



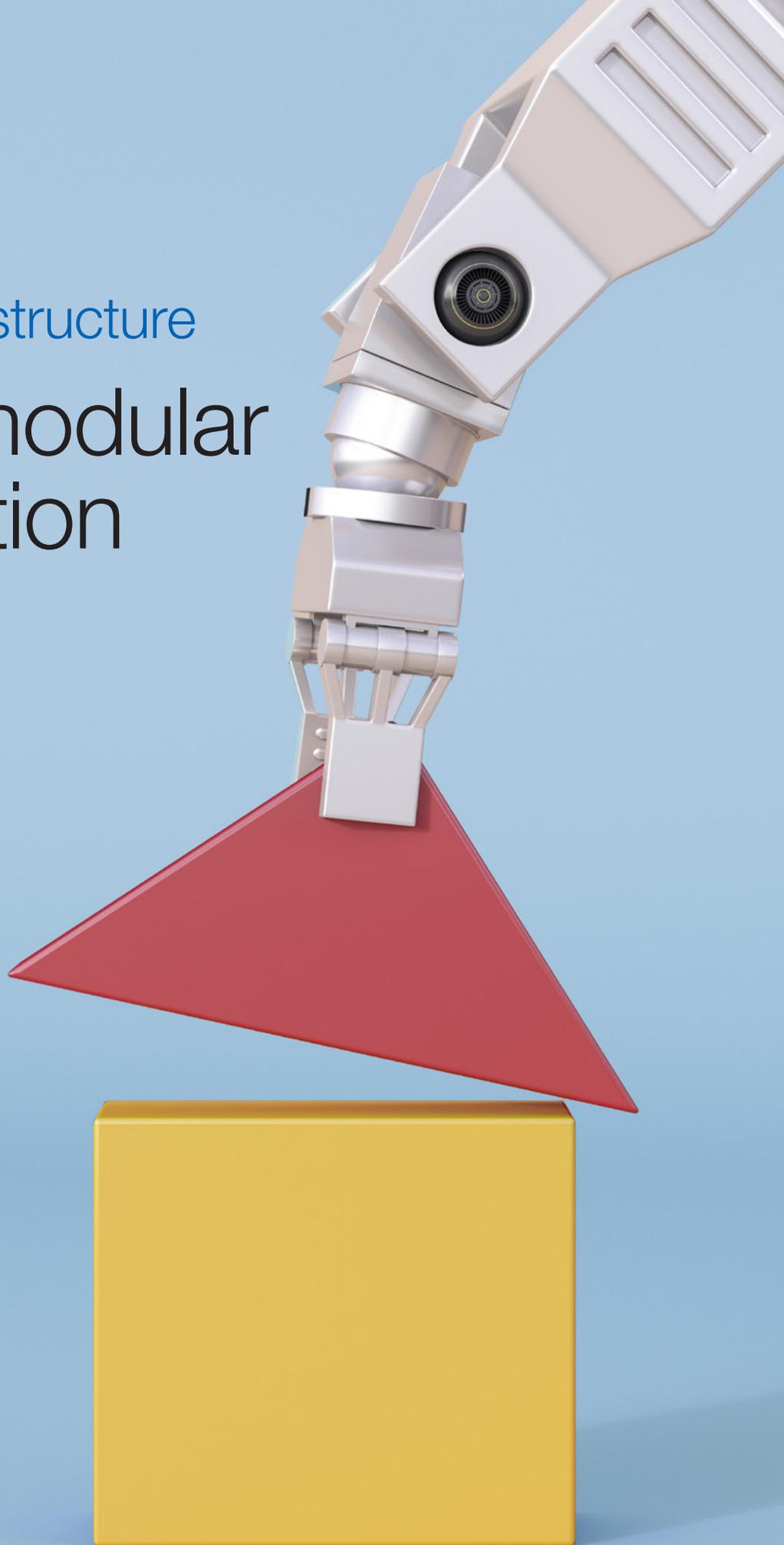
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