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SMART BUILDINGS

ABOUT THE AUTHOR

Navitas Capital is a venture capital firm focused on early-stage technology investments for the real estate and construction industries.

Navitas' investment strategy is to provide a combination of growth capital, industry expertise, and market access to high growth technology companies. Navitas tests and deploys technology solutions across its own portfolio of real estate assets, as well as helps startups scale through providing access to Navitas' network of industry leading LPs.

Navitas is currently investing out of its second fund, a $60M vehicle that includes anchor strategic commitments from many industry leading LPs. Current and past real estate technology investments include: Katerra, PlanGrid, Aquicore, Matterport, Gridium, View, Honest Buildings, Truss, Bowery, Harbor, PeerStreet, HappyCo., Ravti, Sweeten, Comfy (Siemens) and Can2Go (Schneider Electric). Please visit our website for more information.

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CONTENTS

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INTRODUCTION

In contrast to generalist venture capital firms, Navitas employs a differentiated approach to investing in the technology sector, with a unique focus on Real Estate Technology -- aka "PropTech" or "Building Tech" or "RE Tech". The purpose of this white paper is to provide insight into the current themes and trends in the Smart Buildings sector in 2018, particularly from a venture capital perspective, and serves as a follow up ("second edition") to our white paper titled "Intelligent Buildings & Enterprise," which we published in 2014. At that time, we noted a few key takeaways in our conclusion, namely that:

- However measured or semantically defined, the Real Estate Technology sector brings massive potential but is in the early phases of transformation.

- In practice, Information Technology (IT) is fundamentally changing the way we design, construct, operate and interact with buildings and cities, as well as other physical assets in the built environment.

- The first adopters in the space were in the <u>early</u> stages of seeing the upside of applying technology, with respect to happier, more productive employees, increased operating income, higher lease rates, occupancy rates, and asset returns.

- The longer-term promise of a vibrant, connected urban community (infrastructure, operations, and people) is to create resource efficiency at scale, whereby each building acts as a component of a city's interconnected operating system in a work-live environment.

Since our last paper, the state of the real estate industry has continued to evolve from these core observations, with a significant increase in the acceptance and accelerated adoption of new technology & process innovations, as well as the emergence of a new class of exciting start-ups. Within that spirit, we have refined our focus investment themes for Navitas Capital Fund 2 to where we think technology is likely to be most disruptive, including:

> **Artificial Intelligence (AI) / Machine Learning (ML)**
> **Visualization (AR/VR)**
> **Workflow**
> **Marketplaces**
> **Fintech**
> **Construction Tech**
> **Smart Buildings**

For the purpose of this white paper, however, we will attempt to do a deep dive into the Smart Buildings sub-segment of the market specifically, where the application of technology & process innovations has been embraced by the early adopters and market leaders, has been de-risked in many cases from a technology perspective, and

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has become increasingly more attractive from a price-to-value stand point. To be clear, our objective is to focus on current technology solutions that are currently creating (or are poised to create) real, tangible benefits including: 1) increased rents 2) higher occupancy 3) lowered operating costs, 4) accelerated decision cycles (e.g. leasing), and / or 5) incremental productivity across teams in the enterprise.

We would first like to clarify how Navitas Capital defines the technology transforming a building into a "smart building." That is, we define smart building technology in this white paper as any digital-based solution or physical platform deployed in a building that impacts 1) front of the house operations (tenant experience) and / or 2) back of the house operations (building systems, building envelope, workflow, etc.).

From a technology standpoint, "first generation" smart building solutions were largely point solutions sensors targeting core functions (and obvious expense line items), such as HVAC, lighting, plug load etc. Given the organization of larger real estate players, these types of sales went directly to the facilities manager as more of a tactical "back office sale," rather than to the asset manager as a strategic sale. Moreover, as point solutions, many across the industry viewed technology as it applied only to individual buildings rather than across a portfolio of smart buildings, thereby underestimating the value of scale and the aggregation of data and self-reinforcing intelligence across the enterprise. Until recently, the "smart buildings" that have garnered a disproportionate amount of media attention tend towards one-off office buildings of tech firms, built not out of practicality, but rather an angle of sustainability and the marketing of progressiveness. For example, the Deloitte Amsterdam office, "The Edge", boasts the title of the world's "smartest" building in the world. With 30,000 sensors, it can control lighting and humidity and track occupancy and movement. Additionally, every employee has an app designed to manage desks and conference rooms, as employers are becoming well aware only 25% of workers spend time at their desks at any given moment.[1] Similarly, Microsoft's new offices come equipped with "smart bathrooms,"[2] while DPR Construction in San Francisco became the first commercial office to receive NZEB (Net Zero Energy Building) certification, incorporating electrochromic windows, ultra-energy efficient ceiling fans, and even a living horticulture wine bar.[3] These early adopters clearly adopted technologies and innovations that touch major themes of resource and asset efficiency, space optimization – often *at an individual building level and without regard to price.*

DPR Construction Office   *The Edge – Deloitte Amsterdam*
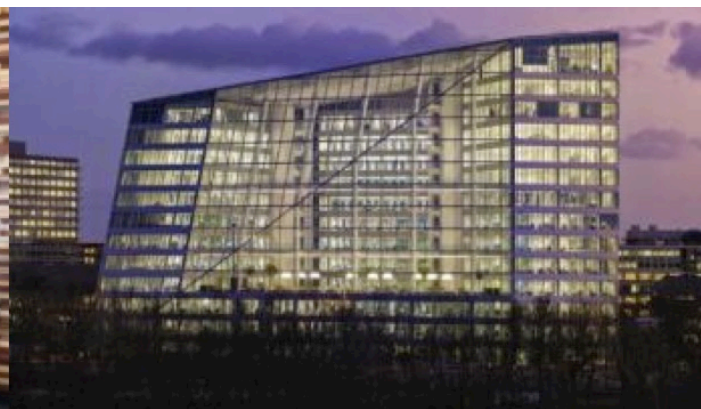
[1] Bloomberg, *The Smartest Building in the World*
[2] Realcomm, *Microsoft Explores IoT Potential in Smart Bathrooms* – Zorba Manolopoulos, Global IoT Program Manager, Microsoft
[3] DPR, *DPR Unveils First Net-Zero Energy Designed Office Building in San Francisco*

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In 2018, we are seeing an acceleration of smart building technology adoption, as the mentality of prominent real estate owners and developers has shifted from improving a single building towards the programmatic implementation of smart building tech cost-effectively; importantly, across entire portfolios. On a rudimentary level, we attempt to highlight and to emphasize smart buildings strategies and start-ups that increase revenue and / or decrease expenses. With rent as the single largest variable in a property owner's income statement, Tenant Engagement (to be discussed later in the white paper) has emerged in 2018 as an important thematic area of focus (e.g. Navitas portfolio company Comfy acquired by Siemens on June 26th, 2018[4]), with respect to enabling increased rent prices, as well as higher rates of retention, tenant satisfaction, and occupancy. Across all of Navitas' identified sub-themes, real estate owners are viewing "smart" building technologies as an enabler that can contribute to a financial strategy of capital preservation, value add and ROI.

Following our observations in 2014 when we penned our first white paper, we see exciting times for the *accelerated* advancement of smart building technologies over the next 3-5+ years. Beyond the basics of utilizing energy and hard real estate assets more efficiently, we believe smart buildings to be progressing towards a more human or tenant-centric service model -- leveraging technology to not only improve efficiency and productivity, but also health, wellness, and happiness; all inter-related. We believe implementing a smart building strategy will not only give owner-operators a differentiating edge in increasing the value of their real estate portfolios, but also, increase the value of real estate as an asset class holistically, strengthening the value of both physical assets and human capital. From our perspective, the Smart Buildings space (and the associated mindset) has evolved from Energy Efficiency to Asset Management / Portfolio Returns.

ENERGY EFFICIENCY *2014* → ASSET EFFICIENCY *2016* → ASSET MANAGEMENT/ PORTFOLIO RETURNS *2018*

The purpose of this white paper is to help investors and entrepreneurs explore the Smart Buildings space and to discuss the opportunity in 2018 through a number of trends & company case studies – importantly, from Navitas' perspective. Many of the 2018 "hot" themes identified in our broader PropTech definition are interrelated and highly interdependent to/on the Smart Buildings sub-segment, including: 1) **Space-as-a-Service**, with a focus on the building occupant's specific wishes, honing in on tenant engagement, 2) **IoT** and the proliferation of sensors that attain information at unprecedented pace, 3) the systematic implementation of **Artificial Intelligence/Machine Learning** to dramatically increase process productivity – including the increased utilization of chatbots as well as biometrics and facial recognition, 4) increased focus on **Workflow** (digitizing & innovating antiquated enterprise processes), 5) **Augmented Reality/Virtual Reality**, and the enhanced "touring" of physical space, and 6) Offsite **Pref-fab Construction**, including supply chain optimization. The white paper will first attempt to summarize Navitas' investment thesis in the Smart Building segment and the hottest current themes/trends in 2018. Then, to help give readers context on a more tangible level, the paper

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[4] Siemens, *Siemens Acquiring Building Robotics to enhance its digital portfolio with workplace app Comfy*

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highlights four relevant startup case studies, benefiting from and driving these themes: 1) Aquicore, 2) Comfy, 3) Matterport & 4) Katerra. Thereafter, the paper will discuss:

- Area of Investment Focus in 2018 (Access Controls)
- The Evolution of Smart Building
- Technology Enablers
- Challenges Driving Returns
- Smart Building Start-ups to Track (Appendix A)
- Proptech Deals in 2018 (Appendix B)
- Market & Growth Drivers (Appendix C)

INVESTMENT THESIS

Three Year Timeline: Venture Capital Investments in Real Estate Tech
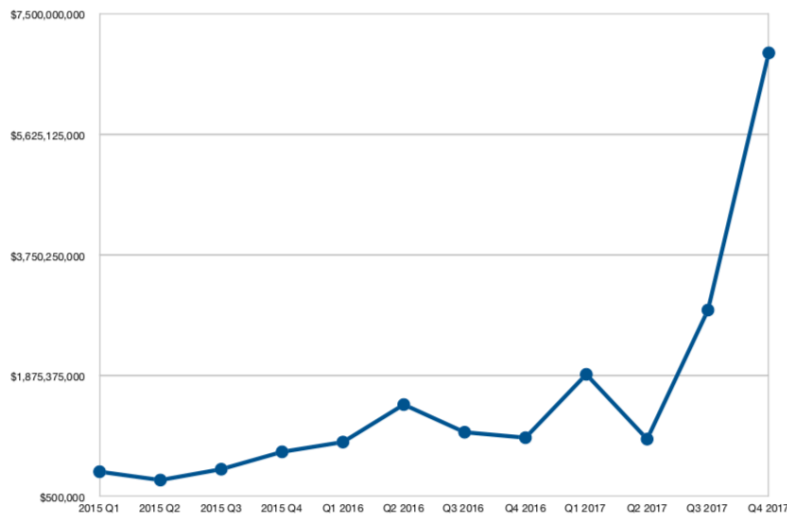
The worlds of technology and real estate are colliding at a pace never seen before in the industry. However measured or defined, the PropTech sector is massive (total global developed real estate represented ~$217T in 2016)[5] and in the "early innings" of transformation. In short, Navitas believes that PropTech has reached a truly exciting time of growth and acceleration —as evidenced by the increase in PropTech funding over time (left) [6] . In practice, this convergence is fundamentally changing the way we design, construct, operate, buy & sell and interact with buildings and cities, including all interconnected infrastructure (e.g. physical assets, digital technologies, people). Over the last two years, we have noticed a considerable change in attitudes within the real estate industry towards technology adoption. In this vein, exciting new startups are emerging with quality management teams.

Additionally and inter-related, we are noticing increased attention and awareness of PropTech as a sector, with many venture capitalists and new entrants on the investor side becoming aware of the massive market opportunity within real estate and viewing real estate as an investable asset class within the Technology umbrella. In short, we see the Smart Building Segment as an important component of the broader PropTech & Real Estate Tech investment thesis -- where the application of technology has been embraced by early adopters, has been de-risked in many cases, and has become increasingly more attractive from a price-to-value stand point. Accordingly, we believe there is a compelling opportunity to invest and participate in "V2.0" of Smart Buildings & Real Estate Tech over the next 3-5 years.

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[5] Savills, *World Real Estate Accounts for 60% of all mainstream assets*, 25 January 2016
[6] RETech, *Real Estate Tech Annual Report 2017*

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KEY FINANCIAL TREND – INFLUX OF INSTITUTIONAL CAPITAL

With increased interest in this wave of PropTech, investment in the sector is at an all-time high and will continue to grow. In 2010, it's estimated that <$100 million was invested into companies considered Real Estate Tech; in 2016, investments surpassed $4B+, and in 2017, investments in global real estate tech hit $12.6B across 300+ deals.[7] The influx of investment has changed the landscape of Real Estate tech as leading venture capital firms and established real estate giants have begun to fund the smart buildings of tomorrow.

Much of the institutional capital being invested into Real Estate tech is from the world's leading venture capital firms. These top Sand Hill Road venture capitalists are not alone in their big bets in the emerging space as Softbank's Vision Fund is also pouring money into Real Estate Tech, as well as all key areas of the GWP. In December 2017, Softbank made a $450 million dollar bet on Compass, a tech-driven real estate platform also backed by established venture capitalists such as Founders Fund and IVP. In January, Softbank continued to expand their holdings in the space by leading an $865 million Series D (Navitas participated as a "major investor," along with Soros & Foxconn) for the prefabricated construction company, Katerra. As indicated and as reported, Softbank is also gearing up for another multi-billion investment into WeWork (reportedly at $35B to $40B valuation, making it second highest valued start-up behind Uber).[8] That said, the 800 lb. gorilla in the venture capital space is not the only fund to turn its head towards real estate, as we see the likes of Sequoia, Index Ventures, Andreesen Horowitz, Battery, Khosla, Insight Venture Partners, Bain Capital Partners, USVP, General Catalyst, Global Founders Capital, and many others seeing PropTech as a relevant extension to fintech and to enterprise software.

While Sand Hill Road and other prominent venture capitalists are taking an interest in Real Estate Tech, traditional real estate companies have begun carving dedicated innovation and venture strategies as well. Institutional capital is just starting to channel into "PropTech" with industry leaders such as Brookfield announcing a $200M to $300M Real Estate Tech fund in 2018[9], and JLL announcing "JLL Spark" in 2017 – a $100M fund dedicated to PropTech start-ups.[10] The list of real estate firms who have increased their focus on funding the "smart buildings" of tomorrow, either through dedicated personnel or direct investment strategy, is longer than ever, including Hines, Cushman Wakefield, CBRE, Rudin, Prologis, Colliers, Swire Properties, Moinian Group, Equity Office and many others. We have seen creative collaboration efforts to channel innovation as well. For example, Cushman announced a tech partnership with Metaprop, while Colliers recently announced a collaboration with Techstars, and Swire Properties announced that they would be expanding their corporate venture program with some new strategic hires. Additionally, progressive real estate operators-owners & investment managers (e.g. DivcoWest, Normandy, Rudin, WeWork) are also entering the private equity/venture capital market as important direct investors.[11]

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[7] RETech Annual Report 2017
[8] Wired, *Softbank's Futuristic Vision Fund Takes on the Real (Estate) World*
[9] Wall Street Journal, *Brookfield's New Venture-Capital Unit Eyes Real-Estate Tech Startups*
[10] Bisnow, The Real Estate Tech Arms Race Continues with JLL Spark's New $100M Global Proptech Venture
[11] Zach Aarons, Metaprop Demo Day, February 8, 2018

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Strategic Partnerships

Direct Investment

Outsourced Venture

SMART BUILDINGS: HOT THEMES AND TRENDS 2018

To help shine a light on our investment focus in 2018, we would like to first highlight some of the current "hot themes" in the smart buildings space. The success of WeWork, Airbnb, and others demonstrate a key principle that a tenant-first mentality is paramount and prospering. We are in a demand-driven market, likely to reward amenities, productivity tools, flexibility, and health and wellness enablers. Satisfaction amongst tenants will drive higher rent prices, higher occupancy rates, and lower turnover – thus lowering operational costs and increasing asset value. Secondly, with the rise of "smart buildings" as a buzzword, this begs the question, why would we want a building to be smart? Put simply, what do we do with a smart building?

We believe the trend will be to leverage the data from not only the individual buildings but of the entire real estate portfolio, allowing the point solutions to feed into a broader and deeper asset management platform. Finally, we, like WeWork, Google, Amazon, Cisco, and others, believe that smart buildings will ultimately integrate into a larger "holistic OS system", creating a more sentient experience between humans and the built environment – suggesting increasing relevance of health and wellness (e.g. air quality), productivity trends, human behavioral analytics, mobility, connectivity and efficient resource consumption trends within a city or community.

