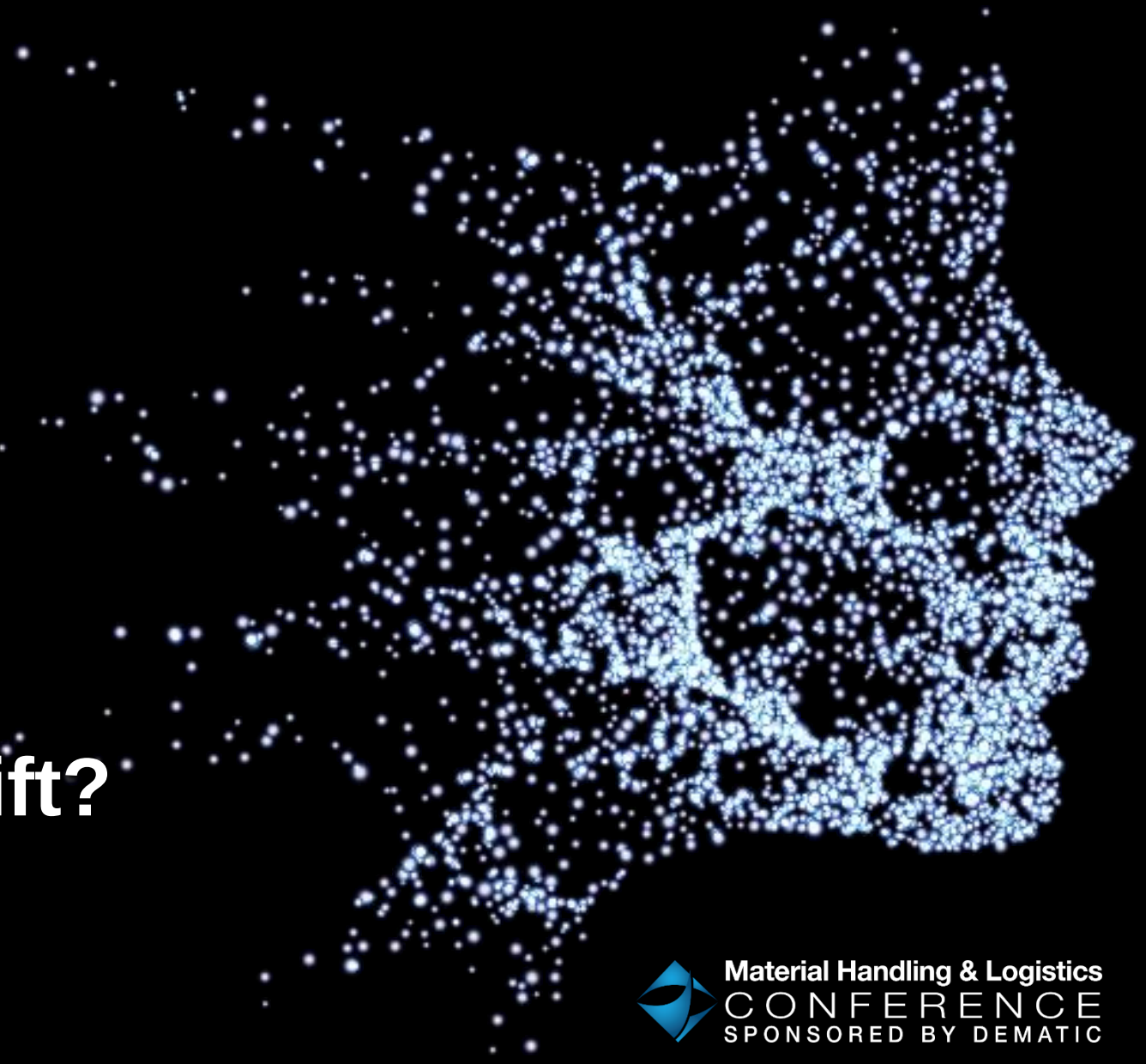
THE PREDICTIVE REVOLUTION

Embracing the Smart & Connected Future

Micro Fulfillment: Passing Fad or Permanent Market Shift?



Material Handling & Logistics CONFERENCE

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Speaker Information

- **Marc Wulfraat**
- **President**
- **MWPVL International**
- **Supply Chain and Logistics Consultants**
- **(514) 482-3572 x 100**

- Marc is the founder and president of **MWPVL** International
- 32 years of supply chain consulting experience to the supply chain industry
- Currently working on three (3) e-commerce MFC/CFC projects within the grocery sector
  - Designed a grocery e-commerce facility dark store for a major grocery retailer
  - Currently working with 3 grocery companies to evaluate for MFC versus CFC versus Dark Store
- Managed more than twenty (20) automation consulting mandates in terms of evaluation, design and deployment in North America and overseas
- Widely recognized as an industry expert on Amazon's distribution strategy, Marc has appeared in the Economist, Time, Wall Street Journal, Washington Post, New York Times, Forbes, and many other journals.
- He is also an advisor to many institutional investment firms on the topics of e-commerce and Amazon.
- Marc has written over 50 white papers, 110 articles and has spoken at over 120 industry events
- He has a BSc in Mathematics and an MBA.

Micro Fulfillment:
Passing Fad or Permanent Market Shift?

The line between stores and warehouses is getting fuzzy:

- **Grocery retailers are now opening metro-market dark stores and store expansions to satisfy the expanding demand for e-commerce fulfillment, click & collect, and home delivery**
- **Automated with standardized material handling solutions, these smaller facilities can be deployed quickly at a price point that enables many markets to be covered**
- **Attend this session to hear who is doing what, what solutions are being deployed, and the impact this trend is having on the automation industry in general**

Agenda

- Supply Chain 4.0 : What Does Out Future Hold?
- What Societal Changes are Driving E-Commerce Fulfillment?
- What Options Exist for Grocery Retailers to Service the E-Commerce Channel?
- How Does Micro-Fulfillment Work?
- Strategies Being Taken by Different Companies

Supply Chain 4.0 - What Does Our Future Hold?

