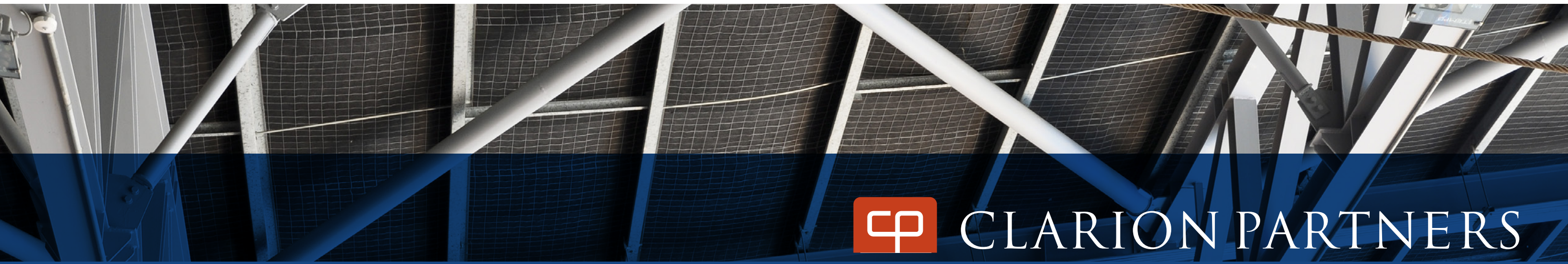

SPRING 2018

DISRUPTIVE TECHNOLOGIES DRIVE NEW OPPORTUNITIES IN COMMERCIAL REAL ESTATE

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INTRODUCTION

Technology increasingly connects the digital and physical worlds. Billions of people now access products and services in a highly efficient manner. The growing pervasiveness of the internet and advanced industries presents both opportunities and challenges for commercial real estate (CRE) investors. Clarion Partners believes emerging technologies will create more disruption and rapid change over the next two decades.

New innovations will encompass virtually every aspect of our lives, including the way we reside, commute, work, shop, and manufacture. These changes will inevitably alter the way we use CRE, as well as overall demand and—we believe—lead to the highest and best use of properties. Herein, some of the implications that technology will have for property types are discussed *(Figure 1)*.

FIGURE 1: Disruptive Technologies

Internet Platforms / Networks	Robotics & Artifical Intelligence (AI)	Autonomous Vehicles	FinTech	The Cloud	Drone Delivery	3D Printing

Source: Clarion Partners Investment Research, April 2018.

SHARING ECONOMY PLATFORMS

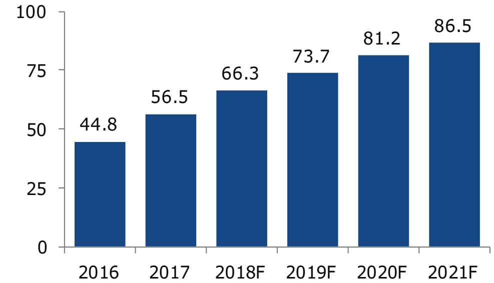
The age of networks brings connections that create tremendous social and economic power. Online platforms have given rise to the 'sharing economy,' which is revolutionizing many businesses across different industries. The 'sharing economy' encompasses the peer-to-peer (P2P) based activity of obtaining, giving, or sharing access to good and services. Alternative names for this include the gig, platform, or access economy.

New Developments

In 2018, technology companies with universal internet platforms (e.g. Amazon, Apple, Google, Microsoft, and Facebook) comprised most of the largest global companies by market capitalization. The most valuable sharing economy platforms impacting CRE include Airbnb (valued at $31 billion) and WeWork (valued at $20 billion).(1) Both are viewed as a means of empowering individuals and businesses to generate income. The business model involves millions of users—both people and companies—sharing assets, now mostly houses and offices.

