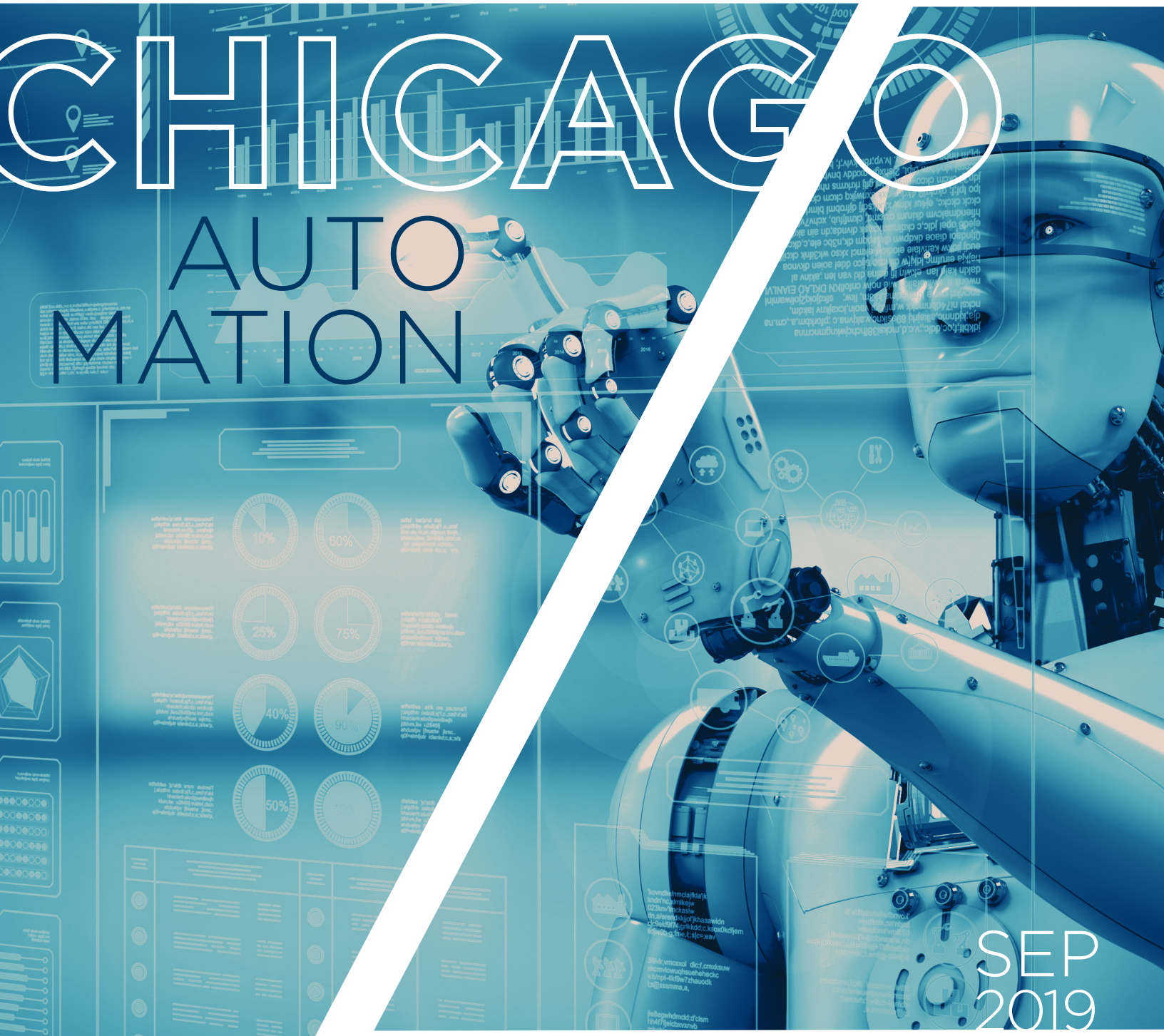
THE FUTURE OF

CHICAGO

AUTO MATION



SEP 2019

CUSHMAN & WAKEFIELD

AUTOMATION is the technology by which a process or procedure is completed with little or no human assistance. Automation technologies range from advanced robotics to 3D printing to drones.

