Will Robots Take Over CRE?

Driverless Cars, Blockchain, and other Transformative Technologies

KEY TAKEAWAYS

- Ridesharing, autonomous mobile robotics (AMRs) for eCommerce fulfillment and electric vehicles (EVs) will be the technologies that will first impact Commercial Real Estate. Widespread adoption of most other transformative technologies are at least a decade away. Technology adoption typically follows a "hyper cycle" curve before widespread adoption.
- Following wide adoption, there will likely be a lag in any impact on real estate. This lag should not be viewed as a "wait and see" period; rather, the early adoption cycle should be used to determine where impacts may occur and possible remediation strategies.
- The Organization for Economic Co-operation and Development (OECD) estimates 14% of jobs in OECD member countries are 20 years[3] from automation.
- High-risk jobs include routine and low-skilled ones in retail and industrial. Most office-using jobs are low risk due to their requirement for cognitive, emotional or social intelligence.
- Cities best suited to cope with technology disruption are New York, San Francisco, Boston, Washington, DC, Austin, Los Angeles and San Jose.
- Real estate assets likely to see growth include data centers, manufacturing centers for new technologies and remote parking stations for longer-term vehicle parking and recharging stations. Successful real estate offerings are likely to be those that straddle uses.
- Categories of real estate at higher risk due to technology include gas stations, bank branches, non-experiential retail, garages (both residential and commercial parking decks) and non–amenitized, commodity offices.
- CRE players will need to focus on flexibility and efficiencies in order to adapt to changing paradigms brought on by technology advances. Assets positioned to evolve along with technological changes will outperform others that do not keep pace. However, such flexibility may be more costly.

Technologies potentially transformative to commercial real estate (CRE):

1. **Auto related**
   Electric Vehicles (EV)
   Ridesharing
   Autonomous Vehicles (AV)
2. **Distributed ledgers**
   Blockchain[1]
   Cryptocurrency
3. **Supply-chain technologies**
   Drones
   3-D printers
   Autonomous mobile robotics[2]

First of a four part series reviewing technologies that have the most potential to disrupt commercial real estate.

[1] Blockchain is a public database of all executed digital transactions shared among participants. Each transaction is verified by consensus of a majority of the participants. Once entered, information can never be erased. Cryptocurrencies are digital currencies that use blockchain technology, e.g., Bitcoin

[2] Autonomous mobile robots (AMRs) are the evolutionary leap from automated guided vehicles (AGVs) that have been in use in warehouses for decades.

[3] L. Nedelkoska and G. Quintini: "Automation, skills use and training." *OECD Social, Employment and Migration Working Papers, 2018*

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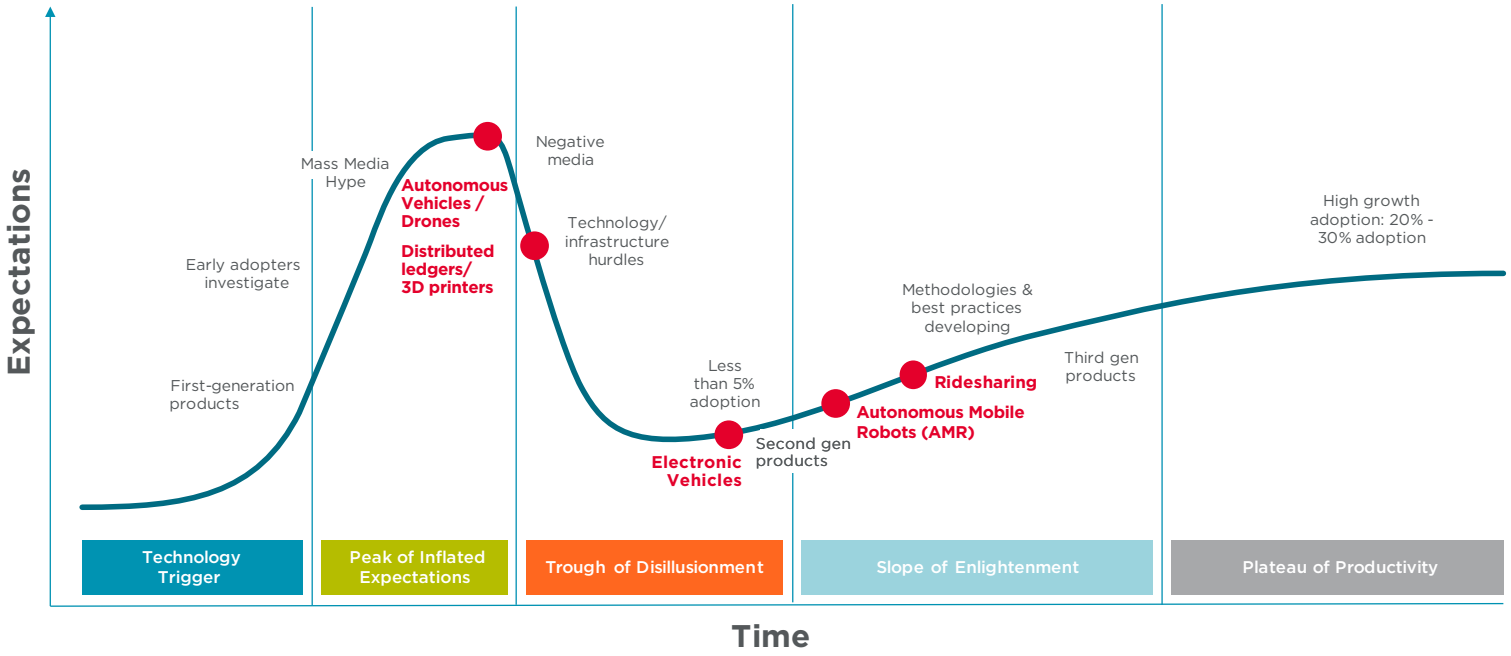
TECHNOLOGIES ON THE "HYPE CYCLE" CURVE