- Forecasts indicate that the sharing economy may encompass 86.5 million users by 2021, up from 56.5 million in 2017 *(Figure 2)*. Furthermore, revenue from companies involved is expected to grow from $15 billion in 2015 to $335 billion in 2025.(2) Online and mobile payment methods like PayPal and Venmo also facilitate P2P transactions.

FIGURE 2: Current & Future Participation in U.S. Sharing Economy (# of Users in Millions)



Source: Statista, April 2018. Note: The growth forecast is based on Uber and Airbnb.

CRE Impact

The sharing of space (and capital goods) has an impact on the built environment. The most positive outcome is that the multitude of mixed-media applications fuels fierce competition between cyber CRE marketing tools, and allows property owners to better engage and communicate with customers and deliver more differentiated niches in local markets. Clarion Partners believes that new internet-powered platforms will have the greatest impact on housing and work trends.

- *Surging Demand for All Housing.* Today it is easier than ever to monetize real estate holdings, with millions collecting a rising share of income from the platform economy. The consumer P2P rental housing market is expanding rapidly and projected to grow 31% per year through 2025.(3) We expect this to boost demand for all forms of investment housing, as well as hotels, which have reported record room sales in recent years.

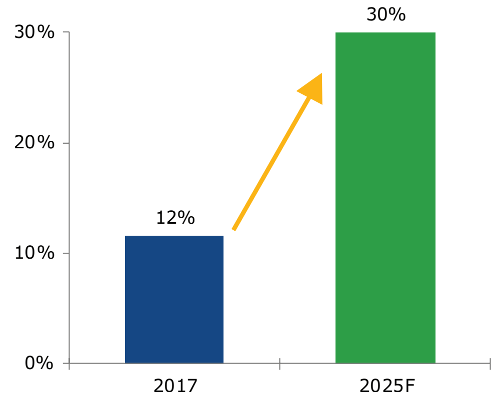
- *Decentralization of Work.* The hypermobility of the sharing economy means that the traditional focus on a property's distance from employment centers could diminish, which might pose challenges to the traditional office in a big city. The "pull factor" of the city as an employment hub may become less relevant in today's 'gig' economy. Occupiers and middle- and back-office workers may move to cheaper and more remote markets.

- *Co-working & Flexible Office (e.g. WeWork).* In several large U.S. cities, many tenants' growing preference for physical and financial flexibility has led to the rise of the flexible office asset class, which offers turnkey workplaces with community and innovative design. Co-working space started as a way to house independent and freelance professionals, but is now being used more frequently by corporations. WeWork, the leading business in this space, now controls 2.9 million square feet in New York City, second to JPMorgan Chase, the largest corporate occupier.(4) Flexible office is now less than 5% of total U.S. office inventory, however, this could rise to 30% by 2030 with many more companies now onboard.(5)

E-COMMERCE & OMNICHANNEL RETAIL

The shifting consumer landscape (online and in-store) is transforming supply chain logistics and shopping preferences. Online sales accounted for 12% of total core retail sales in 2017 *(Figure 3)* and are projected to grow to 30% by 2025, per the Urban Land Institute (ULI).[6]

FIGURE 3: E-Commerce as a % of Core U.S. Retail Sales (2017-2025F)



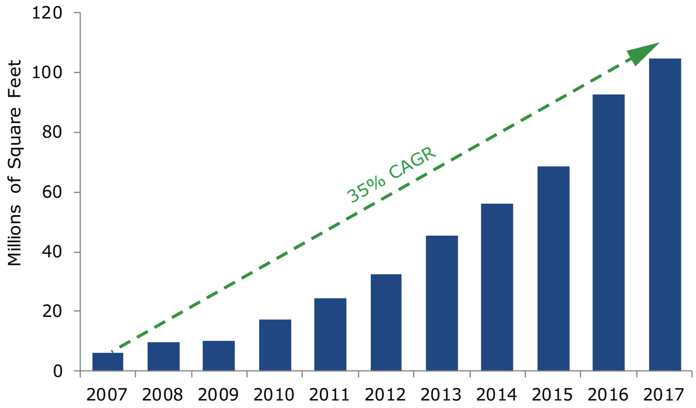
Source: Urban Land Institute, November 2017.