Rapid technological advancements are transforming industrial real estate as we know it. *Automation* is one of the biggest disruptors, reshaping manufacturing employment, factory floors and the way we do business. As one of the nation's largest industrial markets, Chicago is home to 1.2 billion square feet (bsf) of inventory and quickly incorporating new automation into its many facilities.

Industrial occupiers are looking to increase automation in their day-to-day operations. Because of this, modern warehouses require higher clear heights and greater power loads than traditional warehouses. The need for these modern requirements, coupled with strong demand in the market, has helped stimulate a development boom in Chicago. However, despite the substantial increase in new product, over 73% of inventory was built before 2000. These older industrial buildings do not have the appropriate infrastructure to support automation, and therefore owners need to upgrade their spaces to stay competitive.



AUTOMATION

NEW WAREHOUSE TECHNOLOGIES

In the warehouse, automation takes on myriad different forms. This rapid change can be attributed in part to increased venture capital funding within the manufacturing industry. The artificial intelligence industry recorded $7.6 billion invested during the first half of 2019. Highlighted below are some of the advancements in automation that owners and operators will utilize within their facilities.

In the next few years, the number of industrial robots shipped annually in the U.S. will nearly double, from 28,000 in 2018 to nearly 55,000 in 2021. In 2018, a record number of robots were shipped to U.S. factories and warehouses.

Source: International Federation of Robotics



AUTONOMOUS STORAGE RETRIEVAL SYSTEMS (ASRS)

ASRSs consist of a variety of computer-controlled systems for automatically placing and retrieving products within a warehouse or manufacturing facility. These systems optimize manufacturing and warehousing processes by increasing speed, reducing errors and cutting labor costs. They require upfront design to suit a company and employee training to oversee and monitor them. The negative aspects of these technologies are large upfront expenditures in purchasing, customizing and maintaining.



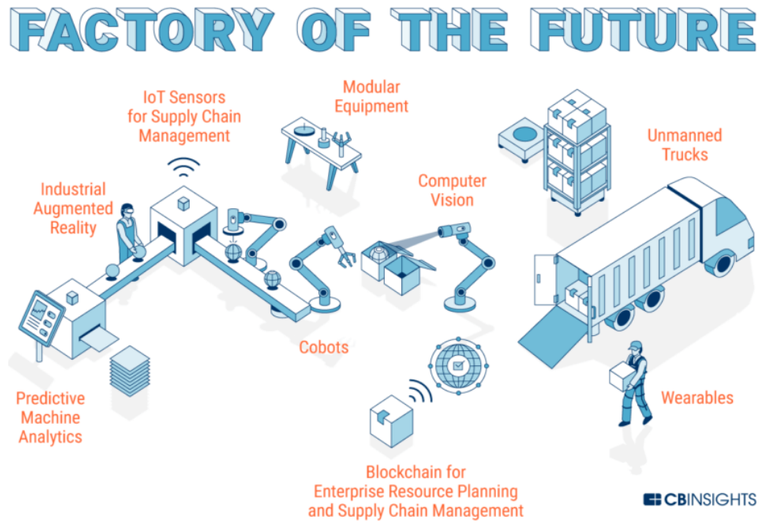
AUTONOMOUS MOBILE ROBOTICS (AMR)

While robots have been used in manufacturing since the 1960s, their limited mobility meant human labor was still critical to operations. Recent innovations, however, have resulted in increased mobility, automation and a reduction in the size of the robots. This frees up human labor to focus on more complex cognitive tasks that require manual dexterity and higher-order thinking such as programming and operations. The adoption rates of AMR in logistics have been increasing as robotic technology continues to evolve and becomes more affordable.

