengthy process without compromising outcomes, public sector organizations can rapidly analyze their current-state hiring processes to understand the most salient pain points. These data can help inform the redesigning of hiring processes to, for example, simplify application requirements, minimize handoffs between teams, and strategically time security-screening procedures to reduce time to hire and improve the candidate experience. Organizations could also create greater transparency into the hiring process for candidates via more proactive communications or by creating a calendar of hiring milestones and expectations.

Enabling data-based decision making
Underpinning all other steps in improving hiring processes is enabling data-based decision making across recruiting and hiring activities. This can be achieved by standing up dashboards that are used to drive day-to-day operational decisions. Such dashboards provide visibility into current process bottlenecks, which allows for attention and action to be directed where it is most needed, ultimately resulting in improved talent attraction and hiring efforts for many public sector entities.

Across sectors, data transparency enables organizations to quickly progress hiring by shedding light on where efficiencies can be swiftly realized (for example, where candidates are getting stuck in existing hiring processes). Deploying dashboards that serve as a single source of truth on organizational recruiting and hiring has proven critical for companies; they are core to any effort to close talent gaps.

How data-enabled talent win rooms transform public sector hiring practices

The four steps above can significantly transform the efficacy of hiring. But implementing them—and doing so quickly and efficiently to close talent gaps—is not easy for any organization, especially for those with dispersed internal recruiting and hiring teams that do not coordinate regularly or that lack readily available hiring data. In the public sector, these challenges are particularly pronounced because the structures of many public sector organizations do not allow for the focus and cross-functional collaboration required to implement these efforts tactfully, nor do they have dedicated teams to execute these changes. As such, many organizations in both the private and public sectors have set up data-enabled talent win rooms to orchestrate and accelerate the implementation of these steps to rapidly close talent gaps.

Building a data-enabled talent win room
Data-enabled talent win rooms include three fundamental characteristics.

A cross-functional team of stakeholders. The cross-functional team brings together the stakeholders needed to hire talent quickly. This core group

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[14] *Time to hire report*, Neogov, 2020.

is made up of members from human resources, such as recruiters and hiring specialists; business functions, such as hiring managers; and subject matter experts, such as personnel security and IT professionals. The dedicated talent win room team works together to help candidates progress quickly through the hiring process by minimizing handoff delays between teams and expediting alignment to hire candidates. This swift stakeholder coordination can greatly reduce the time required to complete critical hiring activities, resulting in more talent in the door when it is needed.

A central repository for accurate hiring data. A central data repository—and, ideally, a set of dashboards that uses the central data to showcase hiring goals and progress—helps aggregate information on hiring across the organization. Data shown could include actual hiring versus planned hiring, the number of candidates at each stage of the hiring pipeline, and vacancy requests filed from the business to the human-capital office. These data can be used to inform hiring planning, drive recruiting and hiring strategies, and deliver a clear picture of current hiring successes and gaps.

An iterative working model. Using an iterative working model supported by agile ways of working—including daily check-ins, weekly planning, and biweekly retrospective assessments—can ensure continuous hiring progress. By working in this manner, the talent win room can rapidly identify bottlenecks to hiring and determine the right interventions needed to accelerate solutions. The data-enabled talent win room team can then rapidly deploy these interventions and measure their impact, adjusting as data show which interventions yield the greatest impact. This approach allows for a rapid, data-informed operating model of continuous testing, learning, and adapting.

Data-enabled talent win rooms in practice
The characteristics and operating models of data-enabled talent win rooms create organizational capacity to transform hiring by bringing together the data and expertise necessary to make quick and sound hiring decisions. Their impact has been demonstrated repeatedly within organizations of

different types, sizes, and locations.

For example, one large US federal agency created a fiscal-year hiring goal that was more than 50 percent higher than the total number of hires they were able to make in the previous fiscal year. To accomplish this goal, the agency set up a data-enabled talent win room to develop executive and operational dashboards that provided visibility into hiring progress and barriers. The cross-functional team could then strategically reduce bottlenecks for hiring critical roles. These efforts allowed the agency to increase its hiring rate by more than 30 percent in the first three months after establishing the data-enabled talent win room.

At a different US federal agency, candidates, hiring managers, and HR specialists reported numerous pain points throughout the hiring process, such as candidates saying the hiring process was delayed and not transparent. The agency explored solutions from a customer-centric approach and subsequently piloted changes through a data-enabled talent win room. Metrics of success, such as process timelines and candidate experience feedback, were rigorously tracked, and a cross-functional team worked together to ensure rapid progress. As a result, the time to hire decreased by nearly 80 percent, and the team within the agency that implemented the data-enabled talent win room efforts saw a more than sevenfold net gain in hiring numbers in that fiscal year.

Data-enabled talent win rooms have also been used successfully in public sector organizations outside the United States. For example, a G-20 ministry was undergoing a major transformation to digitalize its services, which required elevating organizational capabilities to attract, select, and cultivate top tech talent. However, the agency had nascent knowledge of tech talent needs and a recruiting process that took up to six months. By using a data-enabled talent win room, the agency was able to attract the talent it needed to power its transformation, reducing time to hire by 65 percent, quintupling its monthly interview capacity, and developing more than 15 recruiting partnerships with academic institutions and technology

communities across the country. The data-enabled talent win room helped the department deliver results faster while retaining and growing talent. In turn, the department won a national award for client experience.

The path forward for public sector hiring

A robust, qualified, and motivated public sector workforce is critical to drive complex initiatives that affect society. Using data-enabled talent win rooms to implement the four steps described above has been shown to be key in closing labor gaps in any type of organization, but they are especially beneficial to government organizations that face steep hiring gaps and often have limited organizational capacity to close them.

The meaningful nature of public sector work is widely valued by both prospective and existing employees, offering a unique competitive advantage when recruiting and hiring. However, the sector still faces steep, persistent attraction and hiring challenges. Using data-enabled talent win rooms to combat these challenges can help quickly and effectively fill the sector's growing number of open critical roles with qualified and motivated candidates. The accelerated hiring of candidates into these critical government roles can help speed up the many important public sector initiatives that benefit all citizens.

'Dig once' could help states manage material and worker shortages

Multiple excavations for infrastructure improvements can be disruptive to the public. Coordinating projects could minimize negative impacts and help states manage supply chain and labor shortages.

This article is a collaborative effort by Adi Kumar, Shannie Lotan, Nehal Mehta, Sara O'Rourke, and Jennifer Volz, representing views from McKinsey's Public Sector Practice.

It's the sort of thing that might keep state leaders up at night. A heavily trafficked route is made impassible by the second road excavation in a year, triggering complaints from frustrated commuters and business owners, or worse: an accident in a work zone.

These are exactly the types of scenario a "dig once" policy is designed to avoid.

While infrastructure improvements are generally welcomed by the public, they can be highly disruptive. A dig-once approach seeks to mitigate that pain by coordinating the delivery of several infrastructure projects simultaneously, rather than carrying out each one separately. For example, adding more lanes to a highway requires excavation; so does laying new broadband cables to bring high-speed internet service to an unserved rural community. Rather than dig up the road twice, states could dig just once to accommodate both projects.

Curbing disruptions is not the only potential benefit. With hundreds of billions of federal dollars being reinvested in America under the Bipartisan Infrastructure Law (BIL), harmonizing projects through a dig-once approach could help states save money. If complemented by sophisticated digital tools, the approach could also help states manage shortages of building supplies and construction workers more efficiently and secure more BIL funding. And it could pave the way for more integrated infrastructure systems that could better serve households and businesses and advance public-policy goals, supporting lives and livelihoods.

Granted, coordinating major infrastructure projects across multiple agencies, entities, and stakeholders is not without its challenges, but there are strategies that could help tackle some of the most common ones.

Overcoming barriers

By reducing the need for multiple excavations, a dig-once policy can promote better use of public resources, and potentially help mitigate property damage, service outages, traffic disruptions and accidents, and other potential hazards to public safety.[1] The approach could also generate more bang for taxpayers' dollars. A 2012 study by the US Government Accountability Office found that coordinating broadband and federal highway projects could generate cost savings ranging from 25 to 33 percent in urban areas and approximately 16 percent per mile in rural areas.[2] Another analysis estimated that coordinating broadband installations with utility and transportation excavations is approximately ten times cheaper than doing a standalone dig, and that savings are most pronounced in high-density areas where underground installation is the only option.[3]

But coordinating multiple infrastructure projects faces many barriers. Three of the most common include the following[4]:

1. *Budget and funding rigidity.* Creating flexibility within government budget timelines and federal program requirements could be beyond the remit of some government leaders focused on infrastructure projects. This challenge is often compounded if each entity in the process (such as utility agencies, telecom companies, transit agencies, and road owners in a city) has different capital agendas and funding processes that were created separately. Reconciling these to adapt to different

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[1] *Broadband policy and report*, City of Palo Alto, CA, Magellan Advisors, November 2020.
[2] "Planning and flexibility are key to effectively deploying broadband conduit through federal highway projects," US Government Accountability Office, June 27, 2012.
[3] "FOSA Public Policy," Fiber Optic Sensing Association, August 26, 2020.
[4] "Dig once," G20 Global Smart Cities Alliance; Corey Glickman, "How 'dig once' can democratize digital connectivity," World Economic Forum, February 16, 2022; Jed Pressgrove, "Can dig-once policies hasten the close of the digital divide?" *Government Technology*, April 13, 2021; expert interviews; McKinsey analysis.

timelines is unlikely. Also, some BIL funding must adhere to strict statutory guidelines that could thwart efforts to expand the scope of a project to include cross-agency priorities.

2. *Assessing and conveying the business case to initiate, prioritize, and sequence projects.* Coordinating multiple public works can trigger higher costs up front, and it could be hard for governments to evaluate and measure the financial benefits of absorbing those initial costs. Leaders pursuing dig once may also find it difficult to evaluate the nonfinancial impact that projects could have on citizens' lives.

3. *Coordination and implementation of projects across different time horizons and agencies.* Once states have identified which projects to prioritize for a dig-once effort, coordinating their launch across myriad stakeholders such as government agencies, public-utility companies, subcontractors, and other private-sector actors can be difficult, especially with programs that roll out on different timelines and have different stage gates, permitting processes, and so on.

Though these hurdles may seem daunting, they are not necessarily insurmountable. Some states and cities have already implemented various "flavors" of dig once.[5] Arizona, for example, requires its Department of Transportation (DOT) to coordinate with telecom companies during road construction projects along rural highways to install broadband conduits and help close the digital divide.[6] Illinois, Maryland, and Minnesota also promote coordination between their DOTs and private broadband providers. The Michigan Infrastructure Council has a coordination portal that documents infrastructure construction and alerts owners to overlapping projects (see sidebar, "Flavors of dig once").[7]

Flavors of dig once

— *Carlisle, PA.* There is a requirement to consider dig-once opportunities when scheduling any municipal maintenance or public-works project through policies for streamlining integrated infrastructure with a focus on green infrastructure.

— *Arizona.* The dig-once policy states that during road construction projects along rural highways, the department of transportation (DOT) can coordinate with telecom companies to install the conduit. The policy also enables the agency to lease the conduit to telecom providers at a cost-based rate.

— *Boston, Massachusetts.* Boston has a "shadow conduit policy" in which the first company to request a trench takes a lead role and invites other entities to add additional conduits for future use by the city or other later entrants.

— *Maryland.* The DOT coordinates with internet providers and local utilities to install conduits for future use and provides right-of-way access without charge to certain entities.

— *Illinois.* The DOT and ISPs collaborate to install fiber in new state-funded construction, which includes trenching.

The DOT issues public bidding notices, explicitly citing the need for conduits or cable.

— *Utah.* The DOT requires the installation of oversized conduits for certain road construction projects, while interested telecom parties can then extend that infrastructure to neighboring communities. DOT owns the conduit and leases it to telecom companies that want to use it.

[5] Kelli Hughes, *Dig once: Policies and best practices*, California Association of Councils of Governments, 2020; "Dig once policy: 16 state models," Fiber Optic Sensing Association, July 2020.
[6] Tyler Cooper, "Dig once: The digital divide solution congress squandered and policy that could save $126 billion on broadband deployment," BroadbandNow, November 30, 2021.
[7] "Michigan Infrastructure Council debuts public and private infrastructure 'dig once' coordination tool," Michigan Department of Treasury, March 16, 2021.

Tailored visualization could allow state leaders to test multiple coordination options at once, prioritize projects according to estimated ROI, and help address material and labor supply shortages.

These variations of dig once suggest that there is potential for a range of solutions state and local leaders could explore to overcome common obstacles.

Here are five solutions to consider:

4. *Designate an infrastructure coordinator to better align projects and programs.* By becoming a clearinghouse for which programs agencies are applying, and which projects will kick off and when, the coordinator could identify opportunities for overlap.

5. *Create a platform or forum to enhance coordination between the state and private sectors.* This could be a portal, regular working sessions, stakeholder calls, designated councils, or other solutions. The idea is to keep communications flowing over which projects are planned, how they might roll out, and how everyone involved can improve coordination.

6. *Better inform planning by feeding in data on labor and material shortages.* States may want to focus on staging and planning projects that have the most potential for impact and starting with those that are least impacted by shortages could do that.

7. *Put a single person in charge of "bundled" projects in their design and build/construction phases to ensure they can be done together.* This point person could also focus on coordinating stakeholders, aligning and accelerating permitting processes, and ensuring things keep moving.

8. *Plan early and map it out.* Using geospatial analysis can highlight where funding is dedicated and could identify areas of overlap and potential for dig-once approaches.

More sophisticated digital tools could also be harnessed to improve project design and delivery. For example, models that draw from multiple sources could be built on top of a geospatial map of the entire infrastructure portfolio and then layered with information on individual projects. This type of tailored visualization could allow state leaders to test multiple coordination options at once, prioritize projects according to estimated ROI, identify which ones have BIL funding, and help address material and labor supply shortages. These models could even evolve to enable advanced simulations to anticipate how factors such as flooding, wildfires, and other natural disasters, or fluctuations in public-transport passenger numbers, could impact infrastructure investments down the line.

But states don't need to wait until they have sophisticated digital tools to kick off a dig-once policy. One central platform—even one as simple as a shared spreadsheet—managed by a designated leader could help support project planning, prioritization, and implementation. States can then consider building from a humble starting point to move toward longer-term solutions that could create multiple options for addressing core dig-once challenges. And those longer-term solutions could lay the foundation for a fully integrated state infrastructure system.

Integrated infrastructure systems

The advantages of dig once could go beyond saving money and reducing residents' inconvenience. Looking more strategically, the approach can also help catalyze plans for more integrated infrastructure systems. For example, coordinating broadband and lead-pipe abatement could yield dividends for households and businesses simultaneously. Harmonizing transportation, transit, and electric-vehicle-charging stations could help drive more complementary transportation networks. And coordinating critical failure points around green-energy grids could create greater resilience against fires and storms.

With BIL delivering $550 billion in new spending over the next five years, states will have more resources to pool for dig-once priorities, including a more expansive vision of integrated infrastructure. They'll also likely have wiggle room to combine BIL programs because the Federal Highway Administration allows states to transfer funding for some road and highway projects to other entities if it generates cost savings or brings greater expertise to the table.[8]

Moreover, if states can visualize more integrated infrastructure systems, this could help them secure more BIL funding. Some BIL grants will be doled out according to formulas, but others will be awarded on the strength of competitive applications. Framing community impacts through the lens of integrated infrastructure systems could distinguish applications from state, local, and tribal entities, while helping to ensure the funds they do receive are deployed wisely.

While coordinating infrastructure projects is not without challenges, the concept is already being proven in several states. And with the nation's transportation, water, broadband, and other systems receiving a once-in-a-generation federal funding boost, dig once could make the process of upgrading infrastructure less painful for the public and deliver bigger benefits down the road.

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[8] FHWA Order 4551.1: "Fund transfers to other agencies and among title 23 programs," Federal Highway Administration, US Department of Transportation, August 12, 2013.

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One year into the BIL: Catalyzing US investments in energy

The legislation provides an opportunity to improve the country's clean-power infrastructure. More than a year since its signing, we take stock of announced funding, programs, and the road ahead.

by Adam Barth, Bernice Chan, and Ksenia Kaladiouk

Executive summary

The Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (BIL), which was signed in November 2021, will provide more than $1 trillion in public investment. One core component of the legislation is accelerating the clean-energy transition and improving the reliability and resilience of electric-power infrastructure. As of January 2023, roughly 40 percent of total BIL clean-energy funding had been launched,[1] with remaining prenotice programs expected to begin funding cycles in early 2023.

The power sector currently accounts for about a quarter of total greenhouse-gas (GHG) emissions in the United States. Decarbonizing the power sector is therefore critical to mitigating the impact of climate change. At the same time, increased frequency of extreme weather events combined with aging electric-power infrastructure is making the power system increasingly vulnerable to prolonged outages. The act provides funding across a wide range of stakeholders—including state, local, federal, utilities, and industries—and across the power value chain, from generation down to storage and emissions management, including clean energy, electric-grid improvements, carbon capture, and clean-hydrogen development.[2]

This article, part of our *Reinvesting in America* series, breaks down BIL spending on clean-power infrastructure in the following exhibits.

[1] Includes funding that has been awarded, is open for application submission, or has closed its application submission process.
[2] For more on BIL spending, see McKinsey's BIL Navigator.
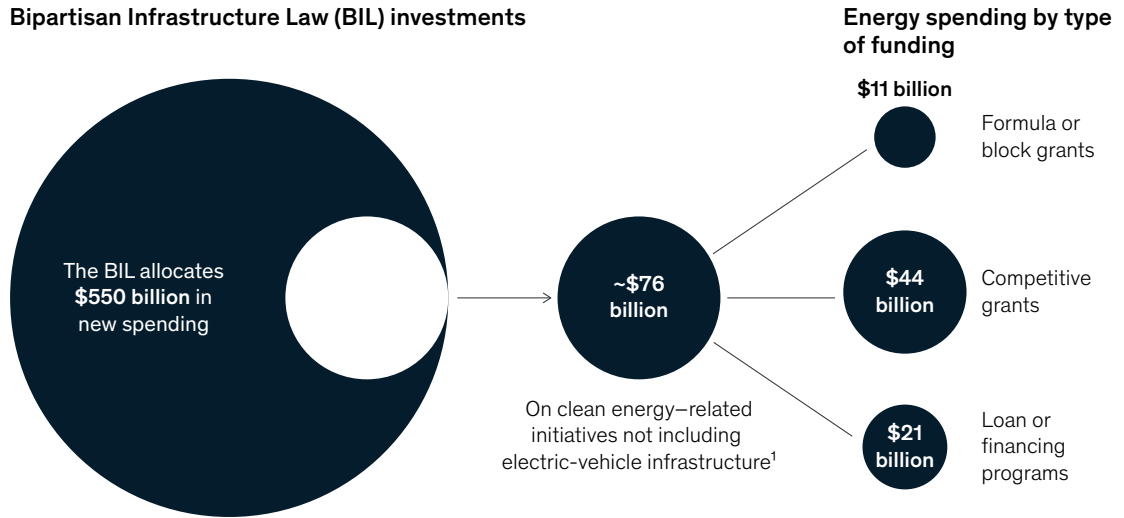
Energy is a core priority of BIL

Of the $550 billion of new funding provided in the BIL, approximately $76 billion[3] is committed to be invested in energy. Most of this funding, $43.5 billion, is available through competitive grants.

Exhibit 1

The Bipartisan Infrastructure Law targets a sizable portion of spending to the energy sector.

Bipartisan Infrastructure Law (BIL) investments

Energy spending by type of funding

The BIL allocates **$550 billion** in new spending

~**$76 billion**

On clean energy–related initiatives not including electric-vehicle infrastructure[1]

$11 billion
Formula or block grants

$44 billion
Competitive grants

$21 billion
Loan or financing programs

[1]An estimate of BIL clean-energy funding, which includes a combination of clean-energy, resilience, and environmental-remediation funding related to the utility and power sector. This does not include electric vehicle–related funding.
Source: *Building a better America: A guidebook to the Bipartisan Infrastructure Law for state, local, tribal, and territorial governments, and other partners*, The White House, May 2022

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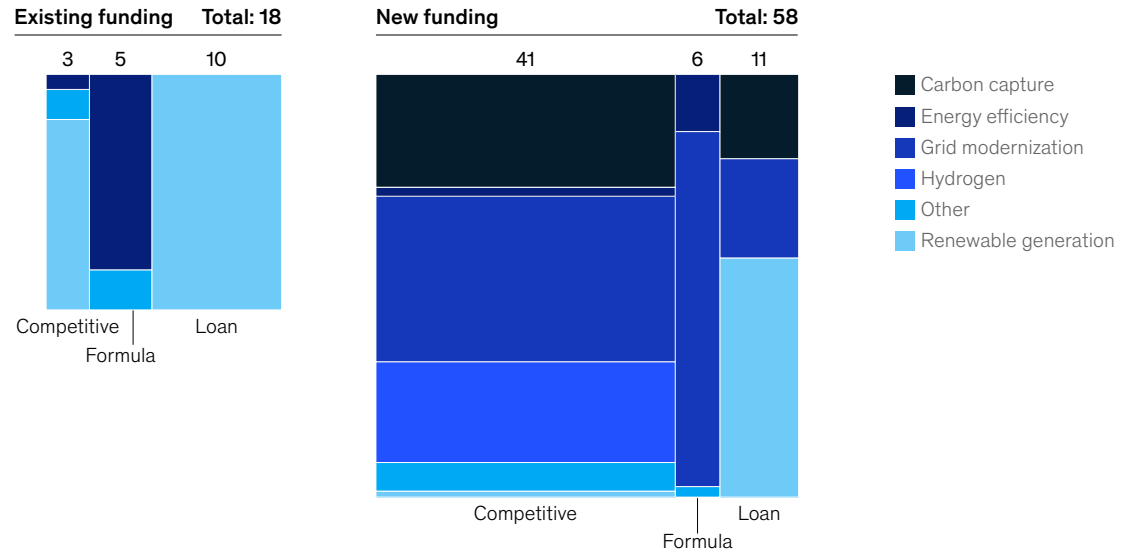

We can expect a host of new programs

A portion of the funding available through BIL will go toward existing programs focused on renewable generation and energy efficiency. But the bulk of incoming funds—which will be available through formula or block grants, competitive grants, and loan and financing programs—will be dedicated to new programs.

Exhibit 2

Most energy sector funding is for new programs.

Funding available by asset category and type,[1] $ billion

Existing funding — Total: 18
3 5 10
Competitive | Formula | Loan

New funding — Total: 58
41 6 11
Competitive | Formula | Loan

Legend:
- Carbon capture
- Energy efficiency
- Grid modernization
- Hydrogen
- Other
- Renewable generation

[1]Estimate of Bipartisan Infrastructure Law clean-energy funding, which includes a combination of clean-energy, resilience, and environmental-remediation funding related to the utility and power sector. This does not include electric vehicle–related funding. Estimates are rounded to the nearest whole number.
Source: *Building a better America: A guidebook to the Bipartisan Infrastructure Law for state, local, tribal, and territorial governments, and other partners*, The White House, May 2022

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The bulk of incoming funds—which will be available through formula or block grants, competitive grants, and loan and financing programs—will be dedicated to new programs.

BIL builds on past spending

The 2009 American Recovery and Reinvestment Act (ARRA) included more than $60 billion of clean-energy investments[4] to modernize US energy and communication infrastructure and enhance energy independence. This stimulus package provided significant investments in energy efficiency, renewable generation, and grid modernization.

Now, more than a decade later, energy efficiency and renewable energy have matured. For this reason, the BIL focuses more on accelerating the development of new technologies, such as clean hydrogen and carbon capture and storage (CCS), as well as continuing to modernize the grid to support electrification, renewable integration, and climate adaptation.

