

# Automation in Real Estate

A PRIMER ON  
SMART BUILDINGS  
AND DIGITAL TWINS



CENTER FOR  
REAL ESTATE



The  
Real Estate  
Innovation  
Lab

AN EDUCATIONAL  
WEBINAR FOR EY





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## INTRODUCTION

Automation continues to be one of the biggest buzzwords in the real estate industry with much discussion about the benefits and best practices for implementation. Organizations are however now beginning to see the benefits of automation and are thinking about how they can automate their processes to ensure their businesses are ready to thrive and compete in a disrupted world.

To help organizations think about what automation means, EY and MIT's Real Estate Innovation Lab have been producing a series of webinars looking at the future of automation in real estate - cutting through the hype, exploring what's happening now to understand what will come next.

In the second part of this series we will look at Smart Buildings and Digital Twins and how they are starting to become mainstream concepts in how buildings are designed and operated.

While Smart Buildings have been around since 2000 and NASA first developed "pairing technology" during the Apollo 13 mission, these relatively new concepts, which were once only presented as science fiction, are now coming to the fore. This article aims to explore what these two technologies are and how they have the potential to provide value for owners, operators, investors and designers across the entire life-cycle of a real estate asset.

**"THE RELATIONSHIP BETWEEN MIT'S CENTER FOR REAL ESTATE AND EY HAS BEEN BORNE OUT OF AN INHERENT CURIOSITY ABOUT THE IMPACTS OF TRANSFORMATIVE TECHNOLOGY ON REAL ESTATE"**

DR ANDREA CHEGUT  
MIT REAL ESTATE INNOVATION LAB



“TECHNOLOGY IS NOT THE  
ENDGAME - IT’S JUST THE  
**ENABLER**. THE REAL ESTATE  
SECTOR HAS A UNIQUE  
OPPORTUNITY TO ENHANCE  
LIVES, SOLVE HUMAN  
DILEMMAS, AND **ACTIVELY**  
**SHAPE THE FUTURE OF OUR**  
**CITIES.**”

SELINA SHORT  
EY OCEANIA REAL ESTATE, HOSPITALITY AND  
CONSTRUCTION MANAGING PARTNER



# THE AUTOMATION ECONOMY

## AI FOCUSED

130 COMPANIES ARE FOCUSED ON AI (MACHINE LEARNING, DEEP LEARNING, IMAGE RECOGNITION, LANGUAGE PROCESSING).

SOURCE: CONWAY [2018] AND CRUNCHBASE [2019]

## DATA SCIENCE

150 DATA COMPANIES ARE FOCUSED ON NEW DATA SOURCES FOR REAL ESTATE.

SOURCE: REI LAB REAL ESTATE TECH DATABASE

## ROBOTS!

JUST UNDER 90 COMPANIES WITH A ROBOTICS FOCUS WORK IN DEMOLITION, CONSTRUCTION, SECURITY.

SOURCE: CONWAY [2018] AND CRUNCHBASE [2019]

## DATA INTEGRATION

JUST UNDER 20 COMPANIES ARE DEDICATED TO HAVING DATA TALK TO EACH OTHER TO CREATE A DATA LAKE, I.E., DATA INTEGRATION.

SOURCE: CRUNCHBASE AND CB INSIGHTS 2019

NEW ARTIFICIAL INTELLIGENCE (AI) STARTUPS IN THE US ECONOMY INCREASED BY 113% BETWEEN 2015-2018

SOURCE: THE AI INDEX REPORT [2018], CONWAY [2018]

The general economy is working towards automating and augmenting our job tasks with a simple objective - codifying the human experience.

The world as we know it has been working on automation in the economy for over 65 years. In the years to come, this will only continue to advance. The real estate sector, however, has lagged behind during this transition and is only now beginning to truly see the impacts of automation and the economy.

In terms of economic development, automation could increase GDP by more than 1.1 trillion dollars in the next 10 years. Ultimately, every industry will be subjected to some level of transformation.

As it stands in the general economy, the number of AI startups increased by 113 percent in just three years. The real estate sector was a substantial part of this increase. There are now over 130 AI-focused real estate companies, 150 data companies, 90 robotics companies, and 20 companies that are working towards next level data science and integration.