DIGITAL TWIN TECHNOLOGY (DTT)

DTT provides both owners and operators with real-time metrics on building performance, enabling building operators to be smarter, more agile, and more efficient in the management of their facilities and workforce. On the ownership side, DTT offers energy efficiency, and increased speed in leasing due diligence, and lease execution.

Other technologies that may play a role in industrial spaces in the years to come are shown here.



Source: Graphic excerpted from "Future Factory: How Technology Is Transforming Manufacturing," CB Insights, June 2019

"When it comes to advances in automation, one size doesn't fit all in relation to how companies adopt these technologies. Companies will have to identify what works best for them."

Tray Anderson, Cushman & Wakefield Logistics & Industrial Services Leader of the Americas

ROBOTS PER 1,000 WORKERS, 2015

MARKET	NUMBER
Detroit-Warren-Dearborn, MI	8.53
Cleveland-Elyria, OH	2.74
Milwaukee-Waukesha-West Allis, WI	2.05
Dallas-Fort Worth-Arlington, TX	1.59
CHICAGO-NAPERVILLE-ELGIN, IL-IN-WI	**1.50**
Minneapolis-St. Paul-Bloomington, MN-WI	1.41
San Francisco-Oakland-Hayward, CA	1.20
Los Angeles-Long Beach-Anaheim, CA	1.18
Boston-Cambridge-Newton, MA-NH	1.04
Houston-The Woodlands-Sugar Land, TX	0.98
Atlanta-Sandy Springs-Roswell, GA	0.94
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	0.91
Seattle-Tacoma-Bellevue, WA	0.82
New York-Newark-Jersey City, NY-NJ-PA	0.45
Miami-Fort Lauderdale-West Palm Beach, FL	0.38

Source: The Brookings Institute analysis of Moody's Analytics data

Chicago is more automated than most: The metro ranks 5TH among top industrial markets for robots in the workplace.

AUTOMATION AND THE INDUSTRIAL WORKFORCE

Advances in automation are reshaping the industrial workforce. By 2025, it is projected that 10-15% of jobs in manufacturing, transportation and storage, and wholesale and retail trade will have high potential for automation. By 2035, the range of jobs with high potential for automation jumps to 35-50% as technology continues to evolve. Automation technologies will arguably impact manufacturing more than any other sector, given that almost half (48%) of hours worked involves manual and routine work. And yet, despite a large portion of jobs being at a high risk of becoming obsolete through automation, the outlook may not be as grim as one might think.

Source: PwC/OECD 2018, McKinsey 2018

AN ANTIDOTE FOR JOB SHORTAGES

The rise in automation comes at a time when employers are facing major challenges in filling open positions. The manufacturing workforce is shrinking, and unemployment is at an all-time low. From 2001 to 2018, Chicago manufacturing employment declined 30% – a loss of over 175,000 jobs. The manufacturing workforce is aging; 56.5% of the current workforce is 45 and older, yet there is no indication that younger Millennial and Gen Z workers will be able to replenish the supply of workers who are close to retirement. In fact, Millennials rank the industry as their least preferred career destination. Initially considered a threat to human jobs by replacing them, many manufacturers today are turning toward automation to supplement the low-skilled jobs they cannot fill.

Source: Bureau of Labor Statistics, 2018 Deloitte and The Manufacturing Institute skills gap and future of work study