Exhibit 3

Compared with historical spending, the Bipartisan Infrastructure Law dedicates more funds to grid modernization and new technology.

Clean-energy funding, $ billion
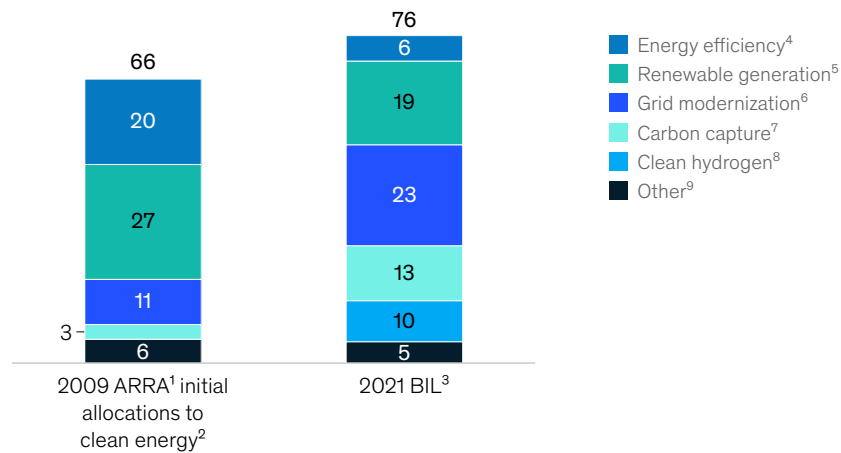
Note: "BIL" stands for the Bipartisan Infrastructure Law. Figures may not sum, because of rounding.
[1]American Recovery and Reinvestment Act.
[2]Does not include $18 billion for transit and high-speed rail or $6 billion for domestic manufacturing of advanced vehicles and fuels.
[3]An estimate of BIL clean-energy funding, which includes a combination of clean-energy, resilience, and environmental-remediation funding related to the utility and power sector. This does not include electric vehicle–related funding.
[4]Pays for energy efficiency retrofits in homes.
[5]Includes, for example, wind turbines and solar panels.
[6]To develop the smart grid that will involve sophisticated electric meters, high-tech electricity distribution and transmission grid censors, and energy storage; also includes battery spending.
[7]Crucial research, development, and demonstration of carbon capture and sequestration technologies.
[8]Clean-hydrogen production, processing, delivery, storage, and end use.
[9]Green innovation and job training to invest in the science, technology, and workforce needed for a clean-energy economy.
Source: *A retrospective assessment of clean energy investment in the Recovery Act*, Executive Office of the President, February 2016; *The economic impact of the American Recovery and Reinvestment Act of 2009: Fourth Quarterly Report*, Council of Economic Advisers, July 14, 2010

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[4] Does not include $18 billion for transit and high-speed rail or $6 billion for domestic manufacturing of advanced vehicles and fuels.
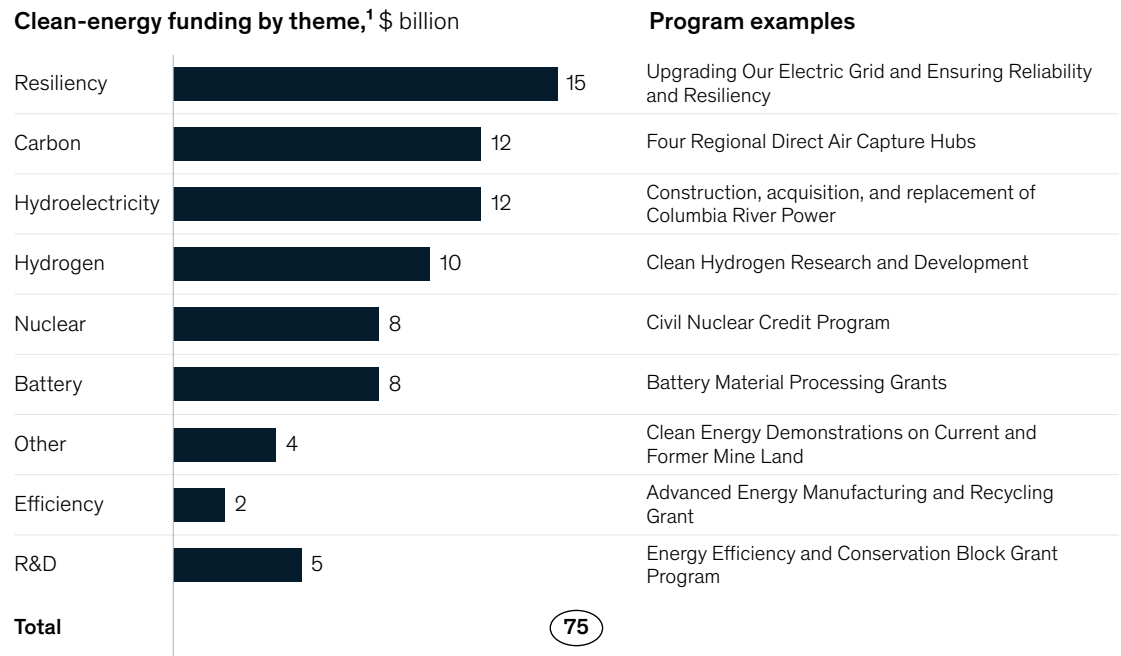
How the money will be allocated across themes

The goals of the largest energy programs are to upgrade grid resiliency, build direct air capture hubs, increase carbon capture and storage, and develop hydrogen hubs. BIL also includes programs to support dams and nuclear reactors, encourage battery recycling and demonstration, deploy energy efficiency, and fund R&D.

For a more detailed look at the specific programs for each theme, see the technical appendix.

Exhibit 4

Clean-energy funding in the Bipartisan Infrastructure Law spans several major themes, including grid resilience and carbon capture.

Clean-energy funding by theme,[1] $ billion

Theme	Value	Program examples
Resiliency	15	Upgrading Our Electric Grid and Ensuring Reliability and Resiliency
Carbon	12	Four Regional Direct Air Capture Hubs
Hydroelectricity	12	Construction, acquisition, and replacement of Columbia River Power
Hydrogen	10	Clean Hydrogen Research and Development
Nuclear	8	Civil Nuclear Credit Program
Battery	8	Battery Material Processing Grants
Other	4	Clean Energy Demonstrations on Current and Former Mine Land
Efficiency	2	Advanced Energy Manufacturing and Recycling Grant
R&D	5	Energy Efficiency and Conservation Block Grant Program
Total	**75**	

Note: "BIL" stands for the Bipartisan Infrastructure Law. Figures do not sum, because of rounding.
[1]An estimate of BIL clean-energy funding, which includes a combination of clean-energy, resilience, and environmental-remediation funding related to the utility and power sector. This does not include electric vehicle–related funding.
Source: US Senate H.R. 3684, Infrastructure Investment and Jobs Act

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Funds are distributed among entities and programs

The private sector and state and local agencies are each eligible for more than $35 billion in energy-related funding from the BIL. All entities have access to numerous programs targeting everything from energy efficiency and renewable generation to grid modernization (see sidebar, "Resources to help navigate BIL clean-energy funding programs").

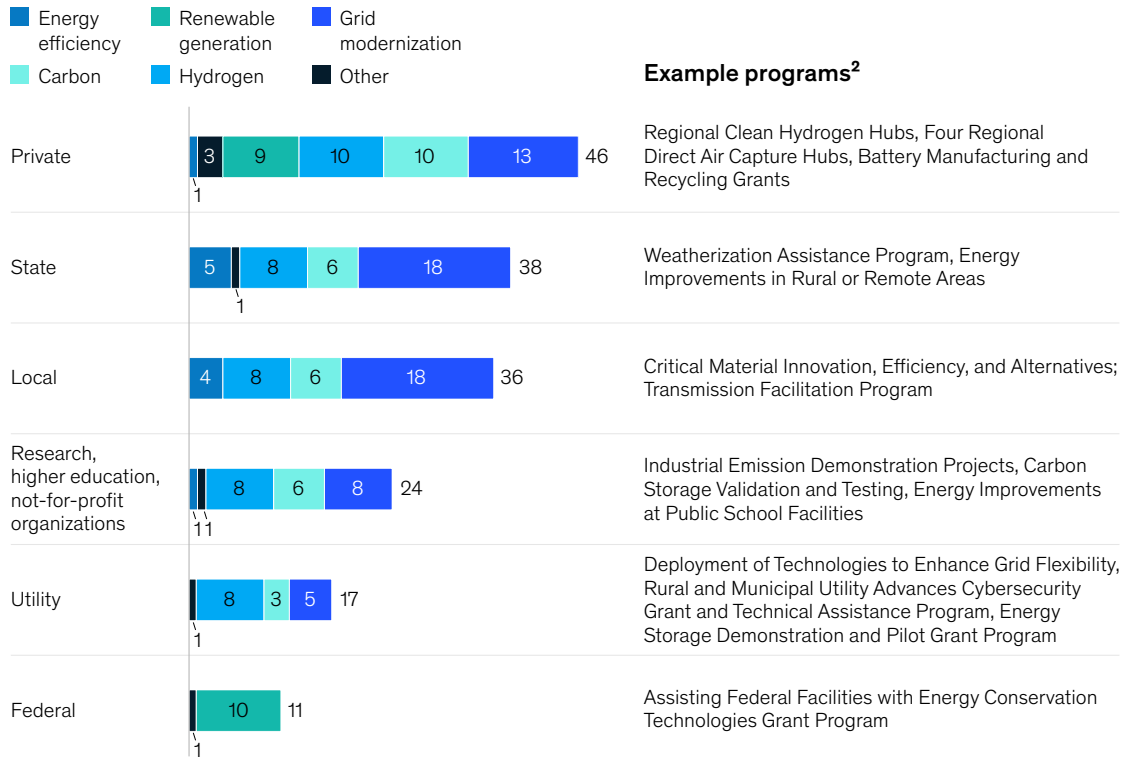## Prenotice funding programs expected to begin funding cycles in early 2023

About 40 percent, or $32 billion, of total BIL clean-energy funding was launched as of December 2022, including large programs such as Battery Materials Processing, for which about $3 billion was released as of January 2023.

Remaining prenotice funding programs are expected to begin funding cycles in early 2023.

Exhibit 5

The private sector and state and local agencies are eligible for the largest chunk of funds through the Bipartisan Infrastructure Law.

Energy funding available in the Bipartisan Infrastructure Law (BIL) by entity type,[1] $ billion

Legend:
- Energy efficiency
- Renewable generation
- Grid modernization
- Carbon
- Hydrogen
- Other

Example programs[2]

Entity	Values	Total	Example programs[2]
Private	1, 3, 9, 10, 10, 13	46	Regional Clean Hydrogen Hubs, Four Regional Direct Air Capture Hubs, Battery Manufacturing and Recycling Grants
State	5, 1, 8, 6, 18	38	Weatherization Assistance Program, Energy Improvements in Rural or Remote Areas
Local	4, 8, 6, 18	36	Critical Material Innovation, Efficiency, and Alternatives; Transmission Facilitation Program
Research, higher education, not-for-profit organizations	1, 1, 8, 6, 8	24	Industrial Emission Demonstration Projects, Carbon Storage Validation and Testing, Energy Improvements at Public School Facilities
Utility	1, 8, 3, 5	17	Deployment of Technologies to Enhance Grid Flexibility, Rural and Municipal Utility Advances Cybersecurity Grant and Technical Assistance Program, Energy Storage Demonstration and Pilot Grant Program
Federal	1, 10	11	Assisting Federal Facilities with Energy Conservation Technologies Grant Program

[1]An estimate of BIL clean-energy funding, which includes a combination of clean-energy, resilience, and environmental-remediation funding related to the utility and power sector. This does not include electric vehicle–related funding.
[2]Many of the example programs are applicable to more than one type of entity. For example, the Regional Clean Hydrogen Hubs program is applicable to not only private-sector entities (eg, technology developers, industry) but also utilities, universities, national laboratories, engineering and construction firms, state and local governments, tribal groups, environmental groups, and community-based organizations.
Source: *Building a better America: A guidebook to the Bipartisan Infrastructure Law for state, local, tribal, and territorial governments, and other partners*, The White House, May 2022

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Resources to help navigate BIL clean-energy funding programs

Public and private entities have a number of resources available to help them track clean energy opportunities:

— *White House Bipartisan Infrastructure Law (BIL) Open Funding Opportunities[1]:* Highlights the latest programs communities could apply for

— *Bipartisan Infrastructure Law Programs at the Department of Energy[2]:* Online catalog of 70 BIL energy programs, including program details and timelines

— *Department of Energy's Office of Energy Efficiency & Renewable Energy (EERE)[3]:* EERE's Funding Opportunity Exchange provides access to the latest funding opportunities, including BIL programs

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[1] "Bipartisan Infrastructure Law: Funding opportunities you can apply for today," The White House, updated February 2023.
[2] "Bipartisan Infrastructure Law programs at Department of Energy," US Department of Energy, accessed February 2023.
[3] "EERE funding opportunity exchange," US Department of Energy, accessed February 2023.

Exhibit 6

Roughly 40 percent of Bipartisan Infrastructure Law clean-energy funding was launched as of December 2022.

Estimated funding amount, $ billion[1]

	Total	Prenotice	Open	Closed	Funding awarded
	76	44	13	9	10
Program numbers	63[3]	54	15	24	14
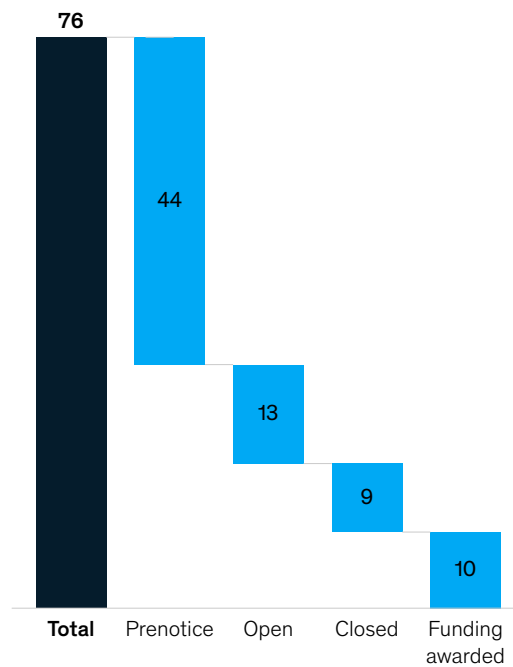
Example programs and grants per stage, $ billion

Prenotice

$6.7 for FY 2024–26 for GRIP[2]
$2.1 for Carbon Dioxide Transportation Infrastructure

Open

$7.0 for Regional Clean Hydrogen Hubs
$3.8 for FY 2022–23 GRIP[2]
$1.2 for Four Regional Clean Direct Air Capture Hubs
$0.4 for Long-Duration Energy Storage Demonstration

Closed

$2.5 for Transmission Facilitation Program
$2.4 for Carbon Capture Demonstration Projects
$2.3 for Carbon Storage Validation and Testing

Funding awarded

$3.2 for Weatherization Assistance
$2.8 for Battery Materials Processing
$1.3 for Advanced Reactor Demonstration

Note: "BIL" stands for the Bipartisan Infrastructure Law. GRIP and Regional Clean Hydrogen Hubs have multiphase applications.
[1]High-level estimates are based on the best available information and may include supplementary, non-BIL funding.
[2]Grid Resilience and Innovation Partnerships program. Includes combined FY 2022 and FY 2023 funding in FY 2023 cycle.
[3]Most programs have grants across stages (eg, FY 2022 round is closed; FY 2023 is open; FY 2024+ is prenotice), so the sum of stages will be greater than BIL total.
Source: Build.gov; McKinsey analysis

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Funding awarded in fiscal year 2022 supported projects across the country, especially in a handful of states

Three programs account for more than 70 percent of the $10.0 billion in funding awarded as of January 2023: Weatherization Assistance ($3.2 billion), Battery Materials Processing ($2.8 billion), and Advanced Reactor Demonstration ($1.3 billion).

Of the awarded funding, the largest single projects are $1.31 billion to support the demonstration of an advanced nuclear reactor in Kemmerer, Wyoming; $1.1 billion to preserve the existing Diablo Canyon Power Plant in Avila Beach, California; and $300 million to support a battery-recycling facility in Hopkinsville, Kentucky.

Exhibit 7

As of January 2023, $10 billion has been awarded to clean-energy projects across the country.

Clean-energy funding awarded under Bipartisan Infrastructure Law

Legend:
- > $1 billion
- $500 million–$1 billion
- $100 million–$499 million
- $50 million–$99 million
- $10 million–$49 million
- < $10 million

Source: Bipartisan Infrastructure Law (BIL) Dashboard, Data to Decisions, January 13, 2023; Build.gov; McKinsey analysis

McKinsey & Company

Conclusion

How stakeholders can make the most of the funding opportunity

Five actions in particular could help stakeholders seize the present opportunity.

Get organized

Successfully developing and implementing these projects will require public and private stakeholders to engage and participate in a coordinated way. Stakeholders will likely want to identify the network of key private-, social-, and public-sector stakeholders that are critical to success; develop an engagement strategy; and proactively build these relationships, for example, by engaging early and often throughout the project development cycle. A few actions could prove important for making the most of the opportunity:

— *Consider opportunities for shared land use and right of way for infrastructure development.* For example, identify a multiuse corridor to facilitate codevelopment of power transmission line and roads.

— *Optimize returns from the funding.* For example, assess the opportunity for public–private partnerships by identifying where collective effort from the public and private sectors could maximize and scale impact (for example, scale up first-of-its-kind green infrastructure and innovation) and where risks need to be managed and mitigated (for example, guarantees) across the energy ecosystem.

— *Develop a comprehensive, integrated plan.* For example, coordinate across stakeholders to build a hydrogen hub to identify opportunities for shared infrastructure.

Stay up to date

Information about BIL funding programs, including guidance, application requirements, and program deadlines, is updated regularly. Developing capacity to track and efficiently scan for these updates and develop a holistic view of how to access, navigate through, and coordinate across the wide range of climate and clean-energy funding and financing opportunities will be critical.

Be ready to tell your impact story. A compelling narrative and a fact base to back it up—for example, preparing the historical performance of delivering projects on time and on budget

Successfully developing and implementing these projects will require public and private stakeholders to engage and participate in a coordinated way.

and modeling decarbonization pathways and scenarios to assess risks and implications—could build credibility and strengthen business cases for energy transition projects. A view of what private-sector "capital formation" is required across the various value chains to manufacture and deploy technologies, and where a state has a differentiated role to play, is also critical.

Set up for success. Identify what it takes—such as organizational structure, resources, culture, technical capabilities, or stakeholder engagement—to support energy transition and decarbonization pathways. This could include developing a capability-building strategy, defining an operating model for efficient project delivery, improving analytics capabilities to inform decision making, and developing metrics to track performance targets, such as through data dashboards. In addition, having a good understanding of the energy technology landscape (for example, hydrogen applications, cost curves, and end-use economics) and equipping teams with technical capabilities, such as energy modeling and economic analyses, could help inform business cases for clean-energy technology and infrastructure. It could also help stakeholders identify how to best use funding to create value across the energy transition value chain.

Stay focused on economic development, environmental justice, and equity. These elements cannot be an afterthought. Analyzing economic development, equity, and the impact of environmental justice—for example, considering the perspectives (including barriers to adoption, place-based considerations, and exposure to climate and economic risks) of all stakeholders, especially those in poor and marginalized communities throughout the clean-technology development—is a critical aspect of planning the energy transition and an important component of successful grant applications.

Technical appendix

Power funding by theme: Resilience

Program	Funding, $ million	Description
Grid Innovation Programs	**5,000**	Funding to states, tribes, and public-utility commissions to work with electric-sector owners and operators to demonstrate innovative approaches to transmission, storage, and distribution infrastructure; this is meant to harden and enhance resilience and reliability and provide new approaches to enhance regional grid resilience, as implemented through states by public and rural electric-cooperative entities on a cost-shared basis
Weatherization Assistance Program	**3,500**	Funding to improve energy efficiency of dwellings owned or occupied by persons with low income, reduce their total residential energy expenditures, and improve their health and safety—aimed to help the elderly, disabled people, and children
Grid Resilience Utility and Industry Grants	**2,500**	Funding for electric-grid operators, electricity storage operators, electricity generators, transmission owners or operators, distribution providers, and fuel suppliers to carry out activities that are supplemental to existing hardening efforts and to reduce the risk of power lines causing a wildfire or reduce the likelihood and consequences of disruptive events
Grid Resilience State and Tribal Formula Grant Program	**2,500**	Formula grant program for states, territories, and tribes to carry out activities that are supplemental to existing hardening efforts and to reduce the risk of power lines causing a wildfire or reduce the likelihood and consequences of disruptive events
Energy Improvement in Rural and Remote Areas	**1,000**	Funding for industry partners, utilities, and state and local governments to take actions (eg, upgrading transmission lines, developing microgrids, and increasing energy efficiency) to improve resilience, reliability, safety, and availability of energy in rural or remote areas of the United States
Cybersecurity for the Energy Sector Research, Development, and Demonstration Program	**250**	Funding to support the development and deployment of advanced cyber-applications, cybertechnologies, and cyberthreat collaboration efforts with the US energy sector
Rural and Municipal Utility Advances Cybersecurity Grant and Technical Assistance Program	**250**	Grants and technical assistance for rural electric cooperatives and utilities to enter into cooperative agreements and to protect against, detect, respond to, and recover from cybersecurity threats
Energy Sector Operational Support for Cyber Resilience Program	**50**	Funding to support a program for small electricity utilities and national labs to build operational support for cyberresilience in the energy sector
Advanced Energy Security Program	**50**	Funding for utilities, national labs, and bulk power system vendors to strengthen resilience of electric-grid operations or natural-gas and oil operations when faced with threats and hazards (eg, developing capabilities to identify vulnerabilities, providing modeling capabilities to identify potential risks, adding physical security, conducting assessments to identify vulnerabilities, and conducting research on grid hardening and recovery solutions)

Power funding by theme: Carbon

Program	Funding, $ million	Description
Four Regional Direct Air Capture Hubs	3,500	Funding for technology developers, utilities, industry, national labs, engineering construction firms, state and local governments, and other community and not-for-profit organizations to develop four regional direct air capture hubs
Carbon Capture Demonstration Projects Program	2,537	Funding to develop six carbon capture facilities and improve the efficiency, effectiveness, costs, emissions reductions, and environmental performance of coal and natural-gas electricity generation and industrial facilities
Carbon Storage Validation and Testing	2,500	Funding for technology developers, industry, utilities, universities, national labs, engineering and construction firms, and state and local governments to establish a program of research, development, and demonstration for carbon storage (eg, feasibility, site characterization, permitting, and construction)
Carbon Dioxide Transportation Infrastructure Finance and Innovation Program	2,100	Loan or grant for state, local, and public authority to finance CO_2 transportation infrastructure and innovation projects
Carbon Capture Large-Scale Pilot Programs	937	Funding to support the development of transformational carbon capture technologies projects that are ready for large-scale pilots and will significantly improve the efficiency, effectiveness, costs, emissions reductions, and environmental performance of coal and natural-gas use, including in manufacturing and industrial facilities
Carbon Utilization Program	310	Grant program for state and local governments to procure and use products derived from captured carbon oxides
Commercial Direct Air Capture Technology Prize Competition	100	Funding to support qualified direct air capture facilities for metric tons of qualified CO_2 captured and verified at the point of disposal, injection, or use
Pre-Commercial Direct Air Capture Prize Competitions	15	Reauthorization of the Pre-Commercial Direct Air Capture Prize Competitions Program to advance research, development, demonstration, and commercial application of carbon capture technologies; focuses on projects that demonstrate the technical and commercial viability of technologies to reduce CO_2 emissions released from coal electric-generation facilities and natural-gas electric-generation facilities for commercial deployment