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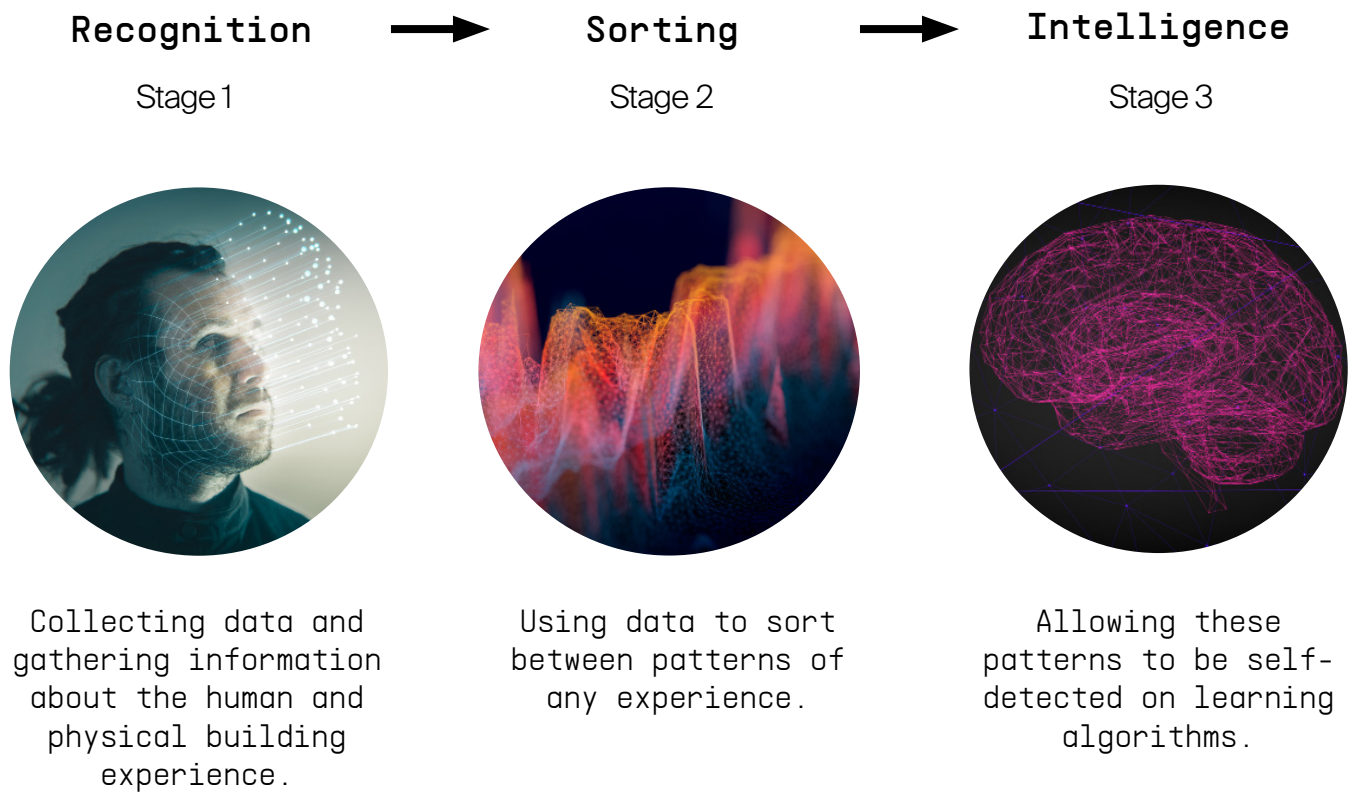
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# WHAT DOES AUTOMATION MEAN FOR BUILDINGS?



There are three phases in the automation of a building:

## Recognition

Building owners and operators are now beginning to recognize and organize all of the information that is available about the physical, human, and hardware experiences throughout their assets. This means that the industry as a whole is still collecting data.

## Sorting

As this data gets collected, we are able to sort information to gather insights more efficiently to make better decisions faster.

This digital decision making, usually referred to in the automation space as modeling or using statistics or machine learning, is then used to make inferences.

## Intelligence

Lastly, we are gaining intelligence that allows us to use our data and models to harness automated decision making. This is a little bit further along in some instances, but it is the ultimate goal for most automated tools. IoT sensors that automate climate control and smart elevators are great examples of automation at work within our buildings.



## SMART BUILDING

### WHAT IS A SMART BUILDING?

Smart Buildings are a bundle of embedded technologies that combined make a building “smart.” These numerous technologies have been paired with building systems to enhance a building’s operations, design, and experience. Historically, this grew out of building information modeling, and in combination with a shift towards more energy efficient and sustainable structures, has enabled this advancement in building system monitoring.