MSA NAME	2001 JOBS	2018 JOBS	% CHANGE
New York-Newark-Jersey City, NY-NJ-PA	591,036	341,032	(42%)
Los Angeles-Long Beach-Anaheim, CA	787,616	501,111	(36%)
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	282,010	180,956	(36%)
Boston-Cambridge-Newton, MA-NH	267,360	174,856	(35%)
Cleveland-Elyria, OH	180,043	123,333	(31%)
Chicago-Naperville-Elgin, IL-IN-WI	**590,880**	**415,780**	**(30%)**
Detroit-Warren-Dearborn, MI	360,402	255,247	(29%)
Miami-Fort Lauderdale-Pompano Beach, FL	121,852	88,282	(28%)
Milwaukee-Waukesha, WI	154,558	118,396	(23%)
Dallas-Fort Worth-Arlington, TX	337,291	275,582	(18%)
San Francisco-Oakland-Berkeley, CA	168,605	143,883	(15%)
Minneapolis-St. Paul-Bloomington, MN-WI	230,328	197,861	(14%)
Seattle-Tacoma-Bellevue, WA	202,318	177,702	(12%)
Atlanta-Sandy Springs-Alpharetta, GA	192,849	170,271	(12%)
Houston-The Woodlands-Sugar Land, TX	233,923	227,123	(3%)

Source: EMSI

The Chicago MSA ranks 6TH when compared to other top industrial markets for manufacturing job loss between 2001 and 2018.

TOP 3 ISSUES THAT WILL IMPACT MANUFACTURING EMPLOYMENT OVER THE NEXT DECADE

UPSKILLING NEEDED

Workers will need new skills and training as automation technologies replace routine and manual jobs.

NO NEW LABOR

Younger workers are entering the manufacturing sectors at lower rates. One major reason is negative views the younger workforce holds towards manufacturing.

AN AGING WORKFORCE

Workers will need to be replenished and retrained as required skillsets shift and older generations retire.

Source: 2018 Deloitte and The Manufacturing Institute skills gap and future of work study

A SKILLSET CHANGER

Automation is changing the required workforce skills. The early stages of automation transformation appear to already be creating a mismatch between the available workers and the skills necessary to fill open jobs. At a national level, a skills gap will likely leave an estimated 2.4 million positions unfilled between 2018 and 2028. Increasingly, employers are looking for workers with computer skills that enable them to program machines on the warehouse floor. In fact, manufacturing executives stated the top five skill sets that could increase significantly in the coming three years due to the influx of automation and advanced technologies are: technology/computer skills, digital skills, programming skills for robots/ automation, working with tools and technology, and critical thinking skills.

To ensure their workforce has the skills necessary to operate alongside automation, employers are not just recruiting new talent, but "reskilling" their existing workforce to enable them to transition to new, more technical jobs. In a survey of 197 private sector organizations, McKinsey found that over 40% of companies said they are focused mainly on retraining existing employees and 41% are focused equally on retraining and hiring. Only 18% of companies are focused mainly on hiring to resolve their skills gap. *(See Investing a Labor: A Case Study)*

Source: 2018 Deloitte and The Manufacturing Institute skills gap and future of work study, McKinsey 2018