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With that as a backdrop, here are several of the hot themes & trends that we see in 2018:

TENANT ENGAGEMENT	**INTERNET OF THINGS**	**ARTIFICIAL INTELLIGENCE / MACHINE LEARNING**
SPACE-AS-A-SERVICE	**AUGMENTED REALITY / VIRTUAL REALITY**	**PREFAB CONSTRUCTION**

Tenant Engagement

As part of the tenant-first mentality, we see enhancements to the tenant experience as a relevant, investable opportunity. Somewhat self-explanatory, we define tenant engagement to be anything that increases the positive engagement of tenants, thereby lowering turnover, increasing rent prices, and increasing tenant retention. This can be anything from property management apps and electronic bill-pay for multifamily tenants, to guest registration, and event booking in office environments, to access to fitness, wellness, and amenity services, among many others.

From Navitas' perspective, we believe that a large sub-area of tenant engagement lies in access controls, which we believe to be the first point of engagement with a building and, by extension, the building owner / landlord. Access controls, which can pre-register guests, let employees and authorized personnel into the building, and identify suspicious persons and VIPs, among many other capabilities, is an illustrative investment area where smart building technology meets security meets tenant engagement (see comprehensive summary in Appendix A). We believe access controls are likely to be a key area upon which a platform of amenities, services, integrated systems & payment platforms, and data can be gathered and offered.

Relevant companies within this theme: District, HqO, Workwell

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IoT

Within the built environment, more and more objects (e.g., equipment, devices) are becoming embedded with sensor networks and gaining the ability to communicate and share information. The resulting intelligent objects are creating a valuable input of data to improve business processes, whereby ubiquitous sensors and actuators are working together with a central-management server to help form a "smart building" network — one that responds to the external environment and the activities taking place within the building. Looking ahead, as more objects in buildings, portfolios of buildings, and cities become embedded with sensors and gain the ability to communicate, the resulting data networks promise to dramatically improve the efficiency and productivity of a smart building, as well as a smart portfolio, as well as a smart city. We see IoT as a relevant investment theme in its application(s) across 3 main areas: connectivity / edge computing, building management, and tenant engagement. We believe sensors will become commoditized over time as every major equipment and asset will have some sort of tagging capability. This allows for connected devices to communicate, creating the infrastructure for a platform that dynamically tracks a building, provides more access points for connectivity and distributed energy, and provides a wealth of data to gather analytics on human productivity, health, wellness, air quality, noise quality, and other metrics we know to be beneficial, but have yet to be quantified.

Relevant companies within this theme: Aquicore (Navitas portfolio company), Comfy (Navitas portfolio company), Humu

Artificial Intelligence/Machine Learning

The early adopters of Big Data Analytics in commercial real estate are realizing the benefits of investing in IT and the impact of the digital transformation. In practice, they have increased their recent investment in sensors, connectivity and analytics to enable data-driven, actionable insights across the enterprise. With the core investment in IT now in place, the Real Estate sector is clearly evolving from basic analytics to more Artificial Intelligence (AI) & Machine Learning (ML) strategies – benefitting from sophisticated artificial neural networks and powerful, self-reinforcing network effects. Given the buzz around artificial intelligence and machine learning, we believe we should specify that while we see huge opportunities in both artificial intelligence and machine learning, we also believe the two terms to be dramatically different in scope of application and believe it necessary to differentiate "true" AI / ML from the rest of the noise.   As it relates to real estate, we believe the largest application of AI to be in the development of chatbots, whether it be for leasing, ticketing, P&C insurance, property management, lead generation, sales and marketing, or any other function. On the other hand, we see machine learning as an enabler of increasing transparency in data for the real estate sector as it relates to purchase price and rent projections, financial analysis, market insights, building and portfolio performance, and the profile, and potential mismatches, between supply and demand of real estate assets. Like IoT, we believe AI / ML to simply be a layer, or a component, of an offering, enabling smarter, predictive data, insights and automation.

Relevant companies within this theme: Truss (Navitas portfolio company), Cherre, Dynasty

Space-as-a-Service

As pointed out in the latest Realcomm Edge Spring issue[12], the theme of "smaller and smarter spaces" will challenge the traditional lease model. We are in 100% agreement with this assertion and believe that space-as-a-service is one of the most profound trends changing the mentality of real estate operations and ownership -- going hand-in-hand with the broader trend of tenant engagement. Tenant demands for flexible lease terms, shared space, alternative uses of space, and a blurring of asset class distinctions, have led to the success of co-working / co-living arrangements, on-the-go booking apps for meetings held in non-office environments, and re-purposing of space across office, retail, hospitality, industrial, and residential sectors.

Relevant companies within this theme: WeWork (Navitas strategic partner), Common, Ollie

Augmented Reality / Virtual Reality

Of all the neurons in a human brain, 30% are dedicated to vision (vs. 8% for touch and 2% for hearing), demonstrating that processing is, in large part, defined by seeing[13]. As it relates to real estate, understanding, managing, and making decisions across real estate portfolios has been a difficult process, in large part due to the lack of visibility. From the beginning stages of architectural design, to construction information modeling, to leasing agents marketing space to prospective tenants, we see augmented reality / virtual reality to be a fundamental part of how real estate professionals will digitally interact with property and bring efficiency to formerly tedious processes. Simply being able to walk a client through a prospective property without having to be on-site unlocks tremendous value for real estate agents who are able to show their clients more listings in less time. It comes as no surprise that the leading companies in this space have succeeded, most notably Matterport, who has amassed more than *1 million 3D models* of real-world environments – represents the largest repository of 3D space data in the world. As Proptech Consult founder James Dearsley mentioned: "With VR projected to generate $4.6B in revenue in 2017, and the industry set to be worth $35B by 2025, Matterport's contribution in the space marks a significant milestone."[14]

Relevant companies within this theme: Matterport (Navitas portfolio company), Magic Leap, Google

Prefabricated Construction

In 2017, McKinsey & Company made the following alarming observation: "construction has suffered for decades from remarkably poor productivity" and, in fact, the construction sector is the only sector in the U.S. economy that has had declining productivity (-1.04% CAGR) over the last 20 years. To many of the "old guards," construction has been long considered outside of the reach of real technology-based innovation because of non-tech knowledge bases and the perception of only marginal operating improvements at high-perceived risk, among other things. In fact, it is estimated that 70% of the construction firms are only dedicating 1% or less of revenues to technology & process innovation. [15] One of the largest enablers in allowing applied technology to be integrated

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[12] *Realcomm Edge, Spring 2018: Conference Issue*
[13] Discover Magazine, *The Vision Thing: Mainly in the Brain*
[14] James Dearsley, *Matterport Launch Core VR*, October 7, 2016
[15] McKinsey & Company, *Reinventing construction through a productivity revolution*, February 2017; *Imagining Construction's Digital Future, June 2016*

into the physical hard asset is the rise of pre-fab construction players, who, by their tech-enabled mindset, serve as more progressive adopters of smart building technologies, provide modular, dynamic, and tagged materials in the design, and significantly de-risk smart buildings technologies by significantly shortening the construction time and processes. While pre-fabricated construction players have a swath of their own technological innovations that make a building "smart", as it relates to smart buildings traditionally defined, we see the rise of these prefab builders as an opportunity for increased adoption within new-build opportunities, serving as an exciting testbed and growth opportunity not to be ignored.

Relevant companies within this theme: Katerra (Navitas portfolio company), RAD Urban, Blokable

THESIS & THEMES "IN ACTION": SMART BUILDINGS CASE STUDIES V2.0

While we agree with Mr. Godin's quote on one level in terms of the importance of "entrepreneurial urgency," we think it's very important to learn from the past, particularly with respect to studying current case studies. As we did with our initial white paper, this white paper explores a select group of start-up case studies within Navitas' portfolio and ecosystem. We would like to reiterate these are just a few among many (and an increasing number) of

"If you wait until there is another case study in your industry, you will be too late!"

--Seth Godin

startups illustrating promising trends and have been ordered according to what is most go-to-market ready to what is most conceptually promising--though perhaps further out in the horizon, in terms of execution.

The objective is to summarize how these start-ups tie into our smart building investment thesis, as well as the hot trends & themes mentioned above. In addition, we present readers with insights into key differentiators of these best-in-class smart building startups. Whereas in our first white paper we discussed these case studies in the appendix, we wanted to bring these case studies forward in the white paper, given the importance of providing tangible examples vs. only higher-level themes.

CASE STUDY A: AQUICORE

LOCATION: Washington D.C.

COMPANY DESCRIPTION:

Aquicore's cloud-based software offers a turn-key "Asset Operations" platform for the CRE sector. The SaaS platform provides seamless real-time building intelligence, analytics and process automation solution that drive higher NOIs and favorable cap-rates by reducing building operating expenses and streamlining daily

building management routines. The company achieves its real-time and actionable insights by introducing a unique and patented sensor-network that is scalable and rapidly deployable to automatically read and compile data from utility meters, submeters, building equipment, and other environmental conditions. In practice, Aquicore offers owners and operators of commercial portfolios a powerful and flexible platform for "dynamic building management"; specifically, to help perform the duties of utility performance management, the accounts-receivable function of tenant billing, and track costly capital project investments to ensure they are meeting vendor commitment. The company has its origins with monitoring energy, water, and gas usage and has recently expanded its platform capabilities to include tenant billing, comfort & air quality, onsite inspections and other services that can be aided with emerging IoT embedded technology.

THEMES:

IoT, Workflow, Artificial Intelligence/Machine Learning (Predictive Maintenance), Data Analytics, Energy Efficiency → Asset Operations

FUNDING:

$12.7MM

Key Investors: Navitas Capital, Normandy Real Estate Partners, Finley Ridge Group LLC, Klingenstein, Four Score Capital, Kiddar Capital

KEY DIFFERENTIATORS

- **Value Proposition** - Aquicore represents a unique platform that allows institutional CRE investors and operators a single software to create scalability, flexibility, and end-to-end management of their building operations workflows. Enrollment with the product typically involves an impressive 30-60 day implementation process that includes deployment Aquicore's sensor-network which streams unique and real-time insights to customers. The company is far ahead of its peers for such technologies by developing a self-installation approach that can offer a bedrock technology necessary to envision a future of fully autonomous buildings. Moreover, Aquicore offers unbeatable speed-to-value with quick paybacks on the order of 7 – 12 months.
- **Customer Traction** - AQ solutions are deployed across 690 buildings across the US with limited international exposure and boasts a list of world-class customers including: Lincoln Property Group, Normandy, JBG Smith, Under Armour, Facebook, Brookfield, Walmart, Salesforce.com, Beacon Capital, AEW, DivcoWest & more.
- **Market Opportunity -** ~$3.6B+ addressable market opportunity and fragmented, with no dominant "data analytics platform" for the 600,000 commercial buildings in the U.S. with 35-200k square foot floor plates. Of the total ~6MM commercial buildings in the US alone, <10% of these buildings have any kind of real-time, "smart" monitoring. Moreover, regulation and building codes such as Title 24 in California and ASHRAE 90.1, NYC Local Law 83, as well as corporate adoption (digitizing workflow, NOI focus), has promoted demand for building intelligence analytics and process automation solutions

- **Expansion Opportunities** - Aquicore expects to expand into new verticals such as retail, industrial, multi-family and new construction. The platform is designed so that even the least sophisticated client can ("light up") their properties at a low cost. As a client matures and acquires a deeper understanding of the data analytics and business process improvements, Aquicore's platform can then extend with the client and eliminate the need for customers to take on additional vendors or integration/implantation risk with another solution. This creates a large and growing upsell opportunity (pipeline) within Aquicore's installation base.
- **Scalability -** With its new SaaS-oriented portfolio strategy towards building operations, AQ is increasingly catering towards portfolio-level sales and the company is generating increased ACV and sales acceleration with a highly seasoned sales team which it recently put in place.
- **Long Term Expansiveness** – AQ is leveraging its customer-base and increasingly unique and proprietary dataset of commercial real-estate information to foster partnerships with new sensor and device makers. This enables the company to continue creating value-add offerings to clients while further establishing its software solution as the dominate platform to access new IoT technologies as they surface.

CASE STUDY B: TRUSS

LOCATION: Deerfield, IL

COMPANY DESCRIPTION:

Truss is a technology-based brokerage platform for small and medium sized businesses. With an impressive and experienced four-person founding team (co-founder Andy Bokor helped lead TrustWave to a $770 million exit in 2015), Truss has alleviated the pains of finding office space -- such as lack of transparency, obsolete listings, and lackluster customer service. Truss instead offers an end-to-end self-service platform that puts the tenant in control, through a combination of targeted listings based on tenant-inputted requirements, virtual 3D-tours, price transparency and lease negotiation and signing tools. Truss' platform reduces the leasing process from ~5 months to 8-10 weeks. In April 2018, Truss added retail spaces to its listing platform, as well as industrial inventory in June 2018. With 200M+ active rentable sq. ft. on the platform (representing 1,100 tenants & $7M+ of commission value), Truss has thoughtfully and systematically built out an extensive supply base from the likes of the largest landlords in the country and brokerage firms including JLL, CRE, Cushman & Wakefield, Colliers, and shared space operators like WeWork. On the demand side, Truss' aggregated data has generated the first set of real-time tenant demand by space requirements and geography.

THEMES:

Marketplaces, Artificial Intelligence / Machine Learning, Data Analytics

FUNDING:
$9M

Key Investors: Navitas Capital, Private Bancorp, Sandalphon Capital, Hyde Park Angels, Chicago Ventures, New Coast Ventures, Service Provider Capital, and others

KEY DIFFERENTIATORS

- **Value Proposition** – Truss has created a unique and powerful platform that addresses a clear "pain point" in the CRE sector. Office space is typically the second largest expense for small businesses, and the process remains complex, opaque and antiquated, often taking 5 months+ to close. Moreover, brokers are not economically incentivized to serve tenants seeking sub-10k sq. ft. spaces, which are traditionally seen as the remnant inventory of traditional tenant rep brokers. Truss presents a "win-win" approach in which landlords post listings for free (including subleases) on a non-exclusive basis, and Truss only presents qualified and verified tenants. In addition, Truss gives back 30% of the commission to the tenant on closed transactions.

- **Platform Edge Fueled By Listing Quality & AI/ML** – Truss' unique listing data gives Tenants full price awareness (specific affordability information) and normalization capabilities across all lease types (e.g. comparing triple net leases to gross leases) that other listings and Tenant Rep brokers do not offer. In practice, Truss listings come directly from listing agents and landlords and are updated daily, capturing listing information in a standardized and accurate fashion. Truss's platform includes a proprietary chatbot, "Vera," who captures required tenant demands (i.e. monthly budget, neighborhoods, public transportation, etc.) and leverages AI to better match Truss's listings supply, advise on fair market prices, and schedule tours (including 3D virtual tours by Matterport – a Navitas Portfolio Company).

- **Customer Traction** – Truss has built out a robust, high quality, and well-diversified base of ~600 inventory suppliers. Key clients who have successfully found office space include Foxtrot, Hologram, Benjamin West, Page Vault, Kin Insurance, and many others. Moreover, close ties with technology incubators and co-working space providers such as WeWork (~10% of deals closed with WeWork) have also enabled Truss to be a transaction and data platform of choice.

- **Multi-Dimensional Growth Opportunity –** Truss is currently live in Chicago, Dallas, Houston, Washington D.C., Austin and expects to be live in San Francisco, Los Angeles, Boston, Philadelphia and Miami in 2H-18. Looking ahead, the total transaction size of <5k sq. ft. spaces within Truss's 18 target markets is $1.5B+ alone. Beyond transaction commissions, however, Truss' amassed data at scale represents a $500M+ annual opportunity selling market data. In the vein, Truss' new subscription service will soon be in pilot with a "big brand" strategic partner. Additionally, Truss's growth into new geographic markets and asset classes, as well as other monetization strategies such as white-labeling solutions for small, independent brokerages present large expansion opportunities (in pilot).

- **Scalability –** Truss's targeted SEO / SEM efforts have generated brand awareness, enabling Truss's marketplace platform to grow at an explosive rate. Truss's platform can easily incorporate new listings, as evidenced by the increase of 40M+ sq. ft. of industrial space in Chicago and Dallas in June 2018 and a roll-out plan to capture a comprehensive set of office, retail, and industrial inventory in all major U.S. markets over the next 12-18 months.

CASE STUDY C: COMFY (AQUIRED BY SIEMENS IN JUNE 2018)

LOCATION: Oakland, CA

COMPANY DESCRIPTION:

Comfy provides a mobile software solution for engaging commercial building occupants directly with the building HVAC control system (BAS). Comfy offers tenants direct control over HVAC systems in the workplace through a mobile software app (THISROOM.IS) to increase personalized occupant comfort and productivity, while decreasing work for facilities managers and reducing energy use in empty or unused spaces. Data from tenant feedback is used to optimize temperature bands in different rooms and create a building automation network to automatically adjust and learn the preferences of its occupants.