New Developments

Warehouse demand has grown rapidly over the course of the current economic cycle that began in 2010. Low vacancy and robust rent growth continued in 2017. Amazon, which occupies almost 120 million sf in the U.S., exemplifies the rapid expansion of e-fulfillment real estate. The company added 26.6 million sf in 2017 alone and is expected to grow by another 23 million sf in 2018.[7]

- Amazon totaled almost half (43%) of U.S. online retail sales in 2017, accounting for over half (70.2%) of U.S. e-commerce sales growth.
- From 2007 to 2017, Amazon's footprint by square footage grew at a 35% CAGR *(Figure 4)*. Super-fast delivery (same-day, one- and two-day) is now commonplace. Amazon Prime now offers one-hour and two-hour delivery in more than a dozen cities.

FIGURE 4: The Rapid Expansion of Amazon Warehouse Space



Sources: Supply Chain Consultants, Clarion Partners Investment Research, August 2017. [8]

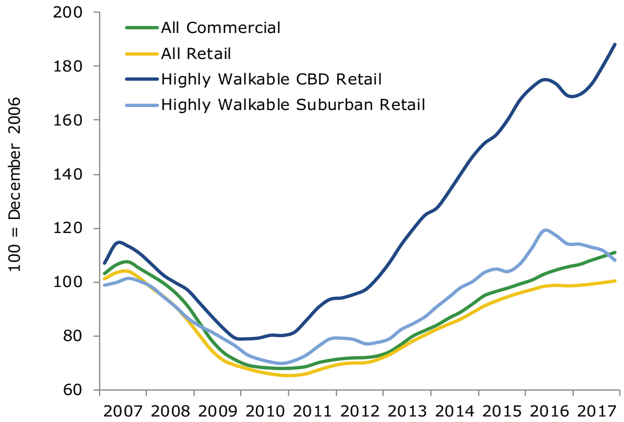
CRE Impact

The impact of the e-commerce and omnichannel boom on brick and mortar is mainly twofold: 1) rapid growth in warehouse space and 2) more walkable, mixed-use retail.

Rapid Growth in New Class A & Last-Mile Warehouses Facilities. Both new and modern class A warehouses and small to midsize facilities serving the last mile near major population centers have seen strong absorption. Clarion Partners estimates that $1 billion in new e-commerce sales is equivalent to 1.25 million sf in new warehouse demand. As a result, 325 million sf of new space will be required for e-commerce growth alone in inland and coastal areas over just the next five years.

More Walkable, Mixed-Use, & Urban Retail. About one-third of all retail trade is now connected to omnichannel retail formats. Asset pricing has remained strong for highly walkable central business district (CBD) retail *(Figure 5)*. Retailers prefer properties in more urban areas for foot traffic and adjacency to mixed-uses, which are generally more e-commerce resistant. In addition, mall and shopping center properties are increasingly adding recreation and entertainment uses.

FIGURE 5: Commercial & Retail Asset Pricing (2007-2017)



Source: Real Capital Analytics, Q1 2018. Note: The four categories (Commercial, Retail, Walkable CBD/Suburban Retail) represent different series from the commercial property pricing indices (CPPI), which capture U.S. sales of properties valued more than $2.5 million. CBD and suburban includes all properties within boundary with a high walk score.

