



MAY 29: PRE-CONFERENCE EVENTS
MAY 30-31: EXHIBITS & CONFERENCES
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The Art, Science + Business of Housing

PCBC 2019: TOP FIVE TECHNOLOGY TRENDS

PCBC is the leading homebuilding show standing at the richest intersections of human, intellectual and financial capital. Providing ample opportunities for quality, connection and dialog with industry experts, product manufacturers and influential builders, PCBC creates a unique environment for business building and innovation.

This year, PCBC will do more than ever before to highlight the important technological trends shaping the future of the homebuilding industry. PCBC's New Technology & Energy forum features a self-guided technology product tour and this Technology and Trend report document: designed to give show goers a context on which to hang the technology discussed in the educational sessions and found throughout the show floor. 2019 attendees will attend sessions on topics including connection and 5G, augmented reality and visualization, cloud-based mobility, and robotics and AI in the smart home. On the show floor, attendees will discover a mix of automation, virtual, security, connectivity, green and artificial intelligence technology. These tools will come together to help homebuilders select the best tech to create affordable, secure, sustainable, convenient and delight-filled housing.

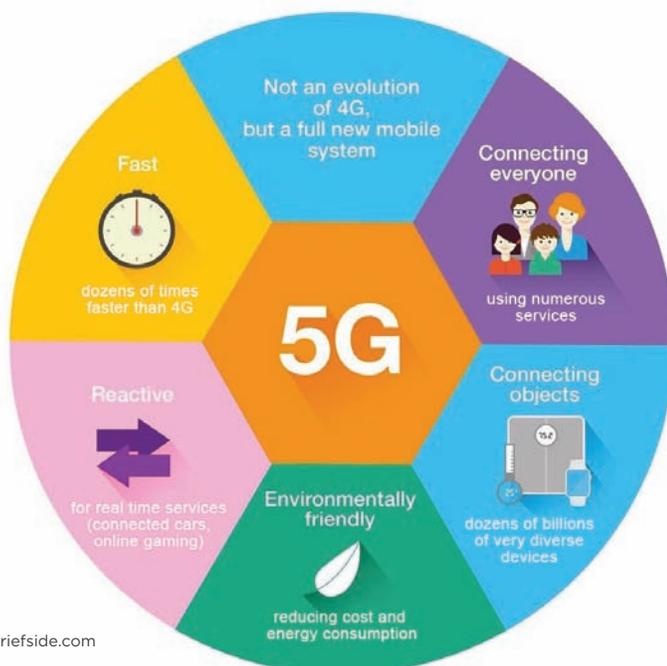


Trend: The Future Home is CONNECTED

One of the most significant trends to hit the housing market in 2019 is the smart home. New advances in networking technology (5G) and miniaturized computing power have launched an explosion in Internet of Things (IoT) connected devices that personalize experiences across every aspect of our lives—including the place that we live. Fueled by a significant drop in tech manufacturing costs and major advances in Machine Learning (ML) and Artificial Intelligence (AI) some reports suggest¹ that the smart home market will double or even triple by 2022.

IoT investment is expected to pass the \$1 trillion mark by 2020, funding a 30 percent annual growth rate in cellular IoT connections.²

This ever-increasing need for cellular connections is one of the reasons that 5G will become ever more important in the housing market. We've nearly maxed out our capacity for creating new cellular connections using existing technologies. 5G encompasses a new set of tech tools that allow us to fit a lot more connections into the available airspace (spectrum) which in turn will make room for the forthcoming explosion in smart homes.



Convenience (and Consistency) are Key

While talking toilets drive novelty and fill press releases, the bulk of current IoT home gadget buying is about convenience. It begins at the door, with smart locks and security monitoring, moves inside with voice applications that turn on lights and entertainment, and travels on to the workplace in the form of home security (as well as nanny and pet) monitoring. Dwellers love their home gadgets, yet can quickly find themselves overwhelmed by too many hubs, remotes and interfaces. Many builders are shying away from the business of building or managing these interfaces and are turning to major platforms using smart speakers (like Alexa, Google Home and Apple Homekit) to unify the interface and tie all the pieces together. Unfortunately, not all apps work equally well on each of these platforms. Over the coming months, builders will be looking closely to see which of these platforms come out on top.