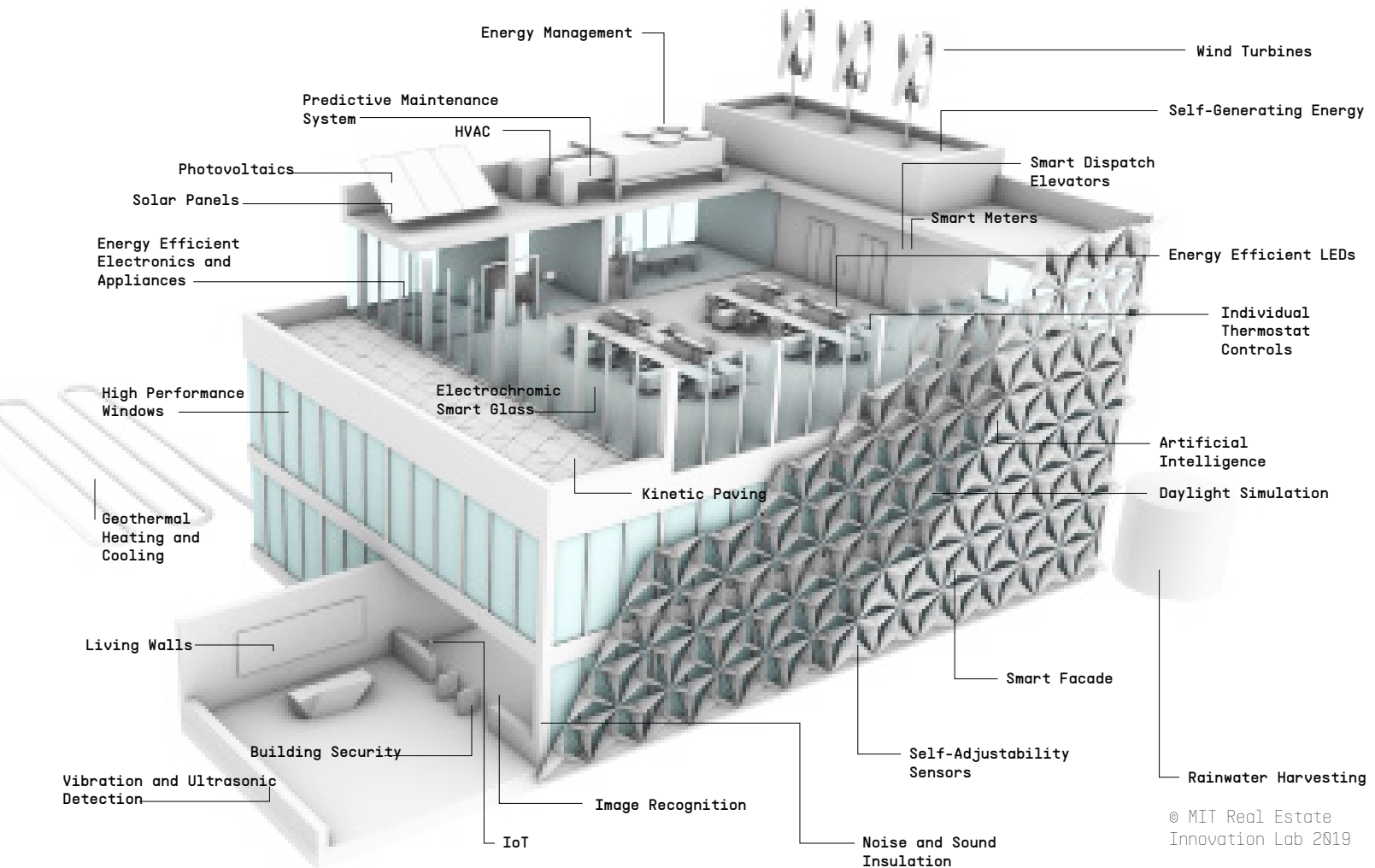
Smart systems use sensors to collect data, then utilize that data to model and understand historical performance,

allowing it to ultimately forecast events. It is important to make this link between automation and Smart Buildings as an extra step, because it is relevant to understand why we are collecting all of this data from these different sources and pairing it together.

Even now, people are starting to make connections between building operations and financial performance through the use of IoT sensors in their assets. This connection between automated systems and the data collected can help build the automation acumen needed to develop tools that help at each stage of automation.