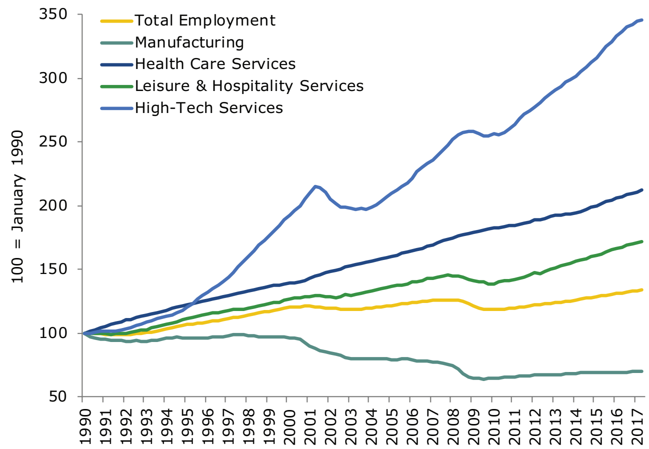
ROBOTICS & ARTIFICIAL INTELLIGENCE

Automation, now mainly robots and artificial intelligence (AI), is leading the fourth industrial revolution globally. Future labor market disruptions may be significant. Labor-saving technologies, together with globalization, have led to the loss of millions of manufacturing and agriculture jobs over the last two decades, and major transformations lie ahead in additional industries. Office-using employment sectors, such as legal, finance, government, and design, may be more at risk.

New Developments

U.S. manufacturers, concentrated largely in the Midwest (e.g. Michigan, Ohio, and Indiana), now use almost 290,000 robots.[9] The number of industrial service and AI robots sold in the U.S. is expected to jump nearly 300% in the next decade.[10] Thanks to automation, U.S. manufacturing output has grown by 85% since 1987, while the number of manufacturing workers has dropped by one-third.[11] *Figure 6* shows that automation-resistant sectors—high-tech, leisure & hospitality, and health care services—have seen the fastest job growth.

FIGURE 6: U.S. Total, Manufacturing, Health Care Leisure & Hospitality, and High-Tech Services Job Growth



Source: U.S. Bureau of Labor Statistics, Q1 2018. Note: High-tech services includes computer systems design and related services, management and technical consulting services, scientific research and development services, and miscellaneous professional and technical services.

A recent McKinsey Global Institute report: *Jobs Lost, Jobs Gained: Workforce Transitions In A Time of Automation*, predicts that by 2030:[12]

- Almost half of work activities in the U.S. and globally could potentially be automated.
- One-third of the workforce may need to change occupational categories.
- Job gains will likely be greatest in health care, construction, business specialties, technology, and education.
- Individual leisure time will increase as the average number of hours worked per week decreases with technology.

CRE Impact

The office and retail sectors' physical footprints have been most impacted by automation and are still most at risk. Clarion Partners continues to be bullish on the technology industry and the service industries, particularly health care and leisure & hospitality, and believes these industries will drive future growth of commercial space.

- *Health Care Real Estate.* Medical office buildings (MOBs) and retail (e.g. clinics and outpatient facilities) offer reliable tenancy due to required office appointments with doctors or physical therapists, where income is covered by patient insurance reimbursements. CVS's recent acquisition of Aetna has the potential to more efficiently connect providers with physical stores, with the goal of offering better service and cheaper prescription drugs to the consumer.

- *Greater Centralization & Demand for Leisure.* By increasing leisure time, automation might in the future allow people to focus on culture, reemphasize social activities, and develop an experience-driven economy in more urban centers. All experience related real estate will likely boom (sports, entertainment, and food & beverage).

SELF-DRIVING OR AUTONOMOUS VEHICLES (AVS)

Autonomous vehicles (AVs) will add trillions of dollars to the U.S. and global economy over the next few decades. AVs may be available to consumers by 2019, and mass adoption is anticipated by 2030.[13]