Connected and Compatible — Is WiFi the new Home Automation Standard?

While competing IoT standards like Z-Wave, ZigBee, DECT, ULE and even Bluetooth duke it out in the smart-home industry, one format seems to be full-steam ahead. That format is WiFi. Dubbed the surest way to the Internet, WiFi speaks directly to the router over a home network. WiFi has challenges—it is notoriously power-hungry and devours batteries, the signals have to compete with tons of other traffic online, and WiFi devices stop communicating if the network goes down. However, as WiFi is nearly ubiquitous in modern homes, WiFi-enabled smart devices are easy to set up and tend to work right out of the box. Thus, many of the top Smart Home device application manufacturers have turned to WiFi for their initial product offerings, and this format appears to be in the lead at least for the moment.

The Digital Doorman

Market penetration for keyless entry and ignition fobs for passenger vehicles has been growing at a healthy clip, so naturally people are seeking the same sort of convenience for their homes. Traditional lock companies have teamed up with IoT smart hubs like Alexa and Google Home to allow a grocery-laden dwellers to enter their home at the sound of her voice or the proximity of their smart phone. The digital doorman is also responsible for another key job—that of managing packages. Home deliveries from companies like Amazon and Walmart currently make up nearly 10 percent of all retail sales. Unfortunately, a rise in package deliveries has also driven a rise in package thefts.

This has driven innovative technologies designed to thwart package theft like smart lockers as well as entry systems that work with traditional locks and garage door openers that give delivery people codes to unlock cars, garages or even the front door to place packages inside.



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But while the digital doorman can prevent unwanted package thefts, there is also a risk (however slight) of security breaches caused by the technology (representing a unique potential legal risk for builders). Smart builders (and dwellers) will need to educate themselves on good digital security techniques including proper management of passwords to ensure that nobody “bribes” the digital gatekeeper at the door.

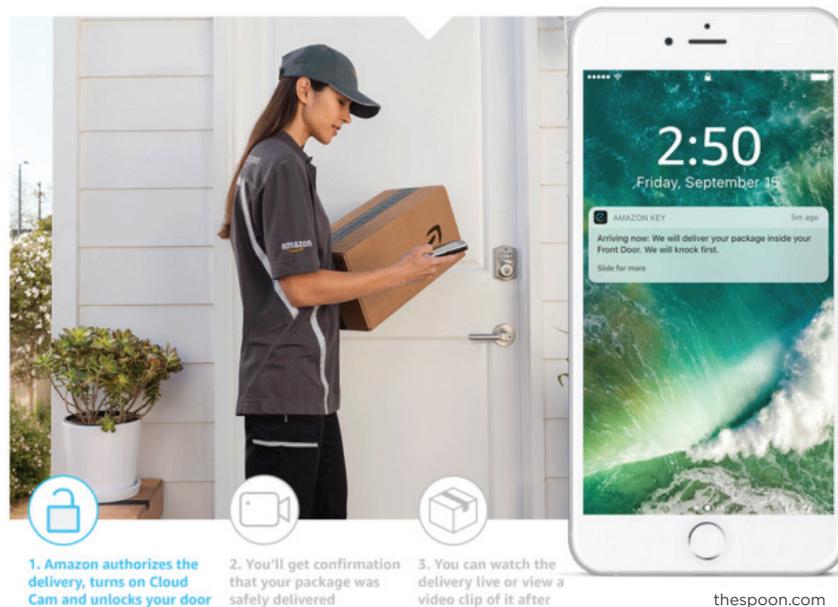
The Digital Entertainer

With both men and women working longer hours than ever, dwellers are increasingly turning to technology to curate a home experience. Smart lighting manufacturers and their partners can create the perfect mood with a simple swipe on the smart phone or audio command to a smart speaker. Roller shades can automatically raise or lower based on time of day or voice commands. Screens lit by short throw projectors may descend from the ceiling, and entertainment systems may automatically play your favorite music, news or TV show.

