![JLL logo]

Research

State of construction tech

Tech adoption accelerates due to the pandemic

Executive summary

Due to the pandemic, three years of construction technology growth and adoption has been compressed into the past nine months. The technology categories that recorded the most growth due to the pandemic have been digital collaboration platforms, virtual scanning tools, and safety focused wearables.

Venture capital funding has continued to flow to construction technology startups post-pandemic, with funding levels roughly on par with the average of the past five years. Most new funding has been concentrated in categories that have grown because of the pandemic.

To organize the wide range of tools available, the technology hierarchy in this report provides detail on each individual category of construction technology, and ranks each as either a foundational tool, a primary impact technology, or a secondary impact technology.

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Contents

Construction tech: 2020 recap

In last year's State of Construction Technology report, we forecast a strong year of tech growth in 2020, driven by lower barriers to adoption and greater efficiency benefits as technology matured. While all those factors were true this year, they were a modest undercurrent compared to enormous changes brought by the impacts of the COVID-19 pandemic.

The urgency and severity of the pandemic condensed technology adoption that likely would have taken three years at a normal pace into a single year. The pandemic pressed tech adoption onto every industry, but for construction the shift of office-based workers to a remote work environment was only one small part of the change. To keep jobsites open and projects running, construction technology was needed to enable virtual inspections, provide contact tracing solutions, track project status remotely, and develop project plans to allow workers to maintain social distancing.

As construction technology has matured, acquisitions and growth has led to a developing ecosystem of hubs and platforms, where a few core tools aim to be the single source of truth that construction firms use to connect their selection of one-off technology tools. Our 2019 report summarized the state of the market one year ago as "after years of talk about the promise of construction technology, the reality on the ground has finally started to catch up to the hype." Now nearing the end 2020, growth in construction technology on the ground, fueled by demand because of the pandemic, has far outstripped even the most optimistic forecasts.

This report aims to organize the wide range of technology options, while measuring how the pandemic has impacted the industry. Our goal is to arm anyone working through the challenges of construction during a pandemic with the latest insights on the state of construction tech, including which categories of technology are foundational tools, which are most likely to have the largest impact in the next few years, and who the top firms are in each category.
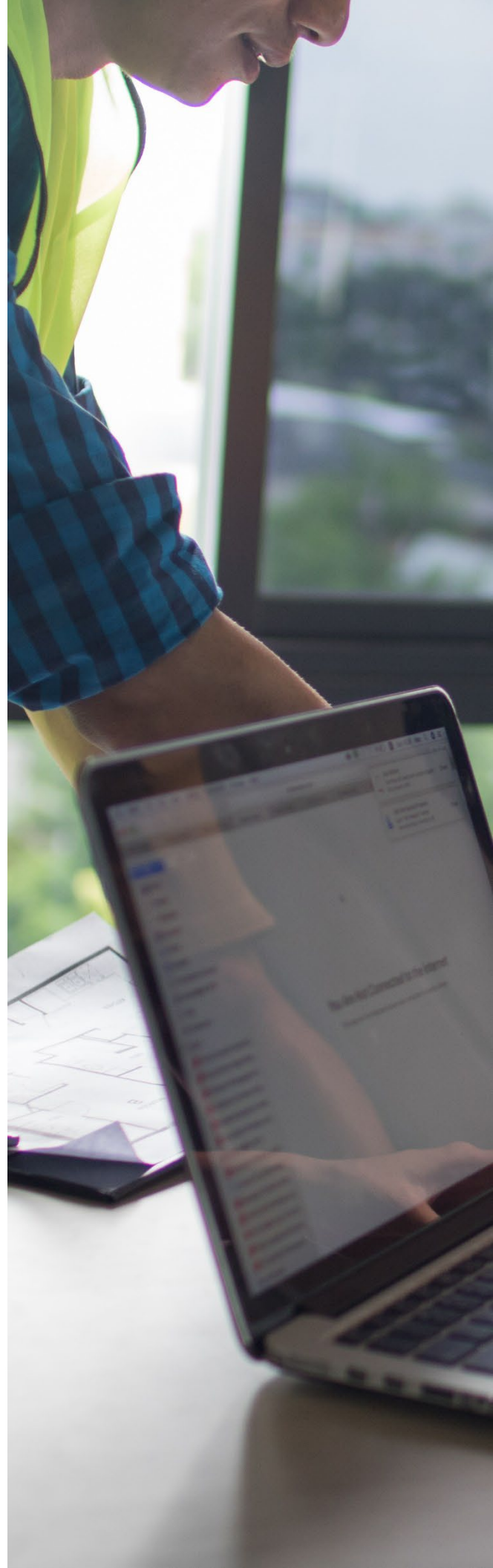
Pandemic impact on construction tech in 2020