Power funding by theme: Hydroelectricity

Program	Funding, $ million	Description
Power Marketing Administration Transmission Borrowing Authority	**10,000**	Funding to finance the construction, acquisition, and replacement of the Federal Columbia River Power System
Rehabilitation of High Hazard Potential Dams	**585**	Funding for eligible states to provide technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness
Maintaining and Enhancing Hydroelectricity Incentives	**554**	Funding to support and enhance existing hydropower facilities through capital improvements related to three main areas: grid resilience, dam safety, and environmental conditions
National Dam Safety Program	**215**	Funding to encourage the establishment and maintenance of effective state programs intended to ensure dam safety, to protect human life and property, and to improve state dam safety programs
Hydroelectric Production Incentives	**125**	Funding to provide incentives to hydroelectric facilities to generate electricity
Watershed Rehabilitation Program	**118**	Funding to rehabilitate and extend the life of dams originally constructed with assistance of US Department of Agriculture watershed program
Hydroelectric Efficiency Improvement Incentives	**75**	Funding to help owners and operators of hydroelectric facilities make capital improvements to improve efficiency
Hydropower Research, Development, and Demonstration	**36**	Funding for industry, national labs, and academia to fund research, development, and demonstration activities to improve the capacity, efficiency, resilience, security, reliability, affordability, and environmental impact of hydropower technologies
Pumped Storage Hydropower Wind and Solar Integration and System Reliability Initiative	**10**	Financial assistance for electric utilities, state energy offices, tribes, institutes of higher education, or consortiums to carry out project design, transmission studies, and power market assessments and to secure permits for a pumped storage hydropower project to facilitate the long-duration storage of intermittent renewable electricity
Capital Improvement and Maintenance for Dams	**10**	Funding to support capital improvement and maintenance for dams

Power funding by theme: Hydrogen

Program	Funding, $ million	Description
Regional Clean Hydrogen Hubs	**8,000**	Funding to support the development of at least four regional clean-hydrogen hubs to improve clean-hydrogen production, processing, delivery, storage, and end use
Clean Hydrogen Electrolysis Program	**1,000**	Funding to establish a research, development, demonstration, commercialization, and deployment program for commercialization to improve the efficiency, increase the durability, and reduce the cost of producing clean hydrogen using electrolyzers
Clean Hydrogen Manufacturing Recycling Research, Development, and Demonstration Program	**500**	Funding for industry partners to advance the efficiency and cost-effectiveness of manufacturing and raw-materials recovery processes for clean-hydrogen equipment projects (eg, develop strategies to increase consume acceptance, develop alternative materials, develop the design and manufacturing process of clean hydrogen, address barriers to the research, and demonstrate and commercialize technology and the process for disassembly and recycling)

Power funding by theme: Nuclear

Program	Funding, $ million	Description
Civil Nuclear Credit Program	**6,000**	Credit program for owners and operators of commercial US reactors to bid on credits to support the continued operations of the reactors
Advanced Reactor Demonstration Program	**2,477**	Funding to accelerate and advance two large demonstrations of advanced nuclear reactors for electricity generation

Power funding by theme: Battery

Program	Funding, $ million	Description
Battery Manufacturing and Recycling Grants	**3,000**	Grants to ensure that the United States has a viable domestic manufacturing and recycling capability to support a North American battery supply chain
Battery Materials Processing Grants	**3,000**	Grants to ensure that the United States has a viable battery materials processing industry, to expand domestic capabilities in battery manufacturing, and to enhance processing capacity
Critical Material Innovation, Efficiency, and Alternatives	**600**	Funding for research, development, demonstration, and commercialization to develop alternatives to critical materials, to promote their efficient production and use, and to ensure a long-term secure and sustainable supply of them
Energy Storage Demonstration Pilot Grant Program	**355**	Funding to support three energy storage system demonstration projects, improve grid resilience, provide services to the grid, enable energy efficiency, and facilitate energy transition (eg, renewable integration and electric-vehicle integration)
Earth Mapping Resources Initiative	**320**	Funding to improve the knowledge of the geologic framework in the United States and to identify areas that have the potential to contain undiscovered critical mineral resources
Energy and Minerals Research Facility	**167**	Funding for the design, construction, and tenant build-out of a facility to support energy and minerals research and associated structures through a cooperative agreement with an academic partner
Long-Duration Energy Storage Demonstration Initiative and Joint Program	**150**	Funding to support demonstration projects that demonstrate promising long-duration energy storage technologies at different scales and help new, innovative long-duration energy storage technology be commercially viable
Rare Earth Elements Demonstration Facility	**140**	Funding program to demonstrate the feasibility of a full-scale integrated rare earth element extraction and separation facility and refinery
Critical Material Supply Chain Research Facility	**75**	Funding program to support construction of a facility that will further enable research, development, demonstration, and commercialization activities throughout the supply chain for critical materials and provide an integrated, rapidly reconfigurable research platform

Power funding by theme: R&D

Program	Funding, $ million	Description
Transmission Facilitation Program	2,500	Funding to facilitate the construction of electric power transmission lines and related facilities to support greater clean-energy growth and provide low-cost clean energy to more US residents
State Energy Program	500	Funding for states to support electric transmission and distribution planning as well as planning activities and programs that help reduce carbon emissions in all sectors of the economy, including the transportation sector, and accelerate the use of alternative transportation fuels and vehicle electrification
Industrial Emission Demonstration Projects	500	Funding to support demonstration projects that test and validate technologies that reduce industrial emissions (eg, emissions reduction industrial material production process, medium-high-temperature heat generation, sustainable manufacturing principles, energy efficiency of industrial processes)
Clean Energy Demonstrations on Current and Former Mine Land	500	Funding to support up to five clean projects (eg, solar, microgrid, geothermal, direct air capture, energy storage, advanced nuclear, and fossil-fueled generation with carbon capture) that demonstrate the technical and economic viability of carrying out clean-energy projects on current and former mine land
Purchase of Power and Transmission Services	500	Funding for Western Area Power Administration to purchase power and transmission services, recover purchase power and wheeling services, and transfer to the Colorado River Basins Power Marketing Fund
Industrial Research and Assessment Center Implementation Grants	400	Funding for small and medium-size manufacturers to improve energy efficiency, material efficiency, cybersecurity, or productivity or to reduce waste production, greenhouse-gas emissions, or non-greenhouse-gas pollution
Front-End Engineering and Design Program Out Activities under Carbon Capture Tech Program	100	Funding for research and development, demonstration, large-scale pilot, and front engineering design for CO_2 transport infrastructure to support carbon capture, utilization, and storage technology deployment
Enhanced Geothermal Systems and Pilot Demonstrations	84	Funding to support demonstration of enhanced geothermal systems for power production and direct use
Marine Energy Research, Development, and Demonstration	70	Funding for industry, national labs, and academia to conduct research and development and undertake demonstration activities to improve marine-energy technologies
Wind Energy Technology Program	60	Funding for research, development, demonstration, and commercialization activities to improve wind energy technologies (eg, establishing demonstration facilities, providing technical assistance, conducting education and outreach activities, and performing precompetitive research and development)
Manufacturing Leadership (Sec 40534)	50	Funding for states to invest in smart manufacturing technologies (eg, high-performance computing resources for small and medium-size manufacturers)
National Marine Energy Centers	40	Funding to advance the research, development, demonstration, and commercial application of marine-energy technologies

Power funding by theme: R&D (continued)

Program	Funding, $ million	Description
Funding to Support Orphan Well Plugging	30	Funding for federal and state governments and tribes to plug, remediate, and reclaim orphaned wells located on federal land (eg, inventory, site characterization, surface remediation, removal of surface equipment, and downhole well plugging)
Advanced Solar Energy Manufacturing Initiative	20	Funding for research, development, demonstration, and commercialization projects to advance new solar-energy manufacturing technologies and techniques
Extended Product System Rebates	10	Funding to provide rebates for qualified extended product systems (ie, electric motor, electronic control, and driven load)

Power funding by theme: Other

Program	Funding, $ million	Description
Smart Grid Grant	3,000	Funding to support projects that help increase flexibility, efficiency, and reliability of the electric-power system, with a focus on increasing transmission capacity, integrating renewables, reducing risk of wildfires or other system outages, and enabling electrification (eg, electric-vehicle integration, building electrification) and other grid edge devices
Advanced Energy Manufacturing and Recycling Grants	750	Grants for small and medium-size manufacturers to build new or retrofit existing manufacturing and industrial facilities to produce or recycle advanced energy products in communities where coal mines or coal power plants have closed
Electric Drive Vehicle Battery Recycling and 2nd Life Apps	200	Funding to support research, development, and demonstration of electric-vehicle-battery recycling and second-life applications for vehicle batteries
Battery and Critical Mineral Recycling	125	Funding to support research, development, and demonstration projects to create innovative and practical approaches to increase the reuse and recycling of batteries (eg, recycling activities, extraction or recovery of critical minerals from batteries that are recycled)
Wind Energy Tech Recycling Research & Development	40	Funding for research, development, demonstration, and commercialization projects to create innovative and practical approaches to increase the reuse and recycling of wind energy technologies (eg, increase the efficiency and cost-effectiveness of the recovery of raw materials from wind energy technology components and alternative materials)
Solar Recycling Research & Development	20	Funding for research, development, demonstration, and commercialization projects to create innovative and practical approaches to increase the reuse and recycling of solar-energy technologies (eg, increase efficiency and cost-effectiveness of the recovery of raw materials from solar-energy technology components, alternative materials, design and manufacturing processes)
Lithium-Ion Recycling Prize	10	Funding for a multiphase competition that encourages American entrepreneurs to develop and demonstrate processes that, when scaled, have the potential to profitably capture 90% of all discarded or spent lithium-based batteries in the United States for eventual recovery and reintroduction of key materials into the US supply chain; funding to support convening of a task force on battery producer requirements

Power funding by theme: Efficiency

Program	Funding, $ million	Description
Energy Efficiency and Conservation Block Grant Program	550	Funding to assist states, local governments, and tribes to reduce energy use, reduce fossil-fuel emissions, and improve energy efficiency
Energy Improvements at Public School Facilities	500	Funding to make energy efficiency, renewable-energy, and alternative-fueled vehicle upgrades and improvements at public schools
Assisting Federal Facilities with Energy Conservation Technologies Grant Program	250	Funding for federal agencies that they can leverage with private capital to make energy and water efficiency upgrades to federal buildings
Energy Efficiency Revolving Loan Fund Capitalization Grant Program	250	Capitalization grants for states to establish a revolving loan fund under and to provide loans and grants for energy efficiency audits, upgrades, and retrofits to increase energy efficiency and improve the comfort of buildings
Building Codes Implementation for Efficiency and Resilience Program	225	Funding for a competitive grant program to enable sustained, cost-effective implementation of updated building energy codes to save customers money on their energy bills (eg, training, data collection, planning, compliance, updates to energy codes)
Industrial Research and Assessment Centers	150	Funding for institutions of higher education–based industrial research and assessment centers to identify opportunities for optimizing energy efficiency and environmental performance at manufacturing and other industrial facilities
Energy Efficiency Materials Pilot Program	50	Funding for not-for-profit organizations with energy efficiency materials (eg, roofs; lighting systems; windows; doors; heating, ventilation, and air conditioning; and plumbing improvements)
Energy Auditor Training Grant Program	40	Funding for states to train individuals to conduct energy audits or surveys of commercial and residential buildings to build the clean-energy workforce, save customers money on their energy bills, and reduce pollution from building energy use
Building Training and Assessment Centers	10	Funding for higher education institutions to establish centers to educate and train building technicians and engineers in implementing modern building technologies
Career Skills Training	10	Funding to pay the federal share of career skills training programs under which students concurrently receive classroom instruction and on-the-job training for the purpose of obtaining an industry-related certification to install energy-efficient building technologies
Energy Efficient Transformer Rebates	10	Funding to provide rebates to industrial- or manufacturing-facility owners, commercial-building owners, multifamily building owners, utilities, or energy service companies for the replacement of a qualified energy inefficient transformer with a qualified energy-efficient transformer

Paving the way to resilience: Strengthening public sector adaptation planning and execution

Increasing resilience to climate change requires a more systematic response than ever before. Governments and public entities play a central role in defining, enabling, and executing it.

by Homayoun Hatami, Mihir Mysore, Hamid Samandari, and Alexis Trittipo

At a glance:

— Extreme weather events, like the record-breaking heat waves in Phoenix, Arizona, and the extreme precipitation in the Sindh province of Pakistan, are becoming increasingly common in communities around the world. While humanity has long adapted to various climatic conditions, climate change is happening faster today than before and is giving rise to conditions that could threaten the habitability of some of the planet's most populated areas.

— Given the magnitude and systemic nature of the impacts of climate change, the public sector has a leading role in propelling adaptation. Sixty-five percent of the world's countries have already developed at least an initial national adaptation plan, covering 61 percent of the world economy and 65 percent of the world population, as of July 2023. Of the remaining global population, almost a third lives in Nigeria, Pakistan, and the United States, which are currently developing their first national adaptation plans, and in India, where climate adaptation is primarily realized through a system of state plans.

— Still, much more remains to be done. Even though the implementation rate of these plans is increasing, many lack critical details and are not keeping up with the rapid evolution of climate impacts. The climate future is uncertain, and the impact of warming will not be linear and will be different from place to place. This requires public policy planners to be flexible, regularly explore a range of climate outcomes, and determine the level of climate risk they want to prepare for.

— We outline five potential actions for governments and government agencies to consider as they start or continue their adaptation journeys. They are the following: set adaptation goals based on defined future climatic conditions and desired preparedness, integrate adaptation into government decision making, approach adaptation with a multilevel focus, systematically engage private sector actors and investors to mobilize funding and promote innovation, and establish and institute centralized principles for monitoring and evaluation throughout the adaptation life cycle.

It's 4 p.m. on July 30, 2023. Pima Park in the metropolitan area of Phoenix, Arizona, is eerily empty. Normally, on a beautiful summer Sunday, the park is bustling with children. But the local temperature has reached a high of more than 110°F (43°C) for a record 31 days in a row.[1] A year earlier, a similarly extreme heat wave was making headlines across the United States. In July 2022, 350 new daily-high-temperature records were set across the country, and over 100 million people were put on heat alert.[2] In August 2022, in the densely populated province of Sindh, Pakistan, 15 days of extreme precipitation, reaching more than five times the 30-year average, unleashed exceptional flooding, submerging one-third of the country. The flood, widely described as the worst in Pakistan's recent memory, ultimately affected 33 million people and destroyed more than 1.7 million homes.[3] The total toll in human lives of such events is large and increasing. A recent study in the *Economist* estimated the excess mortality in South Asia due to extreme heat at around 110,000 people annually.[4]

Humanity has long adapted to various climatic conditions through migration, behavioral changes, and technological solutions. But today's climate change is of a different nature: it is the direct result of human activity, is happening faster than before, and is giving rise to conditions that could threaten the livability of some of the planet's most populated areas. Increasingly frequent and intense climate-related events highlight the need for a more deliberate and coordinated approach to adaptation than in the past. To be clear, the scale and speed of the evolution of the problem are highly variable across geographies and the effects over the next decade will be more muted in certain places than in others. While this buys time for action and makes climate change more manageable, it does not alter the necessity of embarking on a journey that might in time entail major changes across countless systems and processes.[5]

This article focuses on the design and implementation of adaptation plans in the public sector. In the first part, we take stock of the current state of national adaptation plans—the unified body of strategies to adapt to climate change defined and published by national governments. While the implementation rate of these plans is increasing, many of them still lack critical details (for example, many lack a timeline for implementation or a prioritization of solutions or costs) and are not following the rapid evolution of climate impacts.

In the second part, we outline a potential response, including five actions governments and government agencies can consider:

1. Examine and set adaptation goals based on defined future climatic conditions (1.5°C, 2.0°C, 2.5°C, and 3.0°C, and over various time horizons[6]) and with a view on the speed at which these conditions might occur and on the desired and/or possible level of preparedness, while maintaining flexibility to navigate uncertainties.

2. Broadly integrate adaptation into government decision making; evaluate costs and trade-offs, while maximizing cobenefits.

3. Approach adaptation with a multilevel focus; ground solutions in the local context and coordinate at the national and global levels.

4. Systematically engage private sector actors and investors to mobilize funding and drive innovation.

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[1] Catherine Clifford, "Phoenix suffers a record 31 straight days of 110-degree highs, and more heat is on the way," CNBC, August 1, 2023; "Extreme heat in North America, Europe, and China in July 2023 made much more likely by climate change," World Weather Attribution, July 25, 2023.

[2] Judson Jones, Payton Major, and Amir Vera, "More than 100 million in the US face excessive warning or heat advisories as a dangerous heat wave continues," CNN, July 19, 2022.

[3] "Daily sitrep No. 158," National Disaster Management Authority, November 18, 2022.

[4] "India's deadly heatwaves are getting even hotter," *Economist*, April 2, 2023. As of July 2023, according to provisional data, 1,708 people lost their lives because of the 2022 heat wave in the United States; for more, see Giulia Carbonaro, "Extreme heat is killing more Americans than ever," *Newsweek*, July 8, 2023. And 1,739 people died in Sindh because of the flood; for more, see *NDMA monsoon 2022 daily situation report no 158*, Government of Pakistan, November 2022.

[5] "Introduction," United Nations Framework Convention on Climate Change, accessed November 7, 2023.

[6] Throughout the document, we refer to warming levels (for example, 1.5°C, 2.0°C, 2.5°C). All references as such are to a global mean temperature increase above preindustrial levels.

5. Establish and institute centralized principles for monitoring and evaluation throughout the adaptation life cycle.

While we focus on the public sector, we recognize that adaptation success will draw on a broader set of requirements, which we outline in a separate article, "Ten key requirements for a systemic approach to climate adaptation." As we analyze the role of the public sector, we highlight its unique capacity to establish standards, foster knowledge sharing, and propel coordinated efforts that can pave the way for a more resilient future.

Taking stock of public sector adaptation planning today

Visible progress has been made in developing national adaptation plans over the past five years. As of June 2023, 65 percent of countries (128 out of 198[7]) had developed such plans, covering 61 percent of the world economy and 65 percent of the world population and marking a clear first step in the global effort to adapt to climate change (see sidebar "Methodology"). Even among countries without a formal national plan, we observe some progress toward adaptation planning. Almost a third of the global population living in a country without national adaptation plan coverage is in Nigeria, Pakistan, and the United States, which are developing national plans, and in India, where climate adaptation is primarily realized through a system of state plans

Methodology

We used the list of parties to the United Nations Framework Convention on Climate Change (UNFCCC) to identify 197 single-government signatories (excluding the European Union and Kosovo) and included Kosovo, which is drawn from the US Department of State's list of independent states, for a total of 198 countries. For each of the countries in this list, we determined whether they had an adaptation plan. We designated any plan submitted to the UNFCCC as a national adaptation plan; we considered all climate adaptation action plans submitted to the European Commission (both adaptation

strategies and plans were considered, with priority given to adaptation plans in case both were submitted); and we used Climate-Adapt as our primary source for identifying these plans. For countries that did not submit documents to the European Commission or the UNFCCC, we sought out any published national plan (at the country level, not at the state or federal agency level). Those we found were categorized as "independent." In certain instances, this included adaptation communications submitted to the United Nations. If no separate adaptation plan was accessible, we reviewed the country's

most recent nationally determined contribution to find any reference to an independently published plan. If an independent plan was mentioned, we also categorized it as "independent."

If no distinct or independent national adaptation plan was referenced in a nationally determined contribution, we looked for a dedicated adaptation section within the report with stated goals or actions. If such a section was present, we classified the plan as "independent," which was the case for about 10 percent of identified plans.

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[7] Those 198 countries include the 197 single-government signatories of the United Nations Framework Convention on Climate Change (UNFCCC), excluding the European Union, and Kosovo. As of September 2023, the count of adaptation plans includes national adaptation plan submissions to the UNFCCC; climate adaptation action plan submissions to the European Commission as reported in Climate-Adapt; national adaptation plans published independently online and on UN-affiliated websites, a range of institutions, and national department websites; and references to an independently published adaptation plan or a dedicated adaptation section with stated goals/actions in a country's most recent nationally determined contribution. If no plan was identified from these sources, countries were classified as not having a national-level adaptation plan.

(see sidebars, "Adaptation planning in the United States" and "Adaptation planning in India.").[8]

The progress of national adaptation plans has been primarily propelled either by the United Nations Framework Convention on Climate Change (UNFCCC), which provides funding and

technical assistance to vulnerable nations, or by the European Commission, which requires plans from EU member nations. Together, UNFCCC and the European Commission have facilitated nearly 60 percent of existing plans. The remaining 40 percent have been published independently (Exhibit 1).[9] We conducted an analysis on a sample of

Exhibit 1

In the public sector, countries and states are starting to build national adaptation plans focused on risk reduction.

National adaptation plans, as of June 2023

128 of 198
countries have adaptation plans[1]

61%
of the world economy[2]

65%
of the world population[2]
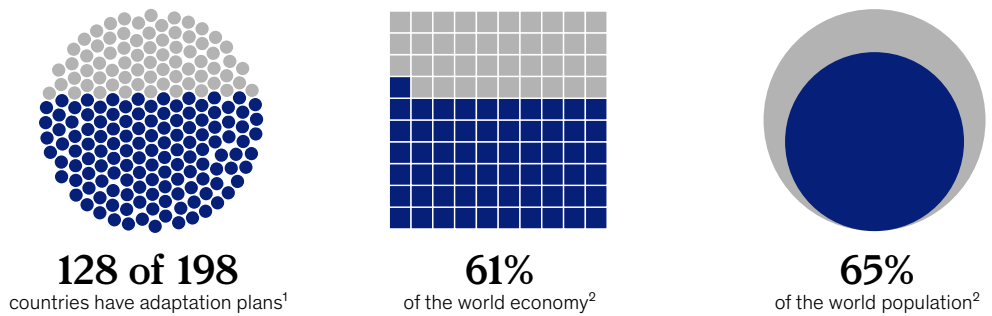
New adaptation plan publication year and affiliation, number of countries[1]
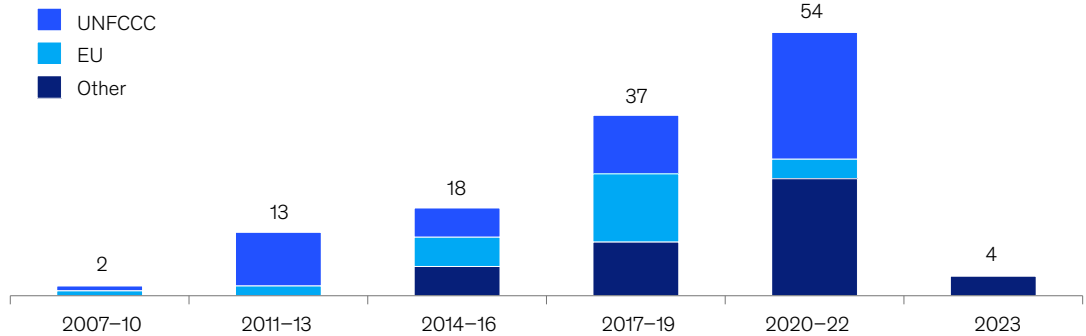
- UNFCCC
- EU
- Other

[1]197 independent nations according to United Nations Framework Convention on Climate Change (UNFCCC) signatories, plus the state of Kosovo.
[2]Based on 2021 global GDP and population.
 Source: UNFCCC; World Bank; McKinsey analysis

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[8]In 2008, India published an integrated national action plan; see *National action plan on climate change*, Government of India, June 2008. This includes adaptation measures but is excluded based on our methodology, because it did not include a distinct adaptation section. The United States has seen numerous subnational plans developed for states, cities, and government agencies, and is currently developing its national adaptation plan. Both Pakistan and Nigeria have initiated the national adaptation plan development process within the United Nations Framework Convention on Climate Change. For more, see *National adaptation plan Pakistan 2023*, Pakistan Ministry of Climate Change & Environmental Coordination, August 2023; and *Nigeria's national adaptation plan framework*, Nigeria's Federal Ministry of Environment, June 2020.
[9]These nonaffiliated plans have been created without a formal structure or set of standards and are not housed in a centralized location. To alleviate some of this fragmentation, the United Nations is currently convening a Global Stocktake, which will produce a synthesized report on global adaptation progress by the end of the year. The remainder of adaptation plans are either embedded as a component of a country's nationally determined contribution—largely mitigation-focused plans or commitments submitted to the UNFCCC—or published as a stand-alone document not affiliated with any multilateral body.

national adaptation plans. We selected 50 countries to represent the world's diverse approaches to adaptation. We made sure to include most of the world population, as well as regions where exposure to climate hazards is greatest (Exhibit 2).