Wondering who’s in the kitchen? Chances are, you’ll have significant digital help in there as well. Many major home appliance manufacturers have created spectacular digital kitchen suites that do far more than remind you when to buy more milk. These systems are designed to recognize the food you put in the oven (that’s asparagus) learn the way you like to eat it (crisp tender) and automatically cook the food without external output or programming. Won’t be long before digital home systems are also mixing up martinis and walking the dog!

“We get insights from the fridge. It has a friggin’ camera in it. ... Wow, this guy really loves onions. He’s Shrek! Let’s give him more things with onions!”

– Lisa Fetterman, Founder/CEO, Nomiku⁴



The Digital Security Guard

Aside from opening the door to dwellers (and their packages) smart homes are utilizing a variety of smart surveillance tools and cameras to keep the bad guys out. These cameras have become so pervasive that some are now calling the IoT the “Eyes of Things.” Amazon recently paid over \$1.1 billion to acquire leading video doorbell supplier Ring. And a recent study indicates³ that all-in-one smart home security systems are expected to increase from \$3.4 billion at the end of 2018 to \$4.8 billion by 2025. These security systems which can contain everything from iPhone app connections allowing you to watch nannies and pets while you’re away to drone surveillance systems, allow home owners peace of mind without requiring expensive installations or costly monthly fees.

Trend: THE FUTURE HOME IS RESPONSIBLE

Home buyers in general (and up and coming generations in particular) see themselves not only as dwellers and neighbors, but also, as global citizens. Younger dwellers have less interest in homes as status symbols and more interest in homes that reflect their hobbies, causes and personal values.

New Homes are Flexible and Space Efficient

Over the past decade we've seen an increasing move towards urbanization. As of the last census⁵, over 80 percent of US Citizens now dwell in cities. The move downtown has had a significant impact on what buyers seek in urban properties. They own fewer cars, and in areas of the country where space is at a premium, the 3-car garage is more likely to be used as a rentable AirBnB flat. And it's not just in the garage where families are seeking to reclaim space. While the traditional house is built for a nuclear family (Mom, Dad and 2.5 kids), only 20 percent of current households fit that description.⁶ New technologies like moveable walls, flexible floor plans, multifunctional furniture and space-saving solutions are needed to make housing attractive and adaptable for families that change from day to day. This flexibility extends to various ages of dwellers as well. Many "sandwich" families need to support both children and aging parents in the same house. Features such as variable height counters, pull down cabinets and ADA compliant restrooms are expected to look great while keeping all family members safely supported.



enviroboards (made from agricultural waste fiber such as straw and grass). However, customers are especially interested in building products that offer a high-tech edge as well as an ecological halo effect such as cement that absorbs and emits light,⁹ solar roofing tiles,¹⁰ furniture created from corn (biomade),¹¹ and bricks manufactured from cigarette butts.¹²

Over 3.5 billion pounds of carpet and 3.7 trillion pounds of construction debris create landfill annually.¹³

2008 marked the turning point...for the first time ever, the majority of the world's population called urban centers home.⁷

New Homes are Globally Responsible

The notion of being a good global citizen is increasingly important to dwellers—especially younger ones. Dwellers have come to expect smart technology that will help them lower their energy use and costs. Smart thermostats are used to monitor when dwellers are home and what temperatures they prefer.



Half of home buyers and renters under 40 years of age actively seek out eco-aware properties, and about one third were willing to pay extra for these features.⁸

Conscious customers are also seeking dwellings built with sustainable materials such as sheep's wool, filterpave (porous pavement made from ground glass and recycled materials), recycled paper, self-healing concrete (made with self-activating limestone producing bacteria), and

New Homes are More Affordable

With an ever-expanding need for affordable housing, some cities like San Diego have even opted to reduce the required number of additional parking spaces required for housing located adjacent to public transportation. Builders are constantly seeking ways to cut costs while retaining high product quality. One important cost cutting measure is utilizing lower-cost/high-tech building materials. Often sold as systems, these building materials may offer better insulation or may protect buildings from earthquakes and fires while simplifying installation and thereby cutting costs.

Trend: THE FUTURE HOME IS VIRTUAL

With 95 percent of home buyers searching for real estate online and over 50 percent actually finding their ideal home there,¹⁸ technology is profoundly changing the way we search for, visualize, review, select and decorate our homes. New tools and services have been developed to improve products that had been created digitally while completely revolutionizing and digitizing products that were previously only available in the tactile/analog world.