THEMES:

Tenant Engagement, IoT, Artificial Intelligence/Machine Learning, Energy & Asset Efficiency

FUNDING:

$19.8MM

Key Investors: Navitas Capital, CBRE Group, Emergence Capital Partners, M12, Claremont Creek, The Westly Group, Dave Eisenberg, Red Swan Ventures, GV, Formation8, Skydeck Labs

KEY DIFFERENTIATORS

- **Value Proposition** – Comfy offers 1) direct tenant control over their comfort and productivity 2) reduction in "hot and cold work orders" for building facilities managers, thus freeing up time to work on more important building operation issues 3) potential energy savings by enabling wider temperature bands for individual rooms in a building.
- **Market Opportunity –** Building automation is a $50B+ market with $100B spent on energy every year. More importantly, just 39% of office occupants are satisfied with their thermal comfort and suggest decreased levels of productivity due to thermal discomfort. With increased awareness, we believe the $1.4B target market opportunity will expand as budgets are increasingly dedicated towards tenant demands. Additionally, Comfy is a first mover in the space, bringing brand recognition to individualized tenant control of temperature.
- **Strategic Appetite** – Interest in Comfy's product from WeWork, Google, USGBC, Johnson Controls, McDonalds, Equinix, Steelcase, Siemens and the likes of many others demonstrates the increasing trend of a tenant-centric product as an access point to HVAC controls and integrated building automation systems that can eventually be built out into a platform solution.

- **Technology** – The team's technical expertise and pedigree, including former Facebook engineer Steve Haggerty, has contributed to an impressive product, garnering 3 patents that further present barriers to entry.

  Notably, the Company (Navitas portfolio company) was recently *acquired by Siemens* on June 26, 2018 for an undisclosed amount.[16]

CASE STUDY D: MATTERPORT

LOCATION: Sunnyvale, CA

COMPANY DESCRIPTION:

Matterport offers an end-to-end platform for quickly and easily creating, understanding and distributing 3D models by essentially creating digital copies of real-world spaces for web, mobile, AR, and VR applications. With 1M+ 3D models of real-world environments, Matterport now holds the world's largest repository of 3D renderings in the world -- fueling its AI-based computer vision technologies to produce digital reconstructions of physical spaces.

THEMES:

Visualization (AR/VR), Artificial Intelligence/Machine Learning, FinTech

FUNDING:
Funding: $66M

Key Investors: Navitas Capital, State Auto Labs, Ericsson Ventures, Qualcomm Ventures, DCM Ventures, Lux Capital, Felicis Ventures, AME, Greylock Partners, iGlobe Partners, Gordon Segal

KEY DIFFERENTIATORS

- **Market Opportunity –** Matterport's technology was first applied to the $12B market opportunity of real estate marketing, allowing prospective tenants to view spaces in 2D and 3D digitally. However, its

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[16] Siemens, *Siemens Acquiring Building Robotics to enhance its digital portfolio with workplace app Comfy*

vertical expansion opportunities represent a massive market opportunity that cuts across various verticals.

- **Scalable, High-Growth Business Model** – Matterport has experienced quadruple-digit revenue growth over the last three years, through the broad expansion opportunities of its underlying technology offering. Expanding across EMEA and APAC, Matterport has also begun to expand across different verticals beyond residential real estate to commercial and multifamily real estate, architecture, design, engineering, construction, insurance, travel, hospitality, and many other industries where the demand for data is increasing such as mobile, automobile, and financial services. Matterport was recently named No. 3 on *Silicon Valley Business Journal's* Top 50 Fastest-Growing Private Companies List. Its customers have produced 1M+ 3D renderings across 90 countries, with the digital copies of these spaces viewed ~400M times.[17]

- **Technology** – Matterport is a first mover in the 3D scanning market, providing a scalable and cost-effective 3D solution with an edge in its UX, 3D media format, platform and distribution (accessible for end users, publishers, and developers) and library of 3D models to drive AI / deep learning of space and object classification.

- **Largest repository of 3D space data models in the world** – Matterport has amassed 1M+ 3D models of real-world environments

  Team – Matterport has attracted a premier technical team at the forefront of deep learning and visualization. As Y Combinator Alumni, Matterport was founded by Matt Bell, Michael Beebe (COO, now CEO of Mayfield Robotics), and David Gausebeck (CTO, former Paypal alum who worked on developing the commercial usage of CAPTCHA tests).

CASE STUDY E: KATERRA

KATERRA

LOCATION: Menlo Park, CA

COMPANY DESCRIPTION:

Katerra is a transformative technology company, leveraging supply chain / ERP platform to integrate and to optimize large-scale prefabricated construction. By taking the reins on global supply chain, onsite construction, design, and insurance, Katerra believes it can deliver efficiencies on time and cost through its vertically integrated process. Katerra's proposed service offerings will include architecture, interior design, engineering, manufacturing building material supply, general contractor, subcontractor, labor management, renovations, and eventually, financing and insurance. Katerra will likely integrate, implement, and then innovate, serving as a relevant construction player for integrating smart building technology.

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[17] Matterport, *Matterport Ranks No. 3 on Silicon Valley Business Journal's List of 50 Fastest-Growing Private Companies*, October 23, 2017

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T**HEMES:**

Offsite /Prefabricated Construction, Workflow, Construction Tech

F**UNDING:**

Funding: $1.1B

Key Investors: Navitas Capital, Softbank, Foxconn, Soros Fund Management, Paxion, Kendall, GreenOaks, RiverPark Ventures, DFJ, Khosla, DivcoWest, Tavistock Group. Acquisitions: Fields Construction Group, Michael Green Architects, Lord, Aeck, Sargent, KEF Infra, New Jersey Construction, Nystrom Olson Architecture, United Renovations.

KEY DIFFERENTIATORS

- **Leadership/CEO** – Katerra's CEO, Michael Marks, ran Flextronics (fully-integrated OEM supplier to Apple, HP, Cisco, etc.) for 13 years, growing the company from $100M to $25B in revenue and managing 25k+ suppliers, solidifying Flextronics's edge as global and vertically integrated. Marks' expertise in supply chain management, technological advances, and network of relevant contract manufacturing players are highly differentiated within the construction space.
- **Market –** Within the context of the massive $8.4T construction industry, Katerra plays well within the growing trend of multifamily construction (estimated to be $1T and quickly growing), given the trends of globalization and urbanism. As a massive, branded, low cost provider of Class B and C housing (largely undersupplied by developers who have focused on Class A housing opportunities in urban environments despite larger demands for more basic, affordable housing), Katerra is well positioned for the global demographic trends and defensible in cyclical environments.
- **Access to Capital –** Katerra's $865M Series D round, including participation from Flextronics' chief competitor, Foxconn, attests to Marks' expertise in the OEM supply chain industry. We believe their access to capital is not only a barrier to entry to unlocking opportunities --as scale begets scale, but also a threatening deterrent to startups facing such a heavily-backed player, given that the largest hurdle most startups in the space face is being undercapitalized in a heavily capital-intensive field.
- **Customer Traction** – Benefitting from the willingness of an initial launch customer, The Wolff Company, to hand over their pipeline of multifamily projects, Katerra has been able to act on the initial inertia to attract key customers including Sobrato, UDR, Discovery, and many others domestically and globally, which will additionally be propelled by the closely-affiliated financing vehicle, Kandle.
- **Team and Network** – Katerra has amassed a global team of more than 1,400 people, attracting senior leadership and talent from the likes of Flextronics, Apple, Google, HP and Nokia. Key team members include: Steve Burrows (Building Engineer, previously Head of Engineering for Beijing's Bird's Nest Stadium and Apple HQ), Michael Green (Vancouver-based architect specializing in Cross-Laminated Timber), and Craig Curtis (Architecture and Design, formerly Partner in Design for the Bullitt Center in Seattle). Moreover, given Marks and his team's repute, Katerra is able to preview cutting edge materials and focus engineering and design efforts for sustainable and expeditious prefab builds.

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AREA OF INVESTMENT FOCUS IN 2018: *ACCESS CONTROLS (TENANT ENGAGEMENT)*

ACCESS CONTROLS LANDSCAPE

An access control system essentially allows building owners and operators to manage, monitor, and maintain who has access to a building. Solutions range anywhere from a standard deadbolt and brass key, to a keycard, to smart phone-based to biometrics-based access. From Navitas' perspective, a key part of the access control opportunity is the simple fact that it is the first point of contact with the tenant, acting as a hook for a more holistic solution.

That said, up until now, real estate owners and operators have been relatively slow to adopt new access controls solutions (e.g. "frictionless," cloud-based, Bluetooth, etc.) given the following factors:[18]

- Access controls are simply difficult to "rip and replace," and while inefficient, most are still functional, providing little incentive to change.
- Most of the legacy "winners" in the space won through indirect sales models dominated by a consolidated network of dealers / integrators with deep affiliations to consulting firms, architecture firms, and building / engineering firms.
- As a result, legacy systems have proprietary technology with which 3rd parties have a difficult time integrating, presenting a myriad of costly compatibility issues -- both in time and monetary cost.
- Some new frictionless technologies (namely mobile devices utilizing Bluetooth) can significantly drain battery life.
- The ROI / payback of access controls is often difficult to evaluate, particularly as it relates to security. Preventative actions such as security updates can reasonably be seen as sunk costs, yet one attack can produce outsized cost drains. Therefore, evaluating the value proposition is often a subjective evaluation of probabilities.

As a result, from an investment standpoint, institutional capital has largely avoided the space given unproven ASPs, LTV / CAC ratios, long sales cycles, and ambiguous value propositions. That said, we believe the access control market is ripe for disruption and presents many opportunities for product expansion. Why?

The current legacy systems are problematic

- *Outdated systems -* Most access control systems are legacy systems using technology from the 1990s or older. For context, it is believed only ~1% of access controls are cloud-based.
- *Security risks -* These systems present large security risks. For example, keycards can simply be given to others or easily replicated /cloned, while tailgating is relatively simple to do, presenting an issue of uneven enforcement.
- *Inefficient credentialing* – The guest provisioning process, even in Class A buildings, remains a huge and inefficient pain point, particularly as it relates to confirming the credentials and identity of large volumes of people in peak times.
- *Unintuitive installation, integration, and operations* – Legacy systems remain expensive, complicated and slow to install, and difficult to operate. Additionally, proprietary designs of access

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[18] Chris Fine, Unikey White Paper: *New Opportunities in Physical Access Control Technology*

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control systems by each large vendor / integrator often weds customers to a dedicated vendor purely for compatibility reasons.

Macro trends and paradigm shifts point to a growing market opportunity

The market opportunity for access controls is large and growing. According to Memoori Research, the global access control market is slated to be a $10B+ market by 2020.[19] We believe this opportunity is substantiated by the following trends and catalysts:

- **Increasing awareness of security -** This is largely driven by the rise of IoT, connected devices, and the increasing relevance of upgrading both physical and cybersecurity. The cost of Yahoo's data breach was $350M alone, while Target's estimated cost of breach was $162M, costing both Target's CEO and CIO their jobs.[20] In fact, Target was hacked through a data breach on one of the vendors, demonstrating the importance of managing / provisioning 3rd party vendors and integration partners, with access controls serving as an intuitive entry and control point.

- **Regulatory and compliance requirements -** Catapulted by increasing awareness and publicizing of large-scale data breaches, corporations are increasingly held to regulatory and compliance requirements that have led to dedicated budgets for upgrading security. The Financial Services industry, in particular, has been an early adopter due to industry standardization regarding security and compliance requirements.

- **Changing workplace dynamics -** The rise of co-working and increasing employee flexibility and mobility have resulted in dedicated spaces handling large volumes of transient populations, bring both more data flow and more diverse types of data that need to be protected.

- **Commoditization / Commercialization of Technological Innovations -** A myriad of technological innovations have unlocked solutions allowing providers to produce lower cost and technologically more advanced access control offerings. Additionally, technological advances, particularly as it relates to IoT devices and cloud / edge computing, have increased the need for more advanced access controls to plug into, secure, and manage the ecosystem. These advances have led to more sustainable business models as well, in which the decreasing value of hardware supports a more SaaS-oriented business model of higher recurring revenue and margins than what was previously possible.

- **IT / Leadership Paying Attention to PropTech -** With access controls in particular, the larger theme of real estate technology adoption and sales pitches going directly to IT and even C-suite level executives, rather than facilities managers, has been a large impetus in allowing new technology providers to gain customer traction.

Horizontal Expansion Opportunities

As mentioned, the appeal of access controls is the simple fact that it is the first point of engagement with a building. This presents many opportunities to control the management of a building and the experience of those inside the building, particularly regarding the following components of an access control system:

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[19] Memoori, *The Physical Security Business 2015 to 2020*
[20] IBM Security, *2017 Ponemon Cost of Data Breach Study*

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- ***User-facing End – Tenant Engagement:*** Knowing when a person enters the building presents opportunities to dictate a user's experience. Simply providing a more seamless experience than the current turnstile system is already a substantial improvement. That said, access controls also have the capacity to dramatically improve tenant engagement, as the first point of engagement. One could essentially pre-authorize a guest, know where the person is headed, have the elevators waiting to take them to the correct floor, display smart signage specifically for the person, and prepare their desk settings or meeting room. Mobile technology has become ubiquitous enough in recent years to the point where all of these functions can be controlled through a single mobile application. Amenities, security functions, and other forms of tenant engagement are now positioned to become widely adopted due to the mass adoption of smartphones.

- ***Owner / Operator End – Analytics***: Put simply, access controls are the simplest point of contact in knowing who is entering and exiting the building and where people are dispersed throughout the building. While simple, the advantages of capturing this data are immense -- ranging from security, to occupancy/space utilization analytics, to human productivity and behavioral analytics -- that can dramatically improve operations for building owners and operators, tenants, and even design / engineering firms and developers who see where and why people spend time in the places they do.

- ***Back-End Hardware – Platform for Integration****:* The architecture of access controls lends itself to being one of the few converging points between the physical and digital world. From a security standpoint, cloud-based access controls are very logical starting points for updating a security system and integrating connected IoT devices. Expanding beyond, access controls can serve as a platform for integrating other sensors and data points, such as video / biometrics-based surveillance, that can eventually feed into a comprehensive platform solution – the "holy grail" of smart buildings tech.

SOLUTIONS

While many solutions exist and have recently gained the attention of venture capitalists and investors, we believe the winning solution will ultimately be one that is open, quick (and easy to install), reliable, compatible, frictionless, optimized (e.g. some access points/doors only need "security light"), comprehensive and cost effective. In addition, Navitas is seeking startups with a strong sales / distribution channel strategy. We believe security to be a key "door into" winning sales pitches, though the edge will likely lie in the comprehensiveness of the product offering. The game is no longer one of IP patents for proprietary hardware to compete against vendors. Rather, it is one of integration in which the winner will likely have an extensive list of integration partners and act as an easily integrable top layer on existing infrastructure, offering a transitional plan from the existing legacy infrastructure onto more advanced upgrades through upselling opportunities. Finally, we believe the winning solution to have a uniquely simple UI / UX design, which can serve as a strong foundation upon which to build a platform tracking data on any sort of analytics from EE / HVAC to asset management data to occupancy analytics—transforming reactive data into predictive insights to improve operations, as well as the wellness, engagement, and safety of tenants and guests.

ACCESS CONTROL SOLUTIONS


THE EVOLUTION OF THE SMART BUILDING SPACE

While the term "smart buildings" has been thrown around for a few years, the evolution in what exactly "smart" encompasses has shifted dramatically. The first wave of smart buildings began with an emphasis on energy efficiency. With the rise of Nest (Google) and Enlighted (Siemens) 5 years ago, most first generation smart building plays were point solutions directed at kWh cost reduction, and gradually broadened out to other IoT devices. Cost and resource consumption management and reduction thus became the first major theme in the smart building space.

As an extension of having smart equipment and appliances, as well as a network to support them, the next major theme of smart buildings emerged: data and analytics. With the mindset of "what is measured can be managed," facilities managers and owner-occupiers began to see the value in amassing useful data and analytics to think more holistically towards a building. Just as a human body benefits from diagnostics, a building benefits from disaggregating mass data to point to specific, actionable problem areas that may translate to significant building-level and even portfolio-level cost savings. Coupled with developments in artificial intelligence and machine learning, the accumulation of data and analytics serves as inputs to drive predictive analytics able to dictate preventative actions (e.g. maintenance, replacement). These actions in turn extend the lifetime of assets and decrease the need for ongoing manual maintenance, again translating into material gains in margins.