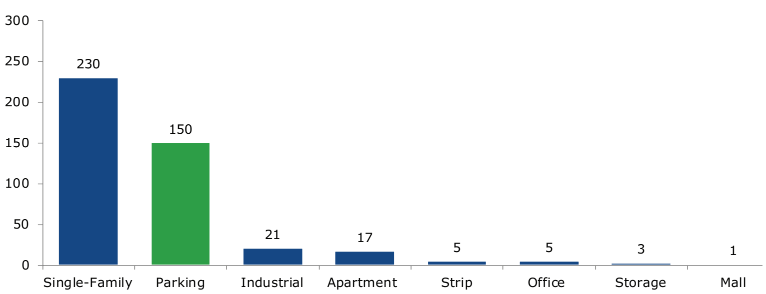
New Developments

The biggest AV investors include Ford, GM, Tesla, BMW, Mercedes, and Google. AVs have been tested in select U.S. cities, including San Francisco, Pittsburgh, Phoenix, and Boston. Although business advocates are pushing lawmakers to act quickly to approve AV use, it could take a few more years to finalize highway and transportation logistics.

CRE Impact

The driverless car transportation revolution may significantly change the urban landscape and transit networks, facilitating greater mobility of goods and people between big cities, suburbs, and more tertiary markets. Clarion Partners believes AVs will eventually be a game-changer for live-work-play patterns across all property sectors, but in the short term will likely have the most impact on industrial logistics and parking *(Figure 7)*.

FIGURE 7: Total Occupiable Square Feet (in Billions)



Sources: Green Street Advisors, ULI, Clarion Partners Investment Research, April 2018.

- *Reconfiguration of Urban Master Plans & Traffic Logistics.* AVs will transform urban neighborhoods, leading to changes in road design and parking requirements. The U.S. has roughly 1 billion parking spaces, equal to four for every vehicle, which accounts for 15% to 30% of urban area.[14] Parking is second to only single-family housing in total occupiable square feet. The ULI predicts parking space could decline by 50% in the next 30 years, which suggests that revenue will decline and more urban infill redevelopment opportunity.

- *Greater Dispersion of Commercial & Residential Property.* Dispersion of commercial and residential property will continue to grow. An increase in urban sprawl is likely, and premiums enjoyed by buildings near transit nodes may erode. In the future, highway access may be preferred over transit-oriented development (TOD) projects. Nevertheless, walkable urban settings will continue to be favored as people become less reliant on cars and more environmentally aware.

- *Relocation of Some Industrial Warehouse to Lower-Cost Areas.* Early AV adoption is anticipated in freight and goods transport, leading to a reduction in transportation costs and delivery time. Approximately 70% of consumer goods are transported through highways.[15] Current Federal regulations cap the number of hours a truck driver can work (which translates into 400-500 miles per day).[16] AVs may allow these restrictions to be relaxed and significantly expand the one-day coverage of trucks, thereby improving supply chain efficiencies.

FINTECH: MOBILE BANKING & BLOCKCHAIN

The financial services industry is undergoing massive technological changes, with greater use of online banking and blockchain. Financial technology, or FinTech, is rapidly changing old-fashioned banks and investment managers, making it easier to save, borrow, and invest without ever dealing with a traditional bank, broker, or accounting ledger. Blockchain, for example, opens the door for game-changing virtual transactions, which could disrupt a wide range of professional and business transactions.

New Developments

The financial services industry alone employs 8.5 million workers, or 5.8% of the U.S. labor force. Over the next decade, employment in the sector may potentially decline as much as 25%, as machines do more work across bank functions.[17]

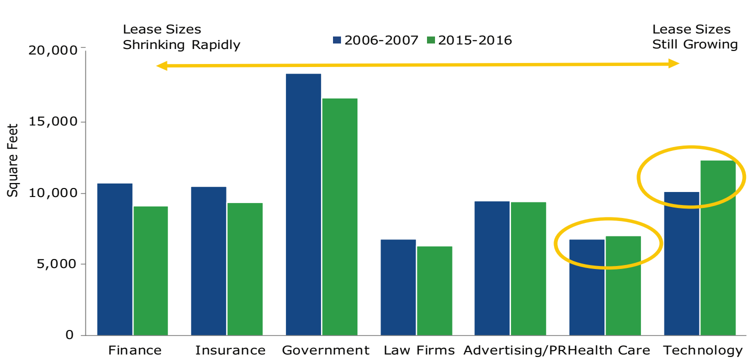
CRE Impact

- *Potential Job Loss in Top 10 Largest Office-Using Markets.* New York, Los Angeles, Chicago, Washington, D.C., Dallas, Atlanta, Boston, Houston, Phoenix, and Minneapolis are the top 10 largest office-using markets, and may be most at risk of back-office job loss.

