



Breaking the mold: The construction players of the future

The engineering and construction industry, long berated for lagging behind in terms of digitalization, is picking up steam. New business models are changing the game.



Katy Bartlett

Associate, Denver
McKinsey & Company



Jose Luis Blanco

Partner, Philadelphia
McKinsey & Company



David Rockhill

Associate partner, London
McKinsey & Company



Gernot Strube

Senior partner, Munich
McKinsey & Company

Digital technologies have transformed industries, from automotive to transportation to banking. Even agriculture, which has historically been slow to transform, has taken a huge leap toward digitalization.¹ For a long time, the engineering and construction (E&C) industry was seen as less vulnerable to disruption. Industry fragmentation, a one-off approach to design-and-build projects, and a ready supply of manual labor kept the need for productivity improvement below that of other industries. This is changing fast: incumbents, new entrants, and investors alike are realizing the potential of technology to accelerate projects, reduce costs, and improve safety in a \$10-trillion-a-year industry.

Contributing 13 percent of global GDP, construction is the largest industry in the world—and is primed to unlock significant value through productivity improvements. We already see new archetypes of successful players emerging, seeking to capture those benefits. Now is the time for E&C companies to make bold decisions on how and where to play in this exciting era.

How disruption in engineering and construction is playing out

The disruption of the E&C industry is exemplified by five movements:

- *Unprecedented (and ever-growing) flows of capital into engineering and construction technology.* From 2013 to 2018, investors poured \$18 billion into E&C technology, compared with \$9 billion over the previous five years.² We expect growth to continue accelerating: for example, in August 2019, Brick & Mortar Ventures announced a \$97.2 million construction-technology fund focused on design, construction, and operations and maintenance.
- *A blossoming field of new technologies fueled by start-ups.*³ Hundreds of start-ups throughout the supply chain have emerged, greatly accelerating the development of technologies such as digital twins, 3-D printing, augmented and virtual reality, machine learning, and lidar. These new technologies also include an expanded range of data platforms for E&C or supply chain information, such as is available through Schindler's BuildingMinds and YTwo Formative. Such start-ups will have an impact on every aspect of E&C, from materials to contracts to design and simulation.⁴
- *Corporate, large-scale tech M&A.* Today, E&C technology M&A is nearing a five-year high, led by industry leaders such as Autodesk (BuildingConnected and PlanGrid), Oracle (Aconex and Textura), ProCore (Honest Buildings), and Trimble (e-Builder and Viewpoint). Much of this M&A represents horizontal growth, as the barrier is lower than going vertical due to the large and diverse customer base of the E&C industry. Done right, this M&A can simplify digital processes by eliminating the need for project stakeholders to navigate multiple software systems, as may otherwise happen when dealing with multiple applications at different stages.
- *Public-sector demand for technology adoption, especially 4-D and 5-D building-information modelling (BIM).* While there is still significant room for the public sector to provide incentives for E&C technology adoption, some governments are taking action to spur innovation on public projects.⁵ For instance, the UK government now requires level-two BIM and a preference for vendors that offer off-site construction. Deutsche Bahn, a German railway company, has introduced 5-D BIM solutions over the past five years.
- *New technology companies showing growing interest in the engineering and construction market.* For example, the Alphabet subsidiary Sidewalk Labs has entered the developer market, while Amazon is pursuing a role in the building-materials distribution market.⁶

Technological advancement alone is not causing disruption

There are broader factors at play in the disruption of the industry besides the new wave of technologies.

- *Many developed economies are facing skills shortages*, with E&C companies struggling to find skilled workers. At the same time, demand is growing, particularly in housing. For example, the United Kingdom needs about 300,000 new homes a year, underpinning demand for new building methods such as modular.⁷
- *Fast-evolving owner and customer needs*, which make future-proofing harder. Customers and other stakeholders are increasingly demanding flexibility of space (as exemplified by the likes of WeWork), lower-carbon construction, and smart infrastructure, for example.
- *Pressure on traditional engineering and construction company business models*, which are prone to lower margins and unforeseen issues such as write-offs. This pressure can raise the stakes on strategic bets, such as diversifying into services and development or taking on debt. When these strategic bets businesses fail, they create ripples throughout the economy. For example, several recent failures of major contractors in the United Kingdom have put large public projects at risk.
- *The prospect of slowing economic growth*, which will increase pressure to better manage costs and fluctuating demand.