Source: Gartner, Cushman & Wakefield Research

Introduction

Technology is disrupting all kinds of industries—from ridesharing in the taxi industry to streaming services in the entertainment space. Apart from the first rumblings of disruption in the retail and industrial space due to eCommerce, however, there has not been much of a paradigm shift in the CRE sector due to technology. Most change has amounted to "variations on a property technology (PropTech) theme:" faster, more efficient ways of leasing or managing properties with significant, albeit incremental, technological enhancements, which this paper does not address.

Change is slow in CRE markets primarily due to the difficulty and cost involved with transition. Real estate and infrastructure assets are expensive, built for longevity and do not lend themselves to flexibility. Therefore, in order to embrace any change, players in CRE markets must first be convinced that the technology will be widely deployed and long lasting. For instance, a number of technological advancements that were once thought to be game changers did not live up to the hype—such as battery-powered cars in the 1990s (GM's EV-1) and fiber optics. Sometimes it is prudent to wait and see what technologies will actually survive.

Technology is to the 2010s and 2020s what the financial services industry was to the 1980s and 1990s – a growth engine, a disruptor, both a jobs creator and killer.

However, there is no doubt that long-lasting and widespread change is on the horizon with several technologies under development. At one end of the spectrum, there are the incremental changes wrought by PropTech; at the other end are potentially transformative changes from technologies like AVs and AI. This paper

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is the first in a series which will focus primarily on the following potentially transformative technologies for CRE:

- Auto related technologies: electric and autonomous vehicles, ridesharing
- Distributed ledgers: blockchain, cryptocurrency
- Technologies transforming supply chains: drones, 3D printing and autonomous mobile robotics

This paper focuses on structural factors that may drive technology adoption in general and evaluates transformative technologies that will affect them. It also addresses the impact of technological innovations on employment going forward and identifies which cities and real estate asset types are best positioned to withstand the change.

Pre-requisites to Technology Affecting CRE

In our view, there are three pre-conditions that a new technology must meet in order to be widely adopted and affect CRE. These include:

Safety/Acceptance: There should be an overall sense that the technology is safe, and that concerns such as privacy, for instance, are left intact or minimally affected.

Convergence with Other Technologies and Infrastructure: In order for these technologies to become truly disruptive, convergence with other technologies is key. For instance, cell phones caused minimal disruption until they were connected to the internet and morphed into smartphones. The technologies under consideration today need more supporting infrastructure than currently exists. All of them require extensive cybersecurity support and a regulatory framework.

Technologies such as blockchain as typified by the cryptocurrency Bitcoin, have considerable energy requirements. Every transaction on the Bitcoin network is estimated to an amount of energy sufficient to power more than eight U.S. households for a day,[4] although that amount is expected to drop dramatically. In addition, the time needed for verification exceeds that of current financial systems, and requires the evolution of cheap processing power in tandem.

Scalability: Widespread adoption of technology takes time and typically follows an S-shaped pattern of acceptability/adoption. Technologies are often met with initial hype and enthusiasm, followed by disillusionment as the realities of constraining costs, competing standards and switching costs preventing mass adoption set in. As those hurdles are overcome and costs decline, new technologies are adopted and become mainstream. It is clear, however, that the pace of technology adoption is accelerating.

eCommerce disruptions to retail have presented new opportunities in the industrial space, as well as an evolution of retail (*i.e.*, experiential retail, Buy Online, Pickup In Store, etc.). More paradigm shifts are expected as a result of automation and AI developments.