The continuing pandemic has reshaped construction technology throughout 2020. The net impact has been positive, as the need to maintain social distancing and work remotely has pushed many construction firms to increase technology adoption. At the same time, the economic downturn created by the pandemic led to difficult market conditions, particularly for less established startups, because construction firms have recorded lower profitability and have less money to spend on unproven options.

Remote work opportunities
As with many industries, the hurried shift to remote work for office-based employees in the early days of the pandemic created an opportunity for construction tech to grow. The design industry largely shifted to cloud-based digital platforms years ago, so there was little disruption during the early stages of a project. Within construction, 67 percent of firms have allowed remote work for office employees due to the pandemic, according to a recent survey by the US Chamber of Commerce. While many large construction firms already used a form of digital collaboration, smaller local firms were less likely to have an existing system in place prior to the pandemic.

Onsite execution

There are two ways construction tech has enabled onsite execution during the pandemic. First, by creating opportunities to have fewer people on a jobsite. Typically, coordination between various subcontractors relies on onsite meetings, walkthroughs, and face-to-face discussions to solve problems. Through scanning tools, virtual walkthroughs, virtual inspections, and digital issue tracking, much of that work can be done with only one or two people onsite, rather than a whole team.

The second category is by keeping anyone who is essential to being onsite as safe as possible. In addition to standard procedures like temperature checks and handwashing, technology solutions that have expanded this year include wearables and monitoring devices to ensure workers stay socially distanced and to allow contact tracing if any issues arise, and planning tools to enable optimal efficiency in staging and scheduling to ensure that teams stay separated.

Economic downturn challenges

While the pandemic has increased overall adoption in the construction tech sector, shutdowns and lower work levels have also created business headwinds for construction tech firms. The economic downturn has reduced demand for new projects, backlogs are falling, and many firms have turned to government support to stay afloat. Construction firms have fewer discretionary dollars to spend and are likelier to pick proven solutions for their technology needs, rather than taking a risk on a less mature startup. As a result, we expect overall growth in the construction tech industry to be tempered by a thinning out of some smaller startups which have struggled to gain traction and revenue, especially those in technology categories that did not benefit from the pandemic.

Ranking construction tech categories by how the pandemic has boosted growth:

▲ High impact

- Digital collaboration
- Scanning
- Safety/wearables
- Bim/cad

▬ Moderate impact

- Drones
- Jobs/employment
- Robotics
- Augmented/virtual reality
- Digital twins

▼ Low impact

- Equipment/materials
- Payment/finance
- 3d-printing
- Artificial intelligence
- Modular construction

Construction tech venture capital 2020

Top investors:

MetaProp NYC

Y Combinator

Blackhorn Ventures

Lux Capital

Brick & Mortar Ventures

Top startups by total funding:

Nonresidential construction focus, not acquired

Company	Total funding	Sector
Katerra	**$1.4B**	Modular
Procore	**$649M**	Digital Collaboration
3D Robotics	**$179M**	Drones
PrecisionHawk	**$136M**	Drones
Matterport	**$114M**	Scanning
Prescient	**$105M**	Modular
DroneDeploy	**$93M**	Drones
NavVis	**$68M**	Digital Twins
Project Frog	**$68M**	Modular
Finalcad	**$63M**	Digital Collaboration

Top construction tech funding rounds

(9/2019 – 9/2020)

1. **$200M** | Katerra | May 2020 | Modular
2. **$150M** | Procore | May 2020 | Digital Collaboration
3. **$95M** | Procore | Sept 2019 | Digital Collaboration
4. **$35M** | DroneDeploy | Nov 2019 | Drones
5. **$35M** | ICON | Aug 2020 | 3D Printing
6. **$33M** | PlanRadar | March 2020 | Digital Collaboration
7. **$32M** | PrecisionHawk | Dec 2019 | Drones
8. **$30M** | LevelSet | Dec 2019 | Payments/Finance
9. **$25M** | Headlight | June 2020 | Scanning
10. **$17M** | RenoRun | Nov 2019 | Equipment/Materials

