



The Built Environment Investment Thesis

January 2021



Nascent Market Opportunity

The \$40 Trillion Built World

Executive Summary

The ecosystem that supports the Built World (real estate, construction, architecture, and engineering) represents one of the largest untapped markets for technology in the world. These markets have generally been slow to adopt technology due to the high degree of fragmentation. That is, it generally takes 50+ entities to execute on a single building. This fragmentation creates a void of innovation, new technology, technology integration capability and technology leadership. Due to multiple shifting macroeconomics factors, fragmentation is receding and, as a result, resistance to widespread technology adoption is lifting. Now, generalist mainstream capital has recognized the market opportunity, creating a new source of exits and acquisitions for opportunistic investors with proven domain expertise.

The Built World includes the following markets:

- Real Estate (Retail, Office, Industrial, Multi-family)
- Architecture
- Engineering
- Construction
- Infrastructure & Capital Projects
- Security
- Utilities & Energy
- Logistics, Transportation, & Distribution

Meet The Built World:

A Laggard Market Ripe for Venture Capital Opportunity

\$40TN

The value of US assets in the built world, the largest asset class in the US.

\$1.4TN

The average annual spend on the built world in the US, representing 4% of US GDP.

< 1-3%

Devoted Corporate Annual Spend To Technology and R&D

2nd

According to McKinsey, The Built World is the *2nd* *LEAST* digitized sector in the world.

Innovation To Save the Planet

“Our bridges are crumbling, roads badly need repair, airports look shabby, trains can't reach high speeds, and traffic congestion plagues every city. How could an advanced country slip so badly?”

-The Economist

“The world technically has only 1/5 of its “carbon budget”—the total is 2.8 trillion metric tons—remaining in order to avoid warming the earth more than 1.5 degrees Celsius. The built environment ... becomes the party responsible for major innovations related to renewable and sustainable energy sources.”

-National Geographic

“68% of the world population is projected to live in urban areas by 2050. Many countries and existing metropolises will face challenges in meeting the needs of their growing urban populations, including for housing, transportation, open public spaces, energy systems, water, and other core infrastructure.”

-The United Nations

A **Non-Consensus** Market

"By definition in venture capital, if you are doing it right, you are continuously investing in things that are non-consensus at the time of investment. And let me translate 'non-consensus': in sort of practical terms, it translates to crazy. You are investing in things that look like they are just nuts." - Marc Andreessen

-1%

Construction is one of the few industries globally where productivity has actually declined since 1950.

1-3%

Real Estate and Construction spending on R&D and innovation. It is among the lowest of any sector.

< 3%

Amount of venture capital in the built world relative to the total market even despite recent increases.



Why Now for the Built World?

Signals of a Market on the Verge of Large Scale Disruption

- **Thinning Margins:** There is a crisis to innovate in the building industry as it becomes more crowded, less profitable, and races to keep up with population growth.
- **Labor Shortage:** As Boomers retire, the built environment is finding fewer skilled workers than ever before increasing the urgency for automated services, robotics, and improve efficiencies.
- **Abysmal Productivity:** Productivity in construction has not only slowed, but also decreased to levels unseen since 1968, making the decline the worst for any industry other than hunting.
- **Environmental Crisis:** Global countries and private organizations are facing challenges a crisis with concerns about the climate/environment, evolving sustainability standards, and meeting the infrastructure needs of growing urban populations.
- **Ubiquity of Tech/Lower Price of Tech:** Unlike a decade ago, owners, investors, lenders, appraisers, builders, designers, and subcontractors carry smart devices in and around buildings/sites constantly. With the proliferation of open APIs, technology infrastructure (AWS), rapid prototyping, and startup tools, young companies are able to start and grow more cheaply than ever before (decreasing the cost to the end user).
- **Mainstream Capital & Exit Potential:** The market opportunity has attracted the attention of large generalist Series A+ institutional investors like Sequoia, Andreessen Horowitz, Softbank, and more.
- **Proven Adjacent Market Adoption:** Advancements in compatible verticals such as 3D printing, IoT, robotics, autonomous equipment, cybersecurity, envirotech, AI, and machine learning are primed to be applied to the built environment.

