15 Removing Chaos from Construction and Intermediaries from Transactions

What Every Business Can Learn from Real Estate Tech

Construction is amazing. High-tech structures reach through the clouds and defy earthquakes. Beautiful architecture improves the livability of our cities. Millions of homes provide shelter to billions of people, giving them a place to raise families and live out their lives. Global real estate is valued at around $300 trillion (Source: Savills).

The Challenge: Mistakes, Margins, and Glacial Transactions

Construction is dangerous, difficult work that is plagued by human error and still runs off 2-D plans. Skilled labor is in short supply, project schedules are tight, and complexity is high. Real estate transactions are glacially slow and result in ridiculous piles of paperwork. The sector is ripe for change.

Costly Mistakes, Skills Shortages, and Safety Issues Constrain Construction

If you've overseen a construction project, or a home remodel, you know that mistakes and rework are all too common. Plans are imprecise, poorly specified, or impractical to build and creative workarounds are required on the job site. Construction is dirty, demanding, and sometimes inexact work that's prone to error. As testament, note how baseboards, light-switch covers, and door jambs all hide imperfections. Common estimates are that

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rework accounts for about 10% of the cost of most construction projects. With industry profit margins at 4–5%, that's significant. The number one challenge reported by 80% of construction companies is a limited supply of craftworkers (Source: AGC/FMI risk management survey, 2019). One in five deaths in private industry occur in the construction business (Source: U.S. Department of Labor). In 2017, there were 14 deaths in U.S. construction *per day*.

Transaction Friction Impedes the Real Estate Market

Markets operate more efficiently when transaction friction is reduced or removed. When stock exchanges left paper behind and moved transactions onto computers, global markets flourished. With the emergence of internet trading, broker fees dropped from hundreds of dollars to 10 bucks or less. Trades execute in fractions of a second. Contrast this with the real estate industry: In 2018, the average mortgage-financed U.S. home purchase took 45 days. Real estate transactions in the United States are horrible. To buy property you must sign a stack of paperwork two inches thick and grease the palms of many intermediaries along the way. The process isn't much different in other countries.

Purchases incur significant fees, errors in public records are common, bureaucracy is high, and transactions move at a snail's pace. High fees and a paper-based workflow deter sales and depress real estate markets.

Generative Design Transforms Architecture

Autodesk, the pioneer in generative design, makes a suite of architectural design tools that allow architects to enhance their design sensibilities with the smarts of an AI. Architects determine the high-level goals and constraints of a project and use computer-based tools to automatically generate hundreds or thousands of design options. The tools sort the options, assess each against project goals, and guide the designer toward optimal solutions. Architects co-create buildings with the AIs. The AI gives the architect greater freedom to explore radical ideas. The design tools find the best ways to bring those ideas to life. This approach enables designers to explore a far wider range of design options than they could alone.

Business Insight: Collaborative AI Increases Creativity and Boosts Productivity

Collaborative AI, in the form of generative architecture design, has proven a powerful tool. It enables architects to achieve more, and to produce more thoughtful, bold, and creative designs. The result is more beautiful architecture, more efficient buildings, better sustainability, lower cost, less waste, and reduced project times. Collaborative AI will show up in every industry. It has the potential to boost the creativity, impact, and productivity of most knowledge workers. Watch carefully for developments in your industry and get ready to embrace collaborative AI as a way to turbocharge your workforce.

From 2-D Plans to 3-D Augmented Reality Models

Most architecture is designed with 3-D software, yet buildings designed with a modern Building Information Model (BIM) are still described to construction workers using flat, two-dimensional blueprints. Augmented reality (AR) headsets keep plans in three dimensions and project them onto physical space to show workers where things need to go. This aids comprehension and reduces errors. AR headsets are suited to all phases of construction but are particularly useful for mechanical, electrical, and plumbing (MEP) systems. Seeing exactly where an air duct needs to go is way easier than trying to interpret 2-D paper projections.

Site inspection is a manual task. Building measurements are taken and compared against printed plans. SRI International's AR-based inspection system tracks the location of an inspector as they move through a site. The inspector visually compares what is being built against plans from the BIM, which are overlaid in her field of view. The solution speeds measurement, using sensors on the headset to measure distances and automatically highlight disparities with the BIM. Blue tape traditionally used to mark the punch list is replaced by holographic markers. The inspector attaches digital photos and notes to guide rework and create a detailed record of the issue so it can be tracked to closure. As AR capabilities improve, AR headsets will become a common sight on most construction projects.