To summarize, the first generation of "smart building" solutions centered around energy efficiency, a cost translating to ~$3 per square foot. The next generation unlocked value at the building level, with rent translating to ~$30 per square foot. The natural evolution, therefore, was to focus on unlocking the largest expense

translating to $300+ per square foot: people. JLL terms this the 3-30-300[21] rule, in which the cost of people translates to ~10x the cost of rent which in turn is usually allocated ~10x the budget spent on energy and utility bills. That said, early adopters began to realize that out of the wealth of big data and analytics, one could extract specific information that would bring value to the end user, the person inside the building. This set in motion the current, "2018" generation of smart building solutions increasingly focused on tenant experience.
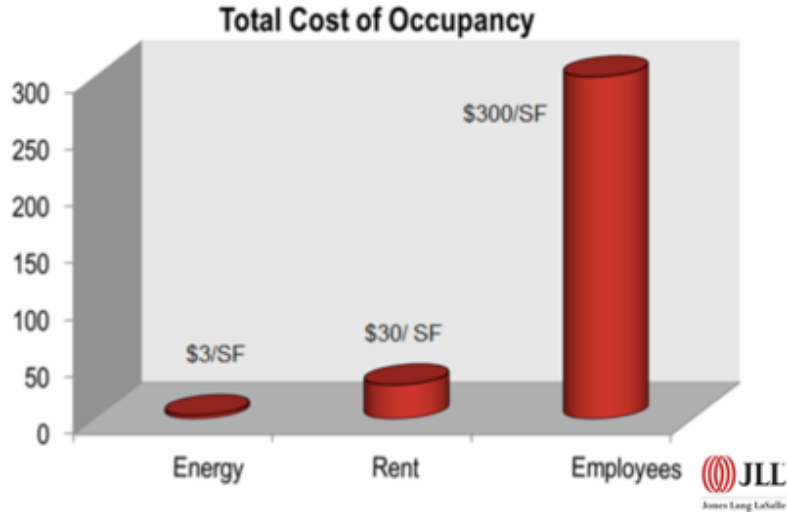
As WeWork's valuation validates, people are willing to trade off Class A office space for a shared space community – amenities on demand, a service store

upon request, a corporate culture on demand. Thus, WeWork absolutely embodies the next generation of smart building players, offering "space-as-a-service." Anything bringing control and support back to the end user we see as "space-as-a-service" and possibly an interesting investment prospect in the coming years. This might include services offering directions to your destination, managing services for rooms, or on-demand hotel and timeshare booking, etc. Ironically, the smartest building plays in the coming years may be those that enable people to flow out of the building as conveniently as possible -- offering mobility and flexibility with respect to connected "Live-Work" resources. We therefore see asset classes to begin to blur, with most buildings as multi-use. Urban high-rises may feature a Whole Foods on the first floor, housing in the middle, and an urban farm roof with leased solar panels or wind turbines on the roof. In architecture, we see similar desires to blend the built with the natural environment, creating a self-sustaining ecosystem, as 8 House and The Mountain in Copenhagen by Bjarke Ingels Group (BIG) demonstrate.
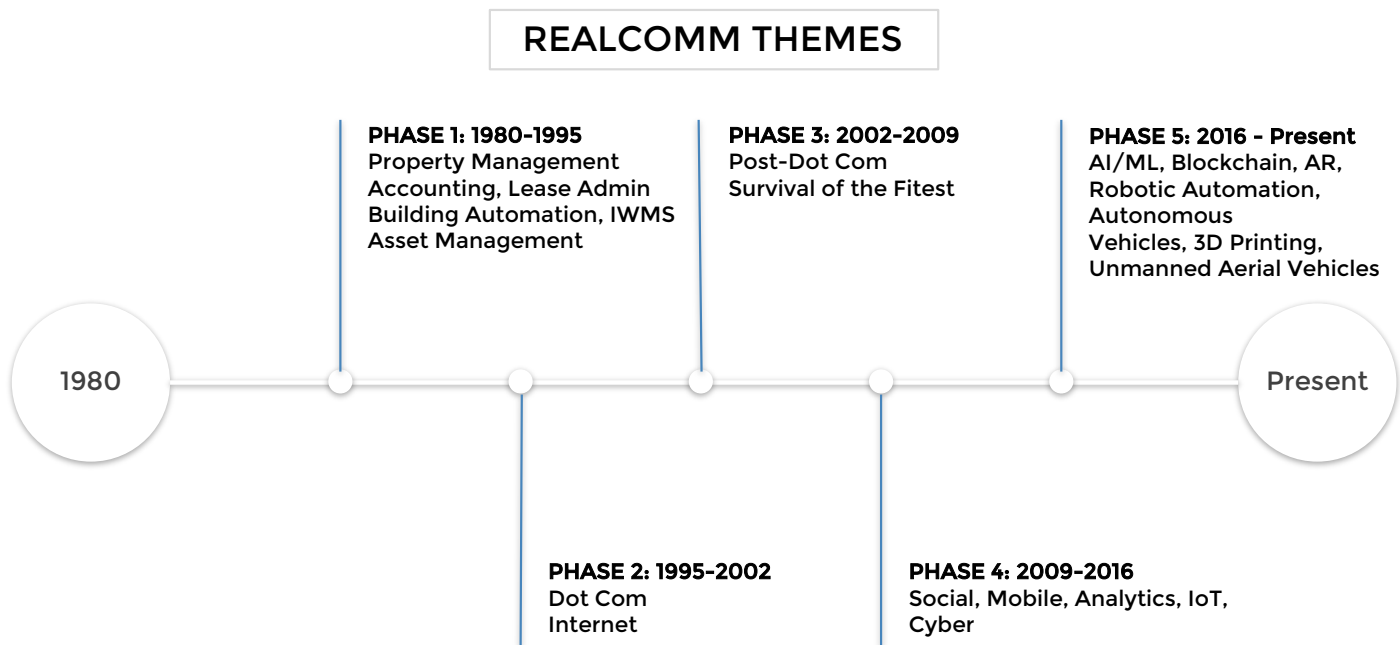

8 HOUSE

THE MOUNTAIN

[21] JLL – Green Productive Workplace Perspective

In 2013, the Bullitt Center was hailed as the first net negative commercial building ever built. Tenants of the Bullitt Center have yet to pay for electricity, and after a mere 2 years after opening, the building generated 60% more energy than it used. Using mass timber materials, the Bullitt Center integrated technology to be net-zero energy, net-zero water, and net-zero waste, proving cutting edge within the property and construction technology landscape.[22] Over the past 5 years, however, the industry has been slow to build upon such momentum, with the Bullitt Center proving to be a large anomaly in terms of invested projects. That said, we believe the time is ripe for growth in the smart buildings space.

As Realcomm aptly notes, the evolution of smart building technology has evolved dramatically, particularly over the last 10 years. From 1980-1995 (Phase 1), preliminary property management, accounting, lease administration, IWMS, and basic asset management workflow tools dominated the space. 1995-2002 (Phase 2) marked the dot-com era and the age of the Internet. 2002-2009 (Phase 3) demonstrated an economic downturn that vetted the winners, while those that simply rode the internet wave without offering a truly valuable product were eliminated. 2009-2016 (Phase 4) marked another wave of innovation, dominated by social, mobile, analytics, cloud, IoT, and cyber-related products. We have only recently begun to enter Phase 5, which we expect to be dominated by technologies including AI/Machine Learning, innovative financial technology, visualization and augmented reality, workflow automation, smart buildings, and construction technology. We expect technology to spread across all asset classes, better serving the individual needs of industrial, office, retail, hospitality, single family and multifamily properties.[23]

REALCOMM THEMES

PHASE 1: 1980-1995
Property Management
Accounting, Lease Admin
Building Automation, IWMS
Asset Management

PHASE 3: 2002-2009
Post-Dot Com
Survival of the Fitest

PHASE 5: 2016 - Present
AI/ML, Blockchain, AR,
Robotic Automation,
Autonomous
Vehicles, 3D Printing,
Unmanned Aerial Vehicles

1980

Present

PHASE 2: 1995-2002
Dot Com
Internet

PHASE 4: 2009-2016
Social, Mobile, Analytics, IoT,
Cyber

[22] Seattle Times, *Bullitt Center tops its green goals, is making energy to spare*
[23] Realcomm, *CRETech 5.0 – Reaching New Heights in Commercial & Corporate Real Estate Innovation*

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That said, we expect a few trends to emerge in the next wave of smart building startups. First, while energy efficiency and IoT sensors spearheaded the smart building movement and paved the way for corporate adoption, we see these as simply point solutions lacking an overarching platform that tracks energy, water utilization, HVAC, air quality, etc. on a single integrated dashboard. We therefore expect consolidation in the industry as facility managers and portfolio managers struggle to switch between individual user interfaces for each function and conversely, startups fail to gain sales traction as yet another point solution. While we effectively expect every piece of hardware to be "smart" in sensing and tracking, from the doors to the lights to the windows, printers, and desks, we expect that the user interface for the facilities manager will be simplified, showing only curated, relevant data drawn from the integrated IoT infrastructure of "smart" objects.

Along those themes, we expect demands for transparency in disclosing both monetary and resource consumption to propel movements towards companies that can track and make use of unique and /or large datasets, as senior management starts talking more and more of making informed and data-driven decisions. For example, your personal office chair not only remembers your height and seating preferences but also forces you to stand every two hours given your exercise goals. Furthermore, you can walk straight into the building without a badge, key, or phone as the biometrics-based access control verifies your identity, sends the elevator to wait for you and bring you to your destination, and books a meeting room – all in a frictionless manner. The air quality sensor not only alerts you when the filters need to be changed, but also automatically orders a replacement filter for you. Thus, the data turns from reactive to predictive & proactive, allowing customers to extract unlocked value previously not possible. In many cases, the aggregation of data presents an upside scenario where the availability of standardized metrics can favorably alter previous norms such as requirements for financing, insurance, and bureaucratic processes. The advent of software technology tools will better improve workflow processes and asset management capabilities of large real estate owners, who are finally able to gain visibility into their operations at a building and portfolio-wide level.

Software tools and IoT will also provide the opportunity to implement systems which can be enhanced and updated in the future, allowing buildings to become 'smarter' over time. Similar to the way a Tesla Model S is updated with new features through remote software updates, building owners will be able to update operating systems in their portfolio by simply installing new software updates. Examples might include a software update for a more accurate energy and gas usage operating system, in which an AI technology learns the behavior of building tenants over time and uses that data to schedule more efficient energy use. Building owners may also be also to implement tenant engagement applications which can be updated with new features, offering a dynamic and ever changing experience for the tenants, thus increasing rent prices and retention over time. IoT will enable help to bridge the gap between Moore's Law and long term real estate stakeholders who want to benefit from new technologies without physically altering their building.

Finally, and perhaps more philosophically, we expect to see a challenging of conventional uses of space and the purpose of space. As more workers telecommute, relocate, and work, live, and play together, the lines between an "office" building, a "residential" building, a "meeting space," and a "retail" space are blurring. Hospitality is now supported by residential homes through Airbnb, private office and studio space has largely been reconfigured to afford greater shared amenity spaces in co-working and co-living facilities such

"Companies like WeWork and Airbnb that style themselves as disrupters of the status quo are really helping shore up old inequalities."

--New York Times January 2018

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as WeWork and WeLive, and unused spaces are constantly being repurposed through companies like LeasingSpace, Spacegrab, and Storefront. Moreover, the idea of a smart building is not limited within the confines of a physical building. Giant corporate campuses such as Google, Amazon, and Apple headquarters, demonstrate trends of integration between the built environment and the natural, providing a segway into vibrant, connected urban communities. As a natural composite of smart buildings, smart infrastructure, and smart vehicles, smart cities such as Tampa Bay or the Toronto waterfront demonstrate massive opportunities to redesign entire cities from scratch and serve as natural distribution channels for the emerging startups to implement smart building concepts.

Meaningful capital is being invested in smart city projects, as well as ground up development opportunities as demonstrated by the massive funding round by Katerra and WeWork's ground-up WeLive & WeWork opportunities, providing greater live testbeds of innovation in smart buildings. We see smart buildings as the catalyst to drive a smarter, more integrated ecosystem in which people can live in a technology-powered nexus that delivers community, health and wellness, energy and resource efficiency, amenities, and seamless experiences indoors, outdoors, and on the road. While we are strong technology advocates, we are also aware the most innovative business model companies are often the disruptors—posing threats to the status quo that many have built their expertise and success upon. Perhaps the clearest example of this is WeWork's effects on existing real estate strategics (large owners & operators of CRE, REITs), as demonstrated by the number of mentions on their Q1 2018 earnings calls.[24]

wework earnings transcript mentions

Among real estate strategics

Number of mentions

Represents the date earnings call took place in past quarters

CBINSIGHTS

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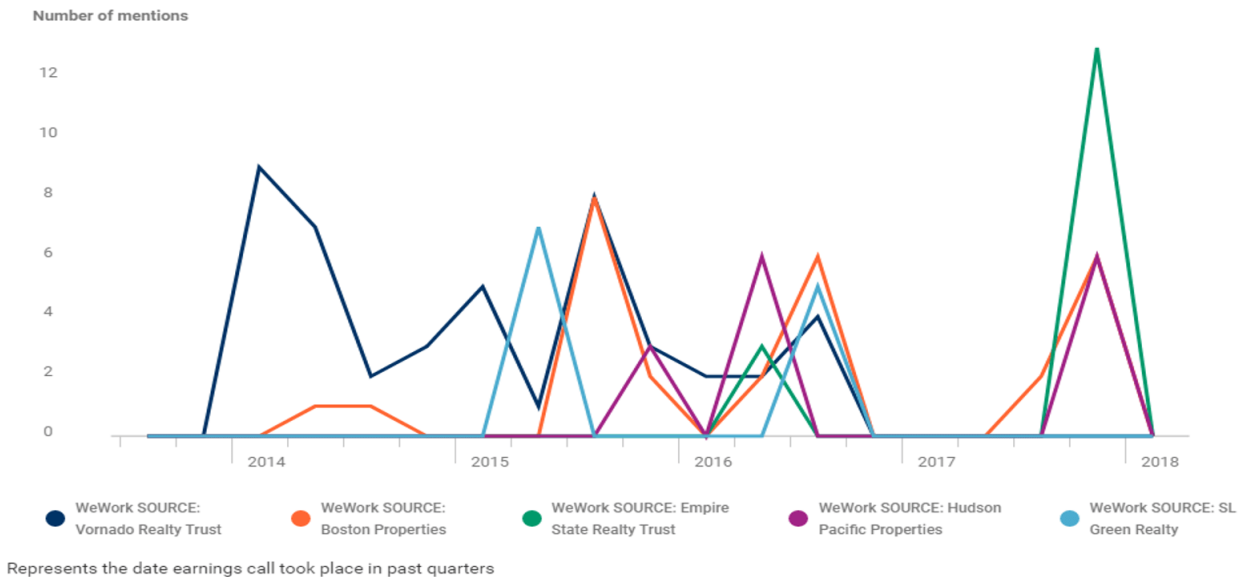
[24] CB Insights, *What Big Real Estate is Saying about WeWork*

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As reported by The Wall Street Journal in May 2018, WeWork's new investment fund (WeWork Property Investors established relatively quietly last year but gaining momentum) "aims to buy buildings where the company would become a tenant."[25] From our perspective, this kind of strategy creates a powerful and synergistic combination of hard assets, combined with a highly disruptive space-as-a-service technology-based offering. Potential conflicts notwithstanding, WeWork's business rationale is compelling given that its role as both tenant and landlord should yield significantly better investment returns than conventional real estate funds that typically have to manage tenant occupancy.

At the end of the day...we expect many more mentions of WeWork on the earnings conference calls of leading Real Estate firms, particularly as WeWork continues to disrupt the market as a tenant (e.g. second largest tenant in NYC behind only JPMorgan Chase)... as well as a landlord/owner.[26]

KEY CHALLENGES TO DRIVING INVESTMENT RETURNS

CHANGE MANAGEMENT

While Real Estate Tech has seen disproportionately less successful startups achieving "unicorn" status relative to the $217 trillion industry opportunity, one of the largest impediments to technology adoption has been change management. While a large and moneyed industry, real estate is also somewhat antiquated, often likened to the finance industry 20 years ago. The real estate industry has been relatively underserved by technology, which has hit the medical, consumer, financial and internet technology verticals much more immediately. However, the nature of real estate makes it difficult to be an early adopter of technology for several reasons.

First, the landscape of property developers is highly concentrated. Prologis owns 683 million square feet of real estate globally[27], while Blackstone manages a total of $120B in AUM.[28] Few large behemoths dominate the space and gaining access to sell into the real estate's royal round table is far from easy. Conversely, for these huge companies, vetting startups for the latest emerging technologies also puts an unrealistic demand that detracts from their core competencies; therefore, large property owners and tech startups have typically operated in two different, non-overlapping spheres. As an extension of that, sales cycles are typically long given both the size and nature of these large entities. Vetting through the

"Change management and program management are the biggest challenges to overcome in delivering data driven facilities management. Most companies do not do it well."

--Jacquie Schultz, Director, Building Optimization at CBRE | ESI

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[25] Wall Street Journal, *WeWork, the Workspace Giant, Wants to be its own landlord, using other investors' money*, May 13, 2018
[26] Recode, *WeWork's massive growth has made it the second biggest private office tenant in Manhattan*
[27] Prologis, Investor Fact Sheet Q1 2018
[28] Blackstone, "Who We Are"

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bureaucracy, gaining access to the actual decision-makers, and convincing those decision-makers that carving out strictly allocated budgets that new technologies is not only justified but necessary remains a tough sell.