Drafting and Rendering Services Go Real Hollywood

Creating a home rendering is certainly not new. Drawing and painting pictures depicting what a home or building might look like began centuries ago with pencil and paper. For many years, drafters have created traditional blueprints detailing how houses and buildings should be made. More recently these processes have been replaced by rendering and CAD/CAM tools. What's new on the horizon is the migration of hyperreal visualization technology from the advertising and movie making industries to architectural drafting and rendering. High-end service bureaus provide not only photo realistic static renderings, but also animations and interactive AR (Augmented Reality) and VR (Virtual Reality) installations that allow one to physically walk through spaces that previously existed only in the mind of the designer and

architect. The appeal of AR and VR offer far more than gimmick appeal. AR and VR allow potential buyers to physically and emotionally experience a potential space in a far more visceral way than a mere drawing—helping to move the needle in the sales space. That's why exclusive home sellers like Sotheby's are beginning to show luxury homes in VR formats. Another reason is the relative expense of creating the model home or model unit for a multi-unit dwelling. Photorealistic AR and VR can be quite expensive. However, when compared to the six or even seven figures required to build a model unit, these virtual technology prices are relatively modest. And it allows one to change decorating, trim and color choices at the touch of a button.

Goldman Sachs predicts the VR and AR market in Real Estate will reach \$80 billion by 2025, and that by 2020, over 130,000 real estate agents will be using VR to sell property.¹⁹



real3dspace.com

“This technology will be highly proficient in unlocking the international investment potential within the world's real estate markets. VR/AR will reach buyers on a global basis and create an increase in foreign investments. This is the future of technology and soon buyers will be able to look at properties in New York while they're sitting at dinner in China.”

– Alex Chieng, A & L Real Estate Team²⁰

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Open Houses / Client Walk-throughs Move Online

In today's fast-moving world, demand has increased for the replacement of physical walkthroughs and open houses with virtual walkthroughs and Facebook Live real estate showings. Property owners no longer need to keep their house pristinely clean for months at a time, nor do they need to pack up the kids to leave every Sunday. Realtors get to spend their time with better qualified prospects that have buying on their mind as opposed to nosy neighbors and Sunday browsers. And buyers can get a better sense of what is available while browsing the web in their jammies at home.

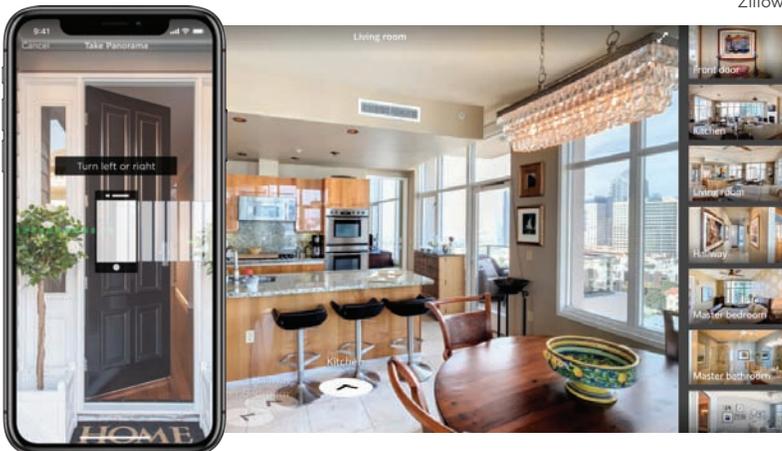
For those interested in purchasing products in multi-unit dwellings, sexy touchscreen presentation products allow potential buyers to tour multiple available units from the comfort of the conference room. Realtors are learning to work together with a cell phone "camera person" to capture the immediacy and trend power of Facebook Live in live-streamed property showings. Zillow takes the DIY walkthrough process even further with their new free 3D Home product which allows you to use the panorama feature on your iPhone to rapidly capture an entire home, from which they will create and build a 3D version of your capture and offer it to prospective buyers with your listing.