In our sample, 70 percent of countries (35 out of 50) published a national adaptation plan. Most plans identify relevant climate hazards, propose solutions, and consider multiple warming scenarios, but meaningful challenges remain. In addition, most of them highlight climate hazards that have been historically experienced or are expected based on

location (for example, most countries with a coastline including sea level rise as a hazard). What's more, most plans consider many different climate scenarios in their projections and propose a wide range of solution levers. They also provide an implementation framework for their adaptation solutions.

Our analysis reveals three significant challenges:

1. While more adaptation plans have been developed in recent years, an increased pace of renewal and refinement is required. The world's understanding of climate impacts is constantly

Exhibit 2

Within the world's most populous and vulnerable countries, adaptation plans have yet to add detail on solution prioritization and cost.

Adaptation planning within 50 of the world's most populous and vulnerable countries[1]

35 of 50	**37%**	**31%**
countries have adaptation plans	have plans with priority actions	have plans costed
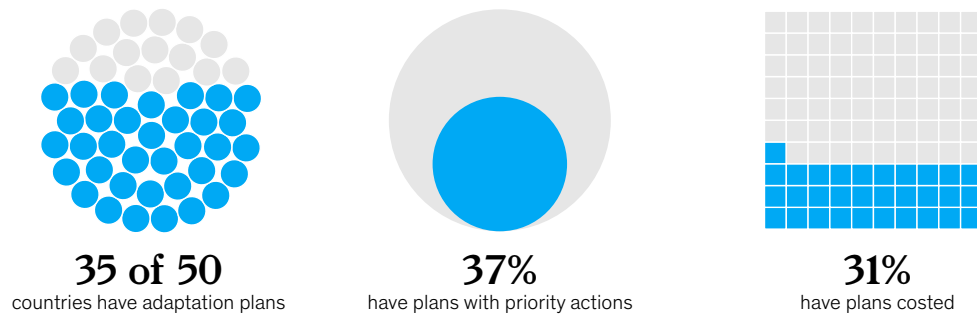
Annual plan costs as a share of GDP,[2] % of 11 countries

0% to 1% GDP	1% to 3% GDP	3% to 5% GDP	≥5% GDP
45	36	9	9
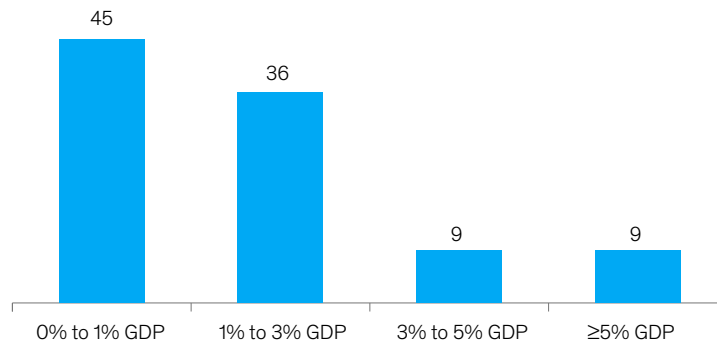
[1]Cross-section of 25 vulnerable countries from ND-Gain and Germanwatch exposure rankings, World Bank and US Agency for International Development (USAID) climate profiles, and Swiss Re Climate Economics Index. The 25 most populous countries independent of this list were found using 2021 UN population data.
[2]In 4 of 5 plans with plan costs <1%, costs were below 0.5% of annualized GDP.
Source: Germanwatch; ND-Gain; Swiss Re Climate Economics Index; UN Population Division; USAID; World Bank

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Adaptation planning in the United States

The United States' approach to adaptation planning relies on a combination of policy instruments, including federal executive orders and specific provisions in federal and nonfederal laws.

At the national level, beyond executive orders from the president calling directly for adaptation interventions, adaptation planning happens primarily through the federal departments and agencies that have published their own adaptation plans. As of August 2023, all 15 executive departments and 13 federal agencies had published adaptation plans.[1] Additionally, resilience is emerging as a topic of focus for the current administration. Recent federal laws, such as the Infrastructure Investment and Jobs Act in 2021 and the Inflation Reduction Act in 2022, include provisions that address climate adaptation. The 2021 law, for example, outlines specific infrastructure improvements in response to climate change, such as reinforcing grid resilience against wildfires and bolstering coastal protection against flooding, and provides over $50 billion in funding to support them.[2] The administration also recently released the National Climate Resilience Framework to guide federal resiliency investments and announced an upcoming White House Summit on Building Climate Resilient Communities.

At the subnational level, adaptation planning is generally carried out by states and municipalities. As of August 2023, 24 states and the District of Columbia had published or were in the process of drafting adaptation plans, covering roughly 55 percent of the US population.[3] In states without a comprehensive adaptation plan, climate adaptation is moving forward through sector or municipal plans. The state of Texas, for instance, does not have an official adaptation plan; it has a state plan for coastal protection and dedicated funds to respond to floods and improve infrastructure resilience. In addition, the Texan cities of Austin, Dallas, Houston, and San Antonio have adaptation plans, covering 20 percent of the state's population.[4] Finally, as of August 2023, more than 50 Native American tribes have officially enacted climate action plans, while many other Native American communities are actively developing initiatives to respond to climate change.[5]

Given its vast and diverse geography, the United States faces a wide range of climate change challenges. The US experience shows that responding to these challenges at a state level can provide an important first step and at the same time highlights the need for central coordination and funding at the state and national levels.

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[1] "Federal progress, plans, and performance," Council on Environmental Quality, accessed November 9, 2023.
[2] "Resilience in the Infrastructure Investment and Jobs Act," Georgetown Climate Center, accessed November 9, 2023.
[3] "State adaptation progress tracker," Georgetown Climate Center, accessed November 9, 2023.
[4] See "Preparing for climate change in Texas," Georgetown Climate Center, accessed November 9, 2023; and "QuickFacts: Texas; United States; Houston city, Texas; San Antonio city, Texas; Dallas city, Texas; Austin city, Texas," US Census Bureau, accessed November 9, 2023.
[5] See "Partnership for tribal governance," National Congress of American Indians, accessed November 9, 2023; and Nicola Jones, "How native tribes are taking the lead on planning for climate change," *Yale Environment 360*, February 11, 2020.

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evolving. Additionally, these impacts are dependent on changes in global emissions over time. Adaptation plans are therefore best developed through iterative refinement. However, 25 percent of published national adaptation plans (32 out of 128) are already more than seven years old, and many lack formal commitments for updates.[10]

2. Many plans require key additional details to be actionable, such as a timeline for implementation, prioritization of solutions, and costs. In our sample, 40 percent of plans (14 out of 35) do not provide any timeline for implementation. Only 51 percent (18 out of 35) map these actions to hazards or prioritize risks (for example, erecting floodwalls and restoring natural features like sand dunes as adaptation measures to protect against sea level rise). Thirty-seven percent of plans (13 out of 35) suggest a list of potential actions without providing a prioritization methodology. Finally, only 31 percent of plans (11 out of 35) estimate

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[10] Thirty-two countries out of 128 published their plans before 2017.

adaptation costs, and those that do take varying approaches.[11]

3. Many plans have yet to put in place a system to evaluate interventions and monitor their execution. Our sample analysis shows that while 80 percent (28 out of 35) of national adaptation plans mentioned the need for monitoring and evaluating, only a third have included a formal framework to do so.[12] These mechanisms, however, are critical to monitoring and evaluating execution, redefining goals and interventions in light of new information, and reinforcing accountability.

Five potential actions for governments and government agencies to consider in the shorter term

We outline five key actions that can help anchor and enable the adaptation journey. This list is not meant to be exhaustive but to offer a tangible path forward in most cases.

Action 1: Set goals based on a range of future climatic conditions over various time horizons

The climate future is clear in its direction (in the absence of a major correction) and uncertain in its timing, details, and—most importantly—feedback loops within and among various physical and socio-economic systems. We are operating outside of temperature ranges we have seen historically. The global mean surface temperature has increased by about 1.1°C above preindustrial levels, and this change is happening orders of magnitude faster than at any other time in at least the last 2,000 years, according to the *Sixth Assessment Report* of the Intergovernmental Panel on Climate Change.[13]

This singular situation carries three areas of uncertainty:

First, significant additional warming is expected, but its full extent is undefined. Even the most optimistic scenarios reach 1.5°C of warming above pre-industrial levels in the early 2030s.[14] That would be the minimum level against which to protect societies from projected climate change impacts.[15] Beyond this, future increases in temperature (2°C, 2.5°C, 3°C) are more uncertain.

Second, the impacts of warming are nonlinear. Linear increases in global average temperature (from 1.5°C to 2°C to 2.5°C) are associated with nonlinear increases in the frequency and severity of extreme weather events.[16] At today's warming of about 1.1°C, for instance, less than 1 percent of the total projected global population (about 0.1 billion) is likely to be exposed to severe heat stress. However, at 2°C of warming, this proportion increases to one-sixth (about 1.4 billion people).[17] And this is before factoring in the interaction between climate and biological systems, which needs to be better understood and integrated.

Third, there is a lack of clarity on how systems that are already operating at capacity will operate under the impacts of further warming. In some geographies, for instance, already underresourced and underdeveloped forest management services are now also struggling to cope with more frequent and intense wildfires, while water systems—already under strain due to overpopulation, obsolescence, and misaligned incentives—are seeing the additional impact of changing rainfall patterns and increased droughts and floods.

In light of this uncertainty, three steps can help governments and government agencies better prepare for future climatic conditions.

1. Explore a range of potential climatic outcomes to effectively navigate uncertainty, while establishing

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[11] Certain countries estimate costs by sector or thematic areas (infrastructure, health, agriculture and fisheries, for instance), by individual adaptation actions (for example, building seawalls, afforestation), by region, or by different mitigation pathways.

[12] This is in line with academic research, which found that as of 2021, more than 60 percent of the countries with a national adaptation plan were not tracking its implementation. For more, see Timo Leiter, "Do governments track the implementation of national climate change adaptation plans? An evidence-based global stocktake of monitoring and evaluation systems," *Environmental Science & Policy*, November 2021, Volume 125.

[13] *See Climate change 2021: The physical science basis*, Intergovernmental Panel on Climate Change, August 2021; and Andy Ridgwell, James Zachos, and Richard Zeebe, "Anthropogenic carbon release rate unprecedented during the past 66 million years," *Nature*, March 2016, Volume 9.

[14] Every time we mention a temperature rise projection, it is assumed to be from preindustrial levels. This level of warming was achieved for the first time in the month of July 2023. See "July 2023: Global air and ocean temperatures reach new record highs," Copernicus press release, August 8, 2023.

[15] For an explanation of the consensus view on climate scenarios and what is deemed the most optimistic scenario, see section "Potential Climate Futures" in *Climate change 2021*, August 2021.

[16] *Climate change 2022: Impacts, adaptation, and vulnerability*, Intergovernmental Panel on Climate Change, February 2022.

[17] For more, see "Protecting people from a changing climate: The case for resilience," McKinsey, November 8, 2021.

a central planning scenario that is continually tested and improved to guide further planning. As they analyze potential adaptation interventions, governments could benefit from considering different climactic scenarios (1.5°C, 2°C, 2.5°C, 3°C), as well as various time horizons, and the desired and/or possible level of preparedness. Argentina's National Climate Change Office, for example, has created an online tool that generates physical risk maps for both moderate- and high-ongoing-emission scenarios (1.5–2.0°C and 2.0–3.0°C

in 2050, respectively).[18] These maps forecast temperature ranges for 2030, 2050, and 2100, as well as their associated physical hazards, such as precipitation or extreme heat. In addition, they overlay social vulnerabilities (for example, exposure to diseases, aging populations), empowering actors to take systemic-adaptation-planning decisions.

It is also critical for governments and government agencies to select a central scenario to anchor adaptation thinking, planning, and implementation,

Exhibit 3

The number of hot days on the South American continent could increase to as much as four months per year under 3°C warming.

Hot days in South America >35°C (95°F) under different warming levels, number of additional hot days
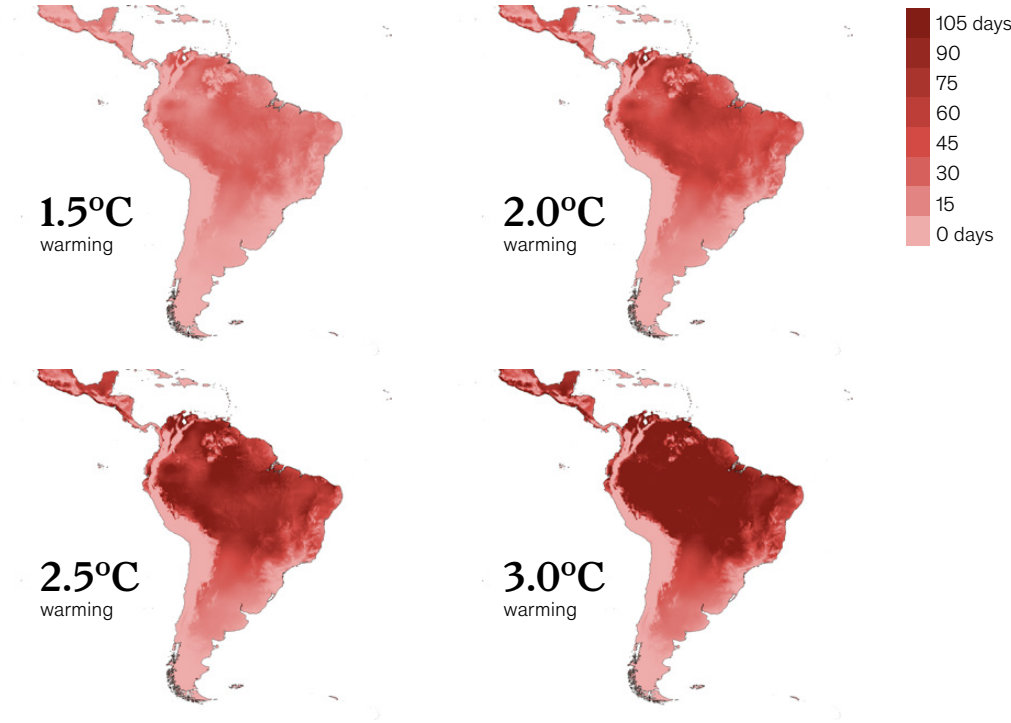
Source: NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP-CMIP6); McKinsey Climate Analytics

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[18] Following RCP4.5 and RCP8.5 emission pathways.

as the magnitude of impacts can vary under different scenarios. To continually ensure robustness, this central scenario should be regularly tested and improved based on new data and modeling. Take, for instance, the decision that many South American countries face in determining the temperature to which they might need to adapt (Exhibit 3). An increase in warming of 1.5°C could result in up to about two more months with local temperatures above 35°C. At 3°C, this risk rises to about four more months.

Of course, changes in global temperature may also cause higher-order impacts on economic development, food and energy security, infrastructure, and, crucially, health. These impacts make planning even more important.

2. Determine the desired level of adaptation, which risks (or extreme weather events) to protect against, and the degree of protection desired. This can entail preparing for events that are relatively frequent (once every ten years) or highly infrequent (once every 10,000 years) today but may increase in frequency in the future. One example of a government's choosing a level of adaptation can be seen with the Maeslant storm surge barrier in Rotterdam, Netherlands, which is the largest mobile barrier in the world and was constructed to withstand a range of storm intensities. The barrier is designed for up to a once-in-10,000-years storm and storm surges from three to five meters in height. It is part of the Netherlands' investment to adapt to sea level rise, with a total cost exceeding $500 million.[19] Other Dutch flood protection infrastructure assets with similar protection standards had even higher construction costs, such as the $2.4 billion Eastern Scheldt Barrier.[20] However, the significant cost of the infrastructure work is weighed against the fact that such an extreme event could cause massive disruptions across the entire country and that constructed assets have a long expected

lifetime.[21] Other governments could benefit from performing similar analyses before investing in adaptation infrastructure.

3. Design adaptation plans to be dynamic and flexible under a range of potential climate futures. Flexibility within adaptation solutions is essential to address uncertainty. Solutions could contain multiple options to allow enough flexibility to fit whichever scenario unfolds. While the initial cost of these types of solutions may be higher, they can result in significant savings.

The Thames flood management system, for example, was developed as a long-term strategy to manage inherent uncertainties associated with future flood risk in London (Exhibit 4).

The plan outlines multiple sets of interventions that accommodate for varying rates of temperature change. These interventions are modular and scalable: the plan has more than 400 small movable structures and 36 floodgates.

Such thinking is even more important where resources are more limited (or where the time horizon of risk manifestation is further out or more uncertain).

Action 2: Broadly integrate adaptation into government decision making
Adaptation planning intersects with many public priorities such as economic development, housing, public health, and climate change mitigation. By using these intersections, governments, multilateral institutions, and philanthropies can magnify adaptation impact and seek to generate positive outcomes for broader groups of stakeholders (as well as avoid unintended consequences). There are three steps in particular that governments can take to optimize adaptation decision making.

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[19] Chris Bentley, "As sea levels rise, Rotterdam floats to the top as an example of how to live with water," World, June 20, 2016.
[20] Aileen Cho, Scott Lewis, and Tom Sawyer, "Storm surge barriers work," *Engineering News-Record*, November 14, 2012; and A. Bouwman et al., *Flood protection in the Netherlands: Framing long-term challenges and options for a climate-resilient delta*, Netherlands Environmental Assessment Agency, December 2009.
[21] Karin de Brujin et al., "Assessment of the Netherlands' flood risk management policy under global change," *Ambio*, March 2012, Volume 41, Number 2.

Exhibit 4

The Thames flood management system aims at flexible and dynamic planning, with over 400 movable structures to address differing levels of risk.

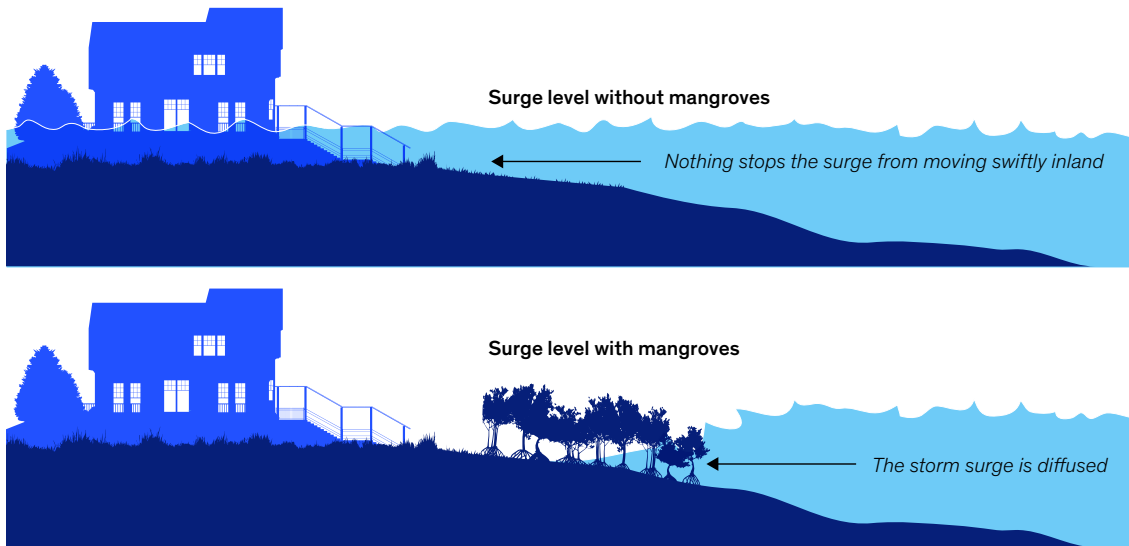**Flood depth for 1-in-100-year flood event in London[1] under a 2°C scenario,[2]** centimeters
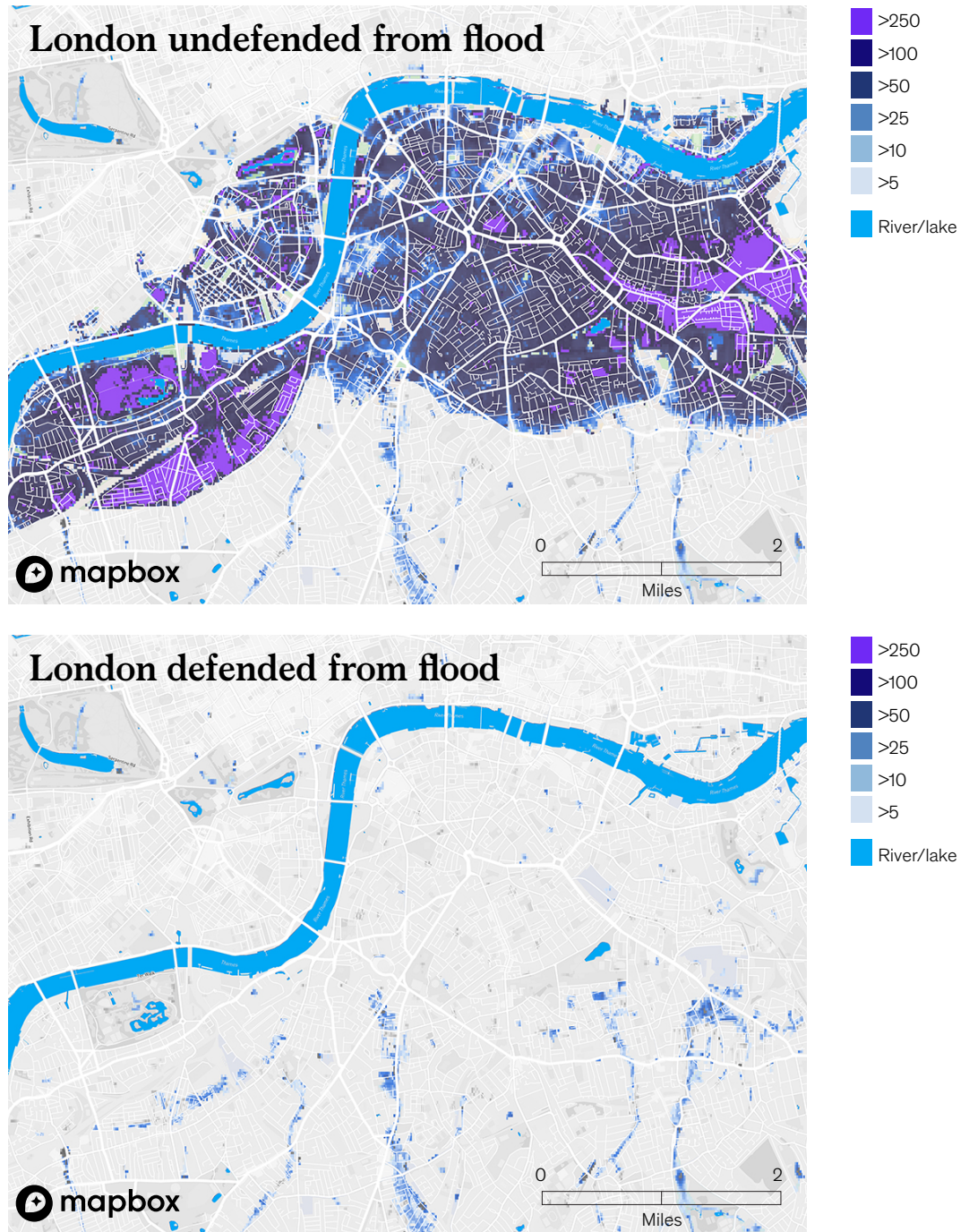
[1]The 100-year return period refers to events having 1% probability of occurring annually. Flood depth represented by sum of median pluvial, fluvial, and coastal flooding during the 100-year return period. Flood defenses such as floodgates (eg, Thames barrier) are explicitly represented in the "defended" run of the dynamical hydrological model. The "undefended" simulation does not include known or estimated flood defenses.