- *Average Square Footage Per Employee & Office Lease Size.* The average square footage per worker has trended down over the long term. Tenants' push for greater space efficiency has created winners and losers within the office market *(Figure 8)*. Lease sizes have increased more in high-growth sectors, such as health care and information technology (IT).

- *Decline in Retail Banks.* The number of bank branches in the U.S. has declined by nearly 7,700 since peaking at 100,000 in 2009, a trend we expect to continue.[18]

FIGURE 8: Average Size of New Office Leases by Tenant Industry

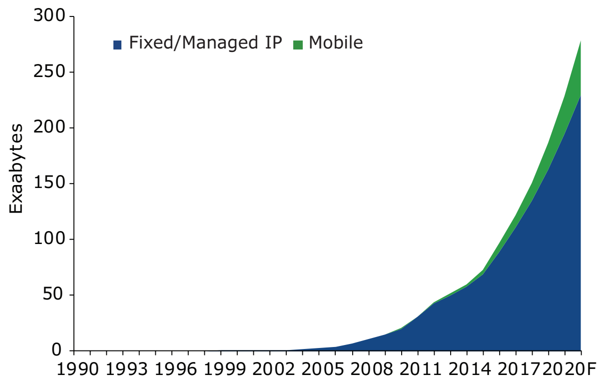


Source: NAIOP, Q3 2017

CLOUD COMPUTING & BIG DATA

Exponential growth in internet-based cloud computing services is increasing demand for data center facilities *(Figure 9)*, which are specialized buildings housing IT infrastructure. Tech giants Amazon, Google, IBM, and Microsoft lead in cloud business.

FIGURE 9: Global IP Monthly Traffic History & Forecast



Source: Cisco Systems, Visual Networking Index 2017. Note: One exabyte is equivalent to one billion gigabytes. Monthly data traffic for 2016 was 96 exabytes, equivalent to 1.2 zettabytes annualized. IP = internet protocol.

New Developments

Over the past three years, data centers have been the best-performing sector of the public REIT industry, returning 30% annually versus 7% for the FTSE NAREIT Index, as of 2017 year-end.[19] Five publicly traded data center REITs have a combined market cap of $71 billion as of December 2017 and now represent 7% of the total public REIT market capitalization.

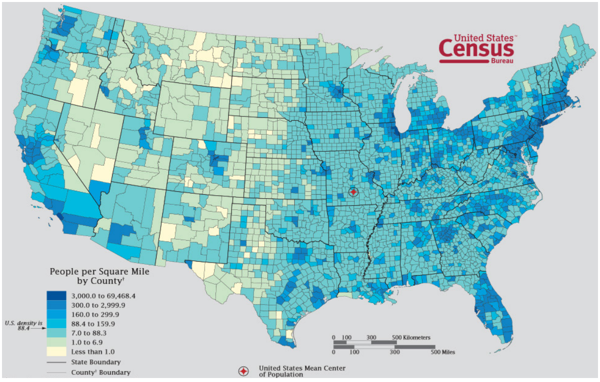
CRE Impact

- *Hybrid Cloud Adoption*. Over the next few years, an investment strategy may focus on enterprise migration to the hybrid cloud at data centers and demand should stay strong at 'network dense' facilities—large-scale data center operators in primary and secondary markets. Heightened demand for multi-megawatt hyperscale cloud users led to record annual net absorption in 2017.[20]

THE FUTURE OF THE SUPPLY CHAIN (DRONE DELIVERY & 3D PRINTING)

Drone delivery and 3D printing have the potential to greatly address current supply chain challenges, such as expenses and long lead times from imports and exports, as well as high inventory costs around the most densely populated U.S. regions *(Figure 10)*.