JLL construction tech hierarchy

Overview: What is the construction tech hierarchy?
This hierarchy was developed as a way of understanding construction tech, particularly for construction firms who are prioritizing adoption and investment in new tools. We categorized the different types of construction technology into a hierarchy divided between foundational technologies, the building blocks of construction tech which are required to use other technologies, primary impact technologies, which are expected to have the largest impact in the next few years, and secondary impact technologies, which are expected to have either an incremental impact in the near time, or a large impact farther in the future.

Foundational technologies

They are the building blocks of construction tech and are interwoven into many of the primary and secondary impact technologies. You will find some combination of these foundational tools as a core part of any construction technology rollout.

BIM & CAD | **Digital twins** | **Artificial intelligence** | **Digital collaboration**

Primary impact technologies

These are the categories we expect will have the greatest overall impact on the construction industry in the next few years. They are more mature than the secondary impact tools and have developed to a point where they can increase the efficiency of current projects if implemented today.

Scanning | **Drones** | **Modular construction**

Secondary impact technologies

These are those that we expect to have a smaller impact over the next few years. This can be for one of the two reasons, either because the total impact will be more incremental, or because the tools are early in their development, and are not mature enough to have a large impact on construction for the next few years.

Tools with an incremental impact: **Safety/Wearables** | **Payments/Finance**
Equipment/Materials | **Jobs/Employment**

Tools that are early in development: **3D Printing** | **Robotics** | **Augmented/Virtual Reality**

Changes in the JLL construction tech hierarchy in 2020:

The pandemic has increased adoption in construction technology, but not all impacts from the pandemic have been positive. Some technologies have become essential tools, while tighter budgets and lower profit margins means that other types of technology have a less certain future. To capture the range of impacts, a new pandemic impact section has been added to the details of each technology category.

Digital collaboration

Upgraded from primary impact tech to foundational tech

This year there was one shift within the hierarchy, as Digital Collaboration tools have changed from ranking as a primary impact technology to now be considered a foundational technology. This change was made for two reasons. First, digital collaboration tools have become a near requirement during the pandemic, to keep projects moving forward even as teams are not able to meet in person. And second, these tools have developed, by growth and acquisitions, into unified platform hubs designed to be the core tool to enable all other technologies to connect.

Jobs/Employment

Added as a new technology category

Companies in this category are generally built around app-based job marketplaces that make it easier to connect workers with opportunities. Jobs/Employment has been added as a new category because of growth of existing companies, new startups joining the fray this year, and companies in this category raising more venture capital funding in 2020 than any prior year.

Augmented/ Virtual reality

Added as a new technology category

Although closely associated with other categories, like Scanning and BIM, Augmented/Virtual Reality has been added as standalone category due to the potential to have a major impact on construction in the future, and continued venture capital investment in the sector.
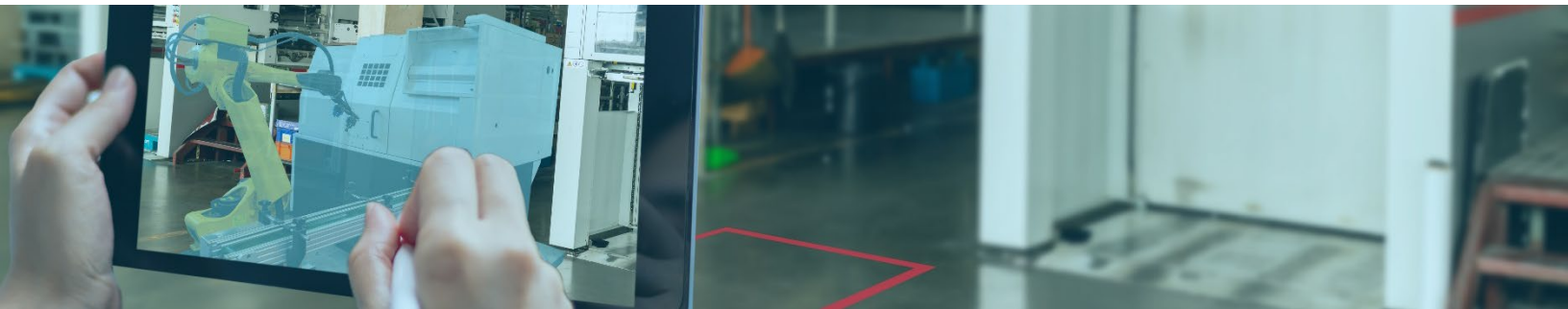
Foundational technologies:

BIM and CAD

Pandemic boost: High ▲

These two categories are the foundation of all types of construction technology. CAD is the name for producing 3D and 2D design models with a computer program, while BIM is also a 3D computer model, but it is fully representative of an entire building and all of the multiple systems within it. Both complement each other, but BIM is the emerging choice for the core single source of truth for construction technology. They are foundational because all other technologies require a base computer model to either feed data into or pull data from.

Digital collaboration

Pandemic boost: High ▲

These tools are truly standalone software platforms, built around a cloud-based system that allows anyone to access and update design drawings, punch lists, schedules, and any other critical project documents from any location. Digital collaboration tools are among the most mature sectors within the construction tech umbrella. The benefits are proven, which is why adoption of digital collaboration tools is high, and why the tools are now considered to be a foundational technology.

Digital twins

Pandemic boost: Moderate ▬

Digital twins take the concept of BIM a step further. By creating a full virtual model of an entire building and how it operates, digital twins can be used to run scenarios and see how building systems might react to certain conditions. Digital twins can also be used to intake data from sensors throughout a building to learn from how the building reacts to real world conditions and use that data to further optimize building operations. Digital twins require overlapping technologies to operate, some combination of BIM, remote sensors, artificial intelligence, and more, and generally make economic sense for larger and more energy intensive projects.

Artificial intelligence

Pandemic boost: Low ▼

Artificial intelligence (AI) is another example of a technology that inherently works within many other forms of construction technology and is a foundational piece of those tools rather than standalone element. Technology solutions from equipment usage optimization, to finance and payments, to augmented reality all incorporate some form of AI technology to learn from data, automate processes, and create more efficient solutions.

Primary impact technologies: Scanning

What is it?

New technology in scanning, often using some combination of automated optical cameras and laser scans, can collect data at unprecedented rates. These scanning tools can be handheld, mounted on tripods, strapped to helmets, or even mounted on robots, and can dramatically improve data collection and quality. The top startups in this category offer combined software and hardware solutions, which typically include the scanner itself, software that analyzes and tracks the data, and a visualization tool that allows users to virtually walk back through the same space.

Why is it important?

The fuel for all construction technology is data. Once the design phase is complete and the physical project work commences, in the past construction jobsites could become a black box, with no easy way to get data out. Critical structural elements were surveyed and mapped to ensure the integrity of the building, but those individual points were generally the only available data. There was no comprehensive data tracking of an entire project, and no way to accurately do so. Scanning will be of critical importance to the evolution of construction, no matter how the industry changes over the coming decades. The industry may become automated, with robots operating on jobsites, or more modular, with everything preassembled in a factory. Effective and accurate scanning and data capture will be essential to all of them.

Pandemic boost: High ▲

Interior scanning has gained importance as a way to replace additional eyes onsite, and as a substitute for in person meetings and walkthroughs. Prior to the pandemic, scanning was a more efficient and comprehensive way to collect data. But under regulations where a limited number of staff can be onsite at any time, interior scanning has often become a necessity to ensure that all members of a project teams are on the same page, even if they cannot be onsite. One area where interior scanning may see additional growth is for inspections. During the pandemic, many municipalities allowed for some forms of virtual inspections, which were often just done over video. If those changes are formalized in some locations, interior scanning technology could play a critical role.

Leading firms:

Matterport   (founded 20011, **$114M** total funding)

OpenSpace   (founded 2017, **$33.5M** total funding)

Disperse.io   (founded 2013, **$92.6M** total funding)

Primary impact technologies: Construction drones

What is it?