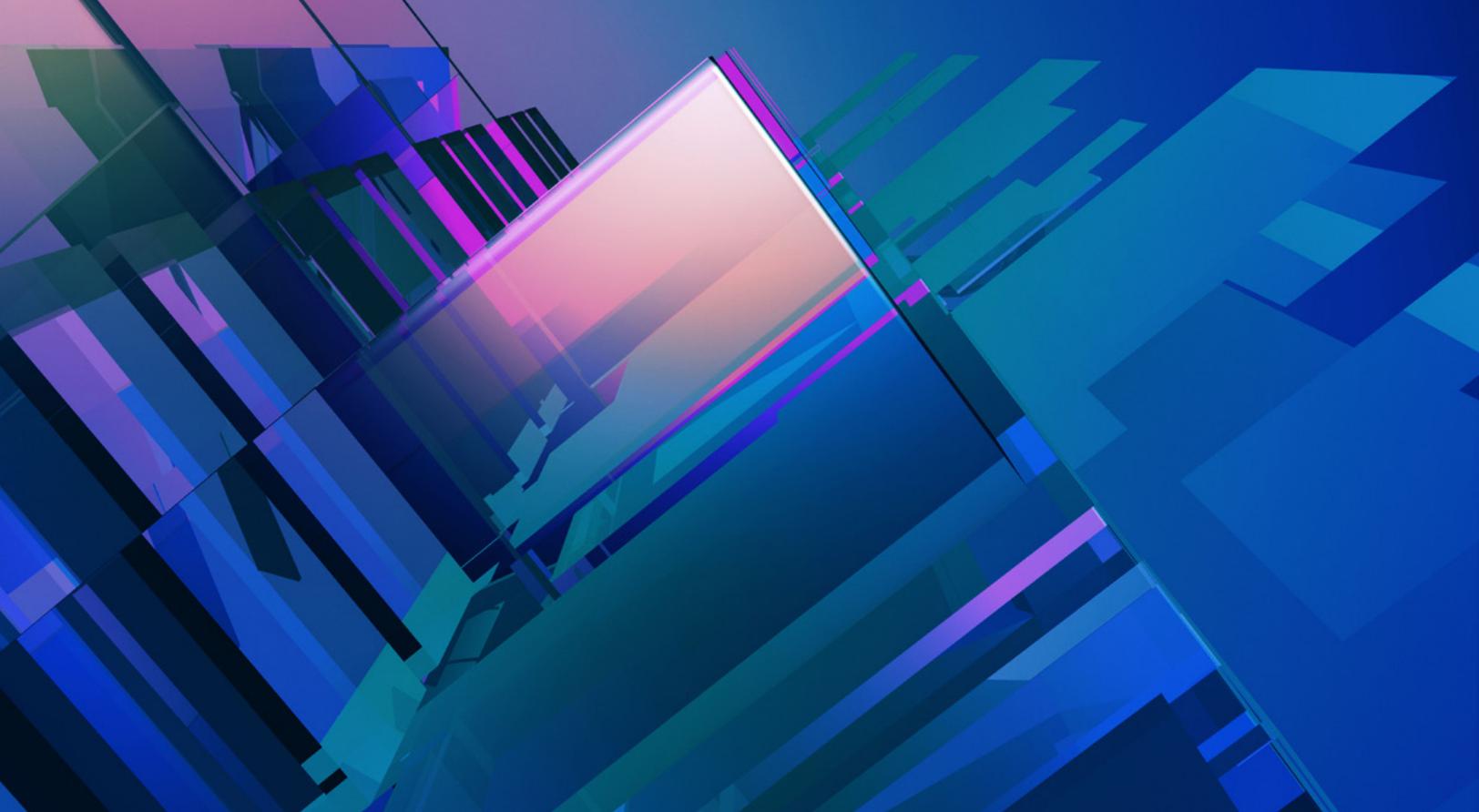
By McKinsey & Company