A NEW JOB CREATOR

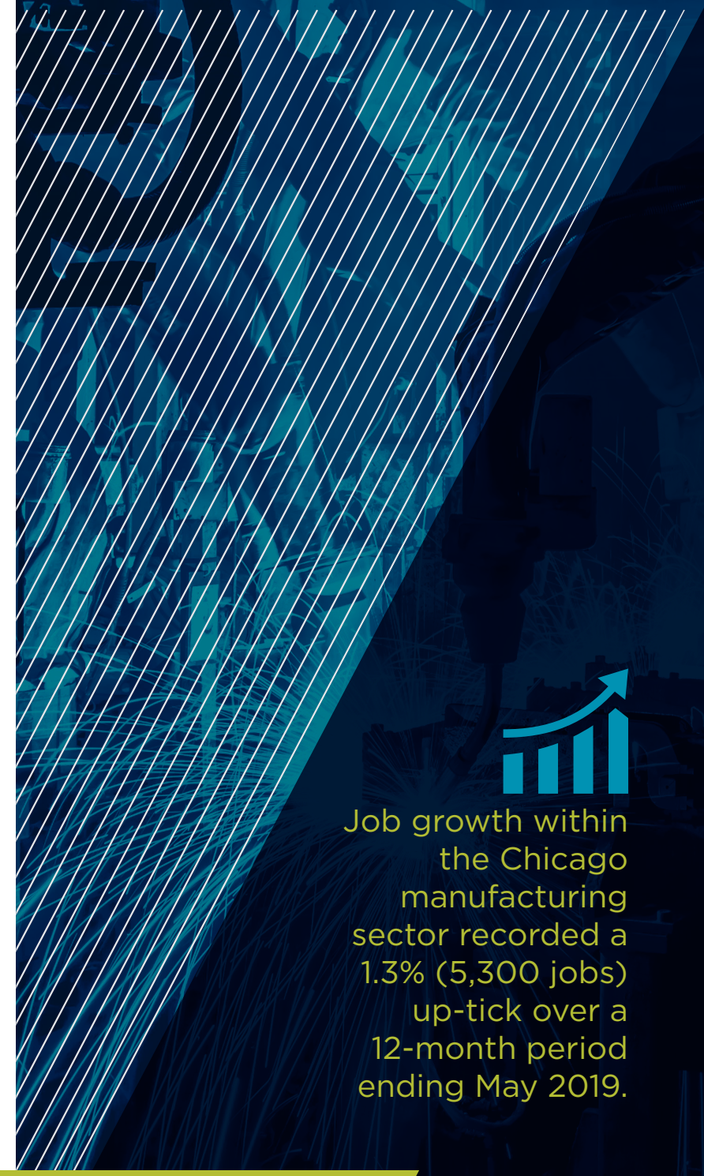
As technology continues to evolve, automation will also create jobs, likely in functions that are difficult for us to conceive of today. Historically, technology has created more jobs than it has destroyed. Unfortunately, although experts agree that jobs will be created by these technologies, there is no consensus on how many. This is likely the biggest x-factor in determining the ultimate impact that automation technologies will have on the workforce.

Source: IPUMS-USA, University of Minnesota 2015, NPR

INVESTING IN LABOR: A CASE STUDY

Amazon recently announced its goal to spend over $700 million to retrain 100,000 of their 300,000 U.S. employees by 2025 in higher skilled jobs. The training is free and voluntary and should allow employees to move to advanced jobs within Amazon or outside of the company.

Source: Tech Disruptors and the Supply Chain, Cushman & Wakefield, August 2019



Job growth within the Chicago manufacturing sector recorded a 1.3% (5,300 jobs) up-tick over a 12-month period ending May 2019.

CHANGING WAREHOUSE DESIGN

Due to increased automation, design specifications have shifted tremendously over the last decade, and industrial tenants are becoming more particular with building requirements. Historically, tenants would lease up any old space, whereas now tenants have requirements for clear heights, parking ratios and increased power. To compete with new state-of-the-art buildings, existing warehouse and manufacturing facilities will need to be redesigned.

Over the last 10 years, industrial buildings have transformed to support automation: buildings are larger, offer higher clear heights, and greater power loads.

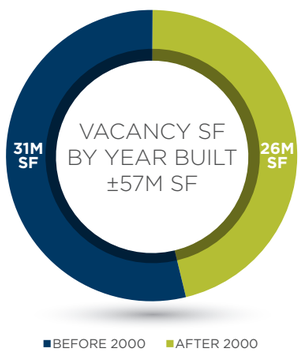
YEAR BUILT	AVERAGE BUILDING SIZE	AVERAGE CLEAR HEIGHT	AVERAGE POWER AMPS	AVERAGE VOLTS
2009	221,128 sf	30′	1500	480
YTD 2019*	310,593 sf	34′	2080	480

**This is a comparative analysis between buildings built in 2009 and 2019 and includes both spec and build-to-suit properties*