Supply Chain 1.0

- Brand Dominant
- First “industrial” supply chains
- Push Based

Supply Chain 2.0

- Retail Dominant
- Supply Chain as a differentiator
- Balance Cost & Service

Supply Chain 3.0

- E-Commerce Dominant
- Supply Chain as a strategic weapon
- Speed & Convenience for “Free” raises the bar of customer expectations

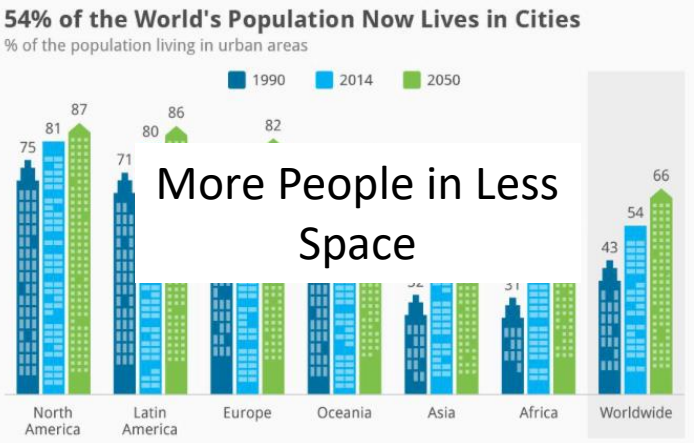
Supply Chain 4.0

- What will be the next evolution of today’s dominant design?

1980s *1990s* *2000s* *2010s* *2020s*

Today's New Normal

Urbanization



Source: United Nations

The "Tyranny of Now"

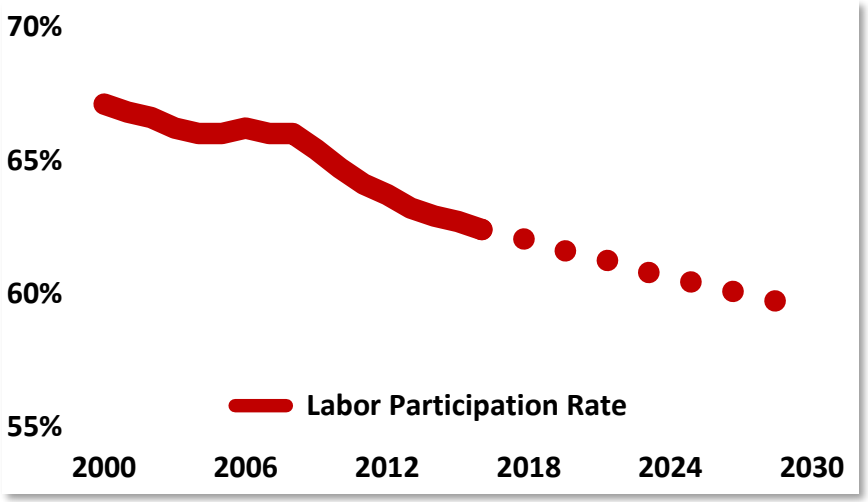
The "Infinite Shelf"

Convenience is King

The Supply Chain Perfect Storm (3Ss)

Shortage of Skill

Lack of Space



Need for Speed

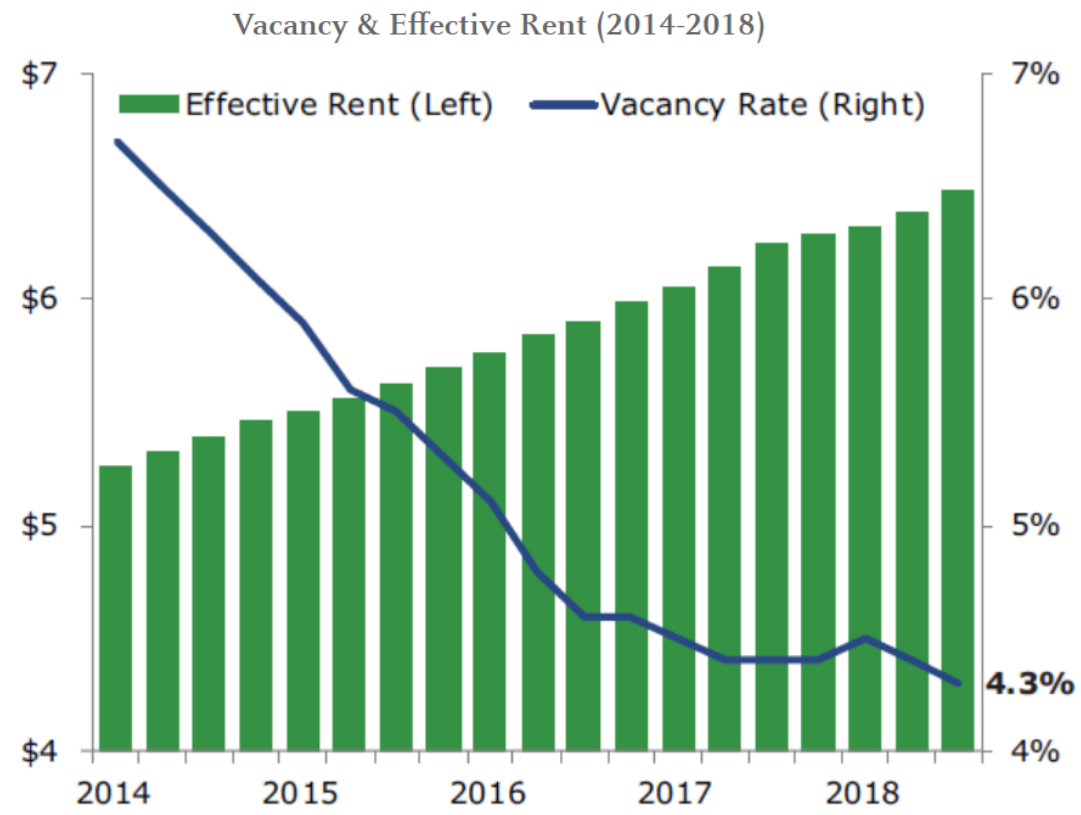
Lack of Space:
Urbanization

- **Today, 54% of the world's population lives in urban areas and this will increase to 68% by 2050**
  - By 2030, the world is projected to have 43 megacities with more than 10 million inhabitants
  - Mass urbanization combined with e-commerce is driving the need for faster response times
  - As a result, distribution and logistics is moving closer to within several hours of high-density points of demand