Drones provide a platform that can unlock automated collection of massive amounts of new data about construction sites. Drones fall squarely into the data collection side of construction tech and are a highly efficient means to do so. Drones are similar to scanning devices in terms of the end data output, and in the combined hardware and software solution offered by most drone providers. The use cases for drones are clearly different from interior scanners, as drones are primarily used outdoors for inspections, monitoring, surveying, and site awareness. Unlike some construction tech sectors, drones are not specific to construction and have become increasingly popular across multiple industries.

Why is it important?

Drones serve as highly efficient force multipliers, taking a job that would require dozens of hours of labor, and getting it done quickly with one person. In this sense, they make existing operations easier, more efficient, cheaper, and safer. Drones can be tasked with complex routing and scanning and can pour data back to a wide range of connected software programs or models. Over the long term, drones open up a new world of opportunity for data analysis, by making data available at a much higher rate.

Pandemic boost: Moderate ━

Drones are among the beneficiaries of changes due to the pandemic due to their ability to do the work of multiple people, and to do so in a way that keeps people socially distanced. A lone operator is able to scan an entire project site, and when connected to a digital collaboration platform, share that data with the full team working offsite or remote. An effective remote work platform requires not just sharing data, but also collecting it. And for ground up projects drones are now an essential element of that data collection system.

Leading firms:

3D Robotics   (founded 2009, **$178.8M** total funding)

PrecisionHawk   (founded 2010, **$136M** total funding)

DroneDeploy   (founded 2013, **$92.6M** total funding)

Primary impact technologies: Modular construction

What is it?

Modular construction encompasses a large set of methods and procedures, but in the broadest sense, it means manufacturing standardized building elements in an offsite factory setting. Additional terms for modular include prefabricated construction and offsite construction, both of which refer to the same concept. The scale of work done in the offsite factory can range from individual pieces, like exterior wall panels, to complete room modules, like a bathroom or a hotel room. Whatever the size of the manufactured pieces, they are then shipped to the project site and assembled on location.

Why is it important?

Firms in the modular construction space are seeking to tackle multiple inefficiencies in the current construction model, all at once. In the early development process for modular construction, a project can actually end up taking longer and costing more as the kinks are worked out in both the manufacturing and the assembly process. But in the longer term, once a successful process is in place, the benefits include greater quality control and reduced construction timelines. Another unique benefit is a work environment where construction workers can report to the same location and have consistent work volume, rather than jumping from site to site with the potential for downtime in between.

Pandemic boost: Low ▼

The impact of the pandemic has been mixed for modular construction. On the positive side, modular manufacturing can be done in a controlled factory setting, with the ability for extensive preplanning to maintain social distancing without the unknowns of an active jobsite. On the negative side, modular construction remains an economically high-risk endeavor. Today's market volatility has led many firms to pull back from risk, which has hurt demand for modular projects. The challenges in the hospitality industry, which makes up a large share of the overall modular demand pipeline, will slow demand for new modular projects in the immediate term. While the long-term benefits of modular remain significant, the market downturn caused by the pandemic is likely to create a multi-year setback in the growth and adoption of modular as a construction method.

Leading firms:

Katerra (founded 2015, **$1.4B** total funding)

Prescient (founded 2012, **$105.4M** total funding)

Project Frog (founded 2006, **$67.8M** total funding)

Secondary impact technologies

Tools with an incremental impact:

Equipment/Materials

Overview:
These tools aim to improve the process of purchasing or renting construction materials and equipment. The solutions generally use an app-based marketplace to make the process more efficient, as the equipment and materials themselves are not being changed.

Outlook:
Low cost of adoption should lead to solid growth for this sector. Expect more success on small projects, as major projects completed by national firms already have standardized processes around materials and equipment procurement.

Pandemic boost: **Low ▼**

Notable startups:

EquipmentShare
(founded 2014, **$58.7M** total funding)
RenoRun
(founded 2016, **$21.1M** total funding)

Safety/Wearables

Overview:
Harnessing real-time data to improve construction safety is a long-time industry goal that has become more feasible with the maturation of IoT technology. These solutions often include wearables (either clip-ons or embedded in hard hats, vests, boots, etc.), along with site monitoring devices, which are all monitored and analyzed on a unified software platform.