Finally, management simply does not have a strong incentive to adopt technology. Much like the financial industry, the industry leaders in real estate have attained great success and wealth in a largely analog world. For many, the dominant ideology is "why fix what is not broken?" Many technology solutions in real estate, such as property management software, amenity services, and tenant engagement applications can be extremely hard to measure on an ROI basis as they do not directly impact rent rolls or costs. So for financially focused property owners and operators, the pitch can be difficult. However, what resonates with real estate incumbents is what can help differentiate and help them get ahead, what can help increase occupancy rates, and what can help drive rent prices up. The nexus of real estate asset owners is consolidated, tight-knit, cooperative, and competitive: a double-edged sword. Thus, technology in the real estate industry experiences a dramatic network effect, in which one successful technology gets adopted by one, then another, and then many more until it is on everyone's minds; however, getting the ball rolling and the inertia moving remains the largest challenge to the adoption of real estate technology.

FRAGMENTED LANDSCAPE

In comparison to the consolidated landscape of real estate buyers, the market for incoming technology is a disparate landscape difficult to maneuver. Although conglomerates like IBM, Schneider Electric, Siemens, Honeywell, and Johnson Controls demonstrate appetites for strategic acquisitions, the rest of the landscape consists largely of small startups with little access to distribution and rivaling technologies. Looking at access control systems in buildings, for example, many recognize the issue with current guest registration in office buildings and security for transient populations. Customers have demonstrated interest in the data to integrate with Wi-Fi networks, HR enrollment, etc. to better control security, identification and resource management.

> *"If I'm bringing one more tool, that's one more thing they have to learn. The more that we can integrate horizontally, the better we can buy into those tools"*
>
> --Charlie Kuntz, Innovation Officer at Hines at CRETech Boston

However, whether the next best technology comes from RFIDs, NFCs, battery-powered access controls, or smartphone-enabled locks remains to be seen. Without a dedicated team allocating resources towards distinguishing the multiple product offerings, it is difficult to sort out the standouts from the mediocre offerings or those that will be rendered obsolete in the next couple years. Once chosen, staying abreast on technologies that can be compatible requires increased dedication, as interoperability remains one of the largest issues in the IoT space, and a growing one as more technologies come into the forefront.

Given the early stage of awareness and adoption, we see this as a transitional time. Customers adopting such technologies are still early adopters in a large market opportunity that can support multiple winners. That said, we expect consolidation in the industry in the event the bull market takes a turn, and building owners become less enthusiastic to experiment on technology.

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VENDOR RELATIONSHIPS – POINT SOLUTION OVERLOAD

While IoT is estimated to be a $50B industry by 2020, standardization remains a growing issue butting against rapid innovation and adoption in the space.[29] As a consequence, rather than being "plug and play" ready, most require an installation and integration process to function with the existing technology infrastructure. Open-source technology and APIs allow products to effectively talk to each other in a common language; however, without a governing body and standardization, the increasingly messy amalgamation of IoT devices creates security and operational risks to the built environment. As it relates to real estate, the relative permanence of implementing IoT and other technologies into physical properties puts added weight on the necessity of having clean and standardized technology that efficiently communicates together as large property developers programmatically install technologies across their portfolios.

"The difficulty behind the scenes to get things connected properly… is still a challenge. While there's consolidation in the space, there's a lot of new players… the more pieces of software out there, the more things need to share data points"

--Robert Entin, CIO & EVP of Vornado Realty Trust

One should note, the lack of standardization applies on both the supply and demand side. While the market is filled with disparate and competing technologies, existing building owners and construction companies also do little to ensure an integrated process. In fact, it is estimated that 99% of various building systems in a construction project are procured separately today."[30] Purchases are seen as one-off and on an ad hoc project basis and therefore lack any programmatic process of procurement. From a financial perspective, though the individual product may reap cost savings, together with the existing technologies, financial losses from implementation, fault detection, and maintenance can far outweigh the benefits.

We expect standardization to be reinforced, whether legislatively or tacitly, as the space develops. In fact, the Industrial Internet Consortium (IIC) is working with major corporations such as Fujitsu, GE, and IBM to create "testbed environments" for all their IoT products.[31] Over time, disparities in legal rights to access, privacy, ownership and liability will also shrink as business and legal entities work to create a uniform code of norms regarding IoT technologies. As with all standardization processes involving public goods issues though, incentive misalignments and free rider issues are sure to arise regarding cost, risk, and customer base sharing.

KNOWLEDGE GAP

While energy cost reduction largely paved the way for the smart building movement, building owners are finding that incentives do not align between the users of the technology, those who benefit, and those who bear the costs. For example, energy costs make up roughly 40% of the lifetime costs of a building, a percentage that is materially decreasing due to the abundance of energy efficiency and energy management innovations. However, construction makes up 20%, and operations make up 40%.[32] The costs of construction have increased

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[29] Forbes, *The Case for Standardizing IoT*, February 28, 2017
[30] Siemens, *Intelligent Infrastructure: How to make a smart building more profitable*
[31] IIC, *Industrial Internet Consortium Announces Three New Steering Committee Members*, August 1, 2016
[32] Deloitte, *Breakthrough for sustainability in commercial real estate*

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dramatically due to labor and talent shortages; however, the cost of operations is a largely overlooked area as well. Oftentimes, facilities managers are decidedly not equipped or compensated to handle sophisticated technologies, and more generally, the building industry faces a dearth of IT skills. Additionally, costs of implementing technology and maintaining the cost of a "smart" building thereafter remain high and largely unpredictable.

> *"There is a missing link as to where [technology companies] need to market and sell their products and insights"*
>
> --Sarah Abrams, Senior Vice President of Global Real Estate at CRETech Boston

The large unspoken truth in the industry is that compensation schemes are not well equipped to align incentives towards innovation; specifically, operational optimization of a building. A tenant might push for a nice-to-have technology, such as sub-metered HVAC controlling down to an individual level, but unless the tenant bears great influence, it remains a difficult sell to the building owner that such investments would see a favorable return on investment. If by chance the product convincingly demonstrates higher occupancy rates or favorable economics, once implemented, such software often requires an orientation process or training by the user, the facilities manager. Uncompensated for the added hassle, it is easy to have spent the cost without fully reaping the benefits and capabilities that such tools offer. Conversely, on occasion, the facilities manager may see technology that would greatly improve their operations and functions and push it up to the decision-makers, but if it does not directly increase tenant satisfaction or improve the economics of the building, it remains again a difficult sell. In fact, many facilities are not compensated to take innovation chances and will often want to avoid getting "any egg on their face," with respect to implementing new technologies. While they go hand in hand, the buildings space first faces a knowledge gap and IT talent shortage, and secondly, is not properly incentivized to change the status quo.

That said, we see an increasing trend of job creation dedicated towards data and technology, with the rise of new roles such as Chief Data Officer (CDO). In fact, 80% of large enterprises are thought to have a CDO fully implemented by 2020 (66% of organizations expect allocated budgets for that office to grow), according to Gartner.[33] This should address much of the issues initial building IoT solutions faced in terms of deployment and customer acquisition hurdles, such as resource constraints and lack of time and training dedicated towards understanding deployment technology and novel usage modes.

UNCLEAR VALUE PROPOSITION

Largely in part due to the knowledge gap outlined above, emerging startups in the space have had limited success pitching a compelling value proposition, or rather, selling to the correct stakeholder. However, from the perspective of real estate owners as well, startups have failed to speak the same language or demonstrate a track record and narrative that conveys sustainable growth and durability. Pricing has remained a large issue, whether per square foot or per

> *"It's got to work, and it has to create value. And you really have to know how to convey the value prop and the value add in a way that people can understand financially and quantifiably"*
>
> --Kevin Danehy, Global Head of Corporate Development / Executive Vice President of Brookfield Property Partners at CRETech Boston

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[33] Tableau, *2018 Top 10 Business Intelligence Trends*

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building or a portfolio-wide sell, which has contributed to an overall hurdle of unproven average selling price (ASP) increases needed to fuel revenue growth.

Lifetime value to customer acquisition costs (CAC) has also remained a challenge given the long sales cycles, upfront cost of hardware installations, slow transitions towards SaaS focused business models (particularly with owners with short term hold horizons), and quality of the product necessary to withstand the durability test of integrating into a building with a 30+ year lease. In fact, as SVP of a large commercial property REIT mentioned, "We can only consider a stable startup that is going to be around for the next 30 years; otherwise, we will have to revert to the giant incumbent."

LEGACY INFRASTRUCTURE / CHANNEL CONFLICT

"There is a tremendous amount of clean up before we can even get to any of the cool stuff"

--Brian Koop, Executive Vice President of Boston Properties at CRETech Boston

The pace of Moore's law, technology's capacity doubling every 18 months, far exceeds the timelines of real estate, where leases are often signed for 10 year leases, and technology is expected to be implemented for 30+ years. While the time of construction is dramatically shrinking--with the advent of construction technology—a construction project can take 3-5 years from site selection to keys. Thus, cutting-edge technology selected during the architecture, design, and engineering process could be on its 3rd or 4th generation by the time a tenant occupies the space.

As it relates to the above challenges of fragmentation and lack of standardization, it is difficult to pick a winner, and competing technologies are often rendered obsolete by the time the building is up and fully integrated with the technology. These challenges are drastically mitigated in ground-up builds; however, consider the landscape of the 5.6 million existing buildings in the US alone (the vast majority of the buildings opportunity).[34] With tenants in the building, existing systems need to operate seamlessly even during the planning and implementation process. Finally, while legacy infrastructure remains a hurdle, oftentimes the larger issue is legacy relationships: pre-existing relationships that create channel conflict, in which new emerging players may upset the delicately interwoven web of customer / supplier relationships.

DISTRIBUTION CHANNELS

Finally, given the large, oftentimes bureaucratic nature of the larger potential distribution channels, startups in the space have faced the issues relating to long sales cycles and lack of visibility on pipeline opportunities. Seasonality with large corporate budgets also contributes to lumpiness and difficulty achieving predictable revenue growth necessary to reach targets for funding and desirable valuations. More broadly, products in the smart building space are simply

"Money is not enough... There's a lot of products out there, but they're struggling with distribution"

--Mihir Shah, co-chief executive of JLL Spark

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[34] Market Wired, *5.6 Million Existing Commercial Buildings in the US Will Now Be Eligible for a Proven Third-Party Certification that Offers Low-Risk Cost Benefits*

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sold differently from those of other industries. Simply figuring out who the right people to sell to has been an ongoing challenge, requiring a network of relationships, industry knowledge, and an understanding of the particularities of real estate owners' budgets and decision-making processes.

CONCLUSION

In the belief that PropTech is still in the early innings, again the purpose of this white paper is to help investors and entrepreneurs explore the Smart Buildings space and to discuss the opportunity in 2018 through a number of current trends & company case studies. As discussed, many of the "hot" themes identified in our broader PropTech definition are interrelated and highly interdependent to/on the Smart Buildings sub-segment, including: 1) Space-as-a-Service, 2) IoT 3) Artificial Intelligence/Machine Learning, 4) Workflow, 5) Augmented Reality / Virtual Reality and 6) Pref-fab Construction.

On the horizon, we believe broader technology themes including Blockchain, FinTech and Enterprise Data Integration (real-time valuation, risk assessment and insights) will play a greater role in transforming real estate, with many startups arising in the early stages. Specifically, blockchain networks offer the promise of creating a standard upon which global trade of assets can be interoperable. Companies and individuals will be able to tokenize almost any asset that represent a wide range of scarce assets going beyond currencies. We can potentially hold ownership claims to a commercial building, early stage equity, and a single-family residence on the same platform.[35] Just as the Internet digitized the cost for communication, blockchain has the ability to eventually commoditize the process of agreement and trust. However, similar to the internet's natural evolution, there will continue be a period of development and trial and error as well as regulatory changes before true commercial applications start to take place. In terms of early commercial applications, we believe blockchain to be an improved underlying "ledger" -- to better the process of cataloging, recording, and storing of information for titles and escrows, which can be adopted by all existing organizations. Notably, Navitas explores blockchain in a separate comprehensive white paper to be published in 2018.

We believe that advances in FinTech x PropTech to eventually bring increased liquidity (leveraging data integration, comprehensive valuation models & trading analytics) and accessibility to the capital markets for commercial real estate, thereby smoothing out market inefficiencies contributing to market cyclicality. Moreover, data inputs from machine learning / artificial intelligence will provide increased "transparency" -- to help make more informed data-driven decisions. One compelling start-up poised to disrupt the real estate data space is Cherre. The company's mantra is "Democratizing Real Estate Data". In practice, Cherre is building a uniquely powerful data/API platform, extracting actionable insights from a multitude of public & private data sets. Importantly, Cherre's platform (data & machine learning) enables more accurate and immediate price and risk assessment (next-gen transparency)-- including to help analyze investment opportunities. While the real estate industry prides itself on the localized, empirical expertise gathered and often holds its cards close to its chest, we

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[35] Catalini & Gans, Some Simple Economics of the Blockchain, 9/2017

believe better, more accurate data available in the market produces more informed and diverse buyers, producing a market of increased specialization rather than competition.

In short, there is a clear convergence taking place with respect to technology and real estate. However measured or defined, the PropTech sector is extremely large and only on the front end of its growth trajectory. As highlighted in the white paper, Navitas believes that PropTech has reached a truly exciting time of acceleration — particularly as technology and real estate assets converge across all asset types. In practice, this convergence is fundamentally changing the way we design, construct, operate, buy & sell and interact with buildings and cities, including all interconnected infrastructure (e.g., physical assets, digital technologies, people). Over the last two years, we have noticed a considerable change in attitudes within the real estate industry towards technology adoption. As a result, exciting new startups are emerging with quality management teams. Additionally and inter-related, we are noticing increased attention and awareness of PropTech as a sector, with many venture capitalists and new entrants on the investor side becoming aware of the massive market opportunity within real estate and viewing real estate as an investable asset class within the Technology umbrella.

 In conclusion, we see the Smart Building Segment as an important component of the broader PropTech & Real Estate Tech investment thesis -- where the application of technology has been embraced by early adopters, has been de-risked in many cases, and has become increasingly more attractive from a price-to-value stand point. Accordingly, we believe there is a compelling opportunity to invest and to participate in the current generation of Smart Buildings & Real Estate Technology over the next 3-5 years.

Navitas' Take on "Smart Buildings":   The Shelf Life is Limited

This probably will be our last white paper focused on "Smart Buildings."   From Navitas' perspective, the use of smart buildings as a characterization will absolutely and undeniably diminish over time. In fact, we believe that the next generation of "Smart Buildings" will be well…. just contemporary buildings, whereby each building acts as a component of a city's or community's interconnected operating system in a work-live environment. In short, the way people work is fundamentally changing, empowered by technology and a new mindset with respect to mobility and the optimization of time and physical space.

In fact, it's estimated that by 2020, ~40% of the workforce (60M people) in the U.S. alone will be "next gen" independent workers or entrepreneurs. The promise is to change our fundamental relationship with work-live, to better align human purpose and productivity – particularly with respect to next-gen (vibrant, connected) urban communities.   *Notably, Navitas will explore next-gen urban cities & communities and the importance of "User Experience (UX)" in a separate comprehensive white paper to be published in Q3-2018.*[36]

> *"People are moving to cities, seeking community, purpose, and the opportunity to create their life's work. There has been a macro shift toward a new way of working and living – people are focused on meaningful connections and being part of something greater than themselves. If employers want to attract top talent, they need to understand and embrace that shift."*
>
> --Shiva Rajaraman, Chief Product Officer at WeWork

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[36] Chief Product Officer Shiva Rajaraman, *Interview with WeWork Chief Product Officer Shiva Rajaraman,* Medium

APPENDIX A: SMART BUILDINGS STARTUPS TO WATCH

In sum, we have tried to create a list that reflects the breadth and depth of the overall opportunity in the sector with the most relevant categories. We recognize many companies overlap between categories and that there are many promising startups not included in this list. With this in mind, we welcome your feedback.