Source: https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

Lack of Space:
Warehouse Vacancy Rates Approaching Record Lows

- **Industrial/Logistics real estate vacancy rates near historic lows ~4%**
- **Demand exceeding supply for last 32 out of the last 33 quarters – nearly 9 years**
- **Rental rates rising 5-6%/year on average far above commercial real estate rates of 2-3%/year**
- **CBRE estimates that an estimated 240 million Sq Ft of new space in the U.S. will be needed for e-commerce alone over the next few years (2019-2023)**
  - E-commerce requires 3X warehouse space per retail sales $ as compared to brick & mortar



Source: CBRE-EA, Clarion Partners Investment Research, Q3 2018. This information is provided for illustrative purposes only and does not reflect the performance of an actual investment.

Lack of Space:
The Multi-Story E-Commerce Warehouse Has Now Arrived in the USA

Seattle, WA: 590,000 Sq Ft x 3 Floors

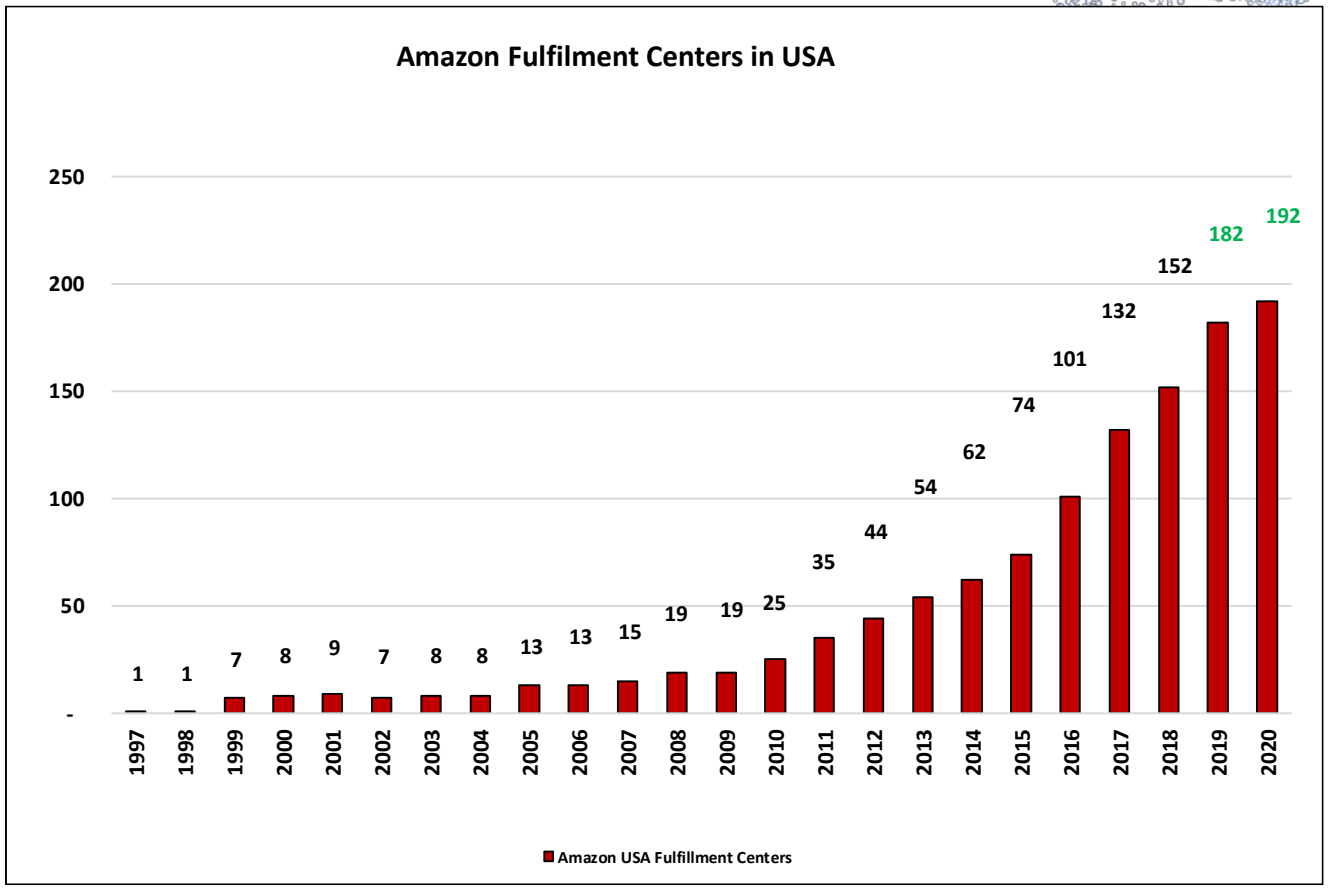
- In 2018, Prologis completed the first ground-up multi-tier distribution center in Seattle
- In Asia, Prologis has opened 84 similar multi-story warehouses with another 25 under construction

Bronx, NY: 595,000 Sq Ft x 2 Floors

- The largest two-story fulfillment center in the country is under construction with a planned 2021 opening, enabling ecommerce tenants to service the New York metro market with same-day delivery
- This is 1 of 5 being planned for New York City