Business Insight: Augmented Reality Limits Mistakes and Helps Hands-Free Workers

The use of augmented reality, particularly to translate 3-D plans onto physical spaces, aids comprehension and makes construction workers more efficient. As the capabilities of AR headsets improve, they will provide valuable support to a wide range of hands-free workers, guiding them to perform tasks and auditing their work. Plans, visualizations, and 3-D work instructions inhabit a worker's visual perception and align directly with the work in front of them. Relevant contextual working data is presented as a heads-up display. The result: increased productivity, quicker decisions, and fewer errors.

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Robot Construction Workers, Drones, and 3-D-Printed Structures

Construction is labor-intensive, from architectural design, to building and final inspection. The industry employs many skilled workers—carpenters, electricians, plumbers, ironworkers, roofers, and joiners—and very little work is performed autonomously. In a 2019 survey, 63% of construction companies report using drones in their operations, while only 14% use on-site robotics (Source: AGC/FMI risk management survey).

Robots are starting to enter the construction workforce. A good human bricklayer can lay about 500 bricks each day. SAM-100, a robot made by Construction Robotics, lays up to 3,000 bricks in a single day. SAM-100 is a cobot designed to work in partnership with construction workers. A worker loads bricks onto the conveyor belt that feeds SAM-100's bricklaying arm, while another worker strikes the wall to remove excess mortar. SAM-100 is fast, but messy.

Hadrian X, a robot made by Australian innovator Fastbrick Robotics, lays bricks like a giant 3-D printer, using a 30 m (90 ft) boom. Hadrian X self-stabilizes and lays bricks with precision, even in windy conditions. It lays a combination of standard and large bricks, 12 times larger than standard house bricks, and fuses them together with adhesive that dries in just 45 minutes. The result is a home with improved thermal and acoustic properties over traditional mortar. Walls for an entire house can be built in one to two days. The process is cheap, creates no on-site construction waste, and is much safer for workers.

The Advanced Industrial Science and Technology (AIST) institute of Japan is developing a robot to hang drywall. The catchily named HRP-5P robot is not as fast as humans but is effective and methodical. Designers gave the humanoid robot additional limb joints to aid it in its work.

Construction drones conduct site surveys, oversee work, track worker productivity, assess progress to goals, document project milestones, perform safety audits, and ensure compliance against plans. These human-piloted drones will soon become autonomous, roaming sites and gathering data with a range of sensors. Machine vision technology will watch for safety violations—improperly secured ladders, trip hazards, and failure to wear personal protective gear. Laser scanners and other sensors will compare the built environment against plans and schedules, highlighting anomalies and project slips. Some construction companies use drones fitted with FARO laser scanners to compare construction progress with the building information model (BIM). Regular inspections

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matter. The sooner issues are discovered and addressed; the more money can be saved. Better to find a wall is misaligned before you install ducting, plumbing, electric, drywall, and paint on it.

Early detection and resolution of safety issues will save lives. Boston-based construction firm Suffolk is testing technology to predict where accidents will happen. The predictive AI, named Vinnie, was trained with 10 years of accident data and images of site safety hazards donated by a group of competing construction firms. Early results are promising. Vinnie predicted one in five safety incidents, a week ahead of time, with 81% accuracy. Technology partner SmartVid claims the system reduces incident rates by 30%. The drone also performs inspections, cutting 60% off the time Suffolk spends tracking progress and documenting milestones.

Additive manufacturing, better known as 3-D-printing, is coming to construction. Giant machines "print" with cement instead of ink. Icon's latest Vulcan II cement printer can build a 650 sq ft (60 m^2) home in less than a day for just $10,000, with prices predicted to drop to $4,000 in the future. It has a build capacity 8.5 feet high by 28 feet wide (2.5 m Å~ 8.5 m), enabling it to print homes of up to 2,000 sq ft (190 m^2). Vulcan II builds resilient structures using a proprietary material named Lavacrete and lays 7 inches (17 cm) of material every second. The printer is delivered on a trailer, requires no on-site assembly and can be operated by as few as four people. Icon claims their printer cuts construction costs in half. Their first commercial project is a 3-D-printed community, built to house more than 400 people and serve low-income families. 3-D-printed buildings increase design freedom, reduce build errors, and use less concrete than traditional construction. Dutch researchers are experimenting with 3-D-printed structures made from bio-based plastics. These biomaterials can be either nonbiodegradable or biodegradable, enabling the sustainable construction of either permanent or fully recyclable, temporary structures suitable for disaster relief.

This was a short abstract from the new best-selling book, "*The Innovation Ultimatum: How six strategic technologies will reshape every business in the 2020s.*" Pick up your own copy of the book to understand more on how artificial intelligence, sensors, augmented reality and other technologies will transform the way we work, create, build, live, and communicate.

Learn more about the book, including a full review of the table of contents, at www.baldfuturist.com/book.

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