Security / Access Control

Flex Space Optimization
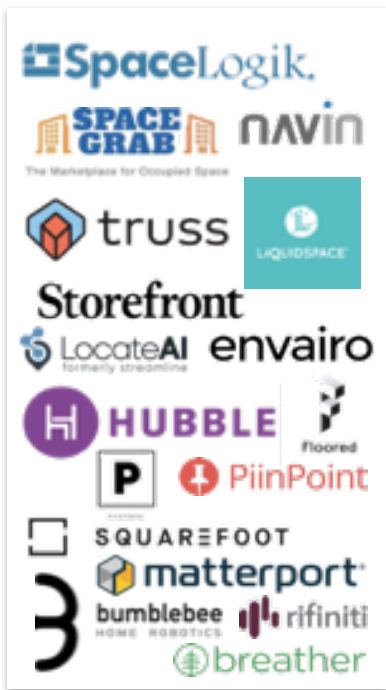
Health, Wellness, & Eco

Co-Working / Co-Living
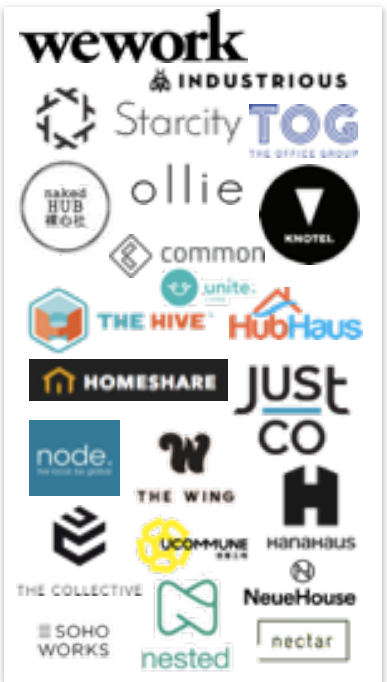
Off-Site Construction

Construction Workflow

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Smart Building Data

Prop Mgmt. / Amenities

Workflow Management

APPENDIX B: REAL ESTATE TECH RECENT DEAL ACTIVITY

Date	Company	Description	Round	Investors	Investment	Investment to Date
7/18/2018	Openpath	Cloud-based access control system	Series B	Emergence Capital, Upfront Ventures, Fika Ventures, Pritzker Group, Sorenson Capital, Bonfire Ventures	$20.00	$7.00
7/18/2018	Foyr	India's first online automated interior designer	Series A	SRI Capital, JLL, Astarc Ventures, Brick Eagle	$4.20	$9.70
7/13/2018	Kindly Care	Non-medical home care for the elderly and disabled requiring help	Series A	Jackson Square Ventures, MHS Capital, FLOODGATE, Javelin Venture Partners, Cherry Tree Investments, Arena Ventures, and others	$5.40	$8.50
7/12/2018	Allthings	Enables communication between property users, owners and managers (Swiss-based)	Series A	Idinvest Partners, Earlybird Venture Capital, Technology Fund, Creathor Ventures, and others	$13.70	$18.60

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7/12/2018	REthink	Co-working for the Real Estate Industry	Series A		$8.00	$8.00
7/11/2018	Olio	Connects neighbors with local merchandises to share unwanted food	Series A	Accel, Octopus Ventures, Quadia, Silvergate Investments, Mustard Seed, and others	$ 6.00	$ 8.20
7/11/2018	Nestio	Marketing and leasing platform for multifamily owners and managers	Series A	Camber Creek, Trinity Ventures, Rudin Ventures, Currency M, The Durst Organization, LeFrak Ventures, Torch Venture Capital, Freestyle Capital, Lazerow Ventures	$ 4.50	$ 16.00
7/10/2018	Convene	Flex meeting and workspace provider	Series D	Revolution Growth, Brookfield, Durst, RXR, Declaration Capital, QuadReal Property Group, Blackrock, Arrowmark	$ 152.00	$ 265.20
7/10/2018	Lodigfy	Vacation rental marketing software that simplifies the rental process	Series A	Intermedia Vermögensverwaltungs, Howzat Partners, Business Angels, Nauta Capital, Seedcamp, and others	$ 5.00	$ 7.30
7/5/2018	Starry	Internet company that creates easy-to-use Wi-Fi for buildings	Series C	Firstmark, IAC, Quantum Strategic Partners, HLVP, Tiger Global Management, KKR	$ 100.00	$ 130.00
7/5/2018	Campfire Collabora-tive Spaces	Industry-focused collaborative spaces based in Hong Kong	Series A	Ring Capital, Sa Sa International, Rykadan Capital, Kwai Hung, Potent Assets	$ 18.00	$ 24.00
7/9/2018	Limebike	Bikeshare provider	Series C	GV, Fidelity, Atomico, Uber, Fifth Wall, Coatue, Alphabet, GIC, IVP, Andreesen Horowitz	$ 335.00	$ 467.00
7/9/2018	Beijing ZhugeFang Fang	Chinese property search engine	Series B	Maintrend Capital, Sequoia, Suben Investment, Aqua Investment, Shanghai Resource, Fosun RZ Capital	$ 22.70	$ 36.70
7/6/2018	City Home	Beijing-based short-term property management company	Series A	Airbnb, Tencent, CBC Capital	$ 5.00	$ 7.50
7/5/2018	Booksy	Marketplace for scheduling appointments, wellness appointments, etc.	Series B	OpenOcean, Kulczyck Investments, Piton Capital, Nomad Venture Fund, Investible	$ 13.20	$ 20.20

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Date	Company	Description	Round	Investors		
7/2/2018	Automation Anywhere	Cognitive Robotics Process Automation (RPA) platform	Series A	General Atlantic, Goldman Sachs, NEA, World Innovation Lab	$ 250.00	$ 250.00
7/2/2018	Starcity	Co-living provider	Series A	Prophit Investors	$ 1.00	$ 21.40
6/27/2018	Density	Occupancy analytics through self-installed, Wi-Fi powered unit to mount above a doorway	Series A	Upfront Ventures, Ludlow Ventures, Jason Calacanis, Dawn Patrol, Hiten Shah, Arjun Sethi	$ 4.00	$ 4.20
6/26/2018	Common Ground	Co-working space based in Malaysia	Series A		$ 20.00	$ 20.00
6/26/2018	Homee	Marketplace for well-priced, qualified home-service technicians and handymen	Series A	Engage, Home Depot, the Fan Fund, Florida Funders, Activate Capital Partners	$ 11.00	$ 13.80
7/1/2018	Trax	Computer vision for retail spaces based in Singapore	Series E	Boyu Capital, Warburg Pincus, Investec, Broad Peak Investments	$ 18.00	$ 24.00
6/26/2018	Unison Home Ownership Investors	Equity provider for home ownership through HomeBuyer and HomeOwner Program	Series B	F-Prime Capital Partners, Citi Ventures, Royal Bank of Canada	$ 40.00	$ 40.00
6/26/2018	Lease-Accelerator	Provides lease accounting software	Series B	Insight Venture Partners	$ 30.00	$ 37.10
6/26/2018	b8ta	Smart home tech store retail play	Series B	Macy's, Sound Ventures, Palm Drive Capital, Capitaland, Graphene Ventures, Khosla Ventures and Plug and Play Ventures	$ 19.00	$ 39.00
6/26/2018	Aclima	Large scale air sensors to monitor air quality	Series A	Social Capital, the Schmidt Family Foundation, Emerson Collective, Radicle Impact, Rethink Impact, Plum Alley, Kapor Capital and First Philippine Holdings	$ 24.00	$ 24.00
6/26/2018	Homee	On-demand property maintenance app	Series A	Home Depot, Activate, Engage	$ 11.00	$ 12.80
6/21/2018	Newchip	Investment marketplace for private companies, RE and REITS, and crypto	Seed	Youbi Capital, Sputnik ATX, JadeValue, Polymath Ventures	$ 2.00	$ 2.00
6/21/2018	Cape Analytics	Machine learning and geospatial imagery to identify property	Series B	XL Innovate, Khosla Ventures, Lux Capital, Formation 8	$ 17.00	$ 31.00

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		attributes for insurance companies				
6/21/2018	Renoviso	Marketplace to connect homeowners to renovation projects	Series A	Corigin Ventures, Bessemer, NextView, FJ Labs	$ 7.00	$ 12.00
6/21/2018	Roambee	Physical asset monitoring	Series C	MDI Ventures, Deutsche Telekom Strategic Investments	$ 2.00	$ 8.60
6/20/2018	Module	adaptable housing	Seed	The Robotics Hub		
6/18/2018	IndiQube	Bengalaru-based co-working space	Series A	Westbridge Capital, Ashish Gupta	$ 15.00	$ 15.00
6/18/2018	Loft Smart	Search and booking platform for student housing	Series A		$ 12.90	$ 17.60
6/13/2018	Homelane	Online home interiors company based in India	Series A	Brand Capital, Accel Partners, Sequoia Capital, RB Investments	$ 3.50	$ 13.50
6/14/2018	Knock	Real estate CRM and communication software			$ 2.00	$ 5.50
6/13/2018	TenantBase	Tech-enabled, tenant-facing brokerage for finding small CRE spaces	Series A	Stonecutter Capital Management	$ 10.70	$ 10.70
6/13/2018	Opendoor	Online home-selling service streamlining sales process	Series E	Access Technology Ventures, Norwest, GGV, Khosla, Invitation Homes, Caffeinated Capital, 10100 Fund, NEA, Andreesen Horowitz, Lennar Corporation, General Atlantic	$ 325.00	$ 645.00
6/13/2018	Distrii	Co-working space based out of Shanghai	Series A	Fenghua Capital, Junzi Capital, CDL China, Hefu Investments	$ 23.00	$ 53.10
6/11/2018	Breather	Short term rental company	Series C	Menlo Ventures, Caisse de Depot et Placement du Quebec, Ascendas-Singbridge, Temasek	$ 45.00	$ 118.00
6/11/2018	Reonomy	Commercial real estate analytics platform	Series C	Sapphire Ventures, Bain Capital, Softbank Capital	$ 30.00	$ 69.40
6/8/2018	Propeller	Drone mapping for construction, mining and asset usage	Series A		$ 10.00	
6/8/2018	Jetclosing	Digital real estate title and settlement transactions	Series A	T. Rowe, PSL Ventures, Imagen Capital Partners, Trilogy Equity Partners, Maveron	$ 20.00	$ 24.30

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6/7/2018	WhyHotel	Pop-up Hotel for temporary empty spaces	Seed	Camber Creek, MetaProp, Rise of the Rest, Mendacre, Working Lab Capital, Mitchell Schear	$ 3.94	$ 3.94
6/7/2018	Nash Work	Shared workspace start-up (Beijing-based)	Series B	Deutsche Bank, Huarong Rongde Asset Management, Clearwater Capital, Sino-Ocean Capital, Kunlun	$ 78.10	$ 112.70
6/6/2018	Danke Gongyu	Property rental platform (China-based)	Series B	Tiger Global Management, China Media Capital, Gaorong Capital (Banyan), Joy Capital, VIsion Plus Capital, Beterlsman Asia Investments, Shenzhen Youjin Investment Management	$ 100.00	$ 114.00
6/6/2018	Lending-Home (Seeking Raise)	Home mortgage loan provider	Series D	Foundation Capital, First Round Capital, Ribbit Capital, FJ Labs, Renren Capital	$ 117.00	$ 210.00
6/6/2018	Spotahome	online booking rental site for mid to long-term accommodation	Series B	Kleiner Perkins Caufield, Passion Capital	$ 40.00	$ 64.00
6/5/2018	EV Hive	Indonesian co-working company	Series A	Softbank Ventures Korea, H&CK Partners, Tigris Investments, Naver, LINE Ventures, STIC Investments, East Ventures, SMDV, Sinar Mas Land, Insignia Venture Partners, Intudo Ventures, Michael Widjaya and Chris Angkasa	$ 20.00	$ 23.70
6/5/2018	Obligo	replace security deposits	Seed	83 North, Entree Capital, HFZ Capital	$ 3.00	$ 3.00
6/5/2018	Raken	reporting app and field management solution for construction	Series A	U.S. Venture Partners, Tao Capital, Eniac Ventures, Rincon Venture Partners, Spider Capital	$ 10.00	$ 12.00
6/3/2018	Coya	AI for insurance coverage	Series A	Valar Ventures	$ 30.00	$ 40.00
6/3/2018	Mews Systems	Cloud-based property management software for hospitality	Series A	HENQ Invest, Thayer Ventures, Notion, Activist Capital	$ 6.00	$ 7.50
6/1/2018	Emagispace	Modular interior space	Series A	Alpha Edison, Circle Ventures, United Talent Agency (Jeremy Zimmer), 54 Madison	$ 5.10	$ 9.30

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Date	Company	Description	Round	Investors		
5/31/2018	SmartRent	Enterprise Smart Home Automation for PM		RETV	$ 1.50	$ 5.00
5/31/2018	Tessin	Crowdfunding service for real estate investments	Series B	NFT Ventures	$ 2.50	$ 4.34
5/31/2018	Kneron	AI chip maker for IoT, IoV, and UAVs	Series A	Horizon Ventures, Alibaba Entrepreneurs, Sequoia Capital, Qualcomm, Alibaba Entrepreneurs Fund, CDIB Capital, Cyzone Angel Fund, Thundersoft, Himax Technologies	$ -	$ -
5/31/2018	Sensetime	Facial recognition AI in China	Series C	Fidelity International, HOPU Investment Management Company, Silver Lake, Tiger Global Management, Qualcomm Ventures	$ 620.00	$ 1,600.00
5/31/2018	Hello Alfred	Automated personal concierge service for multifamily rentals	Series B	DivcoWest, Invesco, NEA, Spark	$ 40.00	$ 52.50
5/31/2018	Flyhomes	Brokerage platform for people to buy and sell homes	Series D	Andreesen Horowitz, Mark Vadon	$ 17.00	$ 19.00
5/23/2018	eLichens	Gas and air quality sensors	Series A	Bpifrance, BNP Paribas Développement and return backers Aereco, DEMETER,SOFIMAC Innovation and France Angels	$ 7.00	$ 11.00
5/22/2018	Life House	Tech-enabled hotel brand				
5/22/2018	LockState	RemoteLock cloud platform for smart locks	Series A	Iron Gate Capital (IGC)	$ 5.80	$ 7.50
5/22/2018	First	Predictive data on why people move and retail analytics	Series A	MATH Venture Partners, Nine Four Ventures, Thad Wong, Mike Golden, IDEA Fund Partners, Charlotte Angel Fund, Pilot Mountain Ventures, Sovereign's Capital	$ 5.00	$ 7.40
5/21/2018	Openpath	Cloud-based access control system	Seed	Upfront Ventures, Bonfire Ventures, Fika Ventures, Pritzker Group Venture Capital	$ 7.00	$ 7.00
5/21/2018	Crexi	Commercial Real Estate Transaction Marketplace to simplify transactions	Series A	Lerer Hippeau, Founder Collective, FreeStyle Capital, TenOneTen Ventures, Jackson Square	$ 11.00	$ 15.30

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				Ventures, Manifest Investment Partners		
5/17/2018	DigitalTown	Blockchain tech for smart city software services	Seed	Pithia Capital	$ 2.40	$ 2.40
5/17/2018	OJO Labs	House hunting AI assistant	Series B	LiveOak, Royal Bank of Canada, ServiceMaster, Silverton Partners	$ 20.50	$ 26.50
5/17/2018	Amber Solutions	IoT for smart home and building infrastructure	Series A		$ 3.30	$ 3.30
5/17/2018	Notarize	Legal, online document notarization	Series B	Lennar Corporation, Polaris Partners, Realogy Holdings, Second Century Ventures, Wayne Chang, Fifth Wall, Flight Ventures, Jeff Seibert	$ 20.00	$ 30.40
5/17/2018	Workframe	Collaboration and communication platform for commercial real estate professionals	Series B	Newmark Knight Frank, Metaprop, Venrock	$ 9.50	$ 17.10
5/16/2018	Offerpad	Direct home buyer and seller platform	Series A	LL Funds	$ 50.00	$ 410.00
5/16/2018	eSub Construction Software	Cloud-based project management for construction	Series A	Autodesk, Revolution, The Investor Group, Farmers Investment Club	$ 3.00	$ 8.00
5/16/2018	Parsable	Workflow tool to help industrial workers move off paper	Series C	Future Fund, Saudi Aramco Energy	$ 40.00	$ 67.90
5/16/2018	Mynd	Property management tech provider	Series B	Lightspeed Ventures, Canaan Partners, Jackson Square Ventures, Barry Sternlicht	$ 20.00	$ 35.60
5/17/2018	JustCo	Singapore-based co-living space	Series B	GIC, Sansiri Plc.	$ 177.00	$ 12.00
5/11/2018	Spacious	Partners with restaurants to create spaces for working and meeting up	Series A	Baseline Ventures, Redpoint, Lerer Hippeau, August Capital, Metaprop, Boxgroup	$ 9.10	$ 9.10
5/10/2018	Perch	Marketplace for buying / selling homes	Series A	Firstmark Capital, Accomplice, Juxtapose	$ 30.00	$ 30.00
5/10/2018	Localize.ai	Residential real estate platform to help users find the right home using AI	Series A	Avigdor Willenz, Zvi Limon	$ 8.00	$ 19.00
5/9/2018	Betterview	Drone-based property inspection	Post-Seed	Nationwide Insurance, Compound	$ -	$ 3.60