Long-Standing Problems

Create Technological Opportunity

- **Labor Shortage** → Robotics, Software Automation, Data & Intelligence
- **Fragmented Communication & Siloed Workflows** → Collaborative project management software, Computer Vision, Interoperable data models
- **Environment Concerns** → Envirotech, 3D Printing, Sustainable Material Science, Facilities Management
- **Thinning Margins** → Robotics and Automation, Prefabrication/Modular, 3D Printing, Advanced Software, Real Estate “Fracking”
- **Abysmal Productivity** → Robotics, Data, IoT/Facilities Management
- **Underutilized Assets** → Real Estate “Fracking”: Shared Economy, Space Utilization, IoT/Facilities Management
- **Payment Issues** → Smart Contracts, applications and platforms facilitating transactions for real estate-related services, including lending, brokerage, titling, wealth management, payments, insurance, titling.
- **Friction** → Most interactions today in the industry have a notable amount of friction between involved parties (interaction with brokers, tenants, financiers, owners, general contractors, subcontractors, etc.)

Built World Technology

Technology to automate, streamline, and improve the way we buy, build, and manage buildings and infrastructure; includes terms like Construction Tech, Real Estate Tech, Prop Tech, Design Tech, Infra Tech, and Enviro Tech.





Our Investment Scope Includes...

- **Architecture, Engineering, Construction Technology:** drone surveying software, autonomous equipment, 3D printed materials and houses, augmented/virtual reality design tools, BIM (building information modeling), architecture and design software, collaborative project management software, machine learning and AI for capital projects, smart cities/grids.
- **Smart Building Technology:** IoT and connected buildings, augmented and virtual reality, space utilization sensors, platforms for managing water, waste, and energy, streamlined access control, facilities management.
- **Property Technology:** applications and platforms facilitating transactions for real estate-related services, including lending, brokerage, titling, wealth management, payments, insurance, titling.
- **Modular/Industrial/Offsite Construction:** "picks and shovels" technology products supporting advances in offsite manufacturing of construction.
- **Sustainability / CleanTech:** sustainable building materials, IoT platforms for reducing water, waste, and energy consumption, clean air management, electric vehicles (EVs), EV charging, transportation, solar power, energy storage, or energy management.

Window of Opportunity

VC Funding Trends Show We're Just In The First Inning

7,117

Number of private tech companies serving the built world that have received venture capital since 2015.

\$75.2B

Total built world VC funding globally since 2015.

324%

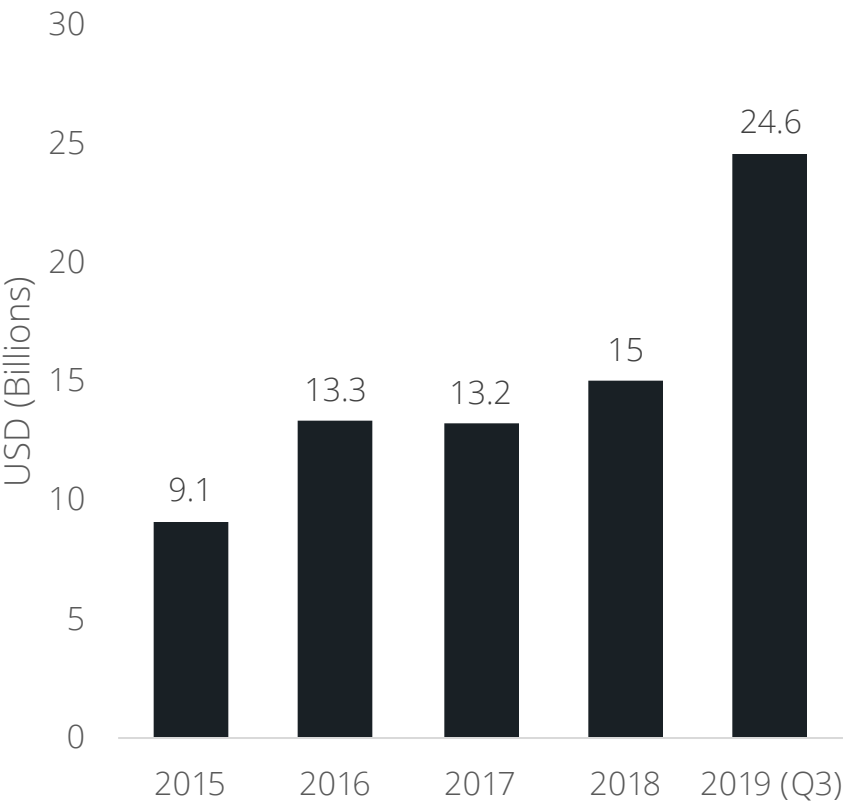
Growth in venture funding in construction technology startups between 2017 and 2018 (\$731M to 3.1B). (Crunchbase)