Once a technology is widely adopted, there is likely a lag in terms of the impact on real estate. The risk to the CRE industry is that, should underlying patterns of human/business behavior change more quickly than the real estate/infrastructure can adapt, a technology could lead to weaker CRE performance.

Most of the technologies under consideration are at least a decade away from widespread adoption. Whether that is a short or long time depends on how ready one is to cope with the aftermath. Of course, many of these technologies will be adopted on a use- or case-specific basis with limited functions and in select geographies (one such example is Waymo AVs in Chandler, AZ), but as noted, they are unlikely to materially affect CRE.

[4] Alex de Vries: "Bitcoin's Growing Energy Problem." *Joule,* May 2017.

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	CURRENT ACCEPTANCE LEVELS	CONVERGENCE WITH OTHER TECHNOLOGIES / INFRASTRUCTURE	ESTIMATED TIME FRAME FOR SCALABILITY/WIDESPREAD ADOPTION AND CRE IMPLICATIONS*
Overarching considerations	Legal issues, regulatory hurdles Affordability	Explosion in cybersecurity, big data requirements Computational power	Variable depending on technology
Ridesharing	High. 21% in major metros,[5] mainly due to parking convenience Reduces public transit use	Regulation	Immediate impact: Reduces demand for parking in prime inner city and the income streams associated Erodes TOD premiums
Electric vehicles	High acceptance (in principle) Friction between state and local regulations	Lack of charging stations: Only 15% of gas stations in the U.S. have EV charging facilities[6] Suboptimal battery capacity and high cost Current electricity grid capacity cannot support EVs in excess of 15% of today's cars.[7]	10 years Use of EVs in China exceeds that in the rest of the world combined[8] Frees up brownfield gas station space for redevelopment Impact on oil dominant economies
Autonomous Mobile Robotics	Moderate Amazon's successful deployment of AMR technology has proven concept, other AMR vendors and warehouse operators pursuing	Cost of deployment, prevailing material handling equipment and network design, and current limits with robotic management systems drive the rate of widespread adoption. Amazon's purchase/deployment of Kiva robots is telling: Each Kiva-equipped warehouse can hold 50% more inventory per square foot and Amazon's operating costs have been reportedly sliced by 20% per warehouse. Further R&D will be needed before AMRs can perform more complex, precision-based tasks required in dynamic picking warehouse operations.	10 years
Blockchain	Unfamiliarity with concept. Acceptance that electronic transactions are safe 51% security flaw area of concern	Not yet scalable. Entire chain computationally and energy intensive Inherently slow to verify records; Currently operationally unfeasible[9]	10 years
Crypto currencies	As above KYC/ Money laundering issues area of concern FTC and SEC regulation		10 years
3D Printing	Low - Safety for use in construction technology still area of concern	Availability of base material Speed and quality of the print. Durability of printed material untested	10 - 15 years
Drones	Low Privacy issues Safety issues with airports	Regulation. Air/land traffic coordination in urban environments.	10 - 15 years
Autonomous vehicles	Low – safety still primary concern	5G connectivity, Data centers to cope with data volume, separating and redesign of road networks Mapping Entire redesign of traffic control system - replacement of traffic lights, peer to peer car signaling capability	20 or more years

Key; AUTO RELATED | DISTRIBUTED LEDGERS | SUPPLY-CHAIN TECHNOLOGIES

[5] Clewlow, Regina R. and Gouri S. Mishra (2017) Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States. Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-17-07

[6] Alternative Fuels Data Center, www.afdc.energy.gov, April 2018.

[7] Mohammed Beshir, USC's Viterbi School of Engineering

[8] ZEV Alliance, Volume of EV Sales 2017, ev-volumes.com.

[9] SWIFT in Europe undertook an evaluation of banking transfers. Need to create 100,000 sub ledgers, which is unwieldy.

Source: Cushman & Wakefield Research, July 2018

*Subsequent series on individual technology categories will delve deeper into the specific CRE implications.