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5/9/2018	Trussle	Free online mortgage broker focused on transparency	Series B	Seedcamp, Propel, Goldman Sachs, Finch Capital	$ 18.35	$ 25.80
5/9/2018	Fixer	No headache home repair	Series A	Oreilly AlphaTech Ventures, Mike Evans, Impact Engine, Hyde Park Venture Partners, Founder Collective	$ 4.00	$ 4.00
5/8/2018	Haozu	First domestic professional house-renting site owned by Anjuke Inc. (China-based)	Series C	Joy Capital, SDIC Unity Capital	$ -	$ 39.00
5/8/2018	HousingAny where	EU-based student housing platform	Series B	HENQ Invest, Vostok New Ventures, Real Web	$ 6.00	$ 13.40
5/7/2018	Cloudvirga	Digital mortgage point-of-sale software provider	Series C	Riverwood Capital, Upfront Ventures, Incenter, Dallas Capital Management, Tribeca Angels	$ 50.00	$ 77.50
5/3/2018	Admyt	Seamless smart parking	Series A	Monash Private Capital, Stonehenge Fleming Family, Bondi Pacific	$ 1.10	$ 2.40
5/2/2018	IronNet Cyber-security	Cybersecurity startup led by former NSA Executive, Keith Alexander	Series B	C5, ForgePoint, Kleiner Perkins Caulfield & Byers	$ 78.00	$ 110.50
5/1/2018	Matterport	Advanced platform for creating, understanding, and distributing 3D models of real-world spaces		State Auto Labs Funds		$ 66.00
5/1/2018	Humu	Behavioral change software startup analyzing human behaviors for office environments	Series B	IVP, Index Ventures	$ 30.00	$ 40.60
5/1/2018	ActivePipe	Marketing automation, lead generation, and predictive data SaaS platform for real estate and mortgage industries based in Australia	Seed	REach	$ -	$ 12.40
4/30/2018	Minim	IoT security platform whose technology protects connected devices and assures fast Wi-fi in homes	Seed	Flybridge Capital Partners, Founder Collective	$ 2.50	$ 2.50
4/30/2018	LeaseLock	Replaces security deposits with insurance	Series A	Wildcat Ventures, Liberty Mutual Strategic Ventures,	$ 10.00	$ 11.50

NAVITAS CAPITAL

		- insuretech play for rental housing		American Family Ventures, Moderne Ventures		
4/27/2018	Variety Space	Online-to-offline home renovation and decoration service platform based in China	Series A	DFJM Digital	$ 7.90	$ 7.90
4/24/2018	Guesty	Management platform for short term rental industry based in Tel Aviv	Series B	TLV Partners	$ 19.80	$ 24.40
4/24/2018	Buildingconnected	Provides builders with cloud-based bid procurement services	Series B - Bridge	Brookfield Ventures	$ 15.00	$ 52.70
4/20/2018	Hometap	Home equity investment platform	Series A	G20 Ventures, Pillar Companies, General Catalyst, American Family Ventures	$ 12.00	$ 12.00
4/18/2018	Squarefoot	Online concierge service to help look for office space	Series A	Rosecliff Ventures, Triangle Peak Partners, RRE Ventures, Primary Venture Partners, Armory Square Partners, Entrepreneurs Roundtable Accelerator, Sinai Ventures, Elevate Innovation, Launch Capital	$ 7.00	$ 13.40
4/17/2018	Agentology	Lead engagement and qualification platform for real estate agents	Series A	Simplexity Ventures, Silicon Valley Bank, OurCrowd, Moderne Ventures, FreeStyle Capital, Defy Partners	$ 12.00	$ 17.30
4/17/2018	Harbor	Automating regulatory compliance for tokenized securities	Series A - Corp. Round	Vy Capital, Valor Equity Partners, Signia Venture Partners, Pantera Capital, Future Perfect Ventures, Founders Fund, Craft Ventures, Andreesen Horowitz, Abstract Ventures, Abstract Holdings, 1Confirmation, Fifth Wall	$ 28.00	$ 38.00
4/16/2018	Measurable	SaaS for sustainability data collection, management, reporting, and building benchmarking	Series A	Camber Creek	$ 7.00	$ 11.30
4/12/2018	Redaptive	Energy-management solution for RE portfolios	Seed	CBRE, Linse Capital, GXP Investments, Engie	$ 20.00	$ 20.00
4/12/2018	Honest Buildings	Data-driven project management and procurement platform for RE owners	Series B	Altus Group, QuadReal Property Group, Oxford Properties Group, DivcoWest, Thrive Capital,	$ 24.50	$ 42.80

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				Westly Group, Rudin Ventures, Rockport Capital, RiverPark Ventures, Navitas, Greensoil Building Innovation Fund, Circle Ventures, C-III Capital Partners, Brookfield Property Partners		
4/11/2018	Abode (Moved)	App to manage your move and a personal assistant to get everything done	Seed		$ 2.70	$ 2.70
4/10/2018	Knotel	Agile workspace provider	Series B	Newmark Knight Frank, Sapir Organization, The Wolfson Group, The Moinian Group, Wainbridge Capital	$ 70.00	$ 95.00
4/9/2018	Sensetime	Facial recognition AI in China	Series C	Temasek, Suning Commerce Group, Alibaba	$ 600.00	$ 1,000.00
4/6/2018	Selina	Co-working and traveling hospitality services in Central America	Series A	Abraaj Group, Adam Neumann	$ 95.00	$ 95.00
4/6/2018	Great Jones	Creates modern platform to serve the $2T in rental homes owned by small-scale homeowners and investors	Series A	Jason Finger, David Rosenblatt, Dave Eisenberg, Kevin Ryan, Juxtapose, and Crosslink Capital	$ 8.00	$ 8.00
4/5/2018	PeerStreet	Marketplace connecting lenders to retail and institutional lenders primarily for fix and flip loans	Series B	World Innovation Lab, Andreesen Horowitz, Thomvest	$ 29.50	$ 50.60
3/26/2018	HappyCo	Workflow product with mobile app for inspections, rental housing, hospitality and RE	Series A	Tempus Partners, Sandalphon Capital, Larsen Ventures, Alium Capital, PieLab Venture Partners	$ 0.50	$ 11.70
3/23/2018	Door	Flat-fee home brokerage	Series A	Picus Capital, Alex Samwer, Court Westcott, Jack Pratt, Roger Ochs, Thomas Hartland-Mackie	$ 12.00	$ 12.40
3/22/2018	Skyline	RE tech platform connecting accredited global investors to US RE opportunities	Seed	Sequoia Capital, Gary Whipfler	$ 3.00	$ 3.00
3/13/2018	Airsorted	Airbnb management company providing key exchanges, laundry, etc; UK-based	Series A	Atami Capital, YYX Ventures, Pi Labs, Maxfield Capital, Concentric	$ 5.00	$ 6.90

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| Date	Company	Description	Series	Investors		
3/12/2018	Turnkey Vacation Rentals	Markets and manages vacation rental homes	Series D	Altos Ventures, Adam Street Partners	$ 31.00	$ 72.00
3/9/2018	HubHaus	Co-living housing for working professionals	Series A	Social Capital	$ 10.00	$ 11.40
3/8/2018	Interior Define	E-commerce site for interior furniture and design	Series B	Pritzker Group, Peterson Ventures, Listen Ventures, Fifth Wall, Breakout Capital	$ 15.00	$ 27.20
3/7/2018	Qualia	Workflow to ease RE closings process	Series B	Menlo Ventures, Bienville Capital Management, Barry Sternlicht, 8VC, Formation 8, LeFrak	$ 33.00	$ 7.00
3/6/2018	Armis	Digitalizes local advertising for physical retailers to grow in-store traffic, French-based	Series A	Iris Capital, Elaia Partners	$ 6.00	$ 7.00
2/27/2018	Industrious	Co-living workplace platform	Series C	Fifth Wall, Riverwood Capital, Outlook Ventures, Alrai Capital, Wells Fargo, Rabina Properties	$ 80.00	$ 142.00
2/26/2018	Danke	Apartment management solution in China	Series B	You Jin Capital, Vision Plus Capital, Joy Capital, China Media Capital, Bertelsmann Asia Investment Fund, Banyan Capital	$ 100.00	$ 114.70
2/21/2018	Knotel	Designs, builds, and operates customized spaces with flexible lease terms and HQ platform	Series A	500 Startups, Bloomberg Beta, Rocket Internet, Invest AG	$ 25.00	$ 25.00
2/21/2018	GroundFloor	Only direct real estate debt investment security available to non-accredited investors	Series B	Crowd Funded, FinTech Venture Fund	$ 4.30	$ 10.30
2/20/2018	Lyric	Property management for multifamily properties	Series A	NEA, Fifth Wall, NFX, AXA	$ 15.50	$ 19.00
2/15/2018	Roostify	Simplifies and accelerates the home-buying experience	Series B	Cota Capital, USAA, Santander InnoVentures, Point72, Colchis Capital, JPMorgan Chase	$ 25.00	$ 33.00
2/15/2018	Limebike	Bike sharing	Series B	Rainbow Technologies, Fifth Wall	$ 70.00	$ 132.00
2/13/2018	HomeSnap	Online platform providing RE services	Series B	Updata Partners, Moderne Ventures	$ 14.00	$ 32.00

		to agents, brokers, and consumers				
2/12/2018	OutDoorsy	P2P marketplace for RVs	Series B	Altos Ventures, Tandem Capital, Aviva Ventures, Autotech Ventures	$ 25.00	$ 25.10
2/6/2018	Badi	Barcelona-based company connecting people to shared spaces	Series A	Spark Capital	$ 10.00	$ 14.90
2/6/2018	Reonomy	Analytics on CRE properties	Series C	Bain Capital Ventures, MMC Ventures, Jaws Ventures, Gristedes	$ 16.00	$ 39.40
1/31/2018	Juniper Square	Investment management platform for RE	Series A	Felicis Ventures	$ 6.00	$ 8.00
1/25/2018	Enertiv	Deploys submeters and IoT sensors to monitor equipment level performance	Seed	Fifth Wall, Rudin Ventures, Metaprop, Cerium Technology, New York Angels	$ 4.25	$ 7.70
1/24/2018	Katerra	Pre-fab construction builder	Series D	Softbank, RiverPark Ventures, Navitas Capital, Four Score Capital,	$ 865.00	$ 1,100.00
1/22/2018	Hippo Insurance	Tech-enabled underwriting for home insurance	Series B	Fifth Wall, Comcast Ventures, Plug and Play, RPM	$ 25.00	$ 39.00
1/19/2018	Ollie	Micro-housing and co-living platform	Series A	Aviva, The Moinian Group, Texas Employees Retirement System	$ 15.00	$ 15.00
1/18/2018	Roofstock	Online marketplace investing in leased single-family rental homes in transparent, low-friction method	Series C	SVB Capital, QED Investors, Nyca Partners, Lightspeed Venture Partners, Khosla Ventures, FJ Labs, Canvas Ventures, Bain Capital Ventures, Asia Pacific Ltd.	$ 42.00	$ 75.30
1/17/2018	Apartment List	Web and mobile based apartment rental marketplace for home finding	Series C	Passport Capital, Quantum Partners, Matrix Partners, Industry Ventures, Canaan Partners, Allen & Company	$ 50.00	$ 109.00
1/11/2018	ClosetBox	Full service storage company	Series A	Boulder Ventures	$ 7.30	$ 19.80
1/9/2018	Rex	Global real estate portal and transaction platform - 2% instead of brokerage model	Series B	Scott McNealy, Dick Schulze, Gordon Segal, Amit Singhal, Jack Greenberg	$ 15.00	$ 30.00

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APPENDIX C: SMART BUILDINGS MARKET & GROWTH DRIVERS

SIZE & IMPACT
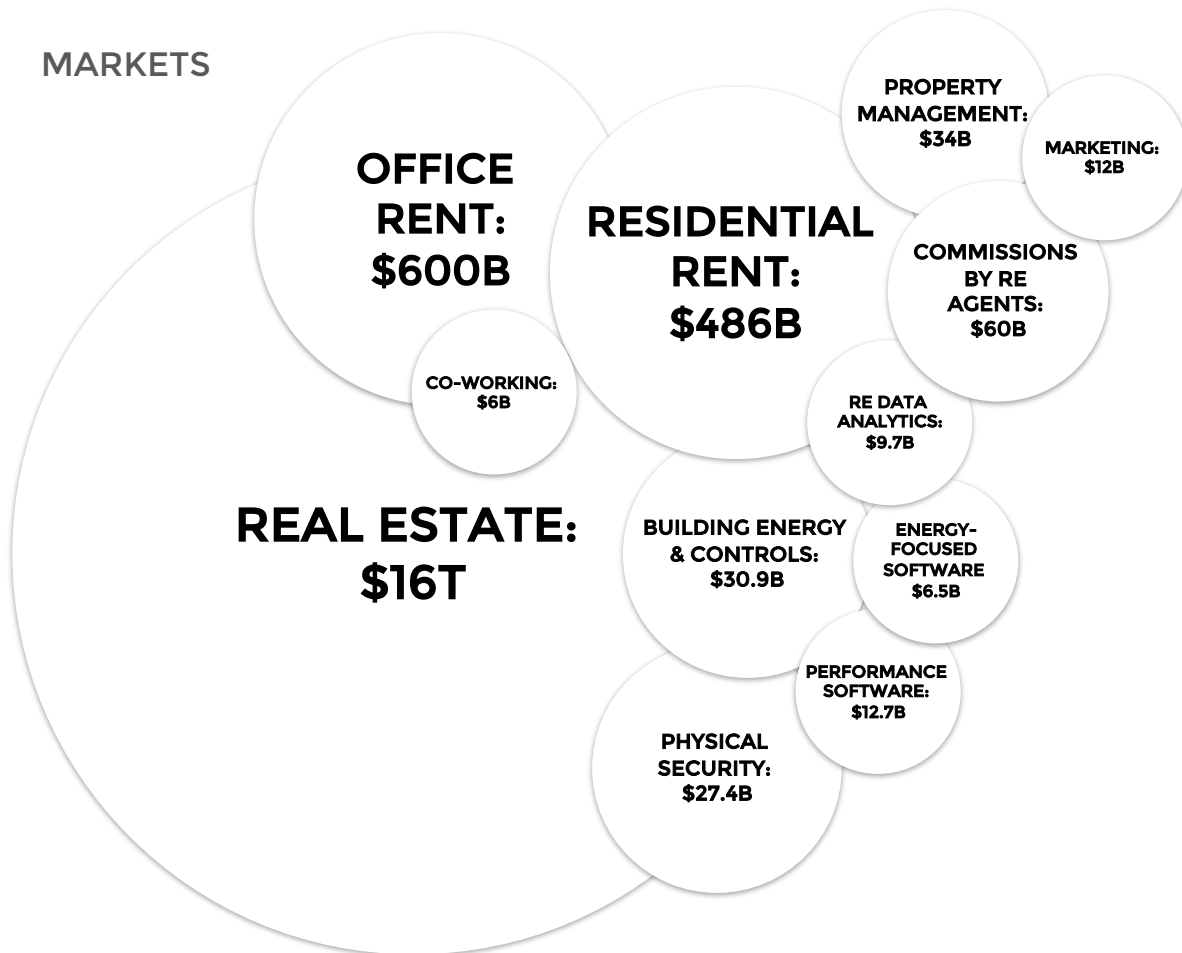
MARKETS

Just as the initial smart buildings technology was myopically tied towards energy efficiency and point solutions, the thinking on the smart buildings market opportunity is oftentimes thought to be synonymous with the building sensors opportunity. However, we would like to again reiterate our definition of a smart building as any solution with the ability to increase at least one point of the value stack within a real estate property (front end or back end), ranging from tenant experience to occupancy optimization and space utilization to listing and search services to marketplace services / amenities, leasing management, security, benchmark analysis, and asset management across an entire real estate portfolio. Thus, there are multiple ways to slice the market and think about the undeniably massive opportunity within the smart buildings space.

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Markets and Markets predicts the smart building market to grow to $31.7B by 2022.[37] What does this mean exactly? Delving in, we see the cybersecurity opportunity in smart buildings to amount to ~$4.26B,[38] with fire detection and safety at $21.9B and physical security amounting to a ~$27.4B market. Building energy and control systems is estimated to be ~$30.9B market, with performance software in smart buildings ~$12.7B and energy-focused software ~$6.5B market. [39] Occupancy analytics alone is expected to be a $1.5B market; however, space optimization analytics is expected to be a key integration, albeit commoditized, in the larger real estate data analytics market of $9.7B.[40] This is also useful for corporate offices, where cumulative corporate office rent amounts to a massive $600B opportunity, of which the fast-growing co-working rent market makes up $6B (~10% of the office rent market share). Along the flexible leasing trend, short term rentals make up $130B globally, with the cumulative rental market amounting to $485.6B. [41] Residential property management alone is said to be a $34.0B market, with the process of buying and selling amounting to $60B in commissions collected by real estate agents alone and $12B just in real estate advertising. What is now termed "wellness real estate", with amenities / health and wellness-centric approaches, is now a $134B industry.[42] Much as Uber was inadequately compared to the taxi market initially, while Airbnb was encased within the hospitality sector, we believe opportunities to crossover to larger opportunities and unlock hidden value are abundant within the massive industry of real estate, boasting the title of the world's largest asset class.