48%

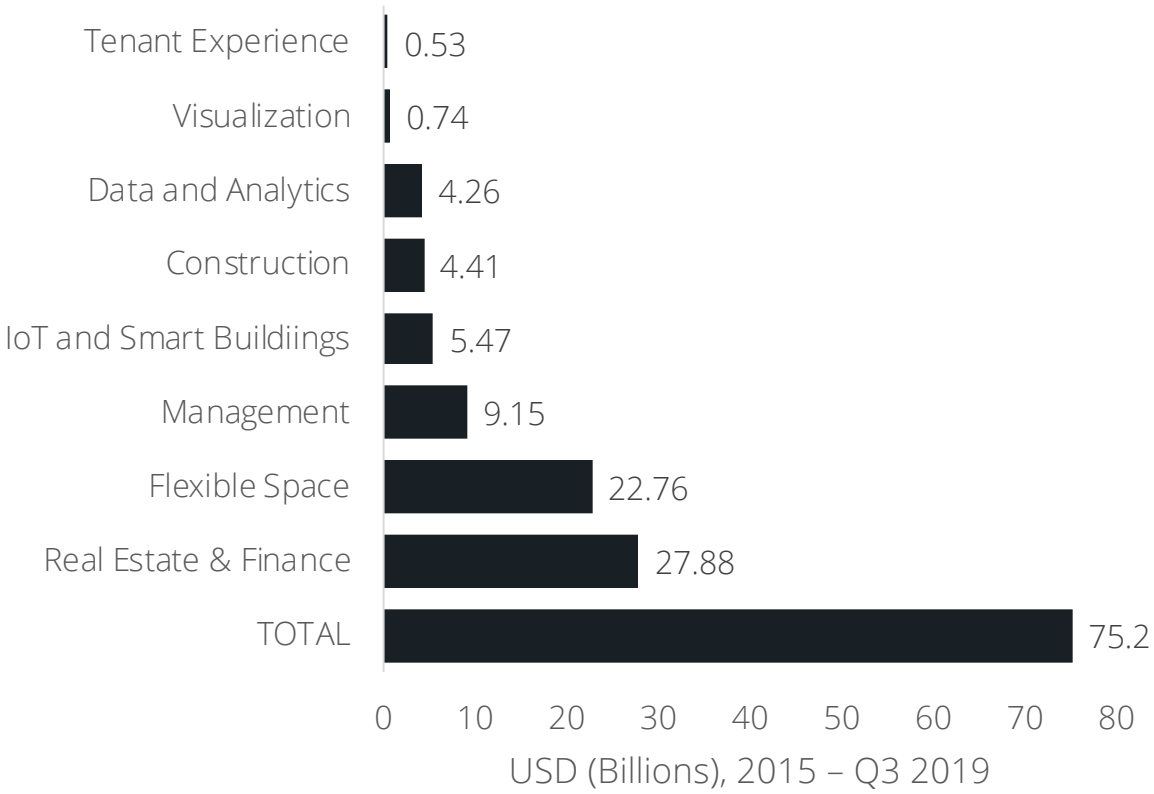
Percent of large real estate incumbents with active investments or will make such investments in the short term. (KPMG)

VC Funding Trends

VC Investments in Built World Tech



BuiltTech VC Investments by Vertical



With an influx of capital coming into the space, the question begs: where will these large institutional firms look to first to deploy funds?