**TAKEAWAY: A SMART BUILDING IS ONE WHERE A COMBINATION OF TECHNOLOGIES AND INTERCONNECTED SYSTEMS SUPPORT THE USE OF THE BUILDING’S USERS, ENABLES A MORE EFFICIENT OPERATION OF THE BUILDING AND ENABLES RECONFIGURATION OF THE SPACE.**

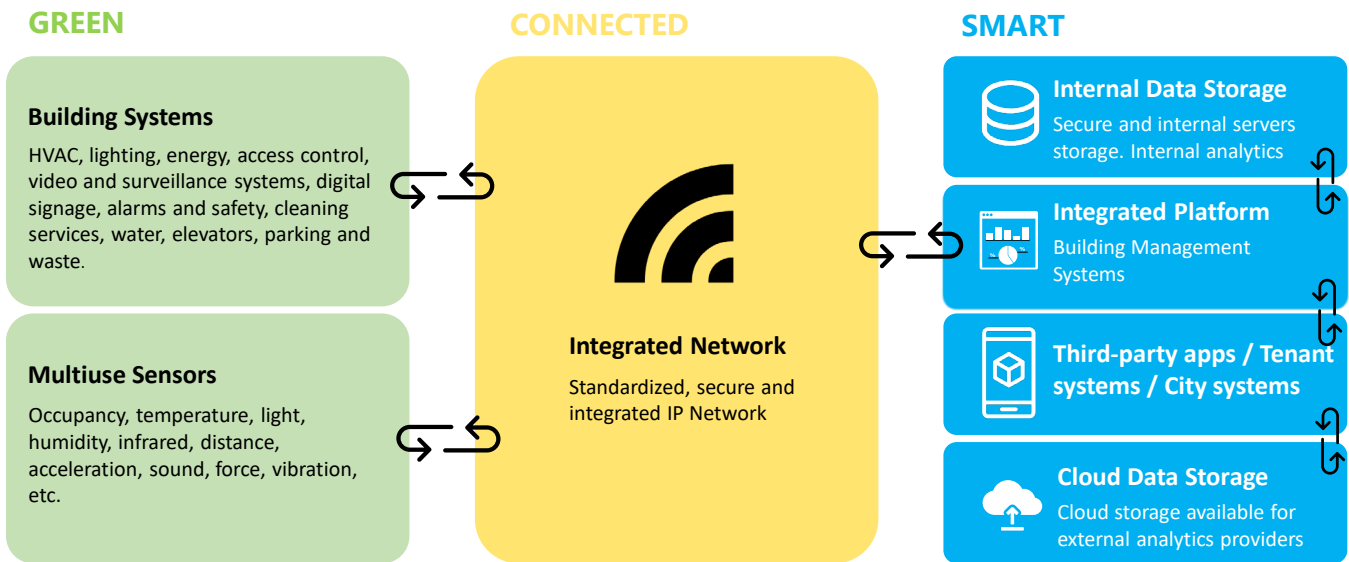
# WHAT ARE THE CURRENT FEATURES OF A SMART BUILDING?



Currently, there are no formal third-party systems that designate when a building meets the criteria to be considered “smart” or “intelligent.” Various studies have documented features of intelligence or systems that are commonly used to make building operations smarter. Yet, we do not have a third-party system as we do for energy efficient and sustainable buildings (such as with LEAD, BREEAM, Energy Star, Green Star, Green Globes etc.).

However, there are some areas where we have come to consistently observe buildings systems becoming digitally monitored with data collection through IoT devices to allow for the codification of a building. This increased transference between numerous devices enables a more holistic perspective in the future. The over-arching purpose of this pursuit is to develop smart building technology that understands and listens to what humans and buildings need to live, work, and play better in their environment.

# THE VALUE OF SMART, CONNECTED, AND GREEN



## MIT STUDY: IDENTIFYING BUILDINGS THAT HAVE SMART TECHNOLOGIES FOR VALUE ANALYSIS

Our research has allowed us to collect the most prevalent Smart Building features of commercial office buildings in NYC and paired that with financial performance data, such as transaction prices and effective rents.

Using econometric modeling techniques, we have controlled for what we know commonly explains rent and transaction prices and disentangled these from the smart, connected, and green buildings.

What we found was that smart, connected and green buildings rent for 8.2 percent more than those buildings without those features, and likewise traded for 23.7 percent more than buildings without smart technology.

Our objective is to continue this analysis with these types of studies to arrive at a more consistent financial picture of what the incremental value of smart, connected, and green is.