Outlook:
The high return in increased safety and relatively low cost to deploy wearables will lead to rapid deployment and adoption across most major construction sites.
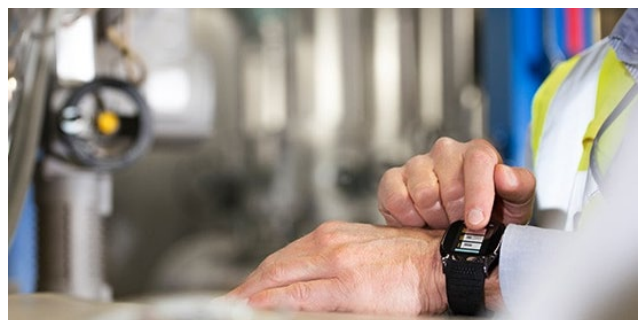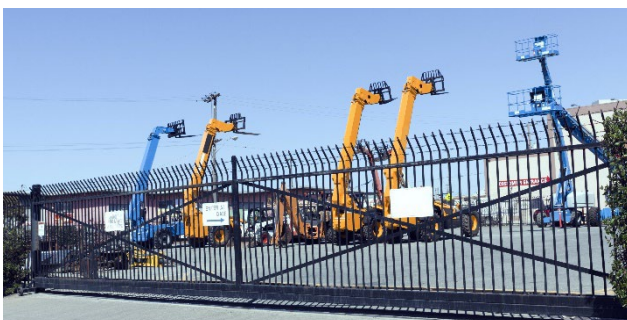
Pandemic boost: **High ▲**

Notable startups:

Triax Technologies
(founded 2012)

WakeCap
(founded 2017, **$2.5M** total funding)

Payments/Finance

Overview:
One of the most frustrating aspects of any construction project for all parties involved can be managing payments and cash flow. A collection of startups are looking to insert themselves into this process to streamline it, with solutions ranging from easing the lien process, to automating payments, to providing short-term construction loans.

Outlook:
This sector is expected to grow significantly, in parallel with the broader finance tech industry which overlaps with this sector and benefit the contractor's back-office workflow in the process.

Pandemic boost: **Low** ▼

Notable startups:

Billd
(founded 2018, **$60M** total funding)

Levelset
(founded 2007, **$46.8M** total funding)

Jobs/Employment

Overview:
A new addition to our report this year, this category includes startups looking to create solutions for connecting workers to projects or employment opportunities via an online job marketplace specific to construction.

Outlook:
A persistent labor shortage and high labor costs, combined with a lack of innovation in how construction employment takes place, have created an opening for this type of job marketplace to grow.

Pandemic boost: Moderate ▬

Notable startups:

TradeHounds
(founded 2016, **$4.9M** total funding)

Core (AKA Crews by Core)
(founded 2020, **$4M** total funding)

Tools that are early in development:

3D printing

Overview:
These solutions create full walls and buildings, often made of concrete, by using an extremely large-scale 3D printer. Proponents advocate 3D printing as a fast, material-efficient, low labor method of producing buildings.

Outlook:
Still far from having a major impact on most nonresidential construction, the future for 3D printing in the next few years is brighter for single-family construction or unique circumstances like military applications.

Pandemic boost: **Low** ▼

Notable startups:

ICON
(founded 2017,
$44M total funding)

Branch Technology
(founded 2014,
$7.2M total funding)

Robotics

Overview:
Specifically aiming to increase construction efficiency by replicating repeatable tasks, like brick laying or rebar tying, with robots rather than human labor. With the addition of AI, this sector is developing for more advanced tasks, including fully automated excavation or interior chalk lining.

Outlook:
This sector is at an early stage of development, and the potential risks and liabilities are extremely high. Robots are expected to be used on a limited basis or for pilot projects for at least the next few years.

Pandemic boost: Moderate ━

Notable startups:

Built Robotics
(founded 2016,
$48M total funding)

Dusty Robotics
(founded 2018,
$7.2M total funding)

Augmented/ Virtual reality

Overview:
This group of technologies builds on existing data from scanning and drones, which when loaded into cloud tools, can recreate a virtual environment for teams to inspect, analyze, and plan projects both as they are built, and in a final design state.

Outlook:
While still relatively early in the development process, both AR and VR have the potential to become standard on projects. However, they will only work on projects with high adoption of other forms of tech that would be required for integration.

Pandemic boost: Moderate ━

Notable startups:

Mira
(founded 2016,
$22.7M total funding)

IrisVR
(founded 2014,
$13.7M total funding)

Need more info?

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