Lack of Space:
Amazon Multi-Tier Fulfillment Centers in North America

- **In Q4 2018, Amazon surpassed Walmart in total North American Square Footage of distribution center space with 141 MM Sq ft compared to Walmart's 132 MM Sq ft.**
  - Many Amazon fulfillment centers have 3 or 4 stories of production space
  - Amazon's 855,000 sq ft 3-Tier FC Template has now evolved to a 640,000 sq ft 4-Tier FC
- **Amazon accomplished their build-out in 22 years**
- **Walmart built their distribution network over 49 years**



Source: MWPVL International Inc. July, 2019

Shortage of Skill:
Aging Populations > 65 Years for 10 Industrialized Countries

Country	2016			2030			Difference		
	Population 65+ (Millions)	Total Population (Millions)	% of Population	Population 65+ (Millions)	Total Population (Millions)	% of Population	Population 65+ (Millions)	Total Population (Millions)	% of Population
Japan	32.9	127.2	25.9%	37.5	116.6	32.2%	4.6	-10.6	6.3%
Germany	17.0	80.6	21.1%	21.8	79.8	27.3%	4.8	-0.8	6.2%
Italy	13.1	62.4	21.0%	15.9	62.3	25.5%	2.8	-0.1	4.5%
France	12.0	65.6	18.3%	15.9	67.9	23.4%	3.9	2.3	5.1%
Spain	8.4	47.7	17.6%	9.7	44.3	22.0%	1.3	-3.4	4.4%
United Kingdom	11.0	62.9	17.5%	15.2	71.4	21.3%	4.2	8.5	3.8%
Canada	5.1	35.5	14.4%	9.3	40.6	22.8%	4.1	5.1	8.4%
Ukraine	7.0	44.0	15.9%	9.3	42.2	22.0%	2.3	-1.8	6.1%
Poland	5.7	38.0	15.0%	8.7	37.7	23.1%	3.0	-0.3	8.1%
United States	49.2	323.1	15.2%	73.1	355.1	20.6%	23.9	32.0	5.4%
10 Countries	**161.5**	**886.9**	**18.2%**	**216.4**	**917.9**	**23.6%**	**55.0**	**31.0**	**5.4%**

- Industrialized labor pool in 10 major developed countries will **shrink by 5.4% by 2030**
- In the U.S., all baby boomers will be older than 65, with **1 in every 5 of retirement age**
- By 2035, **older people are projected to outnumber children** for the first time in U.S. history

Shortage of Skill:
Warehouse Labor Shortage Causes Inflation to Rise (Source: CB Richard Ellis)

- **Bureau of Labor Statistics (BSL):**
  - 2018: Overall employment cost index jumped by **3.0%**
    - Transportation and warehousing workers was even higher at **3.5%**
    - Labor typically accounts for **40% - 60%** of warehouse operations expense
  - California minimum wage will go up from **$10** in 2017 to **$15** in 2023 which translates to a nearly 7% annual increase.
  - Proposed legislation in other states indicates that the minimum wage could approach $15 in the next 3-5 years
  - Many logistics companies now raising wage rates by **10 – 20%** to attract labor

Schedule for California Minimum Wage rate 2017-2023.

Date	Minimum Wage for Employers with 25 Employees or Less	Minimum Wage for Employers with 26 Employees or More
January 1, 2017	$10.00/hour	$10.50/hour
January 1, 2018	$10.50/hour	$11.00/hour
January 1, 2019	$11.00/hour	$12.00/hour
January 1, 2020	$12.00/hour	$13.00/hour
January 1, 2021	$13.00/hour	$14.00/hour
January 1, 2022	$14.00/hour	$15.00/hour
January 1, 2023	$15.00/hour	

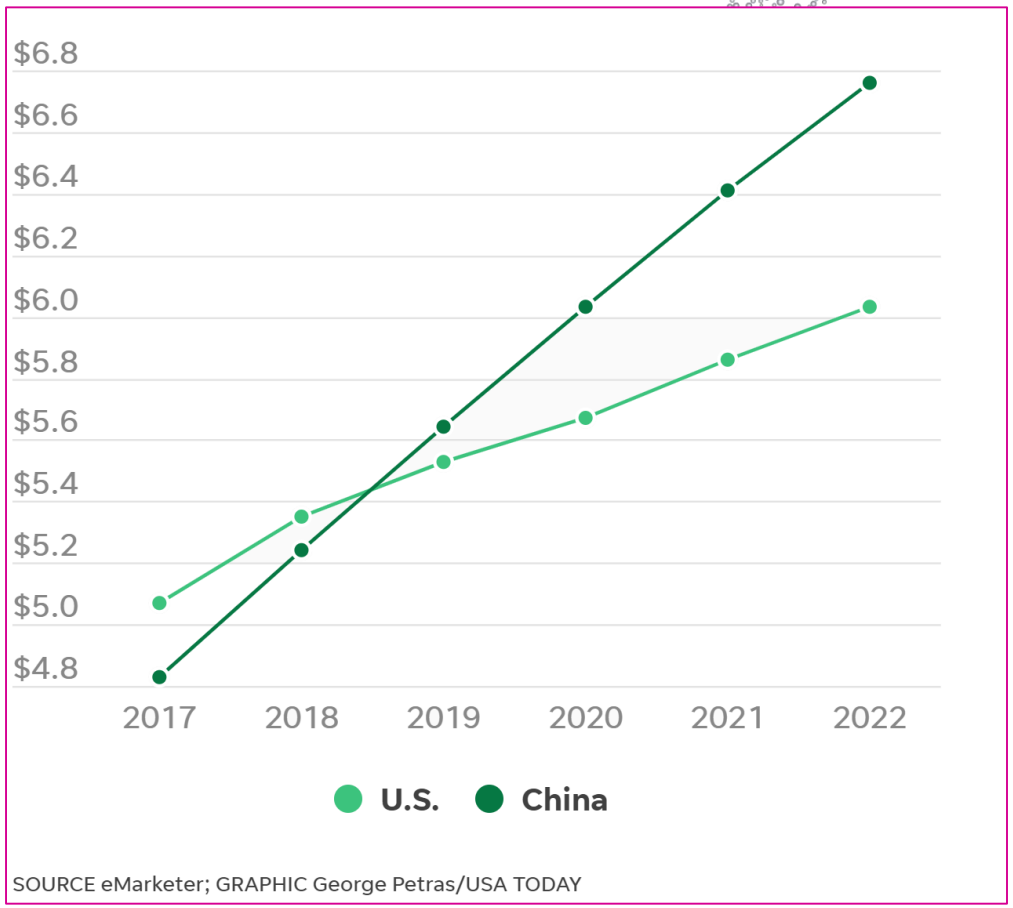
Shortage of Skill:
Forthcoming Perfect labor Storm (PLS)