Voices on Infrastructure

# Scaling modular construction

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## Expert insights: What are three tangible drivers needed to scale modular construction, and how big could it grow?

As modular construction gains traction, industry leaders weigh in to identify common patterns and obstacles to overcome.



**Kez Taylor**

CEO  
ALEC

By 2050, the world's population will be nearly 10 billion, up from 7.7 billion today.<sup>1</sup> Coupled with urbanization, population growth is resulting in more people moving to and staying in cities. In fact, by 2050, 70 percent of the world's population will be living in urban environments. This shift has created new demands for construction that the industry is currently unprepared to meet. The United Kingdom alone has an annual housing shortage of 300,000 homes.

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<sup>1</sup>"Current world population," Worldometers, accessed July 19, 2019, worldometers.info

The construction industry has an opportunity to meet the growing need by becoming product driven and more efficient—both possible through modular construction.

*Increased productivity through automation and technology.* We are facing a global shortage of construction skills as younger workers choose alternative professions. Modular units can help fill that gap. They can be manufactured in factories with efficient automated processes, thereby enabling high volumes of quality products to be delivered at speed and requiring fewer skilled workers. And using technologies such as building information modeling, the product is fully designed before manufacturing commences.

*Effective partnerships.* Global technology providers with alternative industry experiences are stepping into the construction sector, providing momentum and funding. Companies that already have extensive logistics networks with established supply chains, such as IKEA and Toyota, are bringing different but applicable thinking to modular manufacturing. A partnership between existing manufacturing or construction organizations and developers could effectively deliver modular products at scale.

*Capacity to deliver a desirable, cost-effective, quality product.* Large capital investment is required up front to establish a modular production facility; in order to make this investment feasible, a pipeline of secured work should be in place. The best way to secure this work is to ensure a high-quality product. Modular products should be well-designed, sustainable, energy efficient, and well-suited to every aspect of urban living for the prospective end user—this, in turn, creates demand for the products, helping achieve return on investment in the production facility.

***ALEC is a multi-disciplinary construction company based in Dubai.***



**Thomas Gluck**

Principal  
GLUCK+

The modular industry is at a tipping point and poised to become a more common method of delivery. To scale modular construction in this way, the industry will have to address three factors that are currently serving as impediments to growth.

*A limited pool of qualified modular manufacturers.* There are simply very few qualified modular building manufacturers for noncombustible construction as well as limited experience in completing mid- to high-rise modular construction in urban environments such as New York City. This is, of course, a question of the chicken or the egg: how do manufacturers gain necessary experience while the industry is still struggling to provide a reliable delivery option for these urban environments? Despite some false starts in

the past decade, the industry is now gaining traction, so it's becoming more viable for manufacturers to invest in modular construction—and the number of qualified manufacturers will grow.

*The necessity of early contracting.* As cost is paramount, clients are currently forced to commit early to modular or conventional construction without the benefit of in-depth competitive bidding—thus assuming the risk of potentially unnecessary costs. Accurately comparing both methods would require two sets of full documentation, a cost-prohibitive option. In addition, because the fabrication capacities of modular builders vary, clients must engage a specific modular builder early in the design process, essentially mandating a design-build approach.

Fortunately, design-build is gaining industry traction in parallel, which will help to normalize the early awarding of architecture and construction contracts. In reality, because modular construction takes place inside controlled factory conditions, it can provide greater price assurance than conventional construction which is at the mercy of outside conditions and different subcontractors' schedules and rates. As the modular industry matures and develops a track record of comparable early pricing and final construction costs, this problem too will begin to diminish.

*Lack of awareness of conventional onsite construction needs.* At least 75 percent of a building's construction may be produced off-site in a factory, but a critical portion of work must still occur conventionally on-site to complete a building. Given the large geographical area served by each modular manufacturer, this work includes obtaining licenses, which requires localized knowledge. A comfort with and awareness of this type of on-site work does not currently exist in the marketplace. However, as fabricators develop experience finishing projects in various jurisdictions, and as conventional subcontractors accrue experience with modular projects, this problem will wane.

***GLUCK+ is the architect-led design-build firm behind New York City's first modular steel and concrete residential building.***



**Joseph Schottland**

Partner  
Innovatus Capital  
Partners

As one of the few private-equity firms already committed to modular manufacturing, we remain excited by the prospects of its acceptance across many industry sectors, but a few changes are needed for this to happen.

*A shift in widely accepted business norms.* The macrofactors affected by modular and its theoretical benefits are extremely compelling. However, the ingrained business norms of almost the entire construction value chain would need to be disrupted for modular to be adopted en masse.

*A clear demonstration of the business value.* It's a tall order, but for any disrupter, money talks. To accelerate the pace of modular adoption across industries, the primary need is to prove at commercial scale that the modular value proposition delivers on its promised benefits. Imagine if one visionary developer committed to a single factory and a secured pipeline of projects—all with the same basic design (for example, a standard hotel property). The factory could run at extremely high utilization. It would have time to adapt its supply chain and optimize its processes to a standard design and a single client. Costs would drop dramatically, and that developer would reap enormous economic benefits.