Visual Design Tools go DIY

The increase in cloud technology as well as high speed communications has allowed what was once the proprietary space of render-farm-equipped service bureaus to move to smaller architectural, design and building firms. New DIY 2D and 3D modeling tools enable secure, real-time collaboration among architects regardless of physical location, size of office or internet connection speed. Some of these tools offer white label systems to manufacturers allowing consumers to design their own floors or fences.

Consumer access to high end AR design tools continues to increase. IKEA's new app allows customers to see what that flat pack sofa will look like in front of their wallpaper. Lowe's now offers an android augmented reality app called "View in Your Space" that lets you see what the patio furniture will look like in your backyard. Lowe's has also pioneered "Holorooms" where customers can don VR glasses walk around a virtual room they have decorated or even learn how to use power tools.²¹ Aside from allowing customers to have a better idea of what they would like to see in their homes, these apps are further familiarizing consumers with AR and VR and driving both awareness and acceptance of these technologies.

Zillow



"As technology advances, experiencing a property can be achieved in ways other than actually visiting it. It is now a common practice for tenants to commit to a lease for an apartment they have never toured."

– Lee Kiser, Kiser Group²²

Trend: THE FUTURE HOME IS AUTOMATED

Ever since Joseph Henry pioneered the electric doorbell in 1831, we have had a passion for home automation. But today's automation technology extends far beyond the doorbell. Recent market research indicates that nearly 20 percent of homeowners use at least one automated home feature, and 60 percent are interested in owning a home with greater automation. Business Insider and Forbes predict that home automation²³ will soon become a \$1.7 trillion market.

Similarly, automation is revolutionizing the home construction process. With a shortage of workers looming over the housing market, automated tools that can take the place of workers or reduce the number of workers necessary are more important than ever. From drones and security systems that automatically monitor job sites to robots that can lay bricks or create house frames complete with windows, plumbing, insulation and electricity rapidly within a factory, robots and automation are changing the way we build homes.

Energy and Security

Imagine if no father ever had to say again, "Shut the lights off! Do you think we're made of money?" Home automation can go a significant way towards paying for itself in terms of better managing resources. Lighting systems utilize sensors and turn lights off when no one is in the room. Smart thermostats can lower energy consumption when no one is home or dwellers are sleeping. Water systems can shut down those half-hour teenage showers, shut off the sprinklers when it rains and find leaks and problems that drive energy and water bills up.

Home automation for safety and security have also come up a notch. Smoke detectors are enhanced with radon gas and carbon monoxide detectors. And electronic systems can remember that the housekeeper comes at 4PM on Tuesdays and relay a video from the front door to a smart phone so adults can decide whether to let her in. What's more, when the kids come home from school parents get a video text that not only assures them the kids are home safe, but also, confirms that the pesky boyfriend didn't come along too. These sensors can even tell caregivers that their aging parent didn't turn on the light in the kitchen or bathroom today and send a text alert asking for help. This personalization moves home automation outside of the notion of gimmick or even convenience to the realm of reassuring dwellers that all is well when they are away.

Zions Security



“Smart home technology allows a home to take a different position than just being an inanimate object—it creates an emotional relationship. Before you had a door lock. Now you know that your kids are home safe when you're not there. The promise is the personalization.”

– CR Herro, Vice President of Environmental Affairs, Meritage Homes²⁴



familyhandyman.com

The 'Fault with Default'

When discussing connected devices, security and privacy are of primary concern. One of the biggest challenges in any 'smart home' is the lack of education most homeowners have around the settings of their devices. IoT devices come with default privacy and security settings which tend to be focused on simplicity for the homeowner as opposed to safety. Home implementers will need to communicate security and privacy by offering insights around managing settings.



Tying it all Together

As technology improves and prices for components drop, home automation has moved beyond the luxury home to middle of the road housing. But not all home automation systems work together. And what's more, it's not entirely clear which system will win out. Many systems are tied together via simple WiFi and Bluetooth and are accessible via computer, smart phone and tablet. However, other systems such as Zig bee and Z-wave, Insteon, UPB, Thread and Apple Home Kit are less ubiquitous. Thankfully, some companies have stepped to the front, developing convenient and economical all-in-one home automation kits for home construction companies. What's more, companies are upping their "techorating" game offering wireless/ no cables lighting and audio which improve the automation in the house without requiring expensive or ugly wiring setups.