[2]The 2°C scenario refers to warming above preindustrial levels. Timing associated with warming level varies across the model ensemble.

Source: ClimateData.ca; Fathom-Global 3.0; Journal of Geochemical Exploration; UK Environment Agency TE2100 Plan; McKinsey Climate Analytics; © Mapbox; © OpenStreetMap

Exhibit 5

Mangrove restoration is an example of climate adaptation with multiple local and global benefits.

Coastal protections from mangroves

Surge level without mangroves

Nothing stops the surge from moving swiftly inland

Surge level with mangroves

The storm surge is diffused

In addition, mangroves offer multiple cobenefits that increase overall value.

Annual global benefits of mangrove forests

$450 billion

global annual value of mangroves from all benefits[1]

2.3–3.8×

minimum return on investment for mangrove restoration[2]

Food **31%**	
Economic benefits **26%**	Coastal protection **16%**
Ecosystem health **21%**	Carbon sequestration **3%**
	Other **3%**
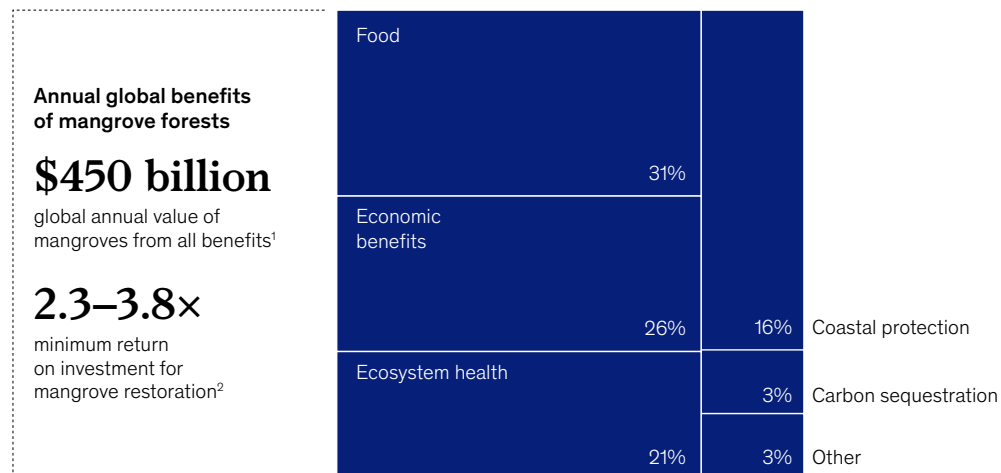
[1]Mangrove restoration has a value of $33,000 per hectare with 13.8 million hectares of existing mangroves.
[2]ROI was calculated using restoration costs and total benefits of mangroves. Restoration costs are estimated at $9,000 per hectare. Restoration benefits are estimated at $33,000 per hectare for existing mangroves and at $21,000 per hectare for restored mangroves.
Source: Daniel Friess, Alexandros Gasparatos, and Jie Su, "A meta-analysis of the ecological and economic outcomes of mangrove restoration," *Nature*, Aug 19, 2021; McKinsey analysis

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1. Consider prioritizing opportunities with cobenefits extending beyond adaptation, where it makes sense to do so. A fertile area for such opportunities is the intersection of adaptation and mitigation. Each opportunity serves a distinct role, yet each can often offer mutual benefits. A hectare of mangroves, for example, can store 1,000 tons of carbon on average.[22] Mangroves also prevent soil erosion and protect coastlines and nearby infrastructure from damage caused by storm surges or other extreme events (Exhibit 5).[23]

2. Design adaptation planning in a cross-government manner. Public institutions are best served by avoiding silos and promoting coordination. For every major investment or infrastructure project, assessments should ideally be made under multiple climate scenarios. They can consider, for example, how adaptation to extreme heat risk intersects with public health impacts, such as exhaustion, heatstroke, and dehydration. As institutions look at the intricate relationship between adaptation and health, they can come up with more comprehensive strategies.

Furthermore, climate change disproportionately affects more vulnerable communities, and adaptation strategies can not only protect lives but also enhance livelihoods. The World Bank's Colombia Resilient and Inclusive Housing Project, for example, focuses on improving housing for low-income families in high-risk areas. Using detailed hazard and climate risk maps, the project targets municipalities at risk of landslides and floods.[24]

3. Seek to avoid maladaptation by evaluating the potential risks and unintended consequences of adaptation actions during solutions design. Adaptation solutions can result in "maladaptation," which occurs when adaptation actions lead to increased risks, such as higher greenhouse gas emissions, heightened vulnerability to climate change, inequitable outcomes, or diminished welfare.[25] Policies that reduce incentives to adapt or that lock in only one adaptation pathway, restricting future actions, are also examples of maladaptation. Such negative effects can be seen in the case of the seawalls on Vanua Levu, Fiji, which were designed as a shield against rising sea levels but inadvertently increased potential hazard exposure by hindering stormwater drainage.[26] The structures also unintentionally redistributed risks to other coastal communities through changes in sediment deposits and resulted in unintended environmental consequences, threatening the health of the marine ecosystems.[27] Maladaptation can also occur in the context of insurance, which provides an important mechanism for transferring and distributing risks but can also lead to suboptimal decisions and/or moral hazards if it is not carefully managed. Agricultural climate insurance, for example, may lead farmers to deprioritize adaptation levers like intercropping and soil moisture maintenance techniques and increasingly rely on cash crops over more resilient subsistence crops, because they offer higher-insurance-compensation potential.[28] Insurance can also give undesirable incentives to people who deliberately choose to inhabit high-risk areas, because they do not assume the full costs of climate hazards.

A few countries, such as Canada, Finland, and the United Kingdom, have started acknowledging and explicitly addressing maladaptation in their national adaptation plans.

Action 3: Approach adaptation with a multilevel focus at the local, national, and global levels
Effective adaptation requires involvement from public entities at the local, national, and global levels, and the optimal setting for decision making can vary. Many cities, for instance, have led local actions to build resilient communities, notably with the guidance of the C40 and Resilient Cities

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[22] "Mangroves in the spotlight," UN Environment Programme (UNEP), July 25, 2017.

[23] For more, see Aaron Ellison, Alexander Felson, and Daniel Friess, "Mangrove rehabilitation and restoration as experimental adaptive management," *Frontiers in Marine Science*, May 2020, Volume 7; and Véronique Helfer and Martin Zimmer, "Mangrove forests – a nature-based solution for climate change mitigation and adaptation," *Rural 21*, March 18, 2022.

[24] The project aims to extend Colombia's home improvement program: Casa Digna, Vida Digna. For more, see *Colombia: Resilient and inclusive housing project (P172535)*, World Bank, February 2020.

[25] *Climate change 2022*, February 2022.

[26] Karen McNamara et al., "Dam(n) seawalls: A case of climate change maladaptation in Fiji," *Managing climate change adaptation in the Pacific region*, March 2020.

[27] Ibid.; see also Lisa Schipper, "Maladaptation: When adaptation to climate change goes very wrong," *One Earth*, October 2020, Volume 3, Number 4.

[28] See "Maladaptation," 2020; and Leigh Johnson, David Kreuer, and Birgit Müller, *Risks of maladaptation: Climate insurance in agriculture*, German Development Institute, 2017.

networks.[29] This potential action requires public sector participation on three levels:

1. Local parties engaging in targeted action within their communities. Local actors, including community leaders and inhabitants, play a vital role in understanding the implications of climate risks and developing effective adaptation interventions. The people on the ground often know firsthand how hazards manifest in their context. Drawing from historical experience, familiarity with local topographies, and close communal and cultural ties, local leaders are well positioned to anticipate impacts from risk (for example, flood-prone zones in their locality that are particularly vulnerable during the monsoon) and identify interventions. In Maharashtra, India, for instance, the local community organization Swayam Shikshan Prayog

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[29] The C40 network includes nearly 100 influential cities, including Amsterdam, Beijing, Mumbai, and San Francisco. See "About C40," C40 Cities Climate Leadership Group, accessed November 8, 2023.

Adaptation planning in India

India's adaptation planning occurs at the state level through State Action Plans on Climate Change (SAPCCs). The SAPCCs document the unique vulnerabilities of each state to climate risks and lay out planned interventions that both respond to physical climate change and activate a transition to a lower-carbon economy. They include strategies for mitigation and adaptation across different sectors, such as agriculture, transport, and energy. Given India's geographic and cultural diversity, this system was envisioned to empower states and enable localized planning approaches that tailor solutions to regional contexts, such as specific agricultural needs.[1]

This decentralized planning approach has enabled adaptation efforts to be more embedded into development planning across sectors and has encouraged enhanced climate action.[2] As of July 2023, all 28 states had published at least one version of their SAPCCs, thereby covering 98 percent of the Indian population. The level of ambition and comprehensiveness of the strategies differs across states.[3] Some states have released thorough action plans with state-level vulnerability assessments, timelines, and budget estimates; others rely on national data for their vulnerability assessments and outline high-level solutions.[4]

While coverage is extremely high, implementation has been challenging due to limited funding from both the central and state governments.[5] In addition, the SAPCCs are generally managed by government agencies in each state (such as state departments of environment), which may not have the authority or remit to coordinate action across sectors. In this context, many observers have called for increased inclusion and engagement of local and private sector actors.

India faces a unique challenge, planning for adaptation across a large, diverse population spread out across a wide and varied geography. Having adaptation plans coordinated at the state level, across multiple departments, has shown promise for creating localized solutions tailored to residents and is an important first step. However, India's experience also highlights the need for localized solutions to be followed by much greater central coordination and financial resources in order to propel implementation.[6]

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[1] "India," United Nations Development Programme, accessed November 9, 2023.
[2] Navroz Dubash and Anu Jogesh, "From margins to mainstream? State climate change planning in India," *Economic and Political Weekly*, November 2014, Volume 49, Number 48.
[3] Arunabha Ghosh, "Can India become a green superpower?," *Foreign Affairs*, June 20, 2023.
[4] Aditya Valiathan Pillai, "Guest post: The gaps in India's 'heat action plans,'" *Carbon Brief*, March 28, 2023; Elizabeth Gogoi, *India's state action plans on climate change: Towards meaningful action*, Oxford Policy Management, 2017.
[5] Carbon Brief, for example, reports that many states have been constrained by obligations associated with their COVID-19 response. In addition, it conducted an analysis of state and district plans and reports that only 30 percent discuss funding mechanisms. For more, see "Guest post," March 28, 2023; and Ravi Prasad and Ridhima Sud, "Implementing climate change adaptation: Lessons from India's national adaptation fund on climate change (NAFCC)," *Climate Policy*, August 2018, Volume 19, Number 3.
[6] GIZ (Germany's international development department) and the Global Center on Adaptation both explain the need for local leadership in the context of India's limited governmental capacity. *Foreign Affairs* reports that private investors are essential to help India's energy sector respond to climate change. See *India: NAPCC process country case study*, GIZ, March 2019; and *Stories of resilience: Lessons from local adaptation practice*, Global Center on Adaptation, November 2022; and "Can India become a green superpower?," June 20, 2023.

established a climate-resilient farming model for local women who had suffered from malnutrition. It identified the needs of the community and came up with interventions, such as moving from cash crops to certain food crops and focusing on specific women's groups. These interventions may strengthen local food supply, thereby supporting climate adaptation and local communities.[30]

The involvement of local community members can foster trust and active participation, especially for traditionally marginalized groups, and help national and global actors better understand risks and potential solutions. Early participation of local inhabitants can help shape acceptable adaptation solutions from the beginning. Adaptation measures can be disruptive, and not engaging local actors can increase maladaptation risk. In Vietnam, for example, forest management policies designed to manage flood risks are reported to have limited local mountain people's access to land and resources as an unintended impact.[31] In this context, local actors can play a pivotal role in building trust, reinforcing mutual understanding, and improving the effectiveness of adaptation.[32]

In some cases, national governments have set the groundwork and provided local actors the flexibility to determine their adaptation pathway.[33] In other cases, national governments have established a mandate for local governments to create and implement their own adaptation plans. This is, for example, the case in the Philippines, where about 80 percent of local government units have submitted adaptation plans.[34] A third approach, particularly effective for smaller countries, has been to engage local stakeholders in the development of national plans, while maintaining decision making at the national level.

2. National actors coordinating efforts, facilitating knowledge sharing, and managing funding allocation. Central governments can play a key role in adaptation by setting targets, creating a foundational knowledge base, and coordinating action to align with national priorities. They can also put forward and implement a vision for climate adaptation, including determining central scenarios to adapt to, defining common goals, and identifying necessary interventions to achieve desired outcomes. In addition, when functioning and coordinating effectively, national actors are well positioned to build and disseminate critical knowledge, data, and best practices. At the same time, they can empower local actors with the necessary resources to make well-informed decisions. South Africa's Let's Respond Toolkit, for example, provides an overview on integrating climate change into municipal planning.

3. Global actors supporting broader systemic issues, such as setting global standards, sharing best practices, and helping funnel financing to vulnerable countries. Global coordination is often necessary to evaluate transnational impacts of adaptation solutions, reallocate support to the most vulnerable countries, and bring down the unit cost of adaptation. Global actors like the European Union and the United Nations can be well equipped to share best practices and set standards; they have been especially instrumental in encouraging and supporting countries to establish national adaptation plans. Technical support and expertise provided by the United Nations was a determining factor for over 60 developing countries creating their first adaptation plans.[35] When operating effectively, coalitions of governments are well positioned to assess broader implications of adaptation measures and mediate outcomes, preventing initiatives of one nation from creating maladaptive outcomes

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[30] The organization won the Local Adaptation Champions Awards at the United Nations climate talk last year known as COP27. For more, see "20 organizations pioneering locally led climate resilience announced as finalists for the Local Adaptation Champions Awards at COP27," Global Center on Adaptation, September 6, 2022.

[31] Hans Nicolai Adam et al., "Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance, or irrelevance?," *World Development*, May 2021, Volume 141.

[32] Wendy Karen Bragg et al., "Communicating managed retreat in California," *Water*, February 2021, Volume 13, Number 6.

[33] Bangladesh's national adaptation plan, for instance, empowers local governments to select from 113 proposed interventions across sectors, based on local priorities.

[34] Between 2005 and 2021, 1,472 of 1,715 local government units submitted plans. See "Local climate change action plan," National Integrated Climate Change Database Information and Exchange System, accessed November 8, 2023.

[35] "About the NAP-GSP," UNDP-UN Environment National Adaptation Plan Global Support Programme, accessed November 8, 2023.

in another (for example, building dams across transnational water sources).[36]

For their part, international foundations and nongovernmental organizations (NGOs) can enable the development at scale of adaptation technologies and solutions by pooling global resources and supporting development of advanced, localized expertise. Recent adaptation grants from the Bill & Melinda Gates Foundation, for example, have supported the development of a weather intelligence platform to provide farmers with climate-smart agricultural information, research into developing strains of native grasses that enhance soil health, and funding for African scientists' and researchers' engagement efforts with national governments to shape adaptation policy.[37] In India, Tata Trusts has helped fund a nonprofit organization's efforts to restore bodies of water that have been degraded and depleted by long periods of drought in Maharashtra.[38]

Finally, global actors such as international development banks and regional investment funds can help reallocate resources to reinforce the adaptation potential of the countries most susceptible to the impacts of climate change. A notable example of this kind of cooperation is the Green Climate Fund's first-loss investment of $253 million into the Africa Finance Corporation's Infrastructure Climate Resilient Fund (ICRF).[39] Through IRCF, the Africa Finance Corporation finances climate-resilient greenfield and brownfield infrastructure across the region to future-proof existing infrastructure while enabling new infrastructure to be planned with climate change in mind.

Action 4: Systematically engage private sector actors and investors to mobilize funding and drive innovation

Governments and government agencies face challenges that private sector actors can help, at least partially, address. In many contexts, for instance, public funding for adaptation falls short. This is most apparent in developing countries, where resources are spread thinly across competing priorities. In 2022, the United Nations estimated that the adaptation finance gap alone in developing countries is five to ten times larger than today's total flow of international funds and continues to widen.[40] In our sample, the 11 countries with implementation cost estimates had a combined amount of $433 billion. For perspective, the United Nations expects adaptation to require investments of up to $300 billion *a year* globally by 2030.[41]

To catalyze engagement from private sector actors, governments could gain from first understanding the private sector's specific challenges in relation to climate risks and tailoring their approach accordingly. Private sector actors often do not have clarity on climate risks and their associated costs, making it difficult for them to manage risks efficiently and assess potential ROI. Governments could address these challenges by taking three steps.

1. Provide private sector actors and investors with clear and transparent regulations, along with guidance and adequate notice. Private sector actors often lack easy access to adaptation needs and opportunities where their involvement would be beneficial. For example, they are often unaware what funding is needed as only 29 percent of national adaptation plans in our analysis (ten out of 35) include cost estimates for adaptation interventions. Relevant government agencies can help provide resources and expertise to ensure adaptation interventions are costed appropriately.

[36] The building of the Grand Ethiopian Renaissance Dam in Ethiopia, for instance, is threatening the flow of the Nile River and the climate resilience of Egyptian communities downstream. See Max Bearak and Sudarsan Raghavan, "Africa's largest dam powers dreams of prosperity in Ethiopia—and fears of hunger in Egypt," *Washington Post*, October 15, 2023.
[37] "What is climate adaptation?," Bill & Melinda Gates Foundation, April 25, 2023.
[38] "It's time for philanthropy to step up the fight against climate change," McKinsey, October 20, 2021.
[39] "Green Climate Fund commits record US $253 million to AFC's Infrastructure Climate Resilient Fund for Africa," Africa Finance Corporation, March 21, 2023.
[40] *Adaptation gap report 2022*, UNEP, November 2022.
[41] "Finance & Justice," United Nations Climate Action, accessed October 14, 2023.

Government bodies can also influence private sector actors to reallocate funding toward climate adaptation initiatives with regulations that seek to make climate risks more evident. Governments can adjust securities law and fiduciary standards to explicitly include climate-related risks. The European Union, for example, requires financial-market participants to disclose sustainability risks.[42] In Canada and the United States, securities regulators are considering rules to require publicly traded companies to disclose how their businesses are managing climate-related risks.[43] Finally, governments can also enact new standards or certifications directly considering climate adaptation risks.

2. Align financial incentives to clarify and support potential ROI for private sector actors. Direct contributions from private sector actors for adaptation, such as providing financing for interventions, are hindered by the fact that adaptation interventions tend to have asymmetric ROI. The benefits, for instance, of designing and building a net-zero desalination facility or a modular system of flood management mechanisms, such as the Thames flood management system, are spread across a multitude of public and private sector actors, although the costs of these solutions are typically borne by a handful of actors. Additionally, benefits are measured in avoided future damages over a long period of time. The long-term nature and often high up-front costs of adaptation translate into a complex business case.

To address asymmetric ROI, public entities can partner directly with the private sector to prioritize solutions that offer additional value streams or savings. Private sector actors can use their specialized expertise and resources, while national and subnational governments can help reallocate costs and benefits. A district cooling system designed to tackle extreme heat, for example,

can reduce peak power capacity by 30 percent compared with conventional cooling systems, resulting in significant cost savings for businesses.

Public entities have also a critical role in deploying "blended finance" to manage financial uncertainty and derisk adaptation solutions. This approach combines capital from various sources with different return expectations to improve the risk-return profile of investments. One way that blended finance supports adaptation is through guarantees and cofinancing. The Multilateral Investment Guarantee Agency, for example, provided a $13.1 million guarantee in Jordan, protecting private investors' equity investments over a 20-year period.[44] This guarantee enabled the financing of a water treatment plant expansion to tackle climate-related challenges such as storms, droughts, and sea level rise.

Lastly, to incentivize innovation, public entities could provide grants that support research and development on adaptation solutions. Further investment by private sector actors is then facilitated as they can build on publicly funded research.

3. Assist private sector actors in enhancing their risk awareness and in understanding the opportunity cost of adaptation inaction. Private sector actors often do not have the tools to understand the business impact of climate hazards, which often lead them to not pursue or to postpone adaptation interventions or innovation.

Governments and multilateral bodies can help address this information deficiency by implementing standardized methodologies for measuring and pricing risks in decision making, facilitating high-quality data sharing, and improving the availability of and access to assessment tools. The Global Resilience Index Initiative, for instance, aims to provide consistent and reliable risk information

[42] "Corporate sustainability reporting," European Union, accessed November 9, 2023.
[43] "SEC proposes rules to enhance and standardize climate-related disclosures for investors," US Securities and Exchange Commission press release, March 21, 2022; "Canadian securities regulators consider impact of international developments on proposed climate-related disclosure rule," Canadian Securities Administrators, October 12, 2022; In Canada, each province and territory has its own securities commission that creates policy. National-level policy is coordinated and harmonized through the Canadian Securities Administrators, a council of all the provincial and territorial securities regulators.
[44] "MIGA backs wastewater treatment plant in Jordan," Multilateral Investment Guarantee Agency press release, July 24, 2013.

that can help investors better understand and evaluate the financial impact of climate risks.[45]

Action 5: Establish common principles for monitoring and evaluation

Monitoring and evaluation need to be integrated throughout the adaptation life cycle, from assessing initial risk exposure to tracking implementation and measuring its impact. Yet our sample analysis shows that just one-third of national adaptation plans include a formal framework to do so.[46]

This lack of monitoring is challenging because of the uncertain nature of climate change evolution. It is necessary therefore that national adaptation plans be adjusted over time to consider any changes and to continue providing effective responses. As we reviewed national adaptation plans, we identified three key principles to guide monitoring and evaluation frameworks.

1. Set up the right cadence for reassessing plans. The frameworks could include distinct cycles for monitoring the progress of interventions and

evaluating their impact. There would be a review process to track progress on a short-term basis (for example, annually) and a review process for performance over a longer-term basis or when there is a triggering event (every three years or more, for instance) (Exhibit 6). In addition, it is important to have an overarching review process for the entire plan at regular intervals to make sure it is in line with most recent climate projections. The monitoring framework in the Philippines' national adaptation plan, for example, provides an annual assessment of progress to set priorities and budgets, while every three years, a broader evaluation process focuses on efficiency, effectiveness and impacts, and strategy recalibration.[47]

2. Monitor progress against targets, evaluate performance of adaptation interventions, reevaluate risk exposure, and adjust approach. Historically, government funding for adaptation has been limited, and funding for monitoring and evaluation was even harder to come by. When adaptation work is fully resourced, each intervention would ideally have an implementation

Exhibit 6

Effective adaptation implementation requires a continuous cycle of iterative refinements.