*A competitive market that spurs adoption and innovation.* Such a scenario would push local competitors to change their traditional approach to construction, and it would create a showcase for developers in other markets to replicate the strategy for similar gain.

The economics prevail: if a developer creates a 200- to 300-basis-point cap rate advantage, the effect is so profound that it resets the financial threshold for others to even consider participating. In that environment, would-be competitors are forced to adapt or cede that market to those that can meet the new norm. That is the embodiment of the flywheel effect of a successful disrupter.

***Innovatus is an investment adviser and portfolio management firm that is invested in high-rise modular construction.***



**Darren Bechtel**

Founder and  
managing director  
Brick & Mortar  
Ventures



**Kaustubh Pandya**

Principal  
Brick & Mortar  
Ventures

The concept of modular construction has been in our industry for decades, but it has only recently gained significant attention from the media and investors.

*Narrowing scope to build momentum and deliver projects at scale.*

Instead of applying modular methods to broad construction verticals (such as heavy commercial and industrial), companies can start with simpler verticals (such as single- and multi-family homes and light commercial). Another option is to start by focusing on narrower and more manageable scopes—such as bathrooms

or medical modules—within complex verticals. Standardized methods tend to hamper design customization. As a result, we must balance the ability to deliver a product with the end customer's desire for design freedom (including placing limits on that freedom). This narrower focus also allows modular projects to be scaled at a higher velocity, taking lessons from one vertical to the next. Since doing so will need significant capital, building a compelling investment thesis will require proving the potential for returns higher than that of a private company growing at a traditional pace—for instance, potential for tenfold returns if targeting venture capital.

*Incorporating complementary technology to accelerate adoption.* Innovations in adjacent spaces can supercharge the pace of adoption by reducing modular-delivery cost or providing select customization at a fraction of the traditional cost. Such innovations include supply-chain tracking, utilizing materials suitable for finished-product transportation, and 3-D printing, which can provide a unique look by customizing a façade to mask an internal standard module. All of the above technologies are available today and can help scale modular projects.

*Harnessing and improving existing processes and infrastructure.* In addition to new technologies, modular companies can choose existing proven solutions. For example, leveraging the intermodal shipping network to reduce logistics costs for delivering prefab modules to site. The industry will also have to improve existing processes, such as permitting, for the benefits of modular construction to be fully realized.

While adoption in specific verticals will determine the scale to which modular can grow, we can safely assume at least some scope in each vertical can be made modular. Early progress will certainly be in residential and light commercial spaces.

***Brick & Mortar is a venture capital firm that identifies and backs emerging technology companies in architecture, engineering, construction, and facilities management.***



**Roz Buick**

Senior vice president  
Trimble

Although modular construction has been around for decades, digital technology has evolved to a point where it can enable faster, more extensive modularization across the supply chain.

*Create an empowered, high-performing supply chain.* A constructible process that combines design, project management, and engineering models into a collaborative and data-rich platform would lead to greater adoption of modular construction. Inserting build-quality content and metadata into 3-D models early on enables stakeholders to accelerate modeling, increase visibility, and improve predictability across the entire project. From the designer's desk to the fabrication center, mobile devices, and robotic total stations on a jobsite, this process creates a virtuous circle of knowledge sharing that enables more effective collaboration across project teams and stakeholders.

*Embrace the latest solutions.* Stakeholders must continue to embrace solutions that transform the construction industry. Adopting the right software and hardware will enable smart, digital infrastructure that is designed and built using powerful work processes. Cloud platforms and technologies that harness mixed reality, such as the Internet of Things and AI, are leading to more automation. For example, modular construction companies are increasingly relying on off-site factories staffed by autonomous robots that piece together the components of a building.

*Lean on historical data for continuous improvement.* Having accurate data is key to driving optimization, predictability, and automation. The “secret sauce” for designers, engineers, and contractors of the future will be using historical data to draw insights from each project to continually improve processes. Ensuring real-time access to data among all stakeholders will minimize the chance for errors and enable modular projects to be built more efficiently.

By adopting a constructible process alongside digital technologies, modular construction will play an instrumental role in reducing the time to completion for construction projects of all types, positively affecting the industry as a whole.

***Trimble is a provider of digital solutions across the construction lifecycle.***

*Voices highlights a range of perspectives by infrastructure and capital project leaders from across geographies and value chains. McKinsey & Company does not endorse the organizations who contribute to Voices or their views.*

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