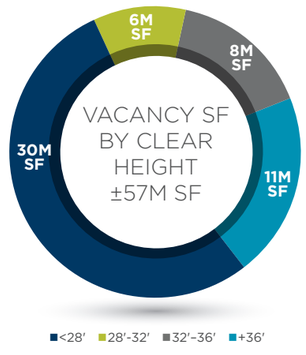
The majority of industrial vacancy consists of older product with lower clear heights

COMPOSITION OF VACANT WAREHOUSE PRODUCT

54.0% OF CURRENT VACANT AVAILABLE SPACE **WAS BUILT BEFORE 2000**

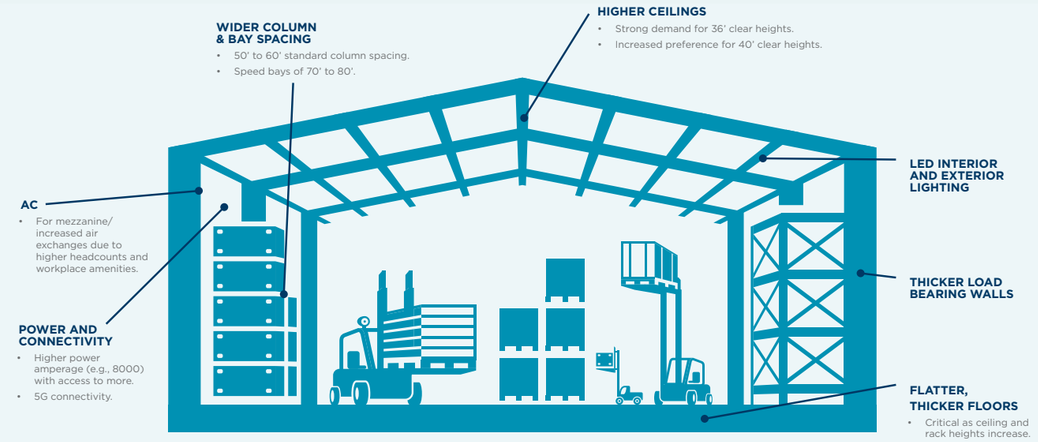


64.0% OF CURRENT VACANT AVAILABLE SPACE **HAS A CLEAR HEIGHT BELOW 32′**



Source: Cushman & Wakefield Research

DESIGN CONSIDERATIONS FOR LARGE WAREHOUSES TO MITIGATE RISK OF OBSOLESCENCE



OUTSIDE

DOCK DOORS & DOCK PACKAGES
- Dock door ratios are increasing, more is typically better.
- Full dock packages with 35-40K lb. locks, 7′ x8′ levelers (preferably hydraulic), and lights.

SEGREGATED TRAFFIC
- Improving truck, auto and pedestrian flow.
- For example, two ingress/egress options, on-site queuing, ring roads to separate traffic, lighted intersections.

Source: Tech Disruptors and the Supply Chain, Cushman & Wakefield, August 2019

WHAT DOES THIS MEAN FOR AN INDUSTRIAL DEAL?

As the physical design of warehouse and manufacturing facilities continues to change due to increased automation, commercial real estate terms and services will as well to accommodate this new landscape. Most notably, this includes lease terms, tenant improvement (TI) costs and site selection in relation to labor.

INCREASED TI'S & CAPITAL EXPENDITURES

As automation increases in manufacturing, tenant improvement allowances and capital expenditures will need to grow to enable retrofitting of product. TI allowances will need to support office space build-outs, power upgrades and flooring upgrades. CapEx will need to support costs associated with equipment upkeep.

LONGER TERM LEASES

As owners and occupiers invest time and capital into their facilities to meet the demands of automation and the interior of buildings become more customized, the length of a lease will likely increase.

INCREASED EMPHASIS ON SITE SELECTION

As the manufacturing workforce becomes increasingly scarce, and as required skillsets transform to support automation, site selection will play a more important role. Leasing, buying or building facilities near high concentrations of skilled labor will become necessary factors to attract and retain talent.



WHAT'S NEXT FOR CHICAGO AUTOMATION?

