

Capital Projects & Infrastructure

Governments can lead construction into the digital era

New technologies can advance project outcomes in the construction industry. Governments are well-poised to cultivate greater adoption.

by Jose Luis Blanco, Thomas Dohrmann, JP Julien, Jonathan Law, and Robert Palter



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An industry notorious for cost and time overruns, the construction sector can capture significant efficiencies by adopting new technologies. While many executives acknowledge the potential of new technology, they often hesitate to risk multi-billion-dollar projects on applications they consider unproven. To create greater value from public and private spending on large capital projects, governments can help clear the path and bring new technologies to bear.

New technologies—advanced analytics, automation, machine learning, and the Internet of Things, for example—have delivered substantial benefits to industries at the forefront of adoption, particularly telecommunications and finance. And while these disruptive forces will eventually wash over every industry, the construction industry still lags.

Digital tools are already available, with \$18 billion invested in construction technology between 2013 and early 2018. McKinsey research, however, finds that leaders struggle to adopt these applications—not because of cost concerns or lack of interest, but rather because of insufficient internal processes and risk aversion.

Pressing need for improvement

Using technologies to boost construction productivity can have a profound impact on public and private spending. In the United States alone, expenditures on construction reached \$1.29 trillion in 2018, after rising an average of 7.4 percent annually over the previous five years.¹

The public sector accounts for a significant share of this total. Stripped of residential and private-use projects, construction expenditure on public infrastructure—for instance health care, education, and transportation—reached \$334 billion in 2018 (Exhibit 1). Public spending will finance almost 80 percent of these infrastructure expenditures, by our estimates.

And the rise in construction spending is unlikely to abate soon. Increased urbanization is creating demand for projects that support denser population centers, such as transportation, power, and sewage. And in the United States, deteriorating public infrastructure must be addressed urgently. McKinsey research found that the country requires an additional \$500 billion in infrastructure funding between 2017 and 2035 to meet its estimated requirements.

Amid this growing need, public and private projects have struggled to keep costs and construction times within original projections, especially for complex, high-cost projects. Early adopters have already begun to test new technologies to improve project outcomes. For instance, some companies are using wearable GPS devices or smartphone apps to optimize workflows and resources. Others have begun using virtual-reality systems for supervisors and crew to “walk through” processes to prepare sequencing, identify potential problems, and conduct safety trainings more efficiently.

Governments are well positioned to catalyze change

Despite these early efforts, many companies are reluctant to experiment in untested waters. This is understandable since billions of dollars and corporate reputations are at risk with these projects, and there is no room for do-overs. These hurdles, however, present a prime opportunity for governments to take the lead and break the inertia that slows the construction industry from entering a digital era.

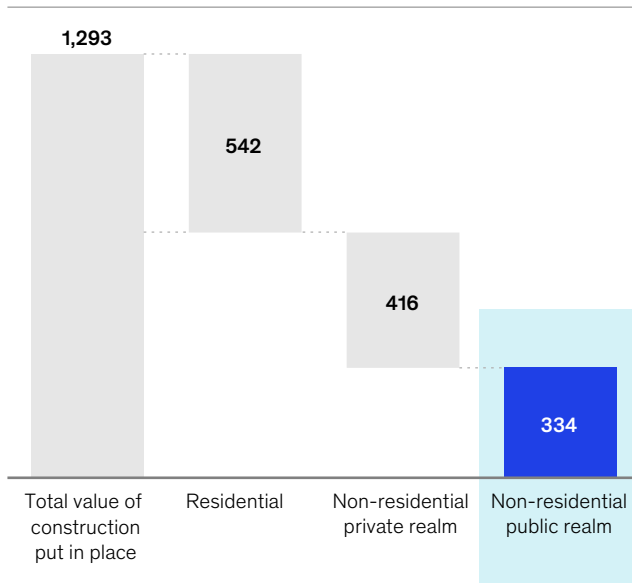
Public expenditures account for a significant portion of non-residential, public-use construction projects, and government agencies work closely with private companies of all sizes to deliver these complex infrastructure projects. Such projects span a wide range of infrastructure, from roads to buildings

¹ US Census Bureau.