- **The Perfect Labor Storm is coming:**
  - **Millions** less people available to do the work by 2030
    - High probability that much of this labor shortage will impact physically demanding blue collar jobs such as distribution operations
  - Forthcoming generation of young people are far more technologically capable than any previous generation and are not interested in doing manual warehouse work
  - Rise in e-commerce channel causing massive increase in demand for low-cost unskilled blue-collar labor
  - Wage rates and union strength will increase as competition for labor resources heats up
- **These data points provide strong indicators that there will be a significant demand increase for automated distribution solutions to minimize reliance on a diminishing labor pool**

Need for Speed

Is the Online Retail Market in China an Indicator to Watch?

- China retail sales in 2019 to **grow 7.5%** to **$5.6 T** versus U.S. retail sales projection of **$5.5T**
- China is by far and away the world's leader in retail e-commerce, with **35.3%** of retail sales online compared to **10.9%** in the U.S.
- In 2019 China's ecommerce sales are projected to **grow 30% to $1.9 Trillion**
- By YE 2019, China will comprise **55.8% of global online retail sales**, the report says
- Alibaba now accounts for **53.3%** of China's online sales



Need for Speed

New Wave of Autonomous Delivery Vehicles (ADVs)

- **Intense rush for first-mover advantage in the e-commerce grocery market in the U.S. is driving retailers to ADVs**
  - Ahold USA's Stop & Shop partnered with Robomart to launch driverless grocery vehicles in Boston, MA
  - Kroger partnering with Nuro, maker of fully unmanned vehicles for driverless deliveries in Scottsdale, AZ
  - Walmart partnered with Waymo in Chandler, AZ for self-driving minivan taxis to transport online customers to stores; and with Udelv for driverless cargo vans to deliver groceries in Surprise, AZ

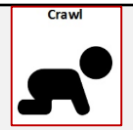
Amazon Acquisition of Whole Foods

- **June, 2017: Amazon acquired Whole Foods for $13.7 Billion and a new era in the Grocery industry was born**
  - Grocery industry was immediately hit with a seismic shock wave:
    - Kroger's share price valuation fell from **$31** to **$22** overnight

Amazon-Whole Foods Domino-Effect

- **Whole Foods gives Amazon 500 distribution points to supply consumers with Fresh Foods as well as a modest supporting supply chain**
- **The domino effect:**
  - All other supermarket companies are threatened and immediately go into the war room to develop defensive strategies to accelerate click and collect and home delivery capabilities
  - Fear is driving a renaissance of new innovations but also a significant challenge to profitability

Options for Grocery E-Commerce Fulfillment

	In-Store Fulfillment 	Dark Store	Micro-Fulfillment Center	Customer Fulfillment Center
How the order gets fulfilled	• Valet manually picks online customer order within store	• A retail store is closed to the public for manual order fulfillment • Tent in parking lot • More popular in Europe	• A small automated fulfillment center is attached to a store to serve one or more stores within proximity to a metro market • Hub + Spoke to small store cluster	• A large fully robotic-enabled warehouse is established for a wide geographical area • Hub + Spoke to wider range of stores
Service Level / Assortment	• Same Day • Full assortment	• Next Day (typically) • Partial assortment of around 4 - 8,000 SKUs	• Same Day depending on geography • 8 – 15,000 SKUs in automation (95% of sales) + last 5% sales from store	• Next Day depending on geography • Full assortment in automation
Space Required and Cost to Deploy	• No additional space needed • In-house service or partnership with Instacart	• 25,000 – 80,000 sq ft leased bldg. • $2 – 3 Million Equip. • Low investment cost	• 11 – 18,000 sq ft within existing store • $4 – 5 Million Equip.	• 300 – 350,000 sq ft • $55 - 100 Million bldg. • $100 – 200M for Equip.
Considerations	• High labor cost • Annoyance to in-store shoppers imposes a limit on sales growth	• High labor cost • Requires separate inventory + store • 30 - 40 mile (2 Hr) radius	• Low labor cost • Needs $25 – 30 Million of sales volume to be viable • 30 - 40 mile radius	• Needs $300 – 500 Million of sales volume to be viable • 75-100 mile radius
Last Mile Delivery	• One order at a time or small batches/route	• Batch of multiple orders required to make efficient outbound routes • Requires decent window of time to organize the routes		