# MIT Study: Measuring the incremental value of Smart Buildings relative to other newly constructed buildings for NYC, 2010 to 2017

Smart, Connected and Green



Premium Effective Rents

Premium Transaction Prices

8.2%

23.7%

Smart and Connected



10.7%

-

Connected and Green



10.0%

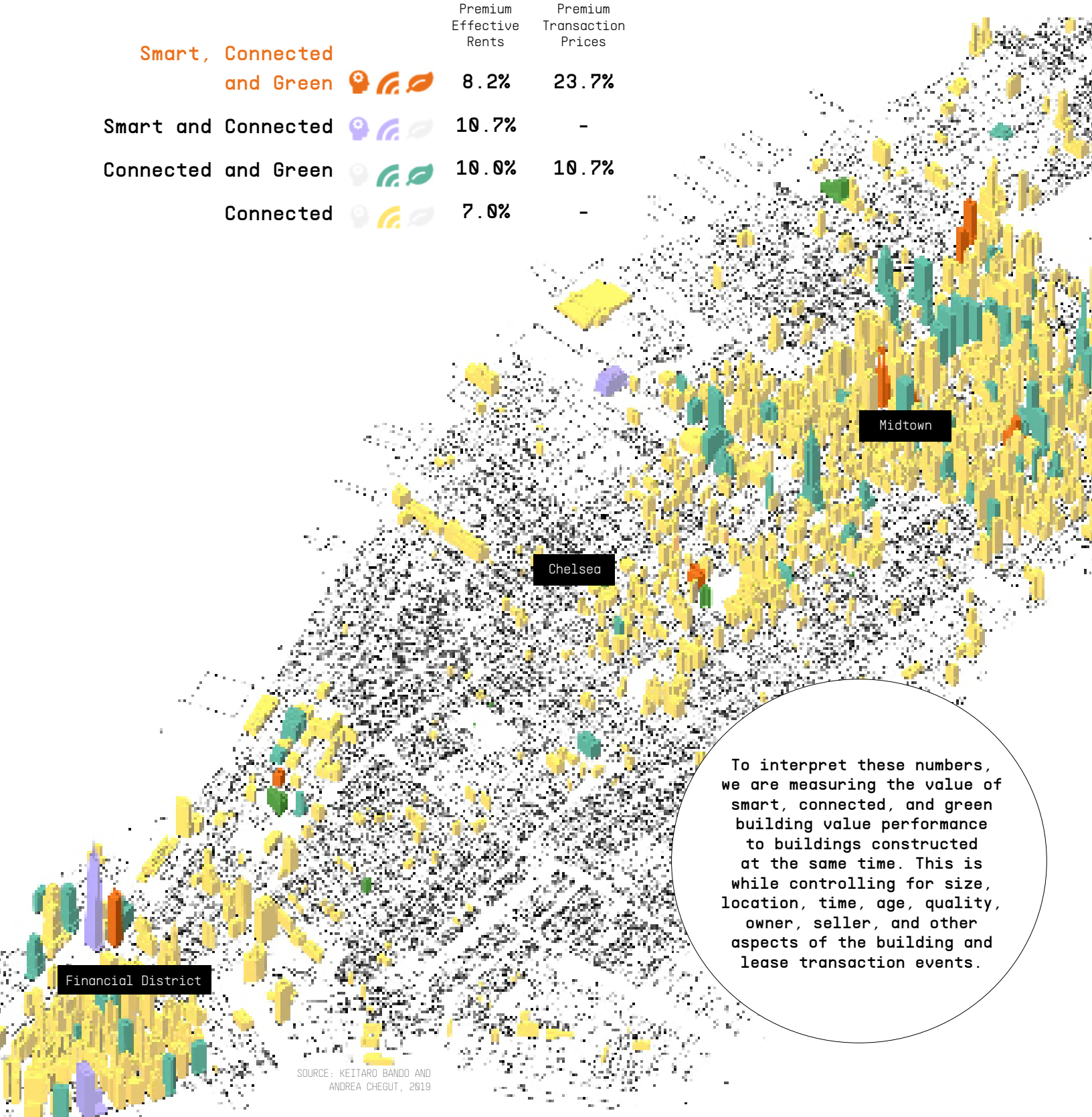
10.7%

Connected



7.0%

-



To interpret these numbers, we are measuring the value of smart, connected, and green building value performance to buildings constructed at the same time. This is while controlling for size, location, time, age, quality, owner, seller, and other aspects of the building and lease transaction events.

## DIGITAL TWIN

### WHAT IS A DIGITAL TWIN?

At its simplest, a Digital Twin is a virtual model of a process, product or service. So in terms of real estate, a Digital Twin is a digital representation of a physical building. We can think of it like a 3D model of a facility combined with all of the dynamic data that can showcase easy-to-understand visualizations and analysis.