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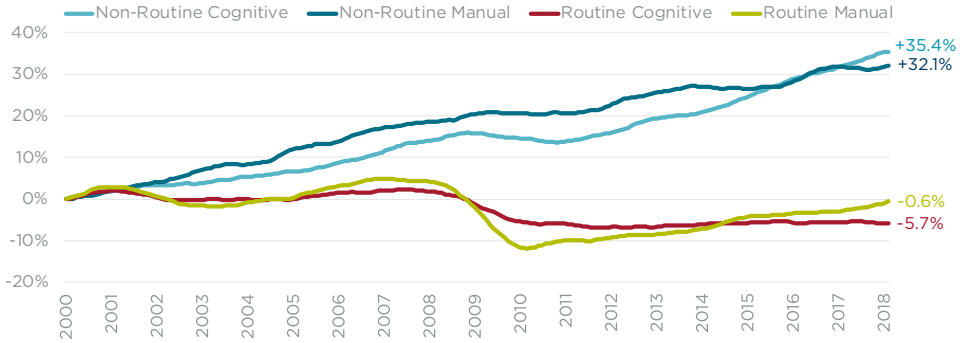
Robots Aren't Coming For (Most of) Your Jobs

The data on the impact of technologies on the labor market are unequivocal. Despite all the doomsayers, new technologies have created more jobs over the last century than they have eliminated. Even so, certain job functions are being decimated by technology, and in some cases robots are indeed coming for jobs.

A 2018 study commissioned by the OECD[10] puts the number of jobs at risk of automation –at just 14%. In the United States that is an estimated 13 million jobs.

CHANGE IN ROUTINE VS. NON-ROUTINE JOBS

Seasonally adjusted, 12-month rolling



Sources: Cushman & Wakefield Research, Bureau of Labor Statistics

TOP 10 AT RISK, 10 LOWEST RISK SECTORS

Click to view by CRE Sector > RETAIL | INDUSTRIAL | OFFICE | MULTIFAMILY | **ALL**

HIGH RISK LOW

EMPLOYMENT SECTOR	CRE SECTOR IMPACT
Agriculture, hunting	N/A
Postal and courier activities	Industrial (Warehouse)
Manufacture of wearing apparel	Manufacturing
Fishing and aquaculture	Logistics
Food and beverage service activities	Retail
Manufacture of food products/wood	Manufacturing
Land transport and transport via pipelines	Logistics
Other mining and quarrying	Manufacturing
Waste collection, treatment	NA
Manufacture of textiles	Manufacturing
Printing and reproduction of recorded media	Industrial
Services to buildings and landscape	
Manufacture of tobacco products	Manufacturing
Manufacture of fabricated metal products/paper	Manufacturing
Manufacture of other non-metallic mineral products	Manufacturing
Manufacture of electrical equipment	Manufacturing
Manufacture of motor vehicles, trailers and semi-trailers	Manufacturing
Forestry and logging	Logistics
Architectural and engineering, technical testing	Office
Employment activities	Office
Real Estate	Office
Extraction of crude petroleum and natural gas	NA
Residential care	Senior Housing
Human health	Medical Office
Telecommunications	Office (Data Center)
Advertising and market research	Office
Air transport	NA
Mining support service activities	Office
Public administration and defense, social security	Office
Travel agency, tour operators	Tourism/Retail/Office
Computer programming, consultancy	Office
Legal and accounting	Office
Social work without accommodation	Office
Programming and broadcasting activities	Office
Information service activities	Office
Remediation, other waste management	Office
Education	Office Services
Head offices, management consultancy	Office

Source: Cushman & Wakefield Research, Survey of Adult Skills (PIAAC) 2012, 2015

[10] L. Nedelkoska and G. Quintini, *op. cit*

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Job Risk Levels Resultant from AI and Automation

Jobs most at risk due to automation are those that either require no training and are highly automatable, or require some training and involve a high level of interaction with machines. Low-risk jobs are those that require cognitive or emotional intelligence, or are service-oriented jobs with a care component that requires social intelligence.

Jobs which are disrupted by automation will undoubtedly lead to the creation of new jobs in different sectors. A recent Pew Research Center study[11] found that in the last 15 years, new job categories were created by the advent of new technologies. Included in Pew's list were new categories that did not exist prior to 1999, including computer network support specialists, information security analysts, and computer network architects, among many others. A similar trend should emerge in the next 15 years.

In addition, technology-related jobs also tend to support wider employment and adjacent jobs, which include support and management. One study conducted has estimated that one additional job in the technology sector — generates about 4.9 new non technology jobs in the same city (three professional and two nonprofessional positions), as new jobs create additional demand for local services.[12]

Local Reversal of Fortunes as a Result of Automation

New technologies have not only transformed regions but also cities. Some, such as San Francisco, are experiencing rapid growth while others, such as Detroit, have spiraled towards bankruptcy. Cities that specialized in cognitive work gained a comparative advantage in new job creation, mirroring trends in population, wage and real estate growth. The rise of new technologies may shift the fortunes of U.S. cities once more, affecting a different group of cities than those impacted thus far.