Monitoring cycle

| Assess climate projections and hazard risks | Develop adaptation interventions | Set up targets and timeline for implementation | Monitor progress of implementation | Assess performance of interventions |

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[45] The Global Resilience Index Initiative was formed in late 2020 at the request of Mark Carney, UN Special Envoy on Climate Action and Finance, to enable open-access reference information for climate risk measurement and disclosure. It aims to provide globally consistent, open physical risk information, based upon insurance risk expertise, frameworks, and metrics. It also integrates future risk projections, additional hazards, exposures, and vulnerabilities, as well as advanced network risk analytics. For more, see "Global resilience index initiative," Oxford Sustainable Finance Programme, accessed November 9, 2023.

[46] This is in line with academic research, which found that as of 2021, over 60 percent of the countries with a national adaptation plan were not tracking its implementation. For more, see Timo Leiter, "Do governments track the implementation of national climate change adaptation plans? An evidence-based global stocktake of monitoring and evaluation systems," *Environmental Science & Policy*, November 2021, Volume 125.

[47] *National climate change action plan 2011–2028*, Philippines Climate Change Commission, June 2016.

Even if the reevaluation of risk does not result in immediate adjustments, governments would still benefit from monitoring adaptation solutions proactively.

framework, with a clear timeline and target. However, even setting general goals can act as a compass as countries develop their frameworks. The next step could be tracking the implementation progress of adaptation interventions against the timeline and measuring the actual performance of each intervention against the adaptation target. This system, even if only partially put in place, could help increase accountability and engagement.

In parallel to interventions, risk exposure could be regularly reevaluated according to new climate projections or triggering events. Even if the reevaluation of risk does not result in immediate adjustments, governments would still benefit from monitoring adaptation solutions proactively and revising them as necessary.

3. Incorporate a clear ownership structure and communicate often to increase accountability.
Each adaptation intervention could ideally be assigned to an identifiable actor (for example, a national or local government leader) who can be held responsible (in some cases as a first among

equals). The monitoring process can be conducted both at an individual level and across relevant stakeholders. In Burkina Faso, for example, the process is directed by both the National Council for the Environment and Sustainable Development, which oversees the national adaptation plan, and relevant ministries for each sector.[48]

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Now is the time to set priorities and move forward on adaptation. Climate change is becoming an integral part of our lives, wherever we live. The global and systemic nature of climate change disruptions makes them difficult to address on an ad hoc basis. Governments and international public institutions can have a large impact in propelling large-scale adaptation interventions because of their overarching position and mobilization capability. We believe that meaningful steps can be taken to accelerate this impact. The themes and steps outlined here may seem a demanding proposition for public sector leaders, especially considering all their other concerns and responsibilities.

[48] *Burkina Faso national climate change adaptation plan (NAP)*, Burkina Faso Ministry of Environment and Fishery Resources, May 2015.

However, inaction will likely be even more onerous and have real (and possibly catastrophic) impacts on lives and livelihoods.

While the challenges and complexity of climate adaptation are undeniable, it is also true that the global, collective level of expertise, dedicated resources, and mobilization in this area have never been higher. As we prepare for the 2023 United Nations Climate Change Conference, our hope is that the public sector will choose to accelerate its efforts around adaptation, while carefully combining and balancing them with mitigation and with other critical priorities, in a spirit of maximizing synergies and cobenefits.

Closing the digital divide in Black America

Five steps could help to bring broadband and digital equity to every Black household in the United States—urban and rural—while bolstering efforts to create a more inclusive economy.

This article is a collaborative effort by Ayebea Darko, Danielle Hinton, John Horrigan, Blair Levin, Kunal Modi, and Todd Wintner, representing views from McKinsey's Public Sector Practice.

The digital divide was first recognized in the mid-1990s.[1] Three decades later, due in part to long-standing economic inequity and the economics of broadband, it remains an impediment to inclusive economic growth, particularly in Black American communities. Approximately 40 percent of Black American households—as opposed to 28 percent of White American households—don't have high-speed, fixed broadband.[2] In dense urban areas such as Chicago and Baltimore, Black households are twice as likely as their White counterparts to lack a high-speed internet subscription.[3] In the rural South, 38 percent of Black households don't have broadband, compared with 23 percent of White households.[4]

But broadband access is only part of a much bigger picture. Ensuring all Americans can fully participate in civic life and the digital economy requires affordable subscriptions, internet-enabled devices, applications, digital skills, and high-quality technical support. For example, while smartphone and tablet penetration are approximately equal among White, Black, and Hispanic and Latino adults in the United States, only 69 percent of Black Americans and 67 percent of Hispanic Americans have desktop or laptop computers, compared with 80 percent of White Americans (Exhibit 1).[5] A 2020 OECD survey found that roughly half of Black workers had the advanced or proficient digital skills needed to thrive in our increasingly tech-driven economy, compared with 77 percent of White workers.[6]

Lower levels of digital readiness are both a consequence and an ongoing driver of large gaps in Black American representation in jobs that require digital skill sets. Although Black Americans comprise approximately 13 percent of all workers, they make up only 7.4 percent of digital workers.[7]

This lack of representation feeds racial income and wealth gaps. The median pay for tech jobs is more than twice that for all occupations, and digital and IT jobs are expected to grow by 13 percent through 2030—1.7 times the overall rate of job growth.[8] To the extent that Black Americans can achieve greater participation in the digital workforce, such jobs could help close income and wealth gaps.

Unprecedented government funding for broadband and digital equity

More than $425 billion in federal funding is available to state and local governments to help close the digital divide. Approximately $350 billion of that falls under the 2021 American Rescue Plan Act (ARPA) State and Local Fiscal Recovery Funds. The Bipartisan Infrastructure Law (BIL), also signed in 2021, provides $65 billion in federal funds for broadband efforts, including approximately $44 billion that will flow directly to states as part of the Broadband Equity, Access, and Deployment (BEAD) and State Digital Equity Capacity Grant programs. In addition, $10 billion is available in the ARPA Capital Projects funds.

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[1] "Falling through the net: A survey of the 'have nots' in rural and urban America," National Telecommunications and Information Administration, US Department of Commerce, July 1995.

[2] McKinsey analysis of 2020 US Census Bureau five-year American Community Survey microdata, retrieved via IPUMS, University of Minnesota.

[3] McKinsey analysis of American Community Survey data.

[4] Dominique Harrison, *Affordability & availability: Expanding broadband in the Black rural South*, Joint Center for Political and Economic Studies, October 2021. The "Black rural South" itself is a term used to describe more than 150 rural counties with populations that are at least 35 percent Black. These counties generally cover areas where enslaved Black laborers once worked on cotton plantations at a time when cotton was the largest cash crop in the country and a major driver of economic growth and prosperity in the early United States. See also: Harin Contractor and Spencer Overton, *An introduction to the future of work in the Black rural South*, Joint Center for Political and Economic Studies, February 2020.

[5] Sara Atske and Andrew Perrin, "Home broadband adoption, computer ownership vary by race, ethnicity in the U.S.," Pew Research Center, July 16, 2021.
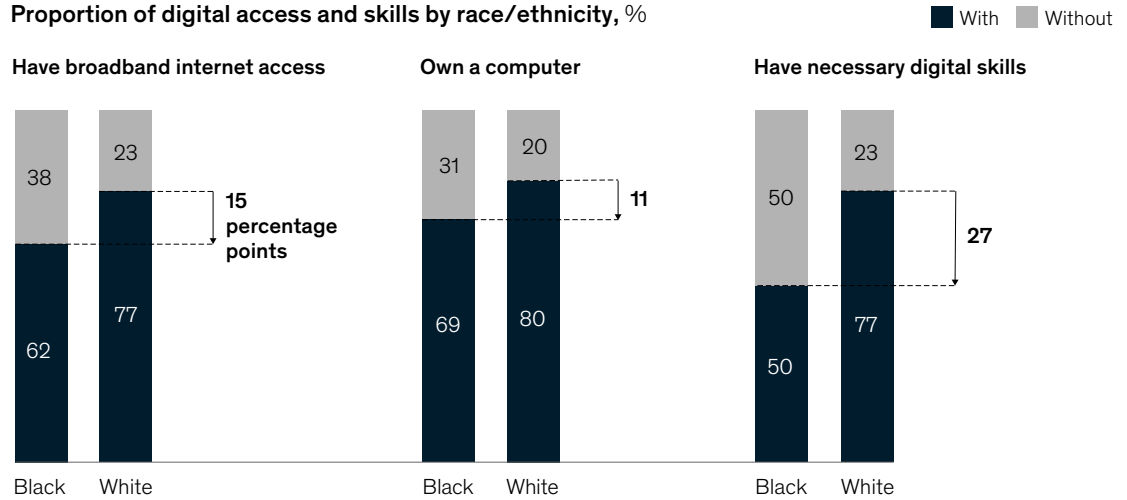
[6] *Applying a racial equity lens to digital literacy: How workers of color are affected by digital skill gaps*, National Skills Coalition, March 20, 2020.

[7] "Labor force characteristics by race and ethnicity, 2020," BLS Reports, US Bureau of Labor Statistics, November 2021; "Diversity in high tech: Executive summary," US Equal Employment Opportunity Commission, accessed November 2022; Padraig Belton, "Why are there so few black tech entrepreneurs?" BBC News, September 4, 2020; Nicholas Jones et al., "2020 Census illuminates racial and ethnic composition of the country," US Census Bureau, August 12, 2021.

[8] "Labor force characteristics," 2021; "Computer and information technology occupations," US Bureau of Labor Statistics Occupational Outlook Handbook, September 8, 2021; "Employment projections 2020–2030," US Bureau of Labor Statistics, September 8, 2021.

Exhibit 1

The digital divide disproportionately affects Black Americans across adoption, computer ownership, and digital skills.

Proportion of digital access and skills by race/ethnicity, %

■ With   ■ Without

Have broadband internet access

Black	White
38 (without)	23 (without)
62 (with)	77 (with)

15 percentage points

Own a computer

Black	White
31 (without)	20 (without)
69 (with)	80 (with)

11

Have necessary digital skills

Black	White
50 (without)	23 (without)
50 (with)	77 (with)

27

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This funding is unprecedented in three ways:

1. *Scope.* The funds, which are administered by the Treasury and Commerce departments, the Federal Communications Commission (FCC), and the Department of Agriculture, are targeted across the board—at infrastructure, adoption, affordability, devices, tech support, digital literacy and skills training, and accelerating workforce development and remote work opportunities.[9]

2. *State led.* Earlier federal infrastructure investments were primarily allocated by the FCC to internet service providers (ISPs). This time, most funding is going directly to states, which can "subgrant" awards to various providers, programs, and organizations, subject to internal guidelines.

3. *Digital equity and inclusion focus.* For the first time, the federal government will provide subsidies that are substantial enough to allow many low-income Americans to afford broadband subscriptions. Considerable federal funds—some directed to states—are also allocated to broader digital-inclusion programming, and additional funding will be distributed to local governments and not-for-profit organizations through a competitive grant process.

These federal funds are designed to encourage progress toward extending affordable, reliable, high-speed broadband access, which Congress has declared as "essential to full participation in modern life in the United States."[10] But the money alone will not be enough to eradicate the digital divide. Fully meeting this moment requires a vision for digital equity and inclusion, new levels of data collection, robust stakeholder engagement, and partnerships

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9 "President Biden's Bipartisan Infrastructure Law," White House.
10 Infrastructure Investment and Jobs Act of 2021, Pub. L. No. 117–58, 135 Stat. 429 (2021).

across the public, private, and not-for-profit sectors. It also requires taking targeted steps to understand the barriers impacting specific communities.

Here are five steps that state and local leaders and broadband stakeholders could take to expand broadband access and promote digital equity and inclusion in Black communities (Exhibit 2).

1. Make explicit commitments to digital equity and inclusion

As states, cities, and municipalities develop their aspirations and make broadband plans, leaders can promote change by elevating a public commitment to digital inclusion and equity alongside the commitment to expanding high-speed broadband-infrastructure coverage. This public commitment also can broaden the set of engaged stakeholders to include private-sector players and not-for-profit organizations with an equity focus. Getting these other stakeholders involved could help deepen the fact base, sharpen the plan, and encourage effective execution.

Several states are already making their commitment to equity clear. In 2021, North Carolina established the nation's first Office of Digital Equity and Literacy to "accelerate the critical work of bringing all North Carolinians up to speed with the digital society so they can live more equitable, prosperous, educated, and healthier lives."[11] This office coordinates with the state's expanded Division of Broadband and Digital Equity, which is charged with executing the plan, including investing $165 million in digital-equity efforts.

Also in 2021, Maryland kicked off an initiative that aims to ensure "universal broadband to everyone, in every single corner of the state" by 2025.[12] To facilitate this work, the state allocated $75 million to provide an additional $15 a month in subscription support and device subsidies to low-income residents.[13] This subsidy was provided in addition to the $50 monthly federal Emergency Broadband Benefit, from September 2021 to August 2022. Furthermore, Maryland has made equity a high priority, and has allocated an additional $10 million

Exhibit 2

There are five steps that could expand broadband internet access and encourage digital equity and inclusion in Black communities.

1. Make explicit statewide commitments to digital equity and inclusion.

2. Conduct a comprehensive survey of unserved and underserved locations, and ensure funds reach communities that need them.

3. Involve all stakeholders in understanding the underlying barriers to access and digital equity.

4. Partner with local stakeholders to ensure households access subsidies for internet subscriptions and devices.

5. Seek out partnerships among private enterprises, not-for-profit organizations, academia, and government to close the digital divide.

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[11] "Governor Cooper establishes nation's first Office of Digital Equity and Literacy," North Carolina Department of Information Technology, July 1, 2021.

[12] "Governor Hogan announces $400 million initiative to ensure universal broadband for Maryland," Office of Governor Larry Hogan, August 20, 2021.

[13] "Governor Hogan, President Ferguson, Speaker Jones announce bipartisan agreement for American Rescue Plan funding," Office of Governor Larry Hogan, March 31, 2021.

for digital-inclusion programming, digital-literacy training, and a digital-navigators program.[14]

2. Conduct a comprehensive survey of unserved and underserved locations, and ensure the funds reach the communities that need them

The allocation of the BIL's BEAD funds will be derived from the number of unserved locations in the new broadband Deployment Accuracy and Technological Availability (DATA) maps, whose creation was required by the 2020 Broadband DATA Act.[15] If governments fail to properly count all unserved broadband-serviceable locations, including individual households and small businesses in minority communities, the broadband DATA maps will not accurately reflect the needs. A proper count is therefore the first step toward ensuring that Black communities receive their fair share of funding to close broadband infrastructure gaps, and is necessary for contesting any errors or omissions in the maps.

The new maps are at the location level and thus much better than the existing FCC maps, which rely on less precise census block–level data. But gaps may still exist. Many rural areas, especially in states such as Mississippi, Alabama, and Louisiana, still have significant infrastructure gaps that disproportionately impact Black Americans.[16] Lower-speed DSL and cable deployments are linked to neighborhood economics; more affluent areas more likely to have higher speed and often have fiber deployments. And multi-dwelling units in under-served areas can experience additional capacity constraints, especially during high-demand hours, due to shared bandwidth limitations and insufficient indoor wiring or Wi-Fi equipment.[17]

To make sure the new maps accurately depict broadband gaps, governments could survey targeted areas using a mix of door knocking, telephone campaigns, and outreach via trusted community members and organizations. They could supplement the initial information they collect with engineering assessments of the available technology to determine whether the area's broadband infrastructure has the capacity to serve residents. Governments could then include that information along with addresses and geographic information systems coordinates in their submissions contesting the FCC maps.[18] As state and local leaders consider the best way to mobilize a workforce capable of gathering information on broadband infrastructure gaps, they could take inspiration from US Census data collection. A similar program could both create jobs and identify data collectors who could subsequently be retrained and connected with other broadband and digital-equity initiatives.

Once the National Telecommunications and Information Administration establishes funding levels, states could work with the administration, corporations, and civic organizations to ensure that funding for reliable and resilient high-speed internet reaches Black communities. Local elected officials who represent significant numbers of Black constituents could have a seat at the table as project areas are being drawn, so that they can ensure their constituents are included in the state's final proposal. After unserved and underserved locations are connected or upgraded, states could prioritize funding for historically Black colleges and universities (HBCUs) and other minority-serving institutions (MSIs). Because they play a trusted central role in Black communities, HBCUs and MSIs could serve as hubs for the digital equity and inclusion resources and programs.

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[14] Maryland Broadband Investment Advisory Workgroup, Maryland Department of Housing and Community Development, May 3, 2022; "The digital navigator model: Adding digital equity to our social safety net," National Digital Inclusion Alliance," accessed November 2022.

[15] Broadband DATA Act, Pub. L. No. 116–30, 134 Stat. 228 (2020).

[16] *Affordability & availability*, 2021.

[17] In older buildings or buildings where funding for wiring upgrades and maintenance is inadequate, indoor wiring to individual units within multifamily dwellings is often insufficient to support higher broadband, which constitutes a further barrier to access. Although indoor wiring gaps within locations will not be captured in the FCC mapping data, and thus not impact their BEAD allocation, indoor wiring upgrades likely constitute an authorized use of Digital Equity Act funding (and BEAD funding, subject to the prioritization defined in the BIL statute). On-the-ground teams could identify and log these gaps and report them to state broadband offices for inclusion in a barriers assessment.

[18] Broadband Data Collection, Federal Communications Commission, December 9, 2022.

The majority of Black households directly impacted by the digital divide live in areas with available infrastructure but simply can't afford broadband service.

3. Involve all stakeholders in understanding the underlying barriers to access and digital equity
To gain a deeper understanding of the underlying barriers that cause the digital divide and identify and create solutions to close it, state leaders could get feedback from a range of stakeholders, including impacted residents, local government leaders, not-for-profit leaders, digital-equity and workforce development practitioners, utilities and electric co-ops, ISPs, private-sector companies focused on growing the digital workforce, and multiple others.

Engaging multiple stakeholders could help state leaders understand the aspirations of impacted communities, the barriers that stand in the way of access and digital equity, and which solutions might yield the greatest outcome based on the experiences of residents and practitioners who have been working for years to close the digital divide. State and local leaders could also work to scale up the existing programs that have been most effective and identify regions where new programs are needed to meet residents' needs.

Not-for-profit leaders and digital-equity practitioners could also proactively engage state leaders through phone calls, letters, and meetings to share their knowledge and help shape the priorities, approach, and plans in development. State leaders could consider paid partnerships with community

institutions to support stakeholder engagement work and the development of implementation plans to drive broadband access and digital equity.

4. Partner with local stakeholders to ensure households can access subsidies for internet subscriptions and devices
Federal, state, and local governments could partner with local broadband stakeholders to ensure eligible households are able to take advantage of the FCC's Affordable Connectivity Program (ACP), which provides subsidies for internet service and devices. The majority of Black households directly impacted by the digital divide live in areas with available infrastructure but simply can't afford broadband service. Approximately 37 percent of Black Americans in the workforce make less than 200 percent of the federal poverty level and are economically insecure.[19] These families would likely qualify for assistance through the ACP, but surveys show that many are unaware of that. Among those who are aware of the ACP subsidy, 32 percent found it difficult to sign up for ACP support.[20] Since the eligibility criteria for ACP include participation in federal programs such as Medicaid and the Supplemental Nutrition Assistance Program, government agencies and community organizations could use existing outreach channels to communicate with eligible Black residents.

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[19] *100 million and counting: A portrait of economic insecurity in the United States*, PolicyLink and USC Program for Environmental & Regional Equity, 2018.

[20] *Affordability and the digital divide: The first in a 3-part series on digital connectivity during the pandemic*, EveryoneOn and John B. Horrigan, December 2021.

Multiple local organizations across the country are doing impactful work to promote ACP uptake. The Baltimore Digital Equity Coalition, for example, hosts live information sessions that provide details on the ACP and how to apply for subsidies. Detroit and other cities supplement their outreach efforts with a printed digital-citizen's guide, which gives residents an overview of the benefits of connectivity and tactical steps for obtaining an ISP subscription. In Ohio, state leaders worked with not-for-profit organizations and K–12 schools to encourage ACP uptake, as an example of cities and states partnering with local organizations to help ensure the ACP benefit gets to the residents who need it most.[21]

5. Seek out partnerships among private enterprises, not-for-profit organizations, academia, and government

Corporations, state and local governments, not-for-profit organizations, and stakeholders in academia—particularly HBCUs—could look for opportunities to partner on initiatives to close the digital divide. These partnerships could include workforce development programs that teach digital skills, develop new talent pools, and provide access to higher-wage jobs.

HBCUs are widely trusted anchor institutions with deep community roots. They also serve as critical platforms for educating and advancing students of color. HBCUs confer 17 percent of all the bachelor's degrees awarded to Black Americans and play a vital role in accelerating Black economic mobility, both for their students and their communities.[22] One report found that HBCUs create roughly 134,000 jobs for their local and regional economies.[23]

Given the importance of HBCUs to their communities, they could play an even larger role in promoting connectivity, digital literacy, and digital-skills development. Several HBCUs are already innovating in this space. For example, Benedict College, an HBCU in South Carolina, has used $6 million from the Governor's Emergency Education Relief Fund (GEER) to partner with the University of South Carolina, providing open access to eight computer labs throughout the state, making digital technology more accessible to local school districts, HBCUs, the South Carolina Technical College System, and community members.[24] At Stillman College, an HBCU in Alabama, the campus-incubated Black Tech Futures Research Institute is focused on cultivating a community-centered Black tech eco-system that informs policy recommendations and eradicates racial tech disparities within cities.[25]

Beyond HBCUs, corporations are already engaged in efforts to expand broadband access and, along with it, the available pool of tech talent to work in the digital economy. For example, Microsoft and Cisco are partnering with not-for-profit organizations and state governments to support and scale existing digital-skills-building programs. Since 2017, Microsoft has used its Airband Initiative to expand high-speed internet access in underserved areas by leveraging fixed wireless technology over the television white-space spectrum.[26] In 2020, Microsoft also launched a skills initiative to help 25 million people around the world to acquire digital skills.[27] The program provides content for people to develop in-demand digital skills, in partnership with LinkedIn, to help with job placement.

In Atlanta and several other US cities, Microsoft has built a broad coalition of partners to create a place-based initiative that aims to close the digital-skills gap and build a more inclusive workforce.[28] Involving state and local leaders and not-for-

[21] For example, see "Digital access policy & strategic infrastructure plan," City of Detroit, April 2022; Affordable Connectivity Program, Broadband Ohio, accessed December 2022.

[22] Integrated Postsecondary Education Data System, National Center for Education Statistics, July 2021; B. T. Nagle and K. M. Saunders, *HBCUs punching above their weight: A state-level analysis of historically Black college and university enrollment and graduation*, UNCF, 2018.

[23] "HBCUs make America strong," UNCF, November 14, 2017.

[24] "Gov. Henry McMaster provides $6 million in GEER funds for community computer labs," South Carolina Office of the Governor, March 30, 2021.

[25] Black Tech Futures Research Institute, accessed November 2022.

[26] *An update on connecting rural America: The 2018 Microsoft Airband Initiative*, Microsoft, 2018.

[27] *Official Microsoft Blog*, "Microsoft launches initiative to help 25 million people worldwide acquire the digital skills needed in a COVID-19 economy," blog entry by Brad Smith, Microsoft, June 30, 2020.