Smart Buildings can enable and supercharge a Digital Twin with their numerous embedded technologies that feed data into the Digital Twin virtual model and bring it to life. Instead of stagnant digital representation of a building, we can now layer the continuous feed of both the building's data systems and human input into the digital dashboard of the twin.

Technologies that can merge two different domains of a sector are always really exciting. The reason why people are getting excited about Digital Twins is that the use cases exist for almost every single domain of the real estate sector. From land selection, architectural design, construction, operations, management, tenant programming, and even demolition, the use of the Digital Twin is relevant for all domains of our sector and can create efficiency and value in a common digital language for the entire real estate environment.

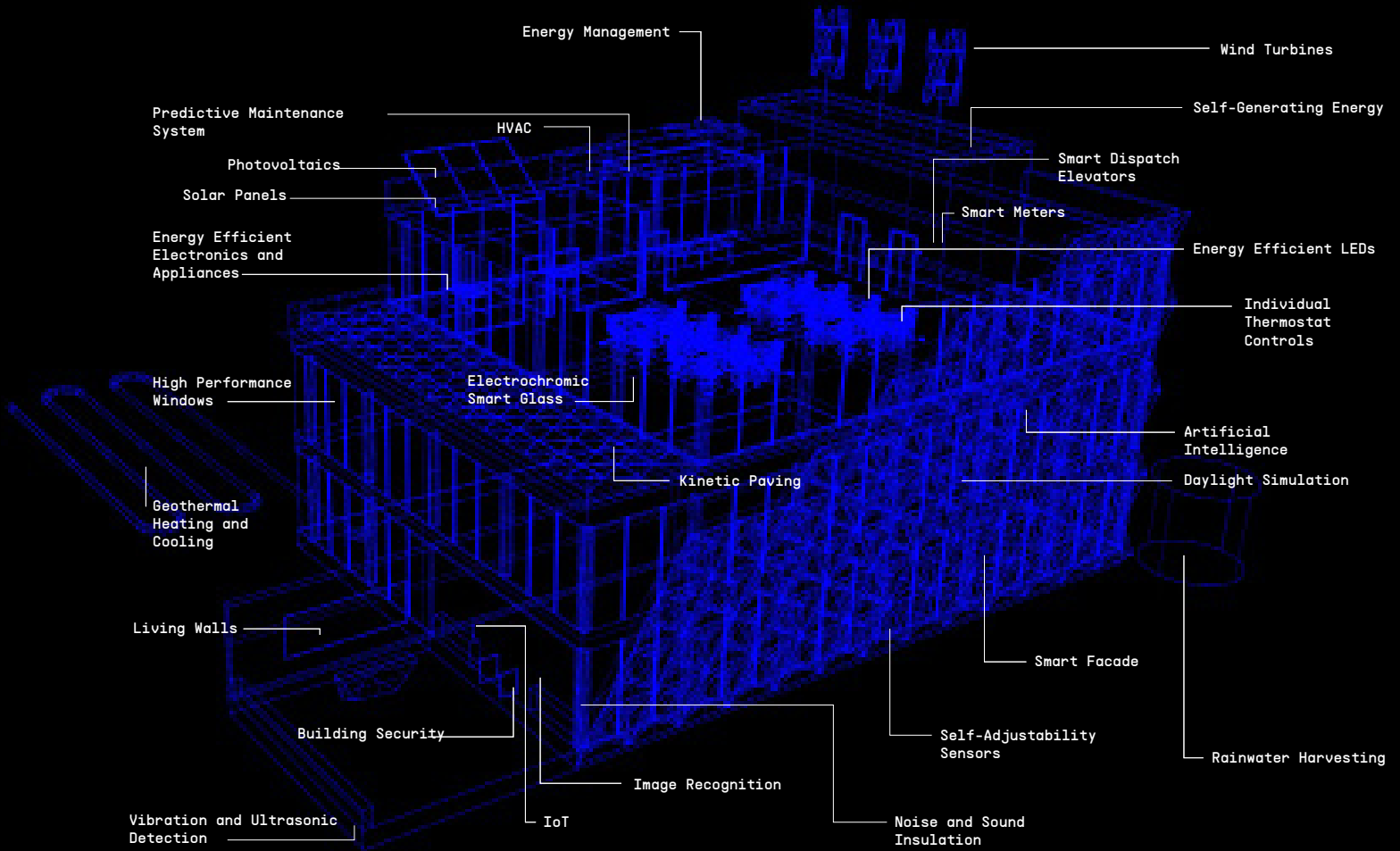
“SMART BUILDINGS CAN **ENABLE AND SUPERCHARGE** A DIGITAL TWIN WITH THEIR NUMEROUS EMBEDDED TECHNOLOGIES THAT FEED DATA INTO THE DIGITAL TWIN VIRTUAL MODEL AND **BRING IT TO LIFE.**”