The cities expected to prosper in the future are those that will be able to facilitate the rapid adaptation of new technologies. The framework required for this is already in place in many markets, but will need to be leveraged to offset some of the expected job disruptions. Some of these key characteristics include:

- **A Robust Millennial Population:** The largest age cohort in the U.S.—and also the largest demographic group in the workforce are those between 17 and 37 years old. This millennial cohort views emerging technology as exciting and revolutionary. Millennials will help drive technology and its adoption both in the short and long term.
- **A Diverse Employment Base with High Tech Concentration:** Markets which have facilitated the growth of hi-tech employment will continue to reap the benefits associated with the sector, including lower unemployment, influx of venture capital and in-migration of a highly educated workforce.

We conducted an analysis of the top 32 metros in the nation to determine the cities best positioned to withstand the job disruption associated with automation and AI. Markets were grouped based on their scoring across tech related variables.[13] On the spectrum of market readiness:

- Ahead: Epitomizes a market which has a framework in place to facilitate the adoption of new technologies while creating new jobs.
- Gearing Up: Some concerns around the widespread adoption of new technologies and their ability to weather job disruptions that will undoubtedly result from automation and AI.

Going forward, cities that invest in training will be better suited to weather the technological shifts. Most technologies are decades away from being fully implemented and so will not have an immediate impact on jobs. However, once adoption becomes widespread, cities with technologically proficient workers will be in a better position to benefit from the economic impact associated with these technologies.

TECH DISRUPTION READINESS (BY MARKET)

AHEAD		READY		IN LINE		GEARING UP	
New York	Boston	Chicago	Philadelphia	San Diego	Minneapolis	Columbus	St. Louis
Washington, DC	Austin	Dallas	Houston	Portland	Miami	San Antonio	Indianapolis
San Francisco	Los Angeles	Seattle	Denver	Orlando	Baltimore	Las Vegas	Kansas City
San Jose				Phoenix	Atlanta	Tampa	Detroit
						Charlotte	Riverside
						Sacramento	

Source: Cushman & Wakefield Research, Moody's Analytics, PWC Moneytree, US News Best Cities, Walkscore.com

[11] DeSilver, Drew: "Reshaping the workplace: Tech-related jobs that didn't exist (officially, at least) 15 years ago." Pewresearch.org, 2014

[12] Enrico Moretti and Per Thulin; "Local multipliers and human capital in the United States and Sweden, Industrial and Corporate Change." Volume 22, Issue 1, 1 February 2013, https://doi.org/10.1093/icc/dts051

[13] See Slide 10 in Chartbook for detailed methodology

Flexibility and Efficiency Drive Value

The pace of technology change makes it almost impossible to predict its impact with any accuracy. The only way for CRE professionals to adapt to changing paradigms brought on by technology advances is to focus on flexibility and efficiencies, particularly flexibility in asset use and design, leases and service offerings.

At the risk of overgeneralizing, there are certain categories of real estate that are at higher risk of obsolescence due to technology. These include gas stations, bank branches, non-experiential retail, and garages – both those in single family homes and in commercial parking decks–and non-amenitized commodity offices. Online and internet banking and financial services have led to bank branch closures. Since 2009, 6% of U.S. bank branches have closed, and the pace of branch closures is expected to accelerate to 20% by 2020.[14] Urbanization trends have led to the decline of gas stations in cities. In Manhattan, the number of gas stations declined by one-third between 2004 and 2014, to just 39,[15] with most being redeveloped into condominiums or offices. Gas stations will face new challenges as EVs gain traction in the markets.

Real estate categories likely to see growth include data centers, manufacturing centers for new technologies, remote-parking, and recharging stations. Successful real estate offerings are likely to be those that offer multiple/ diverse uses: for instance office/hospitality hybrids which offer concierge services, single-family rentals, and conversions of retail into office and industrial.

ASSET FLEXIBILITY	Conversion of space: Parking to office, retail to industrial Designing facilities for reuse, subdivision, and sublease
LEASE / SERVICE FLEXIBILITY AND EFFICIENCY	Shorter lease terms Speculative suites, coworking options Option to flex footprint/ occupancy Technology / hospitality amenity offering Less and more efficient use of space customized to users
SUPPLY CHAIN FLEXIBILITY	Logistics first disrupted markets – less impact on human life, ease of automation and relatively lower costs of assets Supply chain related jobs also more at risk and sooner
COST IMPLICATIONS OF FLEXIBILITY	The option/ability to flex assets and services will cost more than traditional asset services

[14] Intelnet.com

[15] Sarah Maslin Nir: "With Gas Stations Closing, a Fuel Desert Expands in Manhattan." *The New York Times*, April 16, 2016.

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