Built Environment Exit Multiples

Company Name	Sector	Founding Year	Exit Year	Earliest Priced Valuation (Post)	Current/Exit Valuation	Exit Multiple from Seed*
Plangird (acquired by Autodesk)	Construction Tech	2011	2018	\$10,000,000	\$875,000,000	87.5
BuildingConnected (acquired by Autodesk)	Construction Tech	2012	2018	\$6,270,000	\$275,000,000	21.9
OpenDoor (acquired by SPAC)	Real Estate Tech	2014	2020	\$32,300,000	\$13,500,000,000	209.0
Airbnb (IPO for 2020/2021)	Real Estate Tech	2008	2020	\$10,000,000	\$18,000,000,000	900.0
Honest Buildings (acquired by Procore)	Real Estate Tech	2012	2019	\$7,500,000	\$161,600,000	21.5
Procore (IPO slated for 2021)	Construction Tech	2002	2021	\$3,060,000	\$4,000,000,000	1307.2
Porch (acquired by SPAC)	Construction Tech	2013	2020	\$14,500,000	\$525,000,000	36.2
VTS/Hightower*	Real Estate Tech	2012	TBD	\$10,600,000	\$1,000,000,000	94.3
Spacemaker (acquired by Autodesk)	Design Tech	2016	2020	\$15,000,000	\$240,000,000	16.0
WeWork*	Real Estate Tech	2010	TBD	\$15,000,000	\$2,000,000,000	133.3
Katerra*	Construction Tech	2015	TBD	\$15,000,000	\$1,300,000,000	86.7
Compass*	Real Estate Tech	2012	TBD	\$15,000,000	\$3,000,000,000	200.0
Houzz*	Real Estate Tech	2009	TBD	\$5,000,000	\$4,000,000,000	800.0
UpTake*	Industrial Tech	2014	TBD	\$15,000,000	\$3,000,000,000	200.0
Spothero*	Real Estate Tech	2011	TBD	\$8,600,000	\$200,000,000	23.3
Trulia (acquired by Zillow)	Real Estate Tech	2004	2014	\$6,850,000	\$3,500,000,000	510.9
EquipmentShare*	Construction Tech	2014	TBD	\$10,000,000	\$800,000,000	80.0
Homesnap (acquired by CoStar)	Real Estate Tech	2008	2020	\$9,000,000	\$250,000,000	27.8
Zillow	Real Estate Tech	2005	2011	\$75,000,000	\$25,000,000,000	333.3



Industry Trends & Predictions: *Innovation to Save The Planet*

Executive Summary

“Climate change is moving faster than we are”

–The UN Secretary-General

Climate change is the defining issue of our lifetimes. We are now at a pivotal juncture where every choice, every action, and every year can mean the difference between a sustainable, equitable future and the destruction of entire ecosystems.

The built environment has a critical role to play in responding to the climate crisis. Buildings are responsible for 39% of annual global greenhouse gas emissions and 40% of all raw material consumption. Real estate, as an asset class, is extremely vulnerable to rising sea levels, wildfires, floods, and other forms of extreme weather.

For investors and asset managers, climate risk is increasingly becoming a threat to their portfolios. The solution? Technology (of course) and the wholesale adoption of new business models and practices to create a more sustainable and resilient built environment.

In this report, we make the case for the adoption of emerging green technologies in the built environment as a way to mitigate the impact climate change.



Window of Opportunity

VC Funding Trends Show We're Just Getting Started

\$16BN

Total VC investment in climate tech in 2019 (6% of total VC investing)

300

Number of Climate Tech VC Deals in 2020 (tracked by Climate Tech VC)

\$75.2BN

Total built world VC funding since 2015.

49

Number of VC firms focused on sustainable investing.

Why Now For Green Building Tech?

- **Environmental Crisis:** Climate change is the defining crisis of our lifetime and it is happening more quickly than expected. The public and private sectors are up against the clock and must mitigate the impact of climate change over the next 10 years while simultaneously meeting the infrastructure needs of growing urban populations.
- **Policy Changes:** Regulators globally are enacting new legislation to specifically target the built environment with aggressive emissions goals that must be met in the next decades with fines being implemented for non-compliance as early as 2024. This is pushing owners, operators, and developers to implement new technology to meet these goals.
- **Built Environment's Role:** Buildings generate nearly 40% of global GHG emissions, 30% of global energy and 40% of raw material consumptions. About 35% of REIT properties are exposed to climate hazards underscoring the need for increased investment in sustainable practices.
- **Mainstream Capital & Exit Potential:** The market opportunity has attracted the attention of large generalist Series A+ institutional investors and corporate venture groups, with approximately \$36B invested into climate tech in 2019.
- **Changing consumer (tenant) behavior:** There is a rising demand from new generations of professionals for greater transparency and low carbon performance from their landlords
- **Ubiquity & affordability of tech:** Unlike a decade ago, owners, lenders, appraisers, builders, designers, and subcontractors carry smart devices. The basic technological platforms are already on-site and readily used by all parties for the first time.