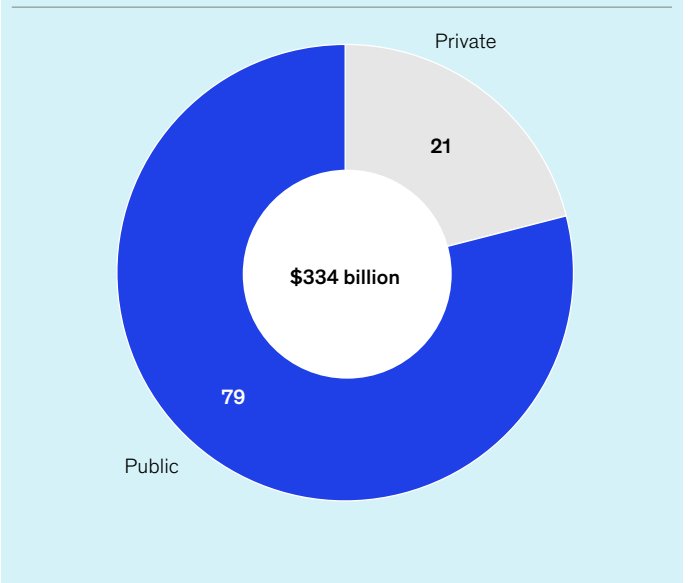
Exhibit 1

In the United States, construction spending on public infrastructure reached \$334 billion in 2018.

Total value of construction put in place,
\$ billions, 2018



Non-residential public realm construction by source of funds
\$ billions, 2018



Source: U.S. Census Bureau, Value of Construction Put in Place at a Glance, December 2018

to sewer systems (Exhibit 2). The government's purchasing power touches every corner of the construction industry, while its regulatory power allows it to set standards that are most easily met using new technologies or even to mandate their use.

Our experience and research suggest five measures available to governments that can be powerful tools in accelerating adoption.

Set bold aspirations

At the outset, governments can articulate bold aspirations for the adoption and use of technology

in public sector projects. Beyond increasing awareness, such public aspirations demonstrate the priority given to developing a more efficient construction industry through broader deployment of new technologies.

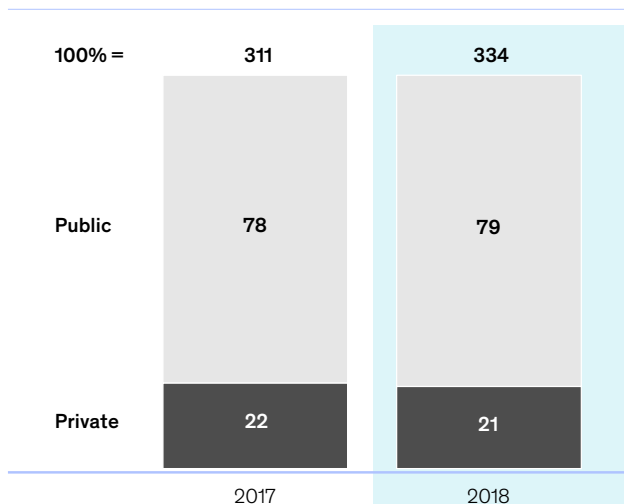
One approach would be to craft a digital construction strategy that encourages the use of new tools to reduce the time and cost of public works projects. For example, clear targets could be set for the use of pre-fabricated or modular components, enabled by digital collaboration tools such as BIM, that would reduce the instances of rework and change orders.

Exhibit 2

Public spending on construction projects spans a wide range of infrastructure.

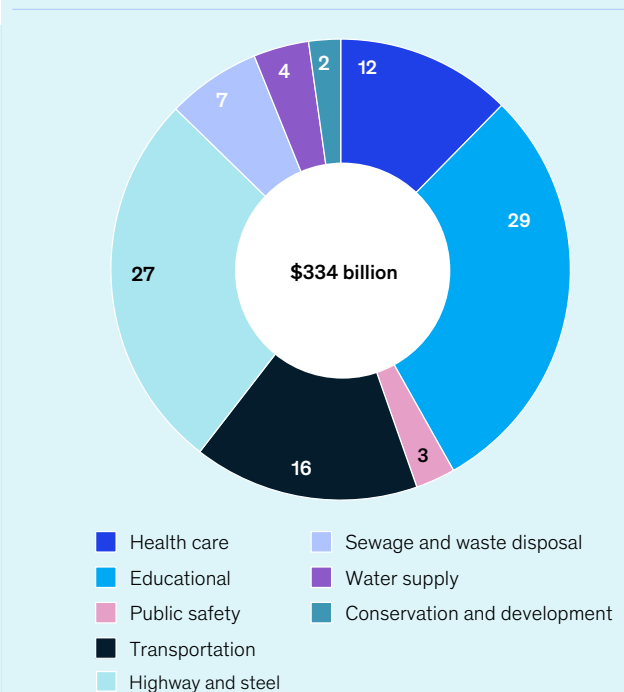
Key public realm construction, US

\$ billions



Public realm construction by category, US

Percent, 2018



Source: U.S. Census Bureau, Value of Construction Put in Place at a Glance, December 2018

Some countries have already taken steps on this direction. In Ireland, for example, the National BIM Council published a national strategy for the construction industry in 2017 that included clear digital targets.² As part of its vision, the council strives to reduce project delivery times by 20 percent, increase construction exports by 20 percent, and cut capital costs by 20 percent, all by 2021 compared to 2018 levels.