Options for Grocery E-Commerce Fulfillment

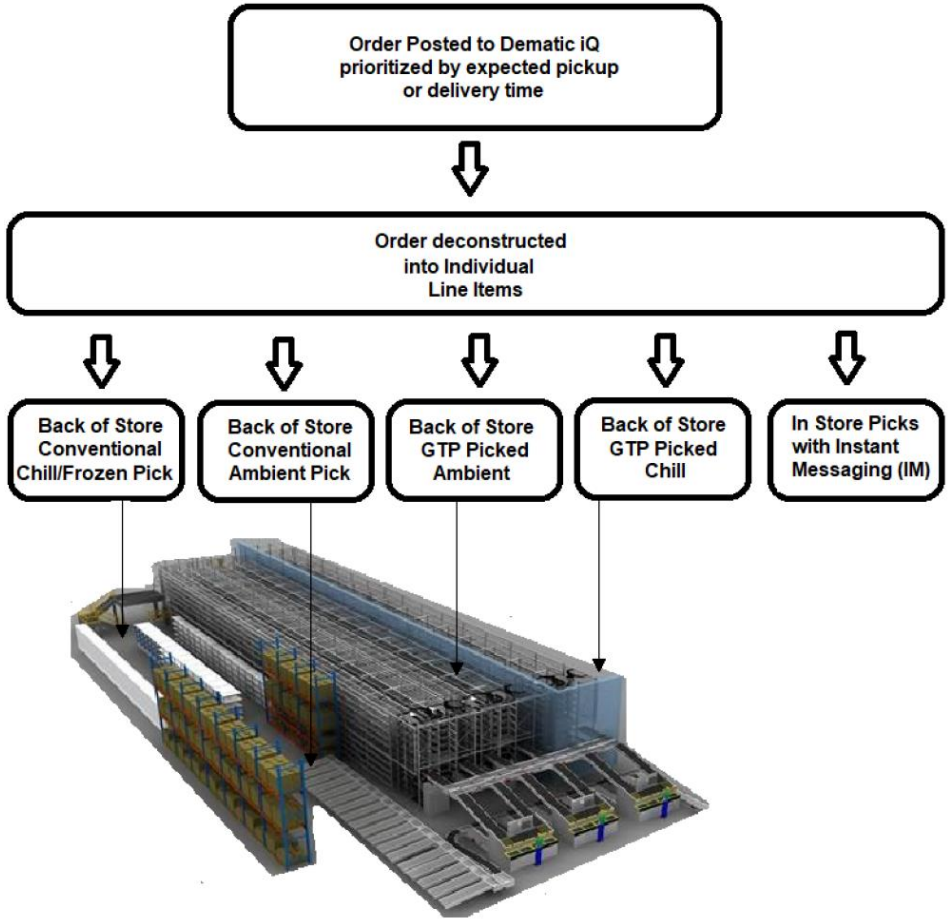
	In-Store Fulfillment (Crawl)	Dark Store (Walk)	Micro-Fulfillment Center (Run)	Customer Fulfillment Center (Run)
Who is Doing What?	Schnucks, Wegmans, SAFEWAY, instacart, H-E-B, Publix, COSTCO WHOLESALE, shaw's, Smart&Final, FOOD LION, ALDI, TOPS Friendly Markets, Cub FOODS, SPROUTS FARMERS MARKET, WHOLE FOODS MARKET, Price Chopper, Raley's	Walmart, HyVee, TESCO, Sam's Club, Sainsbury's, GIANT, FAIRWAY, Ahold Delhaize, H-E-B, WAITROSE & PARTNERS	STOP & SHOP, Albertsons, Sedano's, Wakefern FOOD CORP., Walmart, SUPER-PHARM, Ahold Delhaize, meijer	Kroger, TESCO, Sobeys, ocado, Morrisons, MARKS & SPENCER, Casino, BEST BUY
Assumptions: • $100 order • 43 units • 35 SKUs • $20/hour fully loaded wage rate	• 65 units picked/hour • 40 minutes to process order • **$13.23 labor cost/order** • 5 – 8% out of stock requiring substitutions	• 175 units picked/hour • 85 units/hour overall throughput rate • 30 minutes to process order • **$10.11 labor cost/order** • 1 - 5% out of stock requiring substitutions	• 750 units picked/hour • 175 units/hour overall throughput rate • 15 minutes to process order • **$4.91 labor cost/order** • 0% Out of Stocks	• 750 units picked/hour • 163 units/hour overall throughput rate • 16 minutes to process order • **$5.27 labor cost/order** • 0% Out of Stocks

Last-Mile Delivery Assumptions:	• Curbside pickup is free
	• Instacart: $10 fee per delivery
	• Sprinter van + driver:
	  • Assume fixed rate of $230/day; cost/delivery depends on No. of deliveries;
	  • Typical cost is $10 – 20/stop if route density is low.
				• CFC Transfer to stores with 53’ semi assume $3.50/mile + $50/stop