Moreover, these figures are by no means static. According to Dell, every year, 2.5x more data is created per individual. By 2020, there will be 25x more sensors than people, and by 2030, there will be ~$200B in IoT sensors alone. That said, less than 2% of the data generated is analyzed, so it is important to once again highlight the market need for structured, usable data powering a larger platform solution for data-driven decision-making.[43]

GROWTH DRIVERS

CORPORATE ADOPTION

5 years ago, corporate adoption in smart buildings technology was nearly unheard of. The earliest adopters were a limited number of names including Hines, JLL, Equity Residential, Equity Office, Related, Boston Properties, Vornado, Brookfield, Prologis, Silverstein, Shorenstein, Starbucks, and Google. With the advent of conference and industry forums such as Realcomm, CABA, AHR, BOMA, and Real Estate Tech, resources and industry networking has become more abundant, allowing for the rise of PropTech as a dedicated category. Owner-operators are now aware of the massive benefits transforming buildings into "smart" buildings brings, with Navigant predicting 2017 as the tipping point in corporate adoption. We see an increasing number of large owner-operators collaborating with startups. [44] Representative examples include: Honest Buildings with Rudin Management, Brookfield, and many other high-quality owners, and Aquicore's recent deployment at Normandy. Corporate M&A is also actively searching for strategic acquisition targets, as we've seen with Siemen's recent acquisition of Comfy in June 2018. Finally, we see a new generation of progressive owners as well, including large

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[37] Markets and Markets, *Smart Buildings Market Worth 31.7B USD by 2022*
[38] Memoori, Cyber Security in Smart Commercial Buildings 2017 to 2021
[39] Memoori, The Internet of Things in Smart Buildings 2016 to 2021
[40] SNL Annual Report 2016
[41] Rented, Vacation Rental Best Practices
[42] Robb Report, Why Wellness Real Estate is now a $134B Industry
[43] Ravi Pendekanti, President of Product Management and Marketing, G50-GSCS Smart Cities Conference Presentation
[44] Navigant Research, *10 Trends for Intelligent Buildings in 2017 and Beyond*

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technology firms voraciously acquiring more and more real estate simply to keep aligned with their explosive growth – the obvious example being Google, which recently bought 10M sq. ft. of real estate in San Jose for ~20k employees shortly after its $2.4B deal for Chelsea Market in Manhattan.[45] Along similar trends, the increasing proportion of large enterprises opting for a WeWork or Knotel option given the amenities, flexible leasing terms, and customized build for enterprise customers demonstrates increasing awareness to PropTech players offering a solution to a corporation's often under-researched real estate strategy.

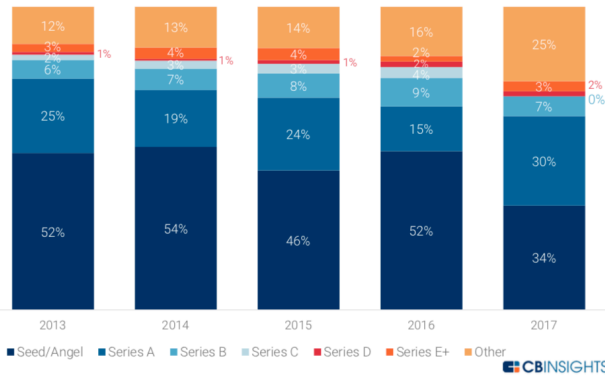FACEBOOK   APPLE   GOOGLE

EDUCATION / AWARENESS

Real Estate tech is growing rapidly with an estimated $6 billion invested since 2011 and ~70% of that coming in the last two years. Recently, companies in the space have gotten some extremely high valuations and a lot of press. Some of the huge Real Estate startups that have become household names include: WeWork, Airbnb, Katerra, Opendoor, SMS Assist, Cadre and Compass-- all of whom have drawn attention to the Real Estate tech boom.

As a result, press has also started to focus on real estate and PropTech as a separate vertical. CB Insights recently started releasing resources on the state of real estate tech. Additionally, university programs have begun to deal with the emerging space as city planning departments across the country begin to talk about smart buildings. At UC Berkeley the Center for the Built Environment has grown and begun to offer undergraduate courses that teach people about the future of smart buildings. Stanford offers similar classes on smart buildings and have even implemented new energy saving and wireless technologies into their own buildings.
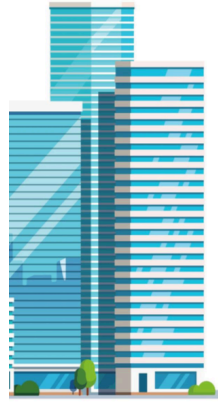
Awareness has also grown from the new trend of marketing buildings as smart buildings and getting press from the angle. In recent years, globally recognized smart buildings such as Bullitt Center, The Edge, Aruba's office, and the new Apple Campus have all brought attention to the new technology in Real Estate. The trend has shifted from people wanting to have the tallest building to people wanting to have the smartest building, viewing a smart building as indicative of the company's activities and an additional vehicle for talent recruitment and retention.

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[45] Bisnow, *Within the Next Decade, Google Could Add over 10m sf to CRE Portfolio*

ANNUAL GLOBAL REAL ESTATE TECH DEAL SHARE
2013 – Q1'17

	2013	2014	2015	2016	2017
Other	12%	13%	14%	16%	25%
Series E+	3%	4%	4%	2%	3%
Series D	1%	1%	1%	2%	2%
Series C	6%	3%		4%	0%
Series B		7%	8%	9%	7%
Series A	25%	19%	24%	15%	30%
Seed/Angel	52%	54%	46%	52%	34%

■ Seed/Angel   ■ Series A   ■ Series B   ■ Series C   ■ Series D   ■ Series E+   ■ Other

CBINSIGHTS

COMMERCIAL REAL ESTATE STILL UNTAPPED...

Property Types: office buildings, hotels, malls & retail stores, multifamily housing, industrial property, warehouses, etc.

Incumbents: CoStar and LoopNet

Early Leaders: VTS, Reonomy, Honest Buildings

Challenges: data cleanliness largest issue as most leasing terms are highly guarded and purposefully opaque

Reasons To Care: large transaction amounts, multi-party transactions (property brokers, mortgage brokers, lenders, developers, appraisers, builders)

CHANGING DEMOGRAPHICS

An additional growth driver for the future of smart buildings will be the changing demographics of tomorrow's workforce. Studies show millennials are much more likely to seek high tech office spaces for their careers and are willing to change jobs more than any other generation. Intuit predicts that in 2020, 40% of American workers will be considered independent contractors.[46] There are a number of forces behind the rise in short-term jobs. For one thing, in this digital age, the workforce is increasingly mobile, and work can be done from anywhere, so that job and location are decoupled. Freelancers can select among temporary jobs and projects around the world, while employers can select the best individuals for specific projects from a larger pool than that available in any given area.

The changing demographics of America's workforce and home renters will dramatically change how office spaces and apartment buildings are built and run. Commercial tenants with Real Estate tech will boast an advantage in attracting top talent within the millennial workforce. While millennials have spearheaded the gig economy, they have likewise reinforced the robustness of the sharing economy. In recent years, ridesharing apps like Uber and Lyft have capitalized greatly such trends, while Airbnb and WeWork have both become unicorns with the space-as-a-service model. As the gig and sharing economy continues to grow, the way office spaces are used will change for the first time in multiple generations towards space optimization, amenities and socially-centered designs, mobility and flexibility.

42M

U.S. Workers are 1099

(65M projected increase by 2020)

91%

of Millennials expect to stay at their jobs for less than 3 years

**34%**

of the Workforce has a second job

1 in 3

Millennials Freelance

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[46] Intuit 2020 Report: 20 Trends That Will Shape the Next Decade; *Customer Summit 2016 – Managing Global Contingent Workforce "

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TECHNOLOGY ENABLERS

SENSORS AND CONTROLS – HARDWARE

The largest technology enabler has been the rise of sensors and controls, setting up the initial infrastructure for data capture. While we see most of the sensor providers as largely tactile rather than platform providers, these first movers laid the foundation and groundwork necessary to overlay improving software and UI / UX platforms that are intuitive to the end user – although perhaps disproportionately burdened in terms of upfront hardware costs, lower LTV / CAC ratios, and longer sales cycles given the lack of market adoption. The ability to map indoor data and to identify individuals as guests or employees suggested the need for occupancy analytics and workforce productivity, catapulting the latest wave of smart buildings sensor and control technology – which has captured the attention of large players such as WeWork and large corporations hoping to optimize usable square footage and take advantage of repurposed space. Looking ahead, we believe we are currently in the depths of the next wave of smart buildings sensors and controls, focused on using the human behavior analytics to enhance the tenant experience – through amenities and tenant engagement apps bringing the landlord closer to the tenant.
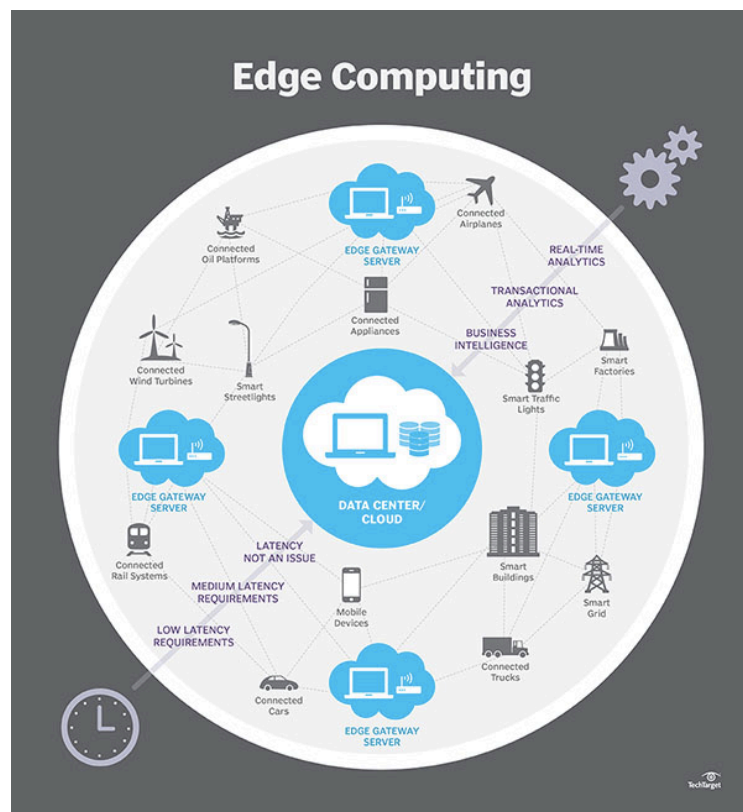
Given the quantity of data expected to be generated from IoT, the existing centralized cloud services will not be able to support the next wave of data processing. Moreover, the speed, security, and costs of transporting data to a distant cloud are also unsustainable.

Thus, companies such as Cisco and Dell have invested $1B+ in creating edge hardware to support the onset of IoT computing.[47] As an extension, real estate will serve a crucial role as the physical assets upon which IoT devices are ingrained. Realizing this, the likes of Amazon and Google in the smart home realm have spearheaded ambient computing as an extension of these waves, given IoT devices are now ubiquitous and able to communicate with each other. We are edging towards the "iOS everywhere": natural, humanistic, haptic, and conversational, facilitating between humans and their built environment.

MOBILITY

While mobile is nothing new, we believe the trend of mobility to be multifaceted in terms of potential unlocked value. On one level, the ability to feed inputs and to connect on-the-go allows for real-time monitoring, reporting

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[47] The Register, *Dell Makes $1B Bet That IoT at the Edge Can Kill Cloud Computing Takeover*

and management. Secondly, advances in mobile cloud computing have empowered teams to work together on-the-go through shared resources and integrated data. Thirdly, we believe mobile to be a central vehicle upon which all connected devices interface. Everything now has an app: The City of Santa Clara, the NY MTA, and even View Glass windows for dynamic tinting, etc. A mobile phone can unlock your door, pay your bills, pre-validate your VIP identity before you walk into a building, tell you where to walk, who to meet; the list goes on.

EMPLOYEES WHO USE MOBILE APPLICATIONS TO PERFORM WORK ARE

34%

MORE PRODUCTIVE

COMPANIES GAIN AN EXTRA

240 HOURS

PER YEAR FROM EMPLOYEES DUE TO MOBILE WORKING

We, therefore, believe mobile as the enabler of tenant experience enhancements, and more broadly, human experience enhancements that can extend beyond the interior of the building. The trend of mobility also extends towards realms of transportation infrastructure. Planning for parking in real estate developments will likely become an obsolete consideration in the near future, as people come with high-density, parking structures for urban living and catapult the sharing economy through bike, scooter, skateboard, essentially anything-on-wheels sharing options. Improving the experiences of people on-the-go, whether it be through increasing their productivity, enabling them to be on-the-go in the first place, or improving literally how they go to and from destinations, all sit within a trend that ultimately envisions an enhanced life experience product leveraging technology: a User OS for Life 2.0, providing a social network / community, safety and security, health and wellness, work productivity, and efficient transit between work, friends and families, and home.

REAL-TIME REPORTING/ WORKFLOW DIGITIZATION

According to an MRI report, 34% of employees are still using spreadsheets, while 9% still use paper, indicating ~42% of real estate organizations lack any sort of real estate workflow software.[48] With the rise of sensor infrastructure to capture data, the ability to process large amounts of "big data", mobile-centric applications, and complementary workflow solutions, we believe the enablement of real-time reporting to be a large, and somewhat underestimated, disruptor as well. For example, we see the ability to monitor energy efficiency and spend in real-time as a potential data layer to feed into asset management platforms, leading to better asset management, more diligent variance reporting, and better budget forecasting across a portfolio of real estate assets. The ability to see construction plans on site through mobile devices and directly report construction progress back to the multiple parties as well as to construction finance lenders can drastically improve safety, construction costs, time efficiencies, and ability to underwrite higher quality loans. The ability to visualize 3D interior data, as well as exterior data real-time, whether through video footage, satellite imagery, Lidar, or aerial imagery from drones, touches across all aspects of real estate from leasing and advertising to risk assessment and insurance underwriting useful for large insurance firms and hedge funds. Finally, the ability to complete property inspections and feed

42%

real estate organizations use spreadsheets and/or paper

34%

50+ employees **use spreadsheets**

9%

50+ employees **use paper**

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[48] MRI, *Market Survey Results: Technology in the Real Estate Industry*

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the data back to an appraiser sitting back in the office of an appraisal firm in real-time saves hours and even days in terms of workflow efficiency. Aside from time savings; however, we see accuracy, standardization of data, and the structuring of data as the most exciting aspect, with the ability to change the metrics and inputs on often antiquated processes, leading to better decisions and creating a more efficient market.

ARTIFICIAL INTELLIGENCE / MACHINE LEARNING

We consider artificial intelligence / machine learning as anything capable of amassing large volumes of historic data in a structured method to provide predictive intelligence for future decision-making. We should make clear this is far from novel conceptually, expanding upon principles of statistical regressions widely used in econometrics and statistics. What is novel, however, is the quality of the data, the ability to integrate, collaborate, and process large volumes of data, and the dedicated effort to apply these techniques to unique use cases requiring domain expertise or knowledge.

Like "blockchain" and "big data", artificial intelligence and machine learning have become buzz words enveloped in hype. While we do believe the technology is disruptive and revolutionary, we also believe the practical use cases need to be decoupled from the majority of "AI" plays likely to be devalued or commoditized in the coming years. We see predictive analytics as key for monitoring the operational efficiency of buildings, whether it be equipment performance, asset performance, connectivity, air quality, or occupancy and utilization. We also see the data layer as drastically improving the transparency of the notably obscure real estate sector, such as data analytics that previously only Excel and Argus may have provided. We see a whole slew of companies aiming to provide increasing transparency on "comparables", financial metrics, valuations, risk assessment, market insights, neighborhood analytics, etc. to better improve the process of sourcing, buying, selling, leasing, renting, occupying and managing property.

We believe smart buildings and the information they emit as integral to larger horizontal and vertical concepts. Buildings are central in slotting into the wider horizontal workflow stream from sourcing and identifying, to advertising, to buying or selling, to renting or leasing out, to obtaining insurance, financing, appraisal, title registry, city permits, entitlements, etc. The more information the building itself captures regarding its performance, the performance and wellbeing of the occupants within, and the nature of the buildings' surroundings, the more ripple effects they create for the various adjacent fields to radically adopt and innovate their businesses. Vertically, and perhaps more obviously, buildings are also central to the wider ecosystem of cities. In essence, cities are composed of buildings and roads; thus, real estate sits at an interesting intersection between the private and public spheres. Buildings are therefore the central axis, placing property tech startups at an advantageous position to go upstream and spearhead the "smartening" of buildings, infrastructures, cities, and ultimately societies at large.