[28] *An update on connecting rural America*, 2018.

profit organizations with deep relationships in the community, Accelerate: Atlanta helps facilitate learning programs, offers career support, and helps connect program participants with job opportunities.[29] The program has targeted learning pathways focused on helping physical laborers, tradespeople, and office and service workers to develop business and technical skills to prepare them for top jobs.

Meanwhile, Cisco's Networking Academy delivers industry-standard IT education through partnerships with high schools, colleges and universities, not-for-profit organizations, prisons, and community centers. In 2021, Cisco launched Skills for All, a free, mobile-first, self-paced program that works to make acquiring technology skills more inclusive and accessible.[30] Cisco also made a $50 million contribution to the Student Freedom Initiative's Access to Education endowment for HBCU students.

Changing the trajectory toward greater equity

The United States is at a pivotal moment for closing the digital divide in Black communities. By gaining a better understanding of the barriers affecting Black communities and engaging communities with a range of broadband and digital-equity stakeholders to address those barriers, public- and private-sector leaders can rise to meet this moment.

[29] Accelerate: Atlanta, Microsoft, accessed November 2022.
[30] *2021 Cisco purpose report: Our purpose, our progress*, Cisco, 2021.

Can public EV fast-charging stations be profitable in the United States?

The United States needs more fast public chargers to support the growth of EVs—but generating a profit at a public charging station remains challenging.

by Peter Fröde, Morgan Lee, and Shivika Sahdev

Although the United States has long lagged other regions in electric vehicle (EV) adoption, the country is now reporting record growth. EVs represented about 8 percent of all new passenger cars sold in the United States in 2022, up from around 5 percent in 2021.[1] By 2030, this figure could rise to 53 percent.

The United States will need about 28 million ports by 2030 to meet the demand for electricity by zero-emission passenger vehicles (Exhibit 1). Private ports are expected to increase in number from around 2.5 million to nearly 27.0 million, representing about 95 percent of the total.

There are two types of public charging: direct current fast charging (DCFC), which is used on highways and for fast fill-ups, and slower Level 2 (L2) charging, which is available at places such as grocery stores, malls, car dealerships, golf courses, and banks, where people may park for longer periods. L2 charging may also occur next to sidewalks or near street parking. About 150,000 L2 and DC plugs are now available across the United States, but that number is expected to increase to 1.5 million by 2030, when they will represent about 5 percent of the total.

While public fast charging is a piece of the overall charging solution, current EV demand for electricity

Exhibit 1

By 2030, the United States will need about 28 million ports to meet demand for zero-emission passenger vehicles.

US charging demand for zero-emission passenger vehicles, millions of ports
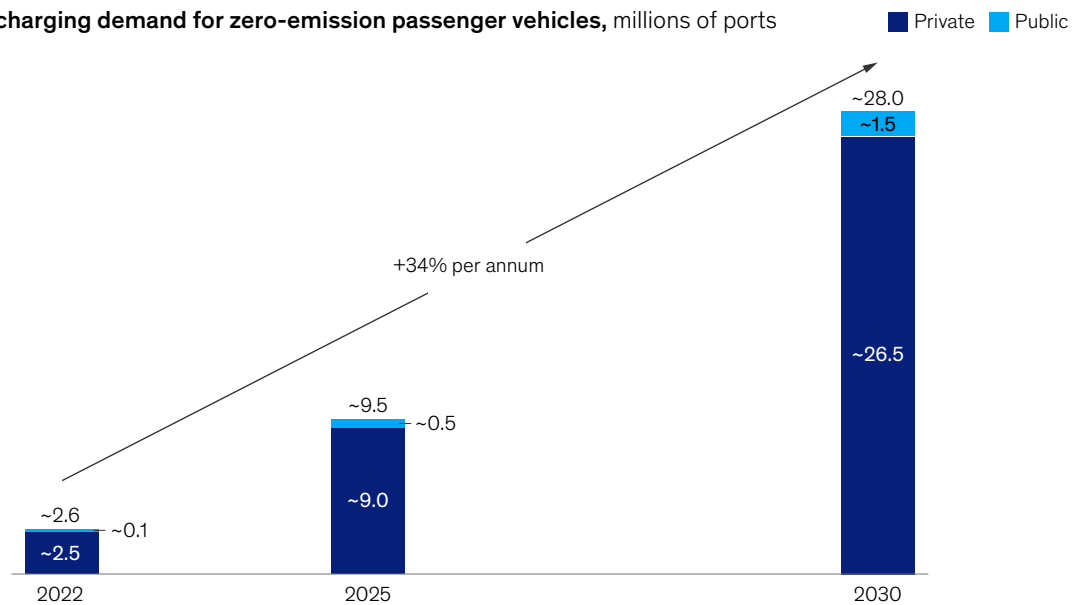
Note: Based on a scenario where passenger electric vehicles account for nearly half the vehicles sold in the United States in 2030, in line with a federal target.
Source: McKinsey Center for Future Mobility

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[1] Maximilian Fischer, Nicolaas Kramer, Inga Maurer, and Rachell Mickelson, "A turning point for US autodealers: The unstoppable electric car," McKinsey, September 23, 2021.

About the McKinsey Center for Future Mobility

These insights were developed by the McKinsey Center for Future Mobility (MCFM). Since 2011, the MCFM has worked with stakeholders across the mobility ecosystem to provide independent and integrated evidence about possible future-mobility scenarios. With our unique, bottom-up modeling approach, our insights enable an end-to-end analytics journey through the future of mobility—from consumer needs to a modal mix across urban/ rural areas, sales, value pools, and life-cycle sustainability. Contact us if you are interested in getting full access to our market insights via the McKinsey Mobility Insights Portal.

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is still so low that profitability is challenging—and this could remain the case over the short to medium term. To help charge-point operators improve their financial picture both now and during scale up, we examined the EV market, including the ongoing shifts in ownership patterns and charging demand. We then analyzed the factors that influence charging station revenues and identified potential improvement levers for optimizing profitability.

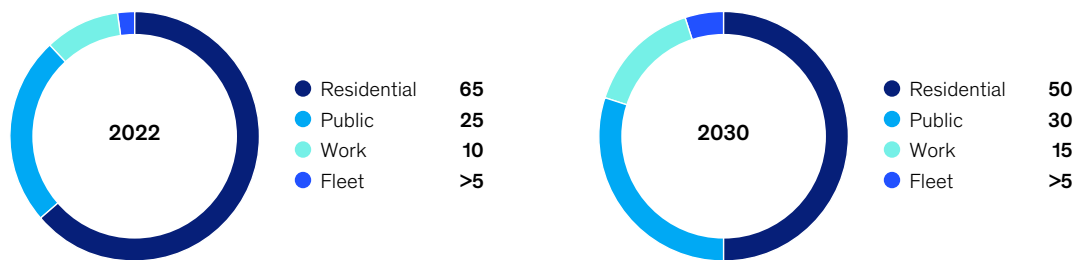Among the most important: a focus on utilization and pricing.

Public charging is required, no matter what

Currently, most EV owners tend to be home owners with access to a home charger, and they often have a second vehicle for long-distance trips. But even

Exhibit 2

While electric vehicle drivers now do most of their charging at home, more public charging will be needed as demand grows.

Passenger vehicles energy demand by charging use case, % of kilowatt hours

2022

● Residential	65
● Public	25
● Work	10
● Fleet	>5

2030

● Residential	50
● Public	30
● Work	15
● Fleet	>5

Note: Based on a scenario where passenger electric vehicles account for nearly half the vehicles sold in the United States in 2030, in line with a federal target; figures may not sum to 100%, because of rounding.
Source: McKinsey Center for Future Mobility

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people that fit this profile will sometimes need public charging. For instance, they might forget to charge their vehicle overnight and thus need to charge on the road, or they might find that the slow L2 charger at their workplace parking garage, where they usually connect during an eight-hour workday, is out of commission. Additionally, long journeys—those more than 150 to 200 miles—will necessitate public charging.

As EVs become more common and their owners no longer come primarily from higher income groups, the percentage of charging that occurs at home is expected to fall to 50 percent by 2030 (Exhibit 2). Although about 65 percent of the US population own or rent a single-family home, many people lack garages where a charger could be placed, or find that installation is prohibitively expensive.[2] Apartment dwellers may also lack a

suitable installation site or encounter resistance from landlords who do not want chargers on the premises. In such situations, public charging, either fast or overnight, is the mainstay.

Recognizing the need for public chargers, many new players are now entering the sphere. For instance, some major automakers are banding together to invest a minimum of $1 billion in a joint venture that will build stations with about 30,000 fast chargers in urban and rural areas of the United States.[3]

The challenging economics of charge-point stations
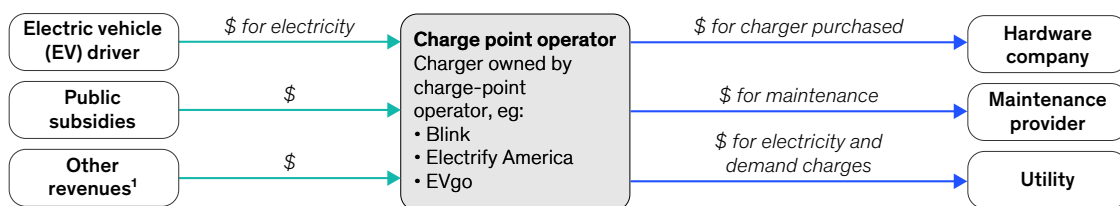
While charge-point operators can follow multiple strategies for generating revenues, two business models are now most common (Exhibit 3):
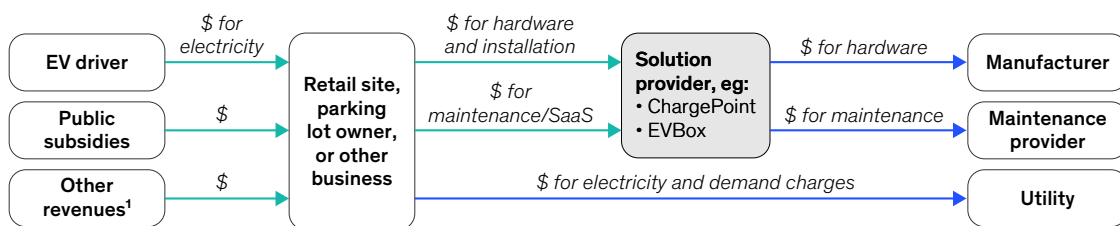
Exhibit 3

There are two main business models for electric vehicle charging infrastructure providers.

Owner operator model (illustrative)

→ Revenue → Cost ☐ Example players

Electric vehicle (EV) driver	$ for electricity →	Charge point operator Charger owned by charge-point operator, eg: • Blink • Electrify America • EVgo	$ for charger purchased →	Hardware company
Public subsidies	$ →		$ for maintenance →	Maintenance provider
Other revenues[1]	$ →		$ for electricity and demand charges →	Utility

Solution provider model (illustrative)

EV driver	$ for electricity →	Retail site, parking lot owner, or other business	$ for hardware and installation →	Solution provider, eg: • ChargePoint • EVBox	$ for hardware →	Manufacturer
Public subsidies	$ →		$ for maintenance/SaaS →		$ for maintenance →	Maintenance provider
Other revenues[1]	$ →		$ for electricity and demand charges →			Utility

[1]Eg, advertising, subscriptions, and original equipment manufacturer partnerships.

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[2] 2021 Census American Housing Survey.
[3] Mike Colias, River Davis, and Ryan Felton, "Big Automakers Plan Thousands of EV Chargers in $1 Billion US Push," *The Wall Street Journal,* July 26, 2023.

- *Owner-operator.* Under this model, the charge-point operator is responsible for all capital costs, including hardware and installation, and for all ongoing operations and maintenance. Owner-operators generate revenue by selling electricity and through other streams (for instance, incentives and energy credits). Currently, three companies—Electrify America, Evgo, and Tesla—have 80 percent of the market for public DCFC charging.

- *Solution providers (site-host owners, third-party operators).* Under this model, the charge-point operator sells chargers to a site host, such as a grocery store or dealership, which bears the cost of hardware and installation. The site host also pays the operator an ongoing fee for operations and maintenance.

Regardless of business model, the up-front capital costs for fast charging stations are high. A 150 to 350 kilowatt (kW) DCFC charging unit can cost anywhere from $45,000 to over $100,000, and installation costs can range from $40,000 to more than $150,000. Additionally, grid upgrade and integration costs can amount to millions, depending on the number of fast chargers installed at the location.

We examined the economics for a hypothetical DCFC charging station with an owner-operator business model in California. In line with typical patterns, we assumed the charging station would have four 150kW chargers.[4] In our first analysis, we assumed that the charge-point operator did not receive any government subsidies or credits; in the second, it did.
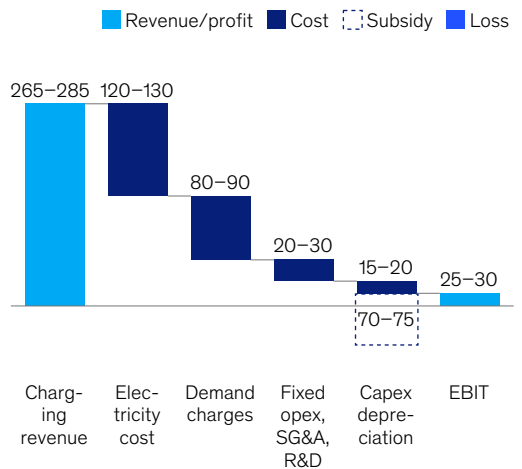
Exhibit 4

Subsidies can meaningfully change the economics of a public fast charging station.

Station economics without subsidy, $ thousand
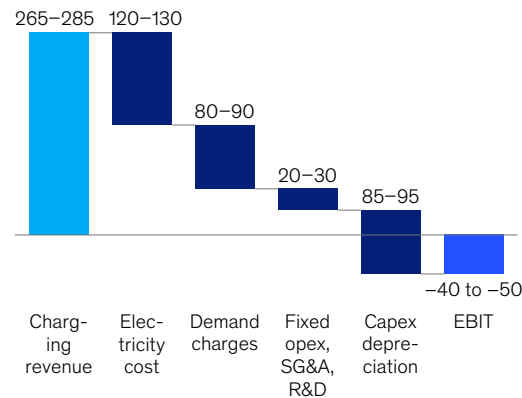
Station economics with subsidy,[1] $ thousand

■ Revenue/profit ■ Cost ⬚ Subsidy ■ Loss

Note: Analysis assumes 4 direct current fast charging (DCFC) 150KW chargers at each station; 15% utilization, 80% charger efficiency, price of ~$0.45/kWh,
Costs assume wholesale electricity at $0.20/kWh with a $20/kW demand charge (PG&E A-10 commercial rate), 75% concurrence, ~$250/month per charger for maintenance, ~$95,000 per charger for the charging hardware and installation excluding grid and site equipment, 5% SG&A/R&D, 15% discount rate.
[1]Analysis assumes ~80% of the capital cost is covered by a subsidy.
Source: McKinsey Center for Future Mobility

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[4] FWHA NEVI Formula Program Guidance, US Department of Transportation, Federal Highway Administration, June 2, 2023.

Fast public charging-station economics without subsides or credits

Assuming 15 percent utilization—equivalent to about seven 30-minute charging sessions per day—our hypothetical station would generate $265,000 to $285,000 in annual revenue, given a price of $0.45 per kWh dispensed. (Pricing may vary by time of day). On the cost side, we assumed annual expenses of $220,000 to $250,000 for electricity, demand charge rates, fixed operational expenditures, R&D, and SGA.[5] Capital expenditure depreciation would total about $85,000 to $95,000 yearly. With these metrics, the station would lose about $40,000 to $50,000 per year in EBIT (Exhibit 4).
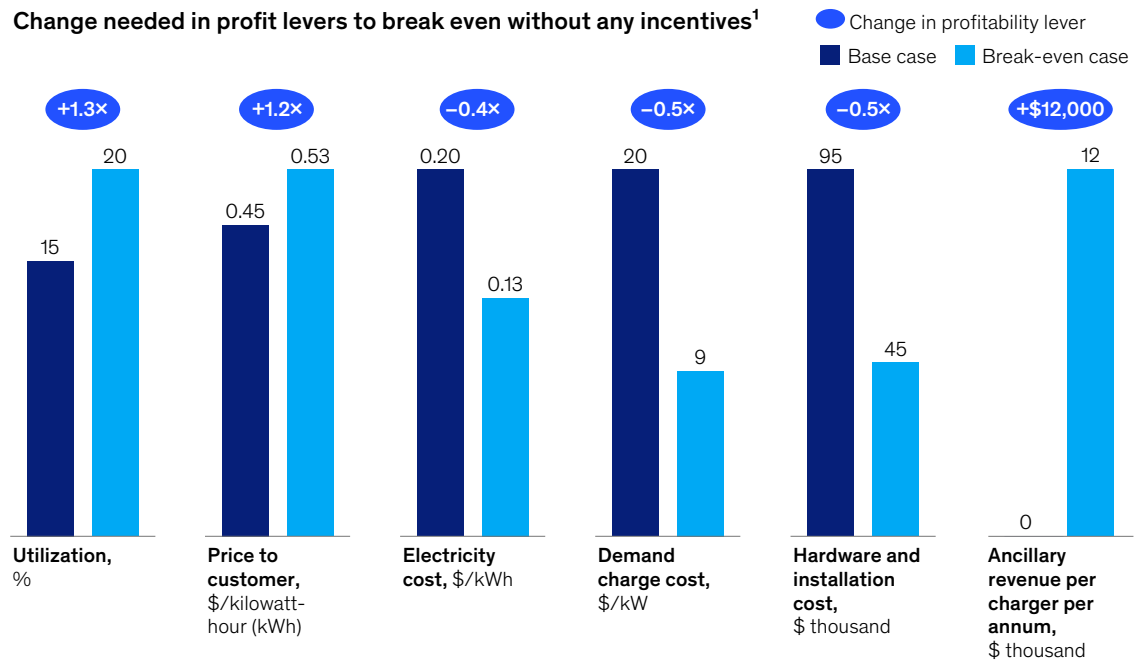
Fast public charging-station economics with subsidies and credits

If the same fast public charging station received government subsidies or credits, the economics would be very different because these programs can significantly reduce costs. For instance, the recent Inflation Reduction Act includes up to a 30 percent tax credit for EV charging stations within low-income or non-urban census tracts through December 2032, up to a maximum of $100,000 per charger.[6] The National Electric Vehicle Infrastructure (NEVI) Formula Program, which will disperse $5 billion in funding from the Department of Transportation over a five-year formula grant period, provides credits and subsidies through the end of fiscal year 2026.[7] For each

Exhibit 5

With increased utilization or reduced demand charges a public fast charging station could be profitable.

Change needed in profit levers to break even without any incentives[1]

Legend:
- ● Change in profitability lever
- ■ Base case (dark blue)
- ■ Break-even case (light blue)

Lever	Change	Base case	Break-even case
Utilization, %	+1.3×	15	20
Price to customer, $/kilowatt-hour (kWh)	+1.2×	0.45	0.53
Electricity cost, $/kWh	−0.4×	0.20	0.13
Demand charge cost, $/kW	−0.5×	20	9
Hardware and installation cost, $ thousand	−0.5×	95	45
Ancillary revenue per charger per annum, $ thousand	+$12,000	0	12

[1]Analysis assumes case of a charging station with 4 direct current fast charging (DCFC) 150kW chargers in California (PG&E A-10 commercial rate) with 75% concurrence, 80% charger efficiency, 5% SG&A/R&D, 15% discount rate.
[2]Inclusive of maintenance, software, network fees, rent, etc.
Source: McKinsey Center for Future Mobility

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[5] We calculated demand charges by assuming a cost of $20 per kilowatt, with peak demand of 480kW per month.
[6] United States Congress, Public Law 117–169, Congress.gov, August 16, 2022.
[7] US Department of Transportation, Memorandum, 2023 Vehicle Infrastructure Formula Program Guidance, Federal Highway Administration, June 2, 2023.

charging station, it will fund up to 80 percent of project costs, provided that the station serves the public and meets other criteria, such as being located along Federal Highway Administration Alternative Fuel Corridors.[8] If the charging station in our example received subsidies or credits, annual capital-expenditure depreciation would fall by an estimated $70,000 to $75,000. With this decrease, the station's EBIT would be positive (in the range of $25,000 to $30,000).

Several levers will be required to achieve profitability

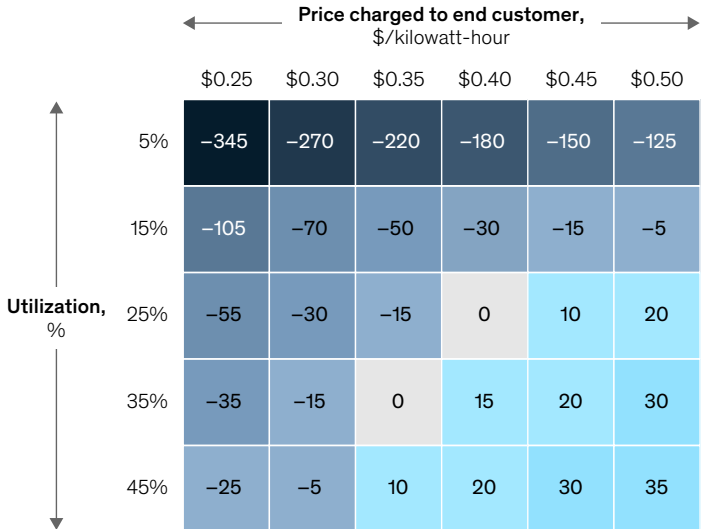Even if fast public charging stations do not receive subsidies or credits, they may still be able to improve their bottom line. We have identified several potential levers for driving improvements that span multiple areas: utilization, electricity cost, electricity price, demand charge cost, lifetime hardware costs, and ancillary revenue (Exhibit 5).

While all of these levers are important, charge-point operators would have to apply them aggressively to make a difference. Consider utilization and competitive pricing, which could potentially drive the greatest gains. Using our example of a typical fast public charging station in California, the owner-operator would break even if utilization increased from 15 percent to 20 percent, or if the price for charging customers increased from $0.45/kWh to $0.53/kWh. Profitability would also be possible in other scenarios (Exhibit 6).

Exhibit 6

Various price and utilization combinations could help public fast charging stations become profitable.

EBIT across utilization and price scenarios, $ thousand

	Price charged to end customer, $/kilowatt-hour					
	$0.25	$0.30	$0.35	$0.40	$0.45	$0.50
5%	−345	−270	−220	−180	−150	−125
15%	−105	−70	−50	−30	−15	−5
25%	−55	−30	−15	0	10	20
35%	−35	−15	0	15	20	30
45%	−25	−5	10	20	30	35

Utilization, %

Note: Based on a scenario where passenger electric vehicles account for nearly half the vehicles sold in the United States in 2030, in line with a federal target.
Analysis assumes: Wholesale electricity cost at $0.20/kWh with a $20/kW demand charge (PG&E A-10 commercial rate), 75% concurrency, 80% charger efficiency, ~$250/month per charger for maintenance, ~$95,000 per charger for the charging hardware and installation excluding grid and site equipment, 5% SG&A/R&D, 15% discount rate.
[1]Including installation; representative of a 4–150kW charging station in California.
Source: McKinsey Center for Future Mobility

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[8] Alternative Fuels Data Center, May 23, 2023.

Achieving the desired improvements in price and utilization may not be easy, however. The average nationwide annual utilization rate for 2022 was about 7.5 percent, with the average for highest recorded month around 12.0 percent—both lower than the 15.0 percent utilization assumed in our example.[9] Going from that level to 20 percent utilization will require an extremely large increase in demand, but we believe that this is feasible in the coming years, given expectations about the increased number of EVs on the road and the belief that charge point operators will begin focusing on utilization rates when deciding where to build new infrastructure, rather than continuing to prioritize market expansion.