Why E-Commerce Grocery is Challenging

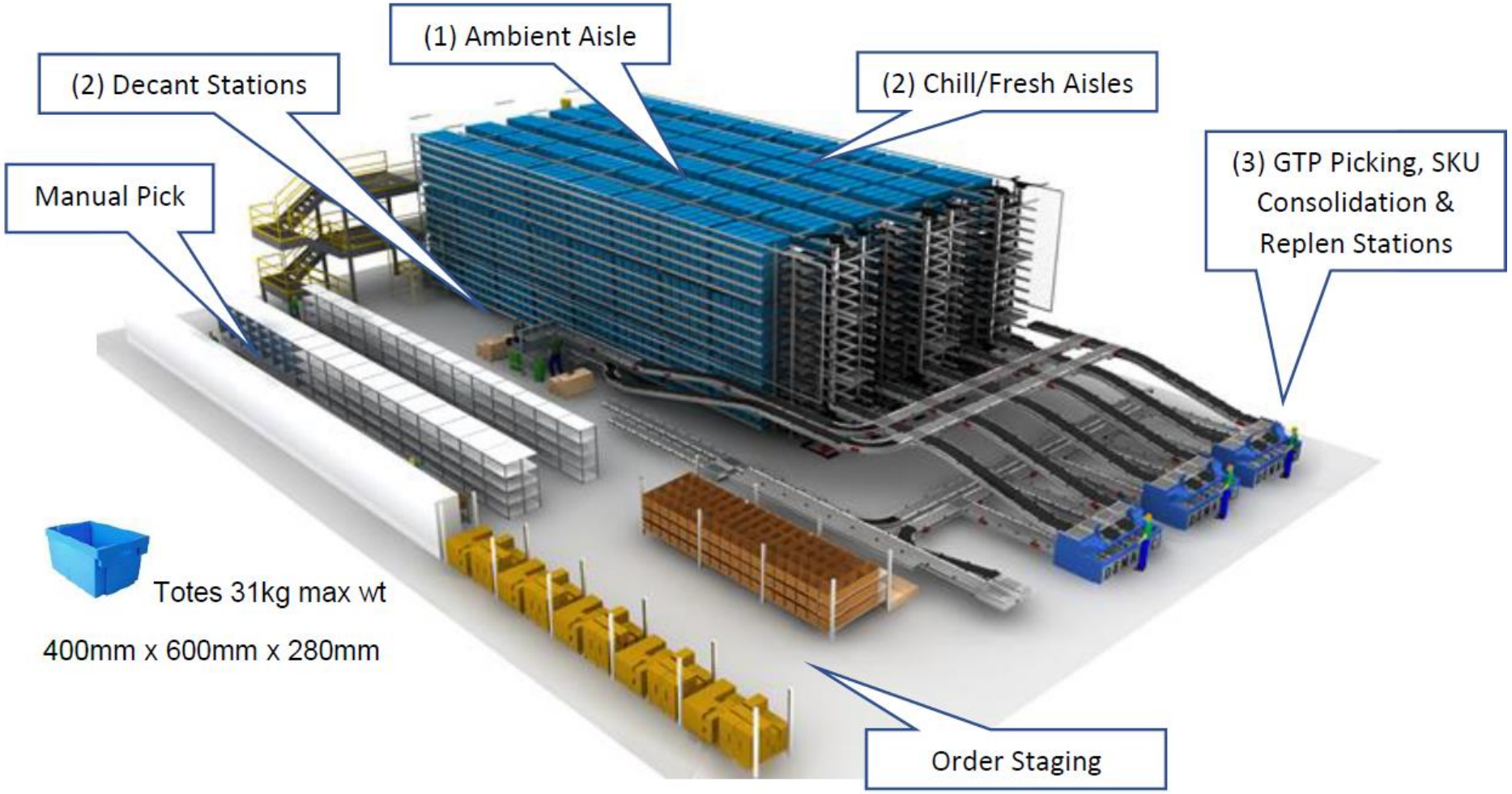
	Assumption	In-Store Fulfillment/ Dark Store	Micro Fulfillment Center
% sales from online shoppers		3%	
Average online order	• Free Service & Delivery > $35 Order	43 units x $2.33 = $100	
Gross Margin per online order	• 65.86% Cost of Goods	$34.14	
Average time to process online order at store	• 43 Units/Order	30 minutes	15 minutes
Labor Cost to process online order	• $20 per hour fully loaded	$10.11	$4.91
MFC Processing Charge (MFC Service Fee)	• $0.075/Unit (Max $50K/Mo) • 33 Units MFC; 10 Units Manual	-	*$2.48** **Does not apply to all MFCs*
Average last mile cost to deliver to home (this can vary depending on geography & route density)	• Can range from $6 - $20 • 90% customers prefer home delivery to curbside pickup given the choice	$10.00	$10.00
General & Admin/Order Allocation	• 5.0% Sales (Rent, Admin)	$5.00	$5.00
Depreciation/Order	• $30M annual Sales Volume • 10 years depreciation on $4M CapEx	$0	$1.85
Net Margin per order	• Excludes cost of interest exp. and MFC Service Fee	$9.03	$12.38
Net Margin %		9.0%	12.4%

Micro-Fulfillment: How It Works



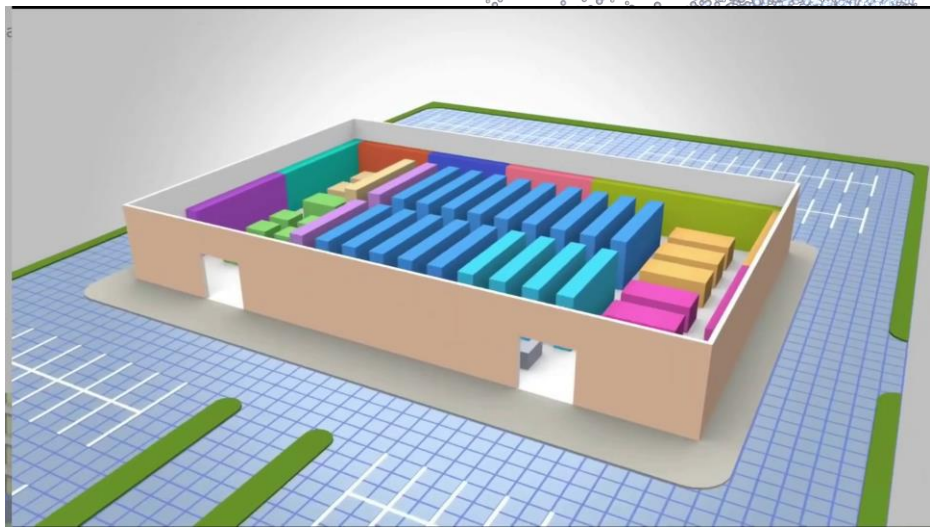
- **Goods to Person Shuttle System**
  - Typical system has 1-2 aisles Dry + 1-2 aisles Chilled
  - 6,600 – 8,000 totes 10-high storage to 24’ x 2-deep
  - 2 decanting stations
  - 2 – 3 pick stations with each station picking at 750 UPH
  - Prebagged insulated totes
  - SKUs account for 95% of sales
- **1 quick-pick manual aisle for DSD, Oversized & Frozen**
- **In-store picks for last 5% of sales $**
- **Consolidate 3 order components into tote**
- **Load totes into vans**
  - Van transfer to other stores within “metro market cluster”
  - Van delivers to home
- **Or transfer tote to store’s refrigerated locker for customer pickup within 60 minutes of order placement**