Sector Trends

What to watch for in Green Building Tech

- **Race to Zero** - The commitments to reach net-zero from local governments and businesses globally have doubled in the past year. Since buildings are a major contributor to greenhouse gases, net-zero buildings have been popping up everywhere creating an opportunity for companies enabling that push.
- **Regenerative Design** - Regenerative design takes net-zero a step further by creating more resources than a building consumes thereby regenerating them. Regenerative projects are heavily reliant on accurate site data to create scientifically defensive metrics. *Companies like ecobot and Planit Impact help designers and planners gather this necessary data.*
- **Healthy Buildings** - Health and wellness initiatives were already on the rise prior to COVID-19. Now, indoor air quality, touchless entry, understanding building traffic flows, water quality, and thermal health are top of mind. *Companies focused in this area include qlair, Awair, and Enverid.*
- **Water Conservation** - As agencies and local governments learn of increasing water shortages around the world, waste-water has become a hot button issue. *Companies like Epic CleanTec are working to decentralize wastewater treatment while Kairos is delivering leak detection to multifamily owners.*
- **Corporate Carbon Management** - Pressure from the public sector, investors, and consumers is pushing corporates to implement sustainability policies that must be tracked for efficacy. *Companies like Sinai Technologies, Measurabl, and Sphera are empowering owners in this space.*

Sector Trends pt 2

What to watch for in Green Building Tech

- **Resilience** - Interest in resilience - designing to mitigate and adapt to changing environmental conditions -- has continued to grow. Not all resilient solutions are sustainable but technologies enabling energy and water independence could be considered both.
- **Embodied Carbon** - As we increase operational energy efficiencies, the pressure is on to begin decreasing embodied carbon. Most solutions in this space are tied to using new, low-carbon materials and understanding the impact of things transportation on a building product's overall carbon footprint. *Companies to watch include Arqlite, Beyond Transparency, Carbon Cure, and Hempitecture.*

COVID's Continued Impact

Defining our new normal

- A year later and COVID-19 is still with us and continuing to impact the way we interact with each other and the built environment
- AEC firms are adopting technology at a greater rate than before the pandemic shifting it from a **nice-to-have** to a **must-have**
- Digitalization, cost-effectiveness, and increased energy efficiency are top priority
- Socially conscious investing continues to **gain momentum**
- **Public health** and **wellness** as key components to resilience have taken center stage.
- The International WELL Building Institute (IWBI) launched their WELL Health Safety Rating system last year, an evidence-based, third-party verified rating for all new and existing buildings.

Our Predictions

Gaze into our crystal ball for 2021 predictions

- **Government Driven Expansion** - The Biden administration is committed to tackling the climate crisis head on with a goal of upgrading 4 million buildings across the country. There are similar initiatives being rolled out across the globe with a specific focus on commercial real estate and infrastructure.
- **Living Materials** - Not just green roofs and skins, but an increase in exploring biological compounds that grow. Think self-mending concrete saturated with bacteria allowing it to bind with the materials around them.
- **Increased Interest in Renovations** - Over half of the buildings in the US were built between 1960 and 2000. Look for an increase in renovations to drive energy efficiency and decrease operational expenses for owners.
- **Green or Greenwashing?** - Overall the marketplace is still going to struggle to independently evaluate green building solutions and projects outside of third parties like LEED.
- **The marketplace wants green** - Between public sector mandates and super-consumers and investors the time is now for green building.

What is Green Building Tech?

The application of Green Technology and building practices into every aspect of a building's life cycle offers significant advantages in both new facilities and existing structures, including mitigating risks from climate change. But what does Green Building technology look like in practice?

- Platforms automating LEED & green construction compliance
- Cloud software to reduce solar demand charges by actively flexing building loads
- Data driven solutions to monitor and improve indoor air quality
- Building intelligence platforms to reduce emissions and carbon operating costs
- BIM software for energy efficient facade design
- Technology enabling existing facades & windows to be retrofit with the latest energy-saving, smart glass products
- IoT technology to provide energy efficiency and demand response to operators
- AI driven building analytics platforms to enable carbon neutrality
- Innovative materials to reduce a project's carbon footprint and incorporating recycled materials

Green Building Tech Startup Landscape

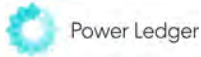
Building Management Systems



WaterTech



Energy Efficiency



Indoor Air Quality



New Materials



Design & Life Cycle Assessment



Corporate Carbon Management



**Investing in startups that
bring innovation to the built
environment.**