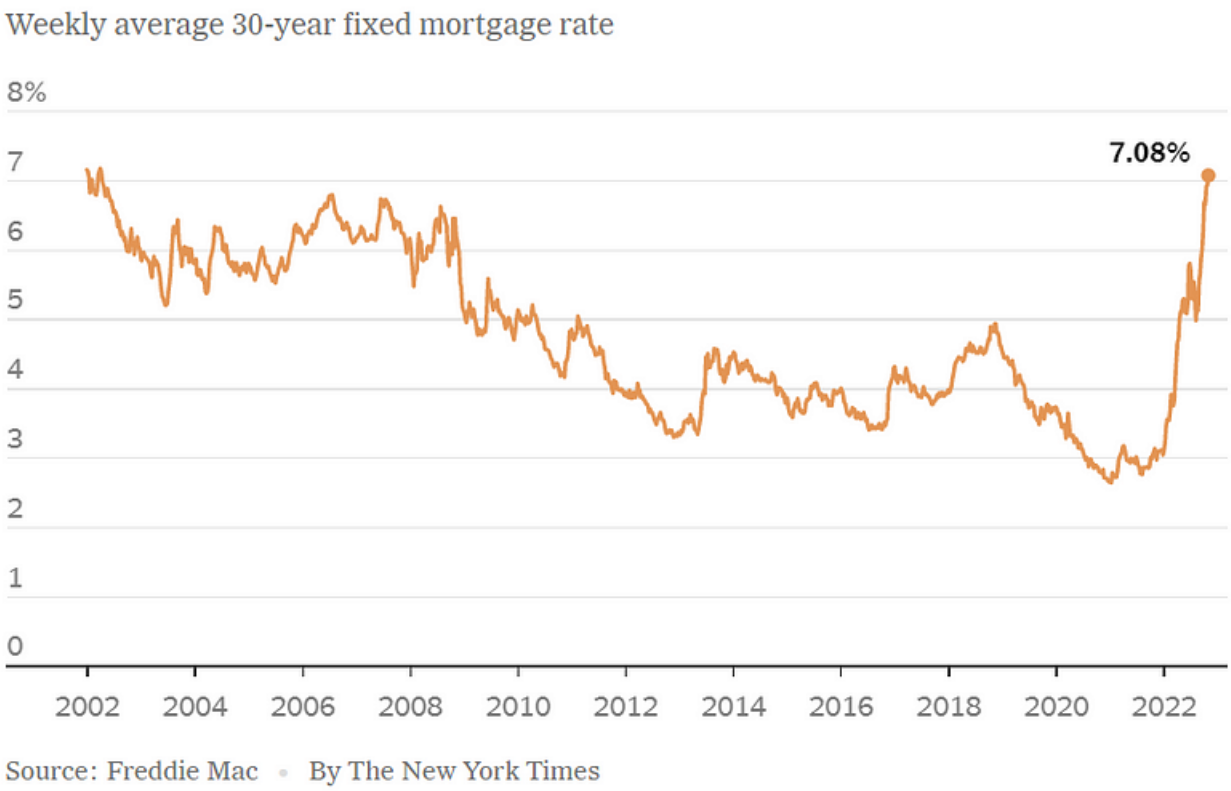
What Proptech is Doing to Address Housing Affordability

Part III: Construction

This article is the last part of a three-part series on Proptech innovation addressing housing affordability. Please see Part I (homeownership) and Part II (rental tech) for its predecessors.