Automation will continue to drive change within the manufacturing industry. Both the labor and industrial real estate markets are continually being impacted and reconfigured by new and improved technology. From warehouse design to attracting and retaining a skilled labor force, owners and users will need to adopt new best practices when it comes to industrial real estate.

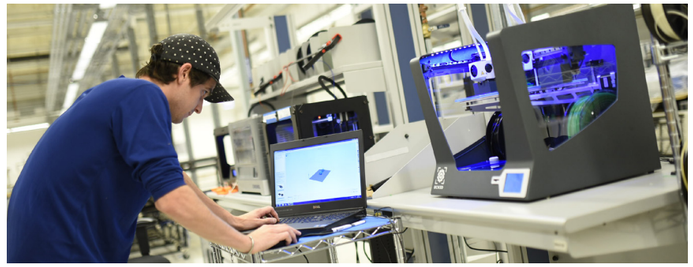
CUBEWORK

INDUSTRIAL COWORKING FACILITIES

Coworking and flexible workspace providers, such as WeWork and Convene, have reshaped the office real estate market. Is industrial the next frontier? Cubework, a coworking firm which focuses on office and industrial users, recently leased a 200,000-sf warehouse in Northern Cook County. The space offers office and warehouse workspaces. With locations throughout the world, Cubework continues to expand. As coworking and flexible workplace providers grow, there will likely be an increased emphasis on options that target industrial users. These providers will offer new and existing companies a space to grow their businesses in collaborative and innovative work environments, which has incredible potential to impact automation technologies.

INNOVATION CENTERS

Innovation centers are popping up across the U.S., where users are making huge strides in industrial automation. These labs are funded by state and local governments, educational institutions and corporations with the sole purpose of driving innovation through the creation of new products and ideas. These facilities offer members a multitude of services such as financing and workspace for new and existing businesses, which will play an important role in fostering new ideas and products.



MHUB

mHUB is the nation's largest and fastest growing innovation center for physical product development and manufacturing. It is a community of product designers and developers, entrepreneurs, engineers and manufacturers, a network of manufacturing mentors, industry experts and investors and a source of intellectual and economic capital. mHUB is home to more than $5M in resources including ten unique prototyping labs and a microfactory for onsite low-volume production runs. In its first two years alone, mHUB's member companies generated more than $48.5M in revenue, raised more than $100M in funding, hired more than 780 employees and launched more than 640 products.



THE MXD INNOVATION CENTER

The MxD Innovation Center focuses on digital manufacturing processes. In partnership with the U.S. Department of Defense, MxD equips U.S. factories with the digital tools and expertise they need to build manufacturing components and advance manufacturing techniques.

AUTOMATION IN ACTION

Locally, the Ford Motor Company assembly plant recently underwent a major overhaul to accommodate the new and improved Ford Explorer and Lincoln Aviator. The plant, located on Chicago's South Side, is one of the company's longest operating facilities. In the span of just 30 days, the plant went through a total refit to accommodate new technologies. This cost Ford upwards of $1 billion. Over 11,000 workers dismantled outdated equipment and installed new state-of-the-art machinery, which included hundreds of robotics and numerous 3D printers. Due to the plant's unique position along the Chicago River, Ford rented a barge to transport various materials. Ford also housed much needed trucks and trailers on nearby rented land sites. In the end, roughly 90% of facility was retrofitted. While the plant was under renovation, employees were trained on the new equipment and processes using virtual reality. This way once the plant was operational, manufacturing operations could commence more quickly.

KEY FINDINGS

- Automation retrofitting is capital intensive – Ford spent upwards of $1 billion on improvements
- Requires training of employees – Ford used virtual realty tools to retrain employees on new processes while building was under renovation
- Retrofitting can be a relatively quick process – The Ford plant was turned around in just 30 days.

Source: Ford Explorer launch required major redo of aging plant, Automotive News, August 2019



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