FIGURE 10: Most Densely Populated U.S. Regions



Source: U.S. Census Bureau, Q1 2018.

New Developments

Drone Delivery. Amazon, Google, Walmart, and UPS are racing to develop drone delivery services, although the movement has yet to take off in the U.S. Super-fast shipping service now depends mainly on delivery trucks in areas serving Amazon warehouses. Commercial deliveries by air await the development of regulations by the Federal Aviation Administration (FAA), which are likely to set limits for drones later this year. In the short term, drone deliveries will likely mainly be for government use.

3D Printing. 3D printing, commonly referred to as additive manufacturing, is now a rapidly growing multi-billion-dollar market. The technique is already used by two-thirds of manufacturers, although it remains a small share of global factory output. Traditional manufacturing has been built around achieving economies of scale in materials and labor, and mass production has generally been outsourced to low-cost regions (e.g. China and Southeast Asia). 3D printing is now bringing larger-scale production within reach of major U.S. population centers. Going forward, it will be incorporated more into existing logistics businesses.

CRE Impact

Clarion Partners anticipates that the following shifts may occur as these technologies take off.

- *Localize Global Supply Chain: Both Manufacturing & Delivery*. The production and movement of more goods domestically will bring end products closer to the consumer. This translates into shorter lead times and lower transportation expenses, as well as increased immediacy of warehouse storage requirements.
- *Lower Construction Costs & Growing Use of Pre-Fabricated Housing*. All property sectors will benefit from more building materials being produced nearby, which will reduce costs. The pre-fabricated housing industry is anticipated to flourish with 3D printing techniques. Lower construction costs and the expansion of pre-fabricated housing will both spur greater demand in warehouse space. As land costs rise, making it difficult for developers to deliver housing aimed at middle-class households, pre-fabricated structures are seen by some as a way to deliver affordable housing.
- *Cultivate Established Commercial Hubs for Delivery*. Given anticipated distance restrictions on commercial drone deliveries, warehouses may move closer to population centers. Walmart facilities may also profit; there is now a store within five miles of 70% of the U.S. population, which could allow these properties to operate as drone distribution bases, thereby dramatically improving supply chain efficiency.

CONCLUSION: ARE REAL ESTATE INVESTORS READY FOR THE FUTURE OF THE BUILT ENVIRONMENT?

Clarion Partners believes that disruptive technologies will impact every region and sector of the economy. The next wave of innovation has the potential to redraw America's economic map as new cities and places emerge altogether.[21] Greater mobility, efficiency, transparency, and synergy in lifestyle choices will have broad-reaching impacts for all CRE property types. New lifestyle choices facilitated by these forces will prompt more companies and people to challenge the status quo.

FIGURE 11: The Future Benefits of Technology on Real Estate

Rapidly evolving innovations that capitalize on market inefficiencies will create both challenges and opportunities for CRE investors. We expect the biggest headwinds to come from the speed of change and the struggle of existing infrastructure (virtual and built) to keep pace. Large-scale opportunities may emerge from higher out-migration from big cities due to affordability and livability, the urbanization of premier and emerging suburbs, the growing popularity of mixed-use properties with more recreation, shifting supply chain logistics bringing warehouse property to major population centers, and more frequent use of hotels for business and leisure travel in top employment hubs and at destination resorts.

ENDNOTES

(1) CNBC, Fortune articles. 2016-2017.
(2) (1) Brookings. *The Current and Future State of the Sharing Economy*. March 2017. (2) https://www.entrepreneur.com/article/295148
(3) Brookings. *The Current and Future State of the Sharing Economy.* March 2017.
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(9) World Robotics Report. 2017.
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(19) NAREIT. Q4 2017.
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