Pursuing ancillary revenue streams, such as retail sales or advertising, could also help public DCFC charging stations improve the bottom line. At traditional gas stations, 35 percent of sales revenue comes from the associated convenience stores or food service. (About 50 percent of people who buy fuel also make retail purchases). Since public DCFC stations are placed in a wider variety of locations than traditional stations, there may be more variation in the opportunities that they pursue. If the DCFC station in our example generated $12,000 in ancillary revenue streams, it could break even.

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EV sales have finally gained momentum in the United States and continue to accelerate. More public fast-charging stations must be built to support the new EVs, but they require careful planning. Stakeholders must select station locations that maximize utilization and consider dynamic pricing—for instance, increases during commuting hours—to balance demand for chargers. While subsidies will be necessary for near-term profitability, public charging-station operators must also apply other improvement levers, such as branching into retail offerings, for long-term success. These efforts, combined with the support of OEMs, government agencies, real estate operators and others, will help DCFC operators build a profitable public charging network across United States that sustains the growth of EVs.

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[9] This utilization rate excludes California.

Unlocking the potential of generative AI: Three key questions for government agencies

Government organizations may seek to jump on the gen AI bandwagon, but the technology's complexities could sideline their efforts. Our framework addresses some critical implementation questions.

This article is a collaborative effort by Damien Bruce, Ankit Fadia, Tom Isherwood, Chiara Marcati, Aldous Mitchell, Björn Münstermann, Gayatri Shenai, Hrishika Vuppala, and Thomas Weber, representing views from McKinsey's Public Sector Practice.
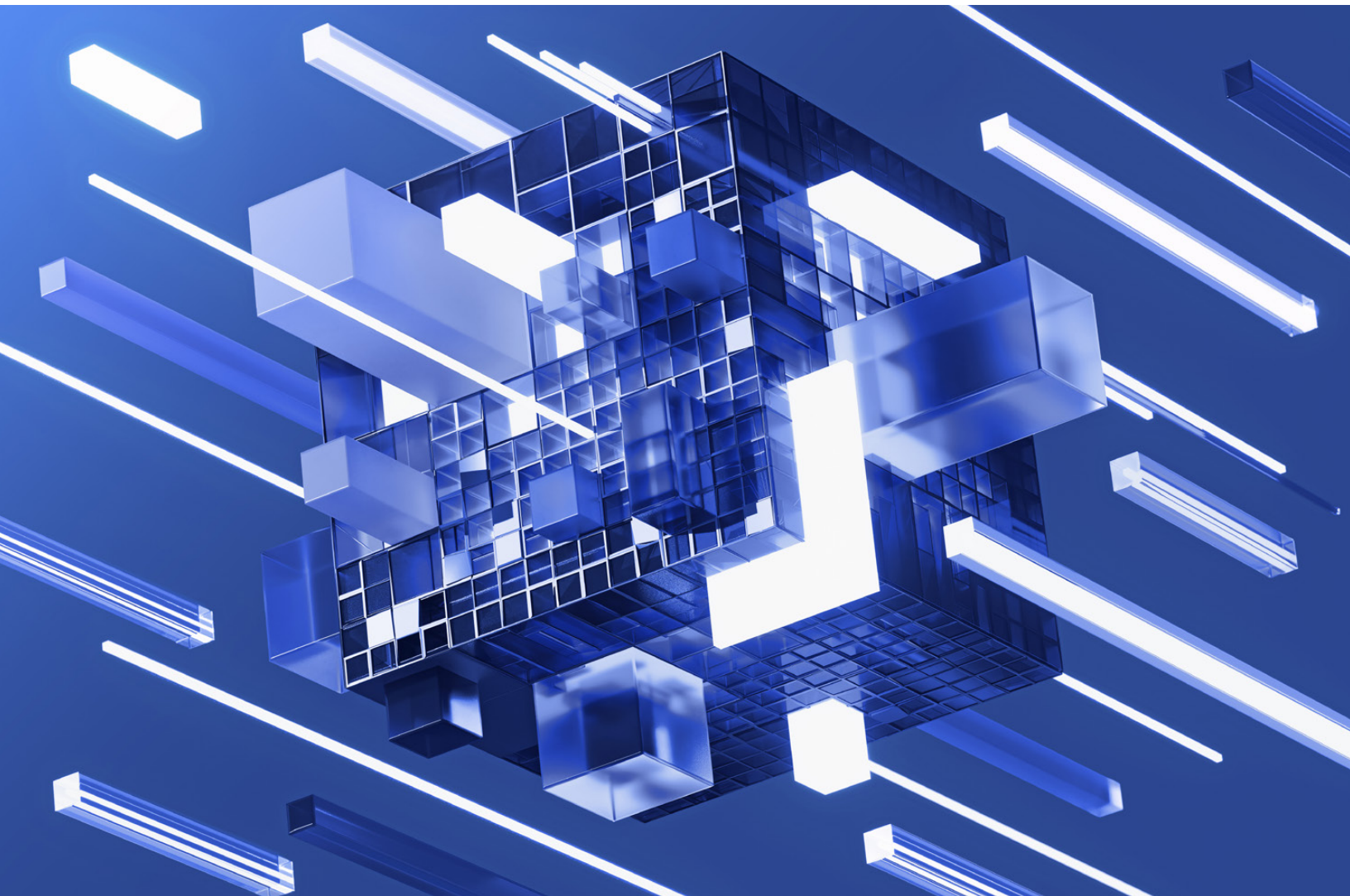
It's been just a year since generative AI (gen AI) tools first captured public attention worldwide. But already the economic value of gen AI is estimated to reach trillions of dollars annually—even as its risks begin to worry businesses and governments across the globe. Gen AI offers government leaders unique opportunities to steer national economic development (Exhibit 1). At the same time, they face the heavy burden of monitoring the technology's downsides and establishing robust guidelines and regulations for its use.

Many government agencies have started investing in transformations made possible by gen AI, but the technology's rapid evolution means that predicting where it can contribute the most value is difficult. In this article, we discuss three important questions

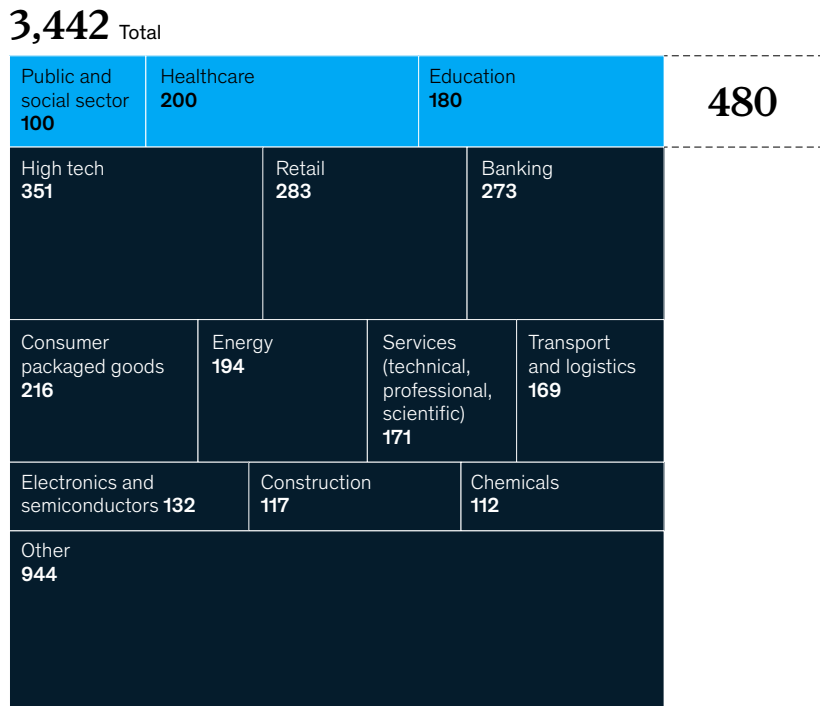that public sector organizations may need to consider before choosing areas for investment:

— How can government agencies address the potential risks of gen AI?

— How can public sector entities begin to transform their own service delivery?

— Should governments develop national gen AI foundation models (core models on which gen AI applications are built)?

We conclude with a suggested eight-step plan for government organizations that are just beginning to implement gen AI use cases.

Exhibit 1

Generative AI could have an estimated $480 billion productivity effect on the public sector and adjacent industries.

Generative AI productivity effect, by industry,[1] $ billion

3,442 Total

| Public and social sector **100** | Healthcare **200** | Education **180** | **480** |

| High tech **351** | Retail **283** | Banking **273** |

| Consumer packaged goods **216** | Energy **194** | Services (technical, professional, scientific) **171** | Transport and logistics **169** |

| Electronics and semiconductors **132** | Construction **117** | Chemicals **112** |

| Other **944** |

[1]Excluding implementation costs (eg, training, licenses).
 Source: McKinsey analysis

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1. How can government agencies address the potential risks of gen AI?

By now, the risks of gen AI—such as its tendencies toward unpredictability, inaccuracy, and bias— are widely known. Government agencies face different risks than do private sector companies. For example, the technology can be misused to spread political propaganda or compromise national security. Confidential government data can be leaked or stolen if government employees inadvertently introduce that information into foundation models through prompts.

Some outputs from gen AI models might contain inaccurate information—also called "hallucinations"— that could erode public trust in government services that leverage these technologies. Like many private sector organizations, government agencies face challenges with gen AI's transparency and with the difficulty of explaining the conceptual underpinnings of gen AI, as well as the logic of the models' decisions and output. Consequences might include low public acceptance of gen-AI-powered government services and unclear liability when unintended effects occur. And like all organizations, government entities run the risk that criminals may misuse gen AI to carry out powerful cybersecurity attacks.

To address those risks, many countries—such as the United States, Australia, and China—have launched initiatives to create frameworks of regulations and policies for AI, and some have expanded their existing AI regulations to explicitly include gen AI, too. The European Union is leading a global effort to build safeguards for any product or service that uses an AI system. Many state government agencies in the US have also released AI-related legislation, executive actions, and policies focused on mitigating the potential risks of AI systems—by highlighting the negative aspects of AI, transparently communicating where AI is used in government, and addressing the ethical aspects of AI usage.
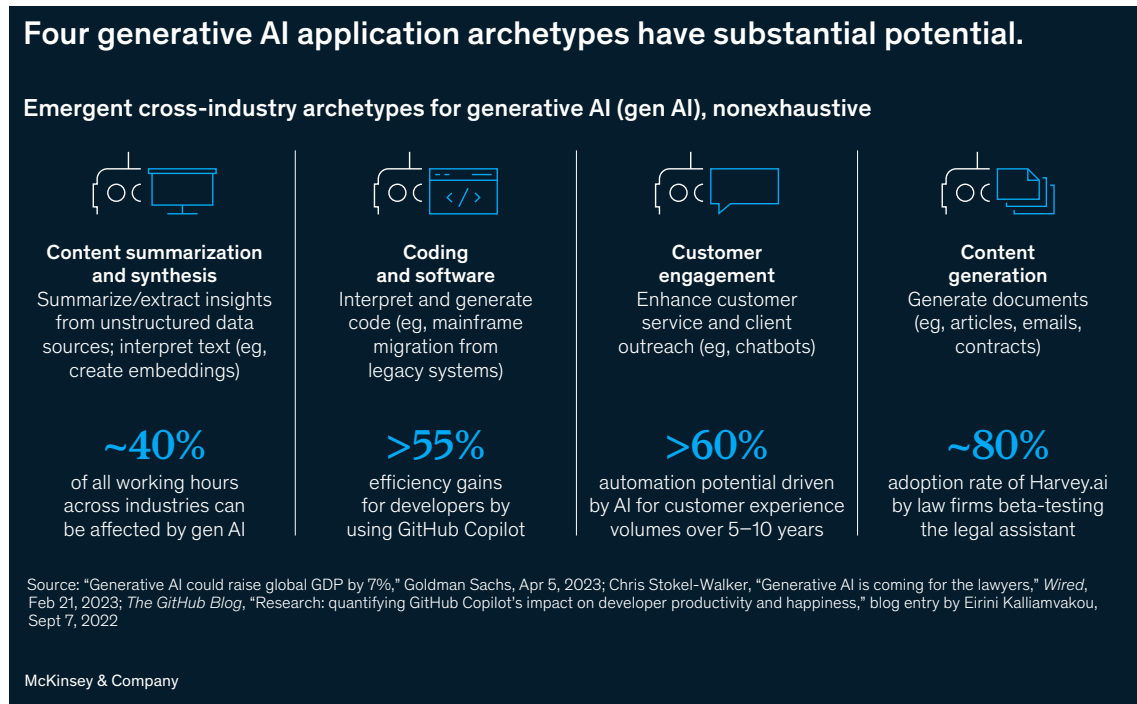
However, those mitigation efforts are still in their early stages in most parts of the world, and gen AI is evolving fast, which means that governments must revise their regulations continually to keep pace. Some government organizations have started

ongoing awareness programs among stakeholders— especially end users—about gen AI's risks and how to address them. For example, the United Kingdom's Central Digital and Data Office has released a guide for civil servants on safe and informed use of gen AI tools. Similarly, Australia's Digital Transformation Agency and its Department of Industry, Science and Resources provide interim guidance to government agencies on responsibly using publicly available gen AI platforms, with emphasis on ethical AI usage, security, and human oversight.

2. How can public sector entities begin to transform their own service delivery?

As key providers of services to the public, government agencies are likely to prioritize the delivery of those services as a critical area for AI-driven improvements. A good place to start may be our "4Cs" framework, comprising four cross-industry categories: content summarization and synthesis, coding and software, customer engagement, and content generation (Exhibit 2). Most gen AI implementations we have seen fall into one of those four categories, which could apply to both private and public sector enterprises.

— *Content summarization and synthesis.* This category involves culling the most relevant insights from a large knowledge repository. For example, Singapore's GovTech has developed the Pair app, which summarizes text and generates reports for internal use.

— *Coding and software.* Software development could gain speed and increase productivity by using gen AI to write code and automate testing. Use cases will then need to be prioritized according to their potential impact, feasibility, and susceptibility to risk. For example, the United Kingdom's HM Treasury (economic and finance ministry) is testing GitHub Copilot (an AI pair programmer that offers coding suggestions) to accelerate software development.

— *Customer engagement.* Customer and client services could get a boost from gen AI apps—for example, in government agencies, chatbots

Exhibit 2

Four generative AI application archetypes have substantial potential.

Emergent cross-industry archetypes for generative AI (gen AI), nonexhaustive

Content summarization and synthesis	Coding and software	Customer engagement	Content generation
Summarize/extract insights from unstructured data sources; interpret text (eg, create embeddings)	Interpret and generate code (eg, mainframe migration from legacy systems)	Enhance customer service and client outreach (eg, chatbots)	Generate documents (eg, articles, emails, contracts)
~40%	**>55%**	**>60%**	**~80%**
of all working hours across industries can be affected by gen AI	efficiency gains for developers by using GitHub Copilot	automation potential driven by AI for customer experience volumes over 5–10 years	adoption rate of Harvey.ai by law firms beta-testing the legal assistant

Source: "Generative AI could raise global GDP by 7%," Goldman Sachs, Apr 5, 2023; Chris Stokel-Walker, "Generative AI is coming for the lawyers," *Wired*, Feb 21, 2023; *The GitHub Blog*, "Research: quantifying GitHub Copilot's impact on developer productivity and happiness," blog entry by Eirini Kalliamvakou, Sept 7, 2022

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could answer questions from or customize services for residents. The city of Heidelberg, in Germany, has launched the Lumi chatbot, the country's first digital citizen assistant. The tool enables people to easily navigate government services such as applying for a new identity card, getting a driving license, and registering a place of residence.

— *Content generation.* Gen AI can help produce a vast variety of content, including emails, social media posts, contracts, and proposals. For example, the US Department of Defense has developed an AI-powered contract-writing capability, called Acqbot, to speed up procurement.

Gen AI implementations could streamline a broad range of services that governments typically provide, in areas such as education, healthcare, defense and intelligence, and urban development (see sidebar "Potential applications of gen AI in government functions and services"). Across all of those areas, we have seen government agencies

implement gen AI use cases in both external and internal operations that fall within the categories of our framework (see Exhibits 3 and 4). For example, in customer-facing applications, gen AI can help the public navigate government services and get access to real-time language translation. Internally, gen AI can draft creative content such as speeches and official correspondence, simplify complex official documents, and consistently generate financial reports and KPIs on schedule.

3. Should governments develop national gen AI foundation models?

Some governments may aspire to develop foundation models—the core models on which gen AI applications are built. But leaders of government agencies must be aware that this endeavor requires considerable investment of time and resources. The many barriers to entry include the availability of talent to build, train, and maintain gen AI models; the necessary computing power; and experience in addressing potential risks inherent in building and serving gen AI foundation models. Almost all current

Exhibit 3

Generative AI can help improve customer-facing operations in governments.

Potential use cases for generative AI in customer-facing government operations, by archetype

	Content summarization and synthesis	Coding and software	Customer engagement	Content generation
Programs and benefits	Eligibility and benefit distribution requirements	Transform legacy code (eg, COBOL to Python); generate code requirements	Citizen interactions via chatbot assistants	Personalized program content
Policies, licensing, and regulation	Policy design research; regulation summaries		License renewals	Legal, permitting, and/or regulatory guidance for new programs
Services	Standard operating procedure syntheses; economic-development incentives		Expert advisers (eg, to improve mental health responses)	Targeted emergency instructions
Infrastructure	Licensing infrastructure projects (eg, multicounty permits)		Auditing of regulatory and/or plan compliance	Requests for proposal and contracts to improve supply chain resilience

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Exhibit 4

Generative AI can help improve internal operations in governments.

Potential use cases for generative AI in internal government operations, by archetype

	Content summarization and synthesis	Coding and software	Customer engagement	Content generation
Operations and delivery	Document summaries	Synthetic data generation	Virtual assistants for suggested responses/ diagnoses	
Technology	Current state mapping; data cleaning	Transform legacy code (eg, COBOL to Python); generate code requirements		Cybersecurity test case generation
Talent	Résumé summaries; feedback synthesis		Personalized recruiting and onboarding materials	Job descriptions; interview guides; training materials
Fiscal, asset, and performance management	Budget summaries; transaction syntheses		Citizen budget navigators	Financial reports; standard performance reports; KPIs

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work in these models is led by a few large private sector tech companies (Cohere, Google, Meta, and others) and by open-source initiatives that are quickly becoming popular (such as Hugging Face, Stability AI, and Alpaca).

Unlike global private sector tech players, government organizations simply lack the capabilities to develop foundation models while managing their risks. For example, violations of intellectual property and copyright laws can

Potential applications of gen AI in government functions and services

We see generative AI (gen AI) uses across different public sector domains. Here's a sampling.

In *education*, gen AI can do the following:

— serve as a virtual tutor to review and grade essays

— act as a student assistant chatbot, providing well-sourced answers

— help students in workshops and labs, guiding them through experiments

— generate preliminary drafts of teaching aids, such as lecture scripts and quizzes

— draft initial versions of university applications based on student profiles

In *urban development*, gen AI can do the following:

— act as a design-compliance assistant for urban administrators

— summarize citizen feedback from hotlines for city planners

— draft initial urban planning layouts to enhance city designs

— design optimal public transport routes to reduce traffic congestion

— simulate urban design impacts, such as traffic flow or sunlight exposure

In *tax and customs*, gen AI can do the following:

— serve as a virtual assistant for complex import-guidance synthesis

— be a real-time document verifier for customs and tax officials

— generate risk-assessment summaries from diverse data sources

— prepare preliminary audit reports for potential noncompliance areas

— act as a public assistant for real-time tax-filing guidance

— prepare first drafts of personalized notifications to taxpayers and traders

In *agriculture, forestry, and fishing*, gen AI can do the following:

— summarize and categorize farmer helpline calls for timely departmental assistance

— act as a virtual assistant to guide farmers on government schemes and benefits

— provide personalized crop-management advisories for updated farming techniques

— analyze crop and soil images to suggest restoration techniques for improved yield

In *justice, courts, and legal systems*, gen AI can do the following:

— act as a real-time legal assistant to judges and attorneys

— simplify and explain intricate legislation and case law

— keep legal professionals updated with summarized regulatory changes

— counsel repeat offenders with tailored legal education

— suggest potential outcomes for judicial sentencing for judges' consideration

— automate the drafting of various legal documents to ease administrative burdens

In *defense and intelligence*, gen AI can do the following:

— act as a real-time translator for intelligence agencies

— draft initial intelligence-operation reports

— tailor training content to specific military missions

— simulate potential conflict scenarios for strategic planning

— generate synthetic misinformation data to enhance surveillance AI

In *healthcare*, gen AI can do the following:

— simplify the descriptions of complex diseases to improve patients' understanding of them

— summarize post-acute-care instructions for patients

— generate concise discharge instructions to optimize clinical operations

— act as a copilot to summarize imaging diagnostics for clinicians

— summarize patients' medical histories for streamlined review

Gen AI is a fast-evolving technology, so early involvement of end users is critical to improve the accuracy and performance of LLM responses.

expose government agencies that own foundation models to litigation; gen AI's occasional lack of proper source attribution makes it even harder to detect potential copyright infringement in its responses. Legal implications also apply to manipulated content—including text, images, audio, and video—that malicious actors may use to harass, intimidate, or undermine individuals and organizations. Users could act unscrupulously or illegally by exploiting inherent biases in the data that a specific foundation model was trained on. As a result, some governments—such as those of Iceland and Finland—have chosen to partner with global large language model (LLM) providers to get access to their existing models and augment and customize them to suit their own needs, by adding proprietary data and insights.

Eight steps for getting started

For public sector agencies just beginning to venture into gen AI, we suggest this eight-step plan:

1. *Define your organization's risk posture.* After identifying your agency's risk parameters, devise a plan to mitigate the risks of using gen AI—with a mix of internal policies, guidelines, and awareness sessions.

2. *Identify and prioritize use cases.* Not everything needs gen AI technology to power it. Government agencies may find our 4Cs framework helpful in developing a list of potential use cases—and then prioritizing them according to potential impact and feasibility—

while avoiding implementations with high potential for risk or limited tolerance for errors.

3. *Select the underlying model; upgrade technical infrastructure as needed.* Most public sector agencies begin with an off-the-shelf LLM and fine-tune it with proprietary data and integration with internal systems to deliver customized results. In very rare cases have we seen government agencies develop and train a new model from scratch. When that happens, it is driven primarily by aspirations to develop a national asset, manage data-sovereignty issues, or reduce dependence on private sector tech companies.

4. *Ensure that the necessary skills and roles are available.* "Head of AI" is one of the hottest jobs around, and governments will need to hire for it—only a senior executive can coordinate all gen AI–related activities and ensure that risks are addressed effectively. Traditionally, governments haven't had AI engineers, AI ethics officers, or prompt engineers, but such roles must now be created and filled.

5. *Develop gen AI apps jointly with end users.* Gen AI is a fast-evolving technology, so early involvement of end users is critical not only for educating them on privacy and safety but also for collecting their feedback to improve the accuracy and performance of LLM responses. For example, users can provide a quantitative score for the quality of each response.

6. *Keep humans in the loop, at least for now.* Until gen AI technologies mature and enforceable regulations are in place, it may be prudent for government agencies to keep human managers accountable and use gen AI implementations only to execute models and not to monitor or assess them.

7. *Design a comprehensive communication plan.* Embed necessary disclaimers in all communication efforts to clarify the limitations of gen AI use cases and ensure safe adoption.

8. *Start small and scale up.* Our research shows that 72 percent of leading organizations find managing data to be one of the top impediments to scaling AI use cases. In our article on scaling gen AI programs, we identify seven actions that data leaders should consider as they move from experimentation to scale.