New engineering and construction archetypes are emerging

All these developments are helping the industry unlock some of the \$1.6 trillion of productivity gains that we identified in our 2016 report.⁸ In fact, first movers are already saving money,

compressing schedules, and lowering asset lifecycle expenses.⁹

Despite the encouraging signs, much work remains to fulfill this enormous potential. Many firms are still in “pilot purgatory” and have not achieved any a significant competitive edge. Even some bold companies never make it past the pilot phase. Some companies are unable to launch their productivity programs at scale and struggle to establish organizational capabilities and governance, develop a data and analytics technology blueprint, or improve data quality and data life cycle management processes.

Players are experimenting with new archetypes to move forward and seize the rapidly expanding value (see box, “Emerging engineering and construction industry archetypes”). These archetypes contrast with the traditional models of architect, engineer, specialist contractor, and design-and-build contractor. They are illustrative, and while there will be variants, the key question for incumbents is whether the traditional models will survive alongside the new archetypes—and, if so, in what form?



Disruption in the E&C industry is no longer coming—it is here. New E&C archetypes are emerging, but it is not clear how the industry will look in the future and what companies will win. What is clear is that the opportunity to capture value through gains in productivity are enormous, and incumbents and start-ups alike should consider where and how they can capture a slice of that value. ■

¹ For more on the gains being made in agriculture, see Sara Boettiger and Sunil Sanghvi, “How digital innovation is transforming agriculture: Lessons from India,” May 2019, McKinsey.com; David Fiocco, Liz Harrison, and Candace Lun Plotkin, “Cultivating the omnichannel farmer,” February 2019, McKinsey.com; Kevin Laczowski, Asutosh Padhi, Niranjana Rajagopal, and Paolo Sandrone, “How OEMs can seize the high-tech future in agriculture and construction,” March 2018, McKinsey.com.

Emerging engineering and construction industry archetypes

- **Platform integrators.** They provide the platforms to design and manage large assets across their life cycle. These platforms include tools such as generative design, 5-D BIM, and digital twins to optimize the asset in design, construction, and operation. Examples of platform integrators include Autodesk, Procore, and Trimble.
- **Vertically integrated designers and manufacturers.** These companies own the design and specification and full fabrication and assembly processes. This enables them to create modular solutions at scale to reduce the cost base and accelerate E&C. Examples of vertically integrated designers and manufacturers include Katterra and the “design-to-make” concept by Autodesk.
- **Lean executors.** These players are close to traditional trade contractors. They run simulations and plan best practices to quickly and safely execute projects. Logistics and on-site materials are managed using digital tools to reduce waste and optimize for just-in-time delivery. Examples of lean executors include Bechtel and Kiewit.
- **Job-site solutions and equipment suppliers.** These tech companies are all about increasing productivity on the construction site. Often, they will start as small start-ups that provide equipment and planning and tracking tools for specific trades; some scale to become bigger players. Examples of job-site solutions and equipment suppliers include Hilti, Qualis Flow, and United Rentals.
- **Tier-1 or tier-2 material suppliers.** These specialists design and fabricate building products and subsystems, such as prefabricated mechanical and electrical risers or integrated plumbing products. They optimize design for assembly to minimize time on-site. Geberit is an example of such a material supplier.

² Jose Luis Blanco, Andrew Mullin, Kaustubh Pandya, Matthew Parsons, and Maria João Ribeirinho, “Seizing opportunity in today’s construction technology ecosystem,” September 2018, McKinsey.com.

³ Jose Luis Blanco, Steffen Fuchs, Matthew Parsons, and Maria João Ribeirinho, “Artificial intelligence: Construction technology’s next frontier,” April 2018, McKinsey.com.

⁴ Blanco, Mullin, Pandya, Parsons, and Ribeirinho, “Seizing opportunity in today’s construction technology ecosystem,” McKinsey.com.

⁵ Jose Luis Blanco, Thomas Dohrmann, JP Julien, Jonathan Law, and Robert Palter, “Governments can lead construction into the digital era,” April 2019, McKinsey.com.

⁶ For more on Sidewalk Labs, see Dan Doctoroff, “Dan Doctoroff on how we’ll realize the promise of urban innovation,” January 2018, McKinsey.com.

⁷ Nick Bertram, Steffen Fuchs, Jan Mischke, Robert Palter, Gernot Strube, and Jonathan Woetzel, *Modular construction: From projects to products*, June 2019, McKinsey.com.

⁸ Filipe Barbosa, Jonathan Woetzel, Jan Mischke, Maria João Ribeirinho, Mukund Sridhar, Matthew Parsons, Nick Bertram, and Stephanie Brown, *Reinventing construction through a productivity revolution*, McKinsey Global Institute, February 2017, McKinsey.com.

⁹ Jan Koeleman, Maria João Ribeirinho, David Rockhill, Erik Sjödin, and Gernot Strube, “Decoding digital transformation in construction,” August 2019, McKinsey.com.

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