Robots in Home Construction

A recent survey by the Associated General Contractors of America found that up to 70 percent of construction crews are challenged to find skilled workers including framers, bricklayers and carpenters. This shortage, which has been worsening since the recent housing crash, had also driven a rise in housing costs. Construction companies have begun to put greater reliance on prefab printing and building as well as robotic construction to fill the gap.



Construction Robotics

"We're at a tipping point where it's finally just gotten too expensive to build the old-fashioned way."

– Margaret Whelan, CEO of Whelan Advisory and an investment banker for the home building industry²⁵

Construction companies are looking to new techniques not only to manage the talent shortage and cut costs, but also, to finish desperately needed affordable housing more quickly than ever before. Prefab companies create trusses or large segments of house framing complete with windows, plumbing, electrical wiring and insulation in chiseled large panels in a single day. And unlike prefab homes in the past which were built on a limited number of models, modern factory plants can churn out flat panels to any blueprint the builder requires. This process can cut the time required to build a home by as much as 50 percent.²⁶

Along with prefab construction, other automated tools are coming on line. Construction Robotics has developed SAM (short for Semi-Automated Mason)²⁷ to do robotic bricklaying. This process can lay 2,000 to 3,000 bricks in an 8-hour day (compared to 400-600 for a human mason). Construction Robotics has also introduced MULE, a Material Unit Lift Enhancer which makes it easier for construction workers to lift heavy objects (up to 135 pounds) such as cement blocks on the job site. Companies like ICON are using 3D printing robots that can print the walls, roof and floor of a 650-foot house in as little as 12 hours.²⁸ Robots are also being used to prepare job sites—allowing bulldozers, excavators and other vehicles to operate autonomously.

Even job site supervision is moving towards automation. Cameras, particularly mounted on drones are used to survey job sites to measure materials. Projects that once required a contractor an entire day with a truck mounted laser can now be completed in 25 minutes utilizing a smart drone. Drones are also being used to help keep job sites secure.

Trend: THE FUTURE HOME IS MOBILE

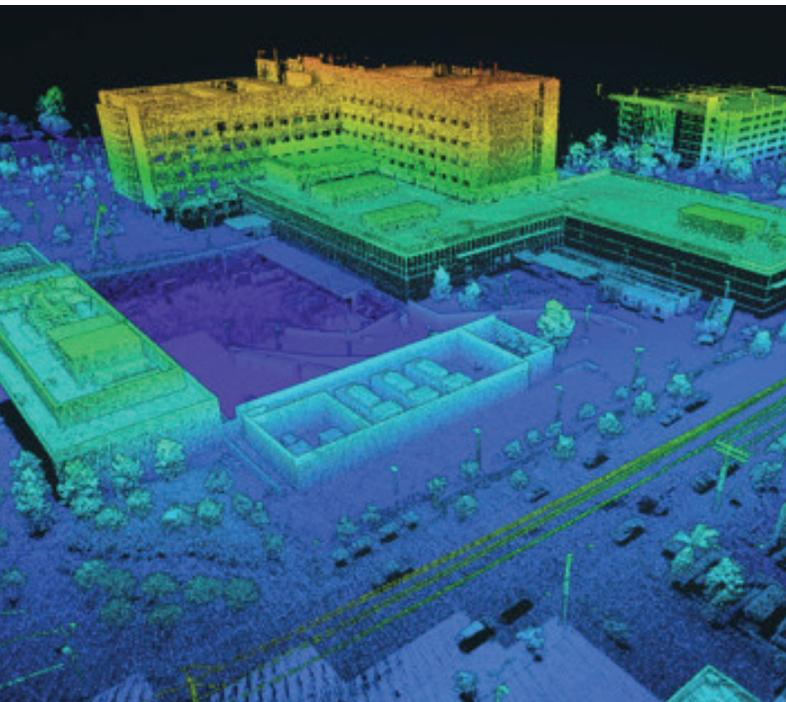
Ask most people what houses are built from and they will suggest materials like bricks and wood and stone. Ask some builders what homes are built from and they will say, “data.” Every building project contains thousands of discreet bits of information including codes, inspections, job orders, material estimates, customer walkthroughs, bids and so much more. In the race towards greater efficiency and profitability in the home building market, it may just be the company with the best data management who will win. Data management also includes the data required to make the sale. We are quickly moving away from simple demographics towards psychographics—an intimate understanding of what physical, intellectual and emotional needs must be met in order to move the needle towards an initial sale.