DR ANDREA CHEGUT  
MIT REAL ESTATE INNOVATION LAB



# WHAT DO DIGITAL TWINS DO?

SOURCE: MIT REAL ESTATE INNOVATION LAB



A Digital Twin generally consists of a 3D graphic of the structural components of the building (think of a BIM model illustrating the building's outline, its walls, floor plans, internal systems). This graphic then incorporates all of the devices and sensors within a building to showcase all of the past and present data, ultimately creating a real-time picture of what is happening in the building at that precise moment.

Looking back at what we discussed earlier, a truly Smart Building can be measured by how well it responds to the long-term needs of the asset's investors and owners, as well as the immediate and ongoing needs of its

occupants. It is able to understand what its occupants want and need today, and what they will need in the future.

A Digital Twin is the platform that is going to help achieve Smart Buildings at scale. Combined with real-time data and machine learning techniques, Digital Twins will allow building operators to make real predictions, understand tenant behavior, and ultimately get ahead of issues before they happen, thus creating truly Smart Buildings.

# COMPONENTS OF DIGITAL TWIN

## CONSTRUCTION

In the construction sector, a Digital Twin offers a wiser and better enabled approach. As it happens, the construction sector has been utilizing Digital Twins with the use of BIM technology for some time, with digital models from computational architecture and engineering software, like Autodesk's Revit. This software then combines the dynamic layers of the construction processes, such as change orders, materials, equipment inventory, and even budgetary assessment. Advanced infrastructure projects have been using this for a number of years, but the key here is to utilize the existing BIM after the building or project is completed.



## OPERATIONAL

Digital Twins have the potential to become digitally connected within a city's larger Digital Twin. Lidar models already exist in certain cities. As we create smart city infrastructure, we can work towards creating a Digital Twin of the urban environment. This will help us in an increasingly complex environment that needs to respond to climate change, autonomous vehicles and other technologies that increasingly transform our urban experience. Additionally, the technology can track how people and spaces are being used throughout facilities and quickly identify security threats or liability issues. This will allow for the simulation of evacuation scenarios with large crowds to determine the ability of such a facility to adequately respond and therefore improve design.



# COMPONENTS OF DIGITAL TWIN

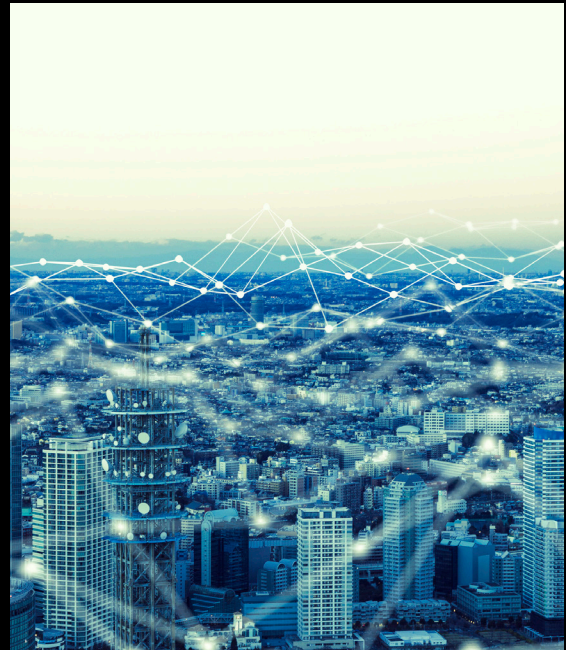
## PROCESS

From a process standpoint, a Digital Twin creates a digital record of the building's experience. This helps us to learn how the building can optimize future experiences for occupants, as well as achieve enhanced operational activities. It also creates a diagnostic record to maintain the physical, functional, and economic integrity of the physical asset's highest standards to achieve the optimal and best use of the asset.



## SIMULATIVE

Digital Twins create a simulation environment where we can re-imagine what the asset would be like if re-programmed. According to an independent study conducted by CBRE, the global average utilization of assigned seats is up to 60% and the global average meeting room utilization is up to 30%. Hence, the increasing adoption of digital engineering in the future buildings will be focused at measuring and optimizing building space. The current goal is to utilize data on existing facilities to improve the design of new projects. This is one of the most exciting elements of what the future of Digital Twins has in store.