Create meaningful incentives

Governments can also use their purse strings and tendering processes to create meaningful

incentives for construction companies. For example, public grants could be offered to help companies adopt technologies that aid in project design and execution. National competitions and prizes that reward technology adoption in construction projects can also provide first movers with additional financial support, as well as publicly recognizing the importance of using technology to accelerate and bring down the costs of construction. Similarly, governments may consider publicly supported incubators that allow low-risk testing for new applications.

² National BIM Council, Ireland, *Roadmap to Digital Transition for Ireland's Construction Industry 2018-2021*, December 2017.

Further, public contracting agencies can insist that successful bidders incorporate digital collaboration tools into publicly-owned projects. For example, the Tennessee Department of Transportation recently announced it will require prime contractors and designers to use construction productivity software on all its projects, beginning with March 2019 contract awards.

In another example, the UK Infrastructure and Projects Authority estimated that public and private investment in infrastructure projects will total about \$780 billion between 2017 and 2027 and pledged “to use its purchasing power to drive adoption of modern methods of construction.”³ Among the announced measures, five major government departments will weigh offsite construction capabilities in assessing tenders for projects.

Manage risk

In addition to creating meaningful incentives to spur adoption, governments can help reduce the barriers and risks that are unique to these emerging technologies. For example, procurement or acquisition regulations often place a great deal of emphasis on a contractor’s past performance in future source selections. However, contractors that wish to pilot new technologies will not have as much experience or demonstrated cases as those offering traditional solutions. If this is seen as a major disadvantage, it could hinder the use of government procurement processes to encourage the adoption of new technologies. Re-thinking these guidelines to make allowances for emerging technologies, giving them time to establish a foothold, may be crucial to accelerated adoption.

At the same time, governments can consider assuming some of the contractor risks associated with trialing new technologies. In selected projects or portions of projects, for example, governments can offer to reimburse contractors if the new technologies fail to deliver projected savings. Such guarantees may sound bold, but they can be successful if focused on targeted project

components, phases, or solutions with substantial long-term savings potential.

Ensure transparency

Measures can also be taken to increase transparency around the costs and progress of public projects. This transparency is supported by digital technologies that provide real-time information on the progress of major projects. In turn, increased transparency creates pressure to complete projects on budget and on time, which becomes easier when new technologies are deployed. The United Kingdom’s infrastructure initiative includes benchmarking tools that track cost and schedule during the life of a project. The system not only follows the progress of individual projects underway, but also assesses the impact of completed projects in their overall asset class, as well as movement toward network goals, such as customer satisfaction and performance, and national goals, such as reduced carbon emissions and economic development.

Ultimately, these benchmarks can be provided on online dashboards that allow the public and other stakeholders to monitor progress, increasing the pressure on construction companies to meet deadlines and costs. For now, like in the United Kingdom, the results of these benchmarking exercises are generally available in annual reports.

Build capabilities

As with most industries, the construction sector will struggle to find the talent needed to use new technologies effectively. Governments can play a dual role in helping to meet this challenge. First, they can invest in training programs that not only build needed capabilities but also provide new opportunities to workers displaced by these technologies.

Singapore, for instance, includes construction in its \$3.3 billion Industry Transformation Programme, announced as part of the country’s

³ UK Infrastructure and Projects Authority, *Transforming Infrastructure Performance*, December 2017.

2016 budget plan.⁴ In this effort, the government wants to train 80,000 workers in new construction technologies, such as design for manufacturing and assembly methods, integrated digital delivery, tools that enhance collaboration, and offsite construction, as well as green building capabilities. Structured internships and additional training for recent university graduates are two measures the country is using to reach this goal.

And second, governments can lead by example by building their own internal digital capabilities. Developing these skills—for instance by creating an advanced analytics group—would allow public agencies to use new technologies more effectively in overseeing projects and optimizing maintenance operations and to understand more clearly how

new technologies can be deployed broadly in the industry.

Around the world, trillions of dollars are spent each year building skyscrapers, highways, pipelines, schools, and countless other structures, and the resources that could be saved using advanced analytics, automations, machine learning, and other technologies that are available now is staggering. As a primary investor and procurer in infrastructure projects and the shepherd of national economies, governments have a clear incentive to help accelerate adoption within the construction industry.

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⁴ Singapore Ministry of Trade and Industry, "Industry Transformation Maps (ITMs)," Oct. 31, 2016.