The real question that needs to be answered is how that data is managed after it is collected. According to consulting firm McKinsey, costs and schedule overruns were the norm in the construction sector.²⁹ Large projects typically took 20 percent longer than estimated and were up to 80 percent over budget. Project planning (often done on paper) often lacked coordination between office and the field. Contracts were also not coordinated or digitally stored. And supply chain management was antiquated at best. Until very recently, construction was among the least digitized of all industries. Couple this with the demand for green building materials, the affordable housing crisis and relative drop in available housebuilding workers and you have a construction industry ripe for disruption.

Surveying and Geolocation go High Tech

One major reason projects get delayed and over budget is geological surprises. Particularly in a market with increased government regulation and customer desires for green and healthy housing, rapidly determining which building sites are healthy and safe is a high priority. Drone and UAV (Unmanned Aerial Vehicle) technologies have a big part to play here. When connected with new techniques in 3-D laser scanning, geographic information systems, high definition photography and LIDAR (which uses optical lasers to detect thousands of points per second) these far ranging scans can be inexpensively and rapidly integrated with project-planning tools such as Building Information Modeling (BIM). When connected with detailed geographic information systems, surveying can be done more quickly and with greater accuracy than ever before.

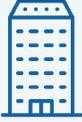
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Best CAD Practices

5-D BIM

There is a need for a single source that provides a coordinated, real-time view of all aspects of a project—including schedule, cost, materials, process and design. Enter 5-D Building Information Management—a five-dimensional representation of the physical and functional characteristics of any given project. It contains the three dimensions with which we are most familiar—height, width and depth representations of the design and plan for the dwelling, and then adds two additional dimensions—project costs (money) and schedule (time). This information is then synthesized into a format where project owners can quickly and easily see what impact any impending change may have on the project design, materials, cost and schedule, and allows project planners to identify problems earlier in the game and brainstorm possible solutions. Ultimately, we can expect these visualization systems to go immersive with technologies like AR and VR.

WHAT YOU BUILD	WHEN YOU BUILD	HOW YOU BUILD
<p>3D Building/ Model</p> 	<p>4D Time/ Schedule</p> 	<p>5D Cost</p> 

‘It is the death of the enterprise and the birth of the ecosystem. A small independent business that tries to specialize in something is better than a bigger company that tries to do everything themselves. Just imagine companies being the best at what they can be at and working together to produce an enterprise level solution through ecosystems.’

– Matthew Jackson,
Global Manager of the Hercules Platform, BIMobject³⁰

A SaaS-y Sort of Collaboration

One key development in the digitization of construction is the spate of new Software as a Service (SaaS) providers who offer online platforms enabling real-time sharing of information with project team members anywhere in the world. This is particularly important as so much important data was previously stuck in the analog chasm between the field and back office. Various SaaS platforms allow builders instant access and search capability for everything from client walkthroughs to part supply catalogs to permits to project bids. The addition of sensors and cameras (both still and video) allow builders, contractors, homeowners and inspectors to literally see eye-to-eye on what is happening on a job site. Onsite workers can access all this data via their laptops, tablets and mobile phones. Post project, myriads of data wranglers can find commonalities and “learn” how to do the next project more efficiently with lower costs. Eventually we can expect a lot of this data wrangling and machine learning to be automatically analyzed by computers utilizing AI and Machine Learning.

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Oracle

The Science of Sales

Data companies help developers and real estate agents develop a much more nuanced look at neighborhoods and who potential buyers are. These companies move beyond demographics (basic information about age, income, gender and profession) to psychographics—a more detailed look at what a potential buyer needs to flip the switch from prospect to sale.



Kapture

Of course, once you acquire a customer, you need to keep them. That’s where technology support companies come in with outsourced digital customer service and customer relationship management. When coupled with a SaaS that tracks every aspect of the project process as well as digital record taking from job site cameras, builders can focus on building and leave the delicate process of keeping customers happy to specialists in that space.



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