## ECONOMIC BENEFITS OF A DIGITAL TWIN

The most obvious benefits of a Digital Twin are management of building occupancy, increased budget reliability, expanded financial opportunity through an enhanced capital expenditure on planning and modeling, as well as faster delivery in the construction realm. However, we are only at the beginning of this journey and have yet to fully see what all the benefits will be as the technology is developed further.

### HIGHER OCCUPANCY

UP TO **3.5% HIGHER OCCUPANCY** BY USING BIM

SOURCE: INTRODUCTION OF BUILDING INFORMATION MODELING BY THE EUROPEAN PUBLIC SECTOR

### BUDGET RELIABILITY

UP TO **40% DECREASE IN NON-BUDGETED CHANGE ORDERS**

SOURCE: CENTER FOR INTEGRATED FACILITY ENGINEERING, STANFORD

### FINANCIAL OPPORTUNITY

DIGITIZING ENGINEERING, CONSTRUCTION, AND OPERATIONS PROCESSES CAPTURE **10-20% OF CAPITAL PROJECT EXPENDITURE**

SOURCE: INTRODUCTION OF BUILDING INFORMATION MODELING BY THE EUROPEAN PUBLIC SECTOR

### FASTER DELIVERY

**7% SHORTENED PROJECT TIME-LINE** WHEN USING DIGITAL TWIN

SOURCE: CENTER FOR INTEGRATED FACILITY ENGINEERING, STANFORD

## SUMMARY

Once seen as a futurist concept, Smart Buildings are now very much part of the real estate ecosystem. As more and more systems become available, these intelligent buildings are using an increasing array of technologies to capture and feed live data that enhances both the owner and tenant experience.

In addition, owners and operators of Smart Buildings are learning what works for them. This may include incorporating for example green building systems or an integrated building management platform, firstly in order to identify the value proposition of Smart Building interventions, and hopefully moving onto the ultimate goal of productivity metrics in the future.

Digital Twin is a new technology that is currently gaining viability in the construction, design and management sectors of the industry. However, Digital Twins and Smart Buildings are not the same. Digital Twins, when paired with a Smart Building, could be supercharged for operational, process, and simulative performance outcomes.

This technology offers some of the greatest challenges and opportunities to drive next level insights for the real estate sector and ultimately, to build better and more valuable assets across our cities.

**“DIGITAL TWIN IS A GAME CHANGER. FROM CREATING LOW-COST HOUSING TO THE ENTIRE REGENERATION OF URBAN AREAS, WE CAN CREATE ENVIRONMENTS THAT ARE ENTICING, AND ULTIMATELY, BETTER PLACES”**

**BILL RUH**  
LENDLEASE CEO, DIGITAL



## SURVEY RESULTS

The webinar's deep dive into Smart Buildings and Digital Twins delivered some surprises from polling the webinar attendees, but also confirmed a lot of our suspicions: 41% of survey users rank 'better user experience' as the greatest opportunity for Digital Twins to deliver value. However, just 14% of firms are deploying Digital Twins in their assets. Similarly, while 31% of firms were applying smart building management tools to boost energy efficiency and sustainability, 48% are not investing in Smart Buildings at all.

### GREATEST OPPORTUNITY

41% RANK **"BETTER USER EXPERIENCE"** AS THE GREATEST OPPORTUNITY FOR DIGITAL TWINS TO DELIVER VALUE, AHEAD OF "BUDGET RELIABILITY" [33%] AND "FASTER DELIVERY" [21%]

### DEPLOYMENT OF DIGITAL TWIN

48% OF FIRMS AREN'T EVEN EXPLORING THE POTENTIAL OF DIGITAL TWINS. JUST **14% ARE ACTIVELY DEPLOYING DIGITAL TWINS** IN SOME OF THEIR ASSETS

### SMART BUILDING DEPLOYMENT

**31% WERE APPLYING SMART BUILDING MANAGEMENT TOOLS** TO BOOST ENERGY EFFICIENCY AND SUSTAINABILITY

### SMART BUILDING OPPORTUNITY

**46% AREN'T INVESTING IN SMART BUILDINGS AT ALL** – NOT EVEN TO ENHANCE SECURITY MEASURES, MANAGE OPERATIONS OR TO IMPROVE THE USER EXPERIENCE

SOURCE: AUTONOMOUS FUTURES - SMART BUILDINGS, EY WEBINAR





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