Example of MFC in 10,630 Sq Ft Footprint
6,500 Totes in Storage



Sedano's Micro-Fulfillment Center

- **Sedano's is a grocery supermarket firm in Miami, FL with 18 stores**
  - Opened first Takeoff micro-fulfillment center with 10,800 sq ft in the back of a retail store in Oct 2018
  - Single site services a cluster of stores in Miami market
  - Typical system costs $4 MM to deploy
  - 12 weeks to install and go-live
  - System consists of a 3-aisles (2 Dry, 1 Fresh) Knapp OSR Shuttle system that has 6,600 totes holding 12,000 SKUs
  - Manual pick area for 3,000 Frozen and Direct Store Delivery SKUs
  - $30 MM turnover with 12 FTEs dedicated to the operation which sells 95% of the in-store SKU base; 5% sales picked from store
  - 600 orders per day – 20,000 lines/day
  - 750 retail units/hour pick rate x 2 pick stations = 1,500 UPH output
  - 176 UPH overall throughput rate including receiving through loading labor versus 60 – 65 UPH for a manual pick operation
  - Huge success for Sedanos to enable profitable online business
- **Albertsons, Stop & Shop and Wakefern have 1st store live in 2019**
- **100+ MFC systems now on order as of 2019/01**



Walmart Working w/ Alert Innovation's Alphabot

2,100 Click & Collect Stores Being Planned

- **Walmart testing Alert Innovation's Alphabot automated picking system for online grocery orders at an existing store in Salem, NH**
  - Existing store expanded to contain new system
  - System live in Oct 2018
  - **600–800** units per hour pick rate
  - Unlike picking from the retail store, the automated system runs as separate store with real-time inventory, never having to substitute an item and shipping with 99.9% order accuracy
  - Plans underway to offer click and collect service at **2,100** locations in U.S.

Kroger Invests in Ocado

20 Sites Planned

- **Kroger is investing in customer fulfillment centers (CFCs) to be located close to 20 major metro markets**
  - 1st CFC under construction in Monroe OH will service 12 stores by 2021Q1
  - 335,000 SF
  - 410 associates
  - Online sales of $38.7 MM per facility
  - 24 months to deploy
  - 180 units/man-hour throughput rate
  - $US 55 M Capital Investment for building only
  - Ocado financing equipment and will serve as a 3PL with transaction-based fee structure
  - Hub and spoke delivery model to stores
  - Additional CFCs announced in Groveland FL; Forest Park GA and Mid-Atlantic Region
  - In Canada Sobeys has now committed to 2 CFCs in Toronto and Montreal
  - https://youtu.be/iogFXDWqDak

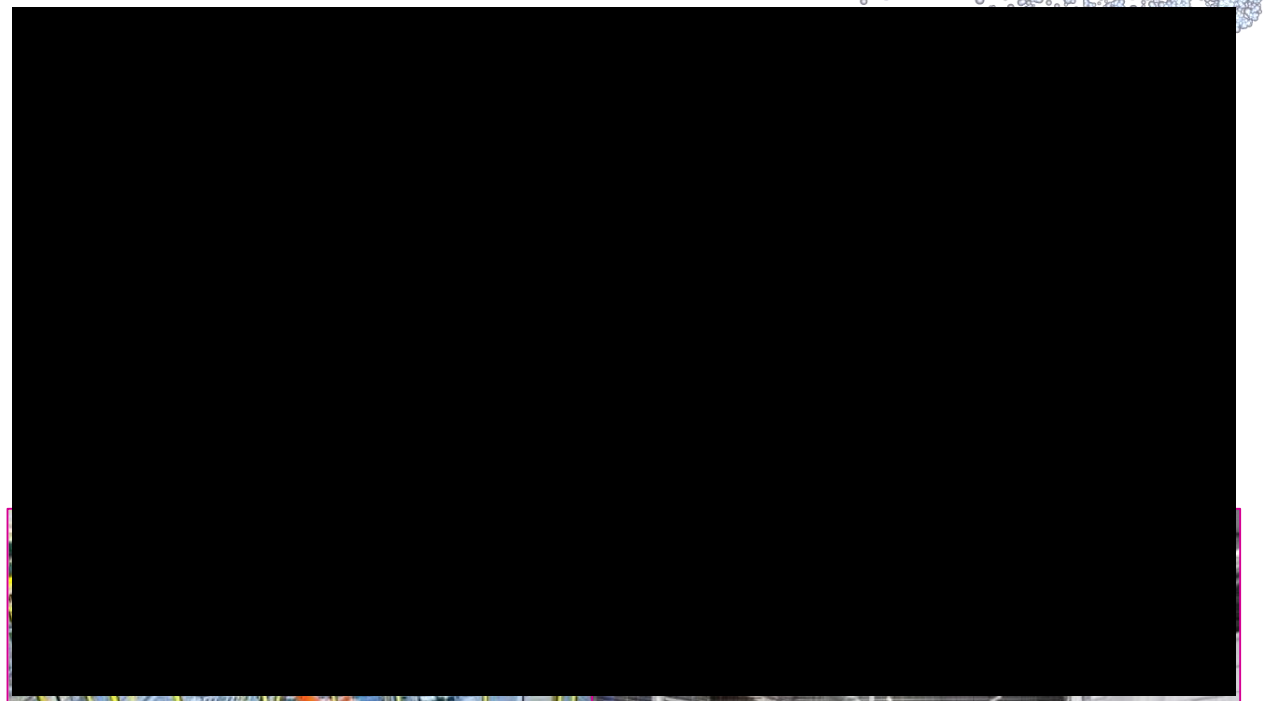
CommonSense Robotics