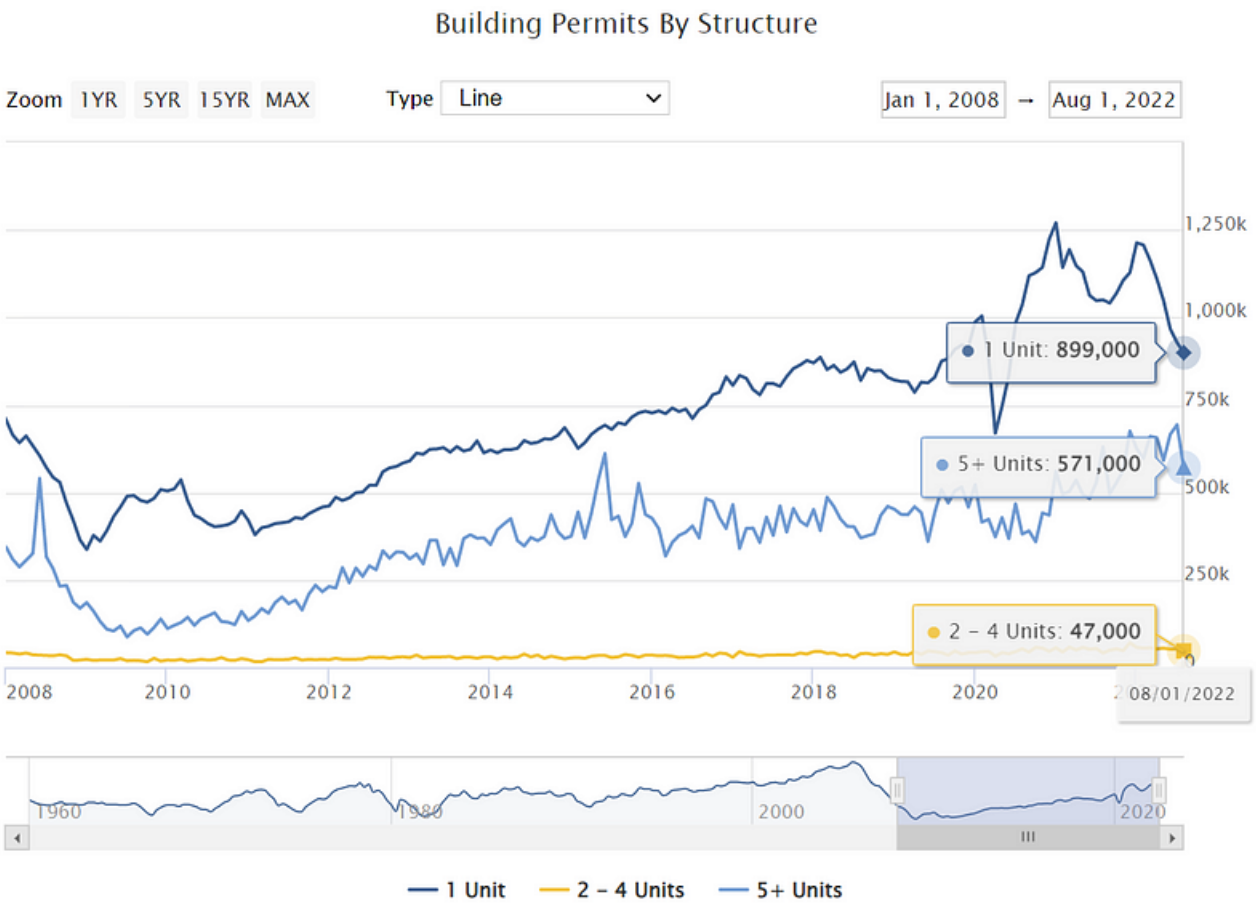
New highs and lows

How times have changed! When we first started this research on Proptech and housing affordability, the average interest rate for a 30-year fixed mortgage in the US was under 3%. In October of this year, that number topped 7%. While some economists expect that number to stabilize in the mid—5's in 2023, the rapid and dramatic shift in the cost of capital for all parties (traditional home buyers, single family rental investors, apartment owners, and more) has had cascading effects on

affordability for both renters and buyers. Spoiler alert: it's been painful for all.

On the buy side, interest rates are driving up monthly payments, putting many homes out of reach. Prices have fallen, but they haven't fallen nearly enough to counteract interest rate effects, resulting in mortgage payment-to-income ratios reaching a 35-year high in September, at 35.5%. Existing home supply is still low, with owners who have locked-in interest rates waiting to sell. Meanwhile, new home construction, which grew over the last 24 months, fell recently as builders face lower demand even as construction costs continue to rise.

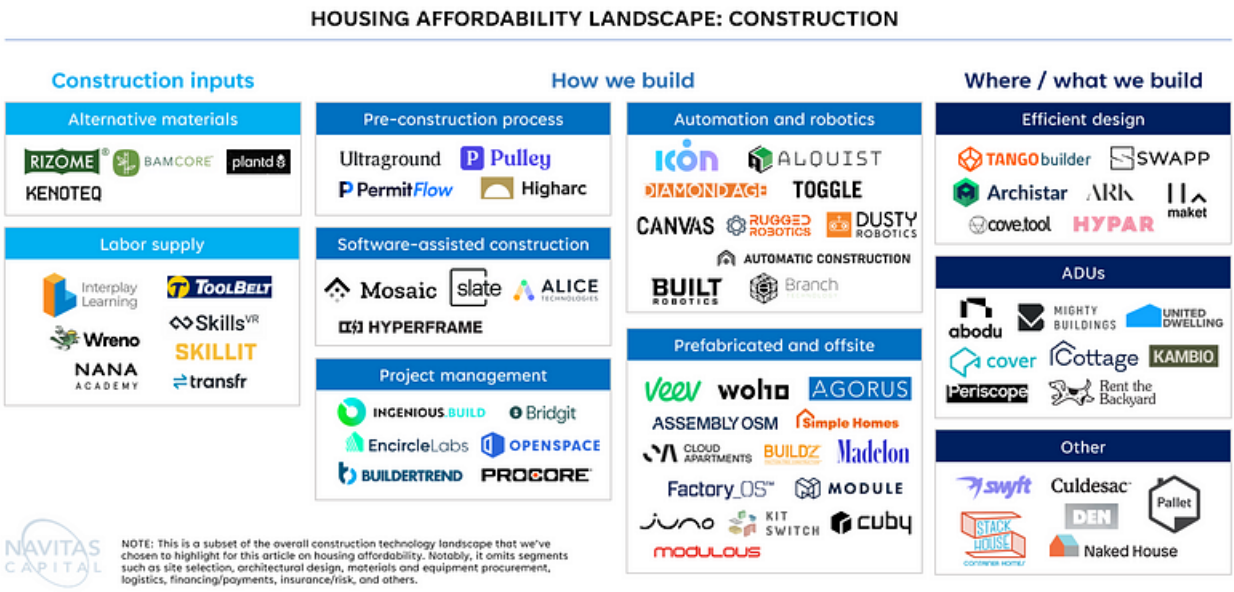
For renters, surging demand from pent-up household formation coming out of the pandemic (roommate decoupling, boomerang children moving out) as well as would-be-buyers continuing to rent is still driving up prices and depressing vacancies to the lowest levels in nearly four decades. Despite these improving top-line economics, multifamily developers and owners are slow to invest in new construction, and there are signs activity may slow: recent data is showing a dip in new building permits.



Source: The Federal Reserve

These record highs and lows are painting a bleak affordability picture right now. In Part I and Part II of this series, we touched on a number of technology companies that help buyers and renters ease these burdens. To fundamentally shift market dynamics, however, we are going to have to build our way out.

In this third installment, we'll explore a sampling of start-ups aiming to address the supply picture through a variety of innovations. All ultimately looking to help make construction faster, cheaper and/or better. We won't address the entire construction tech ecosystem, instead highlighting a few approaches to this ever growing challenge and opportunity:



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a. Construction inputs

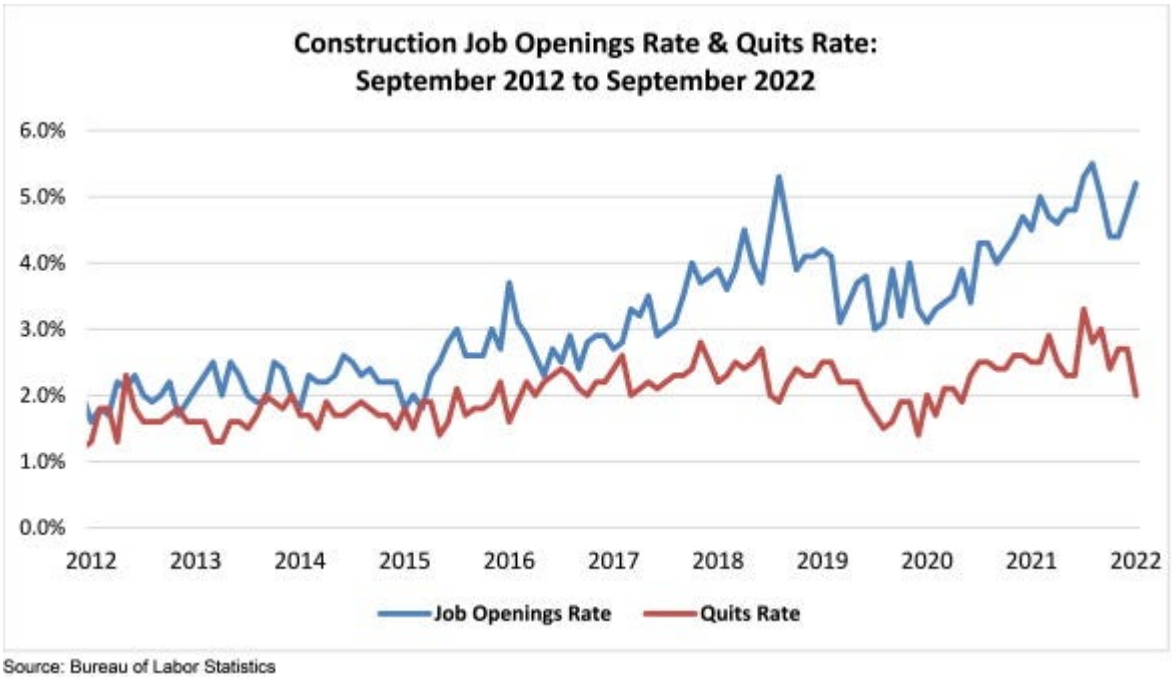
Alternative materials

Much has been written about the rising cost of construction materials, particularly softwood lumber, which was the headline culprit over much of the early pandemic. Lately however, it's gypsum, steel, and ready-mix-concrete that are being blamed, with rising energy prices and supply chain breakages as the underlying drivers.

With this backdrop, it's somewhat surprising that the technology push in alternative materials has mostly taken on a carbon reduction angle, rather than cost. It's our hope that there will be overlap—bamboo-based lumber alternative providers like Bamcore and Rizome, for example, are attempting to use fast-growing bamboo in building products, which should theoretically become cheaper as growers (especially domestic ones) scale. But more engineering progress is still required to make bamboo viable as a structural component, which would allow it to have a bigger market as well as impact on overall cost.

Labor supply

Labor can constitute up to half of construction cost, and the declining population of skilled workers is making this even more problematic. The reasons that young people have seemingly lost interest in skilled trades are varied, but technology may be able to help attract a wider array of workers, as well as accelerate learning so apprentices can be field-ready more quickly and cheaply.



From Associated Builders and Contractors

Construction-related skills training remains underdigitized, but a few start-ups are trying to change that. Interplay Learning, for example, uses virtual reality simulations and self-paced online learning modules to teach workers skills HVAC, plumbing, and soon, framing and roofing. SkillsVR, another VR start-up, creates virtual training environments for facilitator-led training on topics like safety and teamwork. Transfr focuses on career discovery so that would-be apprentices can experience life on a job site. The nature of construction work still requires live onsite experience, of course, but these tech companies may help reduce

the time and cost it takes to achieve skill mastery while enticing new workers into the field.

Other proptech companies are building training into service delivery. Wreno, for example, hopes to take unskilled gig workers and use them to service customers on simple tasks like rekeying doors while building additional skills through a combination of tech and traditional apprenticeship. Nana Academy, similarly, operates a marketplace for home services, where the providers are students in training. To date, both are focused on maintenance and operations and not new construction, but the students-as-supply marketplace approach is one to watch.

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b. Construction processes

Construction productivity has stagnated for decades, as a popular McKinsey study has shown. We're firm believers that this is evidence there is undertapped opportunity for technology to reduce cost overall through improvements like better communication, collaboration, and transparency. We've invested in platforms like Ingenious (project collaboration), Encircle Labs (construction lending verification and draws) and OpenSpace (3D site capture and automated progress tracking) because they each improve productivity in construction in different ways. Ingenious allows different stakeholders like engineers, architects, owners, tenants, GCs and subs access to a single data-centric platform with integrated workflows, which speeds the decisionmaking process and reduces delays and errors from communication breakdowns. Encircle digitizes and accelerates the construction submittal to draws process, allowing disbursements to be handled seamlessly and reducing stoppages from bureaucratic processes that can lead to unnecessary disputes. OpenSpace centralizes project oversight

by allowing managers to see and analyze construction progress remotely, reducing overhead cost but also improving quality and reducing rework.

We also wanted to highlight a number of tech approaches that are specifically targeting speed and productivity in a few different ways.

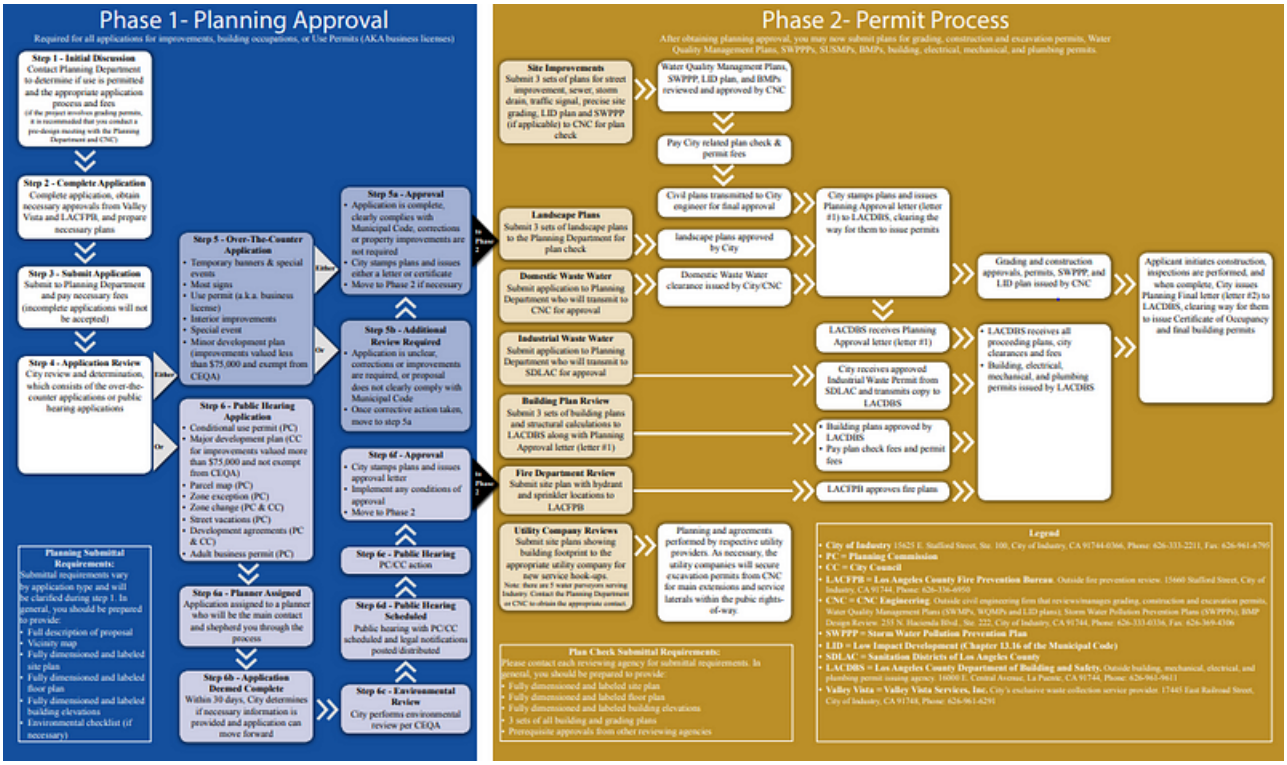
Pre-construction

The pre-construction process can be a wildcard that adds uncertainty and risk to any development project. Entitlements and permitting processes are notoriously idiosyncratic and opaque at best (and ridden with cronyism and bribes at worst).

Is technology the answer? Ultraground is scraping, centralizing, and mapping data and decisions from zoning meetings as they happen to help developers get a pulse on what's happening in different markets, highlighting trends and analogous developments. Permitflow and Pulley are building digital permitting platforms to help developers put together required submissions and manage the permitting process.

Because governments don't tend to make good customers for tech start-ups, these companies are layering on top of existing processes, similar to how Turbotax helps individuals prepare taxes but doesn't integrate with the Internal Revenue Service. But unlike the tax process, which mostly ends at filing (knock on wood), a correctly filed permitting application is only the beginning, and most of the delays and timeline pressure come afterward. We'll be eagerly watching whether any of these platforms can demonstrate enough scale and value to government bodies that they can flip the switch—bringing not just developers but also government administrators onto the platform to track and manage permitting. That

flip would be the real unlock for faster, more predictable and transparent timelines.



Actual permitting workflow posted by the government of City of Industry, California

Software-enabled construction process

Another set of companies is trying to use software to retool onsite construction processes. Mosaic, for example, is a tech-enabled general contractor that says it will use software to optimize onsite work by generating step-by-step instructions that are simple and more efficient for workers to execute. Slate, meanwhile, is building a "virtual assistant" that uses dynamic internal and external data like weather conditions, materials locations, and more to help with task ordering and scheduling. Alice Technologies creates simulations that incorporate existing conditions and delays to help make decisions on resourcing and scheduling that reduce overall cost. Hyperframe combines software optimization, augmented reality and prefabrication—it automatically generates optimized framing designs from architectural drawings,

prefabricates the components, and then supports the build process by guiding framers onsite via a mixed reality Hololens headset.

These algorithmic approaches are a paradigm shift for builders, and they require the industry to take a lean manufacturing-type mindset into onsite construction. Given that most construction sites have barely begun to document or measure their existing processes, the leap from current state to optimization is a large one.

Automation and robotics

Ever since the advent of 3D printing, people have toyed with the idea of 3D printing entire homes. To date, however, only a handful have been built in the US, several of which have been collaborations with the nonprofit Habitat for Humanity, and neither cost nor speed to deliver have proven advantageous over traditionally built homes—yet. Icon, which announced it would build a community of 100 homes with Lennar this year in Texas, and Alquist3D, which planned to build 200 homes in Virginia, have been hit with rising materials costs, as concrete prices have been rising even as lumber has eased. Alquist, for its part, has paused its development.

What about other onsite robotics? It's still early days here, with most of these companies still proving out their concepts. Dusty Robotics and Rugged Robotics (construction layouts) and Canvas (drywall hanging) are all trying to build robots sophisticated enough to not only read plans, but adapt to job site conditions so that they can replace human labor. Diamond Age has engineered a more comprehensive "full stack" solution that brings elements of robotic offsite construction onto the job site, such as sheet metal bending and tile cutting.

Prefabricated and offsite construction

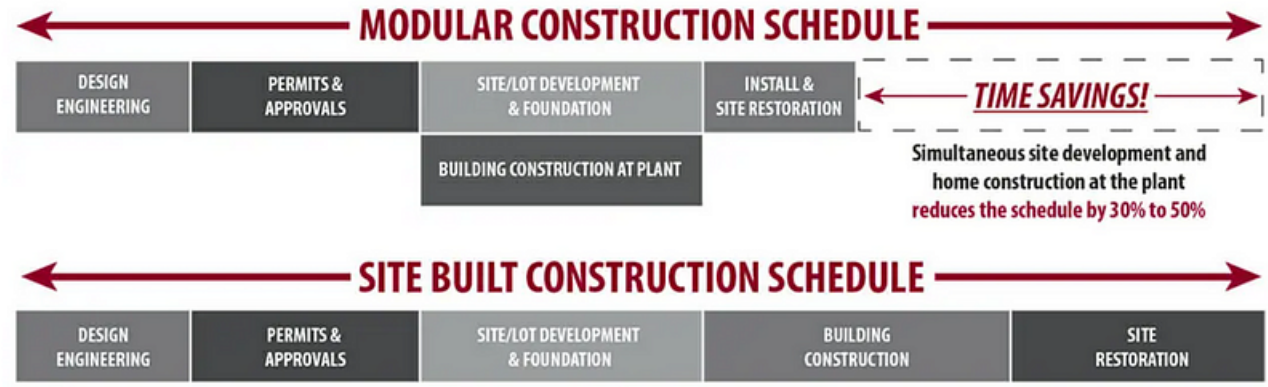
Prefabricated and offsite construction as a category includes both panelized construction, where components are manufactured offsite and assembled onsite, as well as modular construction, where entire homes or building units are fabricated as modules and are closer to complete by the time they are assembled onsite. The goal is to shift most onsite construction labor into higher productivity factory settings. Neither approach is distinctly modern—manufactured housing became particularly popular in the 1950s—but today's prefab startups are infusing technology into the process and use software to guide everything from design to fabrication. This enables customization and a look and feel closer to traditionally built units. Many companies in this space are attacking the ADU (Accessory Dwelling Unit) market first, where customer acceptance seems to have been strongest (more on ADUs later).

A new wave of companies is also tackling multifamily housing development. These take a limited number of unit designs that can be configured to build an apartment with a mix of unit types. They then manufacture the units in controlled manufacturing environments, ship those units onsite and assemble. Assembly OSM, Woho, Cloud Apartments, and Factory OS all take this approach in different markets—each of them have flagship developments or proofs of concept under construction.

Juno and Madelon are taking a more "asset light" approach to a similar idea—rather than building out a manufacturing footprint, they are selling software to multifamily developers and connecting them to a network of manufacturers and suppliers, and taking a management or materials fee. KitSwitch also enables developers to take a modular

approach, but by producing modular components for bathrooms and kitchens that can be installed in otherwise traditionally built structures or retrofits.

While the cost of modular developments may or may not be less than onsite construction due to the cost of transportation, materials, or other factors, most modular construction companies claim to be significantly faster because of parallel processing.



Source: Modular Building Institute

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c. What and where we build

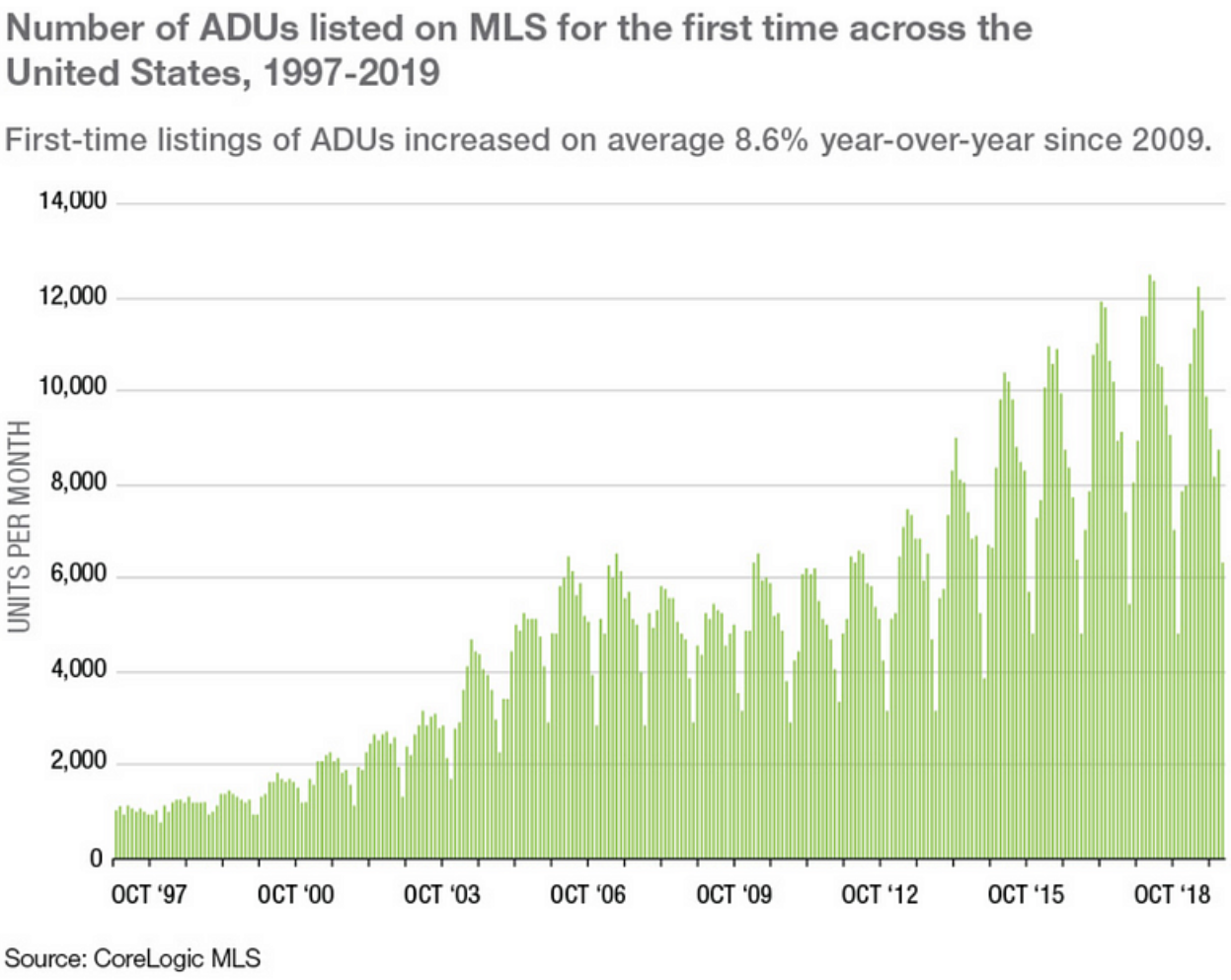
Maybe rather than using cheaper inputs or making the construction process more efficient, we can make greater advances by simply rethinking *what* we build and where. After all, just as hunger is a logistics problem, housing affordability is really a mismatch between where housing is built and where it's needed. A $300K unit that would be affordable but impossible to find for a family in the Bay Area is widely available in the suburbs of Cleveland. For all the buzz around remote work in the post-pandemic era, the reality is that "work from anywhere" is largely still unavailable for lower and middle-income Americans.

Efficient design

AI-generated design can help produce buildings that are denser and more materials efficient overall. While software can certainly speed up the design process, we think the real value that can be captured is in the ability for software to optimize for total cost. Tangobuilder (a Navitas portfolio company), for example, produces efficient structural designs for homes and commercial buildings that can reduce structural materials by up to 40% relative to human-produced design. Swapp and Ark generate multifamily designs that optimize for density and use of space.

ADUs

The rise of the accessory dwelling unit (ADU) as a potential solution to add density into urban and suburban communities has been a fascinating climb. Now embraced not only by California but municipalities across the country—and the President's office of housing policy—ADU start-ups like Abodu, Villa and Mighty Buildings attempt to speed the process even further by productizing the units (including permitting), reducing timelines for builders even further from months to weeks. Multifamily owners and operators are starting to take note, as ADUs can also be added to increase the number of units on existing properties without significant permitting or construction cost in certain jurisdictions.



Other buildings and communities

Mobility and transit-related start-ups have a role to play as well by expanding how far people are able to live from job centers. Swyft Cities, the Google spin-out which builds gondolas for mass transportation, could potentially connect further flung communities and help developers build on land further from the existing core. Culdesac, a tech-enabled developer, envisions building new neighborhoods "from scratch" with built-in walkability and density, connected by transit lines.

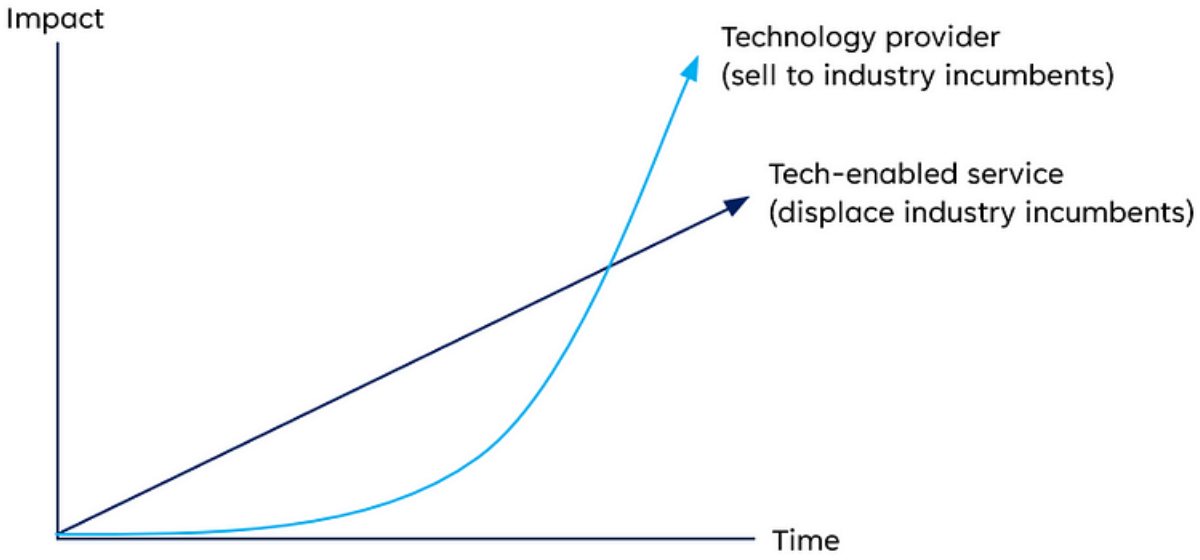
The tortoise, or the hare?

As start-ups join the race to help close the shortfall of housing, the critical question for both investors and the public is which approaches are likely to make their impacts felt the quickest. It's a tricky question

that hinges oftentimes on business model and positioning in the value chain. One fundamental question—do you sell to existing construction players, or do you displace them?

There are major trade-offs. Software-based approaches, for example, are asset-light and often attractive to investors as a result. Once they achieve product/market fit, they can theoretically scale quickly without significant capital. But software companies must sell to incumbent players, and adoption is notoriously difficult in the industry, where "product cycles" are long and the cost of failure can be tremendously expensive.

The alternative approach is to become a tech-enabled business that competes directly alongside more traditional real estate value chain players. Instead of selling to developers, these start-ups can become tech-enabled developers; Instead of selling to general contractors, they may become tech-enabled GCs. They don't have to convince large and slow-moving organizations to adopt technology because they do it all themselves. But the nature of construction means these are usually asset intensive businesses that are slow to scale.



Sustaining vs. disruptive innovation in construction

It's hard to say there's one approach that's definitively better in this industry. Most likely it'll be a mix—a tech-enabled developer that white labels its technology to traditional developers, for example, to scale more quickly in other geographies. Amazon set out to replace traditional retail with e-commerce—but it also worked with brick and mortar retailers to run their online operations along the way, and now operates a massive marketplace business now does more sales than its own retail.

So is Proptech going to be a hero in the affordability quagmire? We think there's certainly opportunity and a role to play. Of course, other solutions, including economic and social policy, education, tax incentives, transportation, and technology advances in other sectors matter, too. What's clear is that more innovators than ever are recognizing the problem and are motivated to build solutions for it. And we think there's room for at least a few massive, industry-defining to companies to emerge as a result.

What do you think? Did we miss something? Email jenny@navitascap.com

By Jenny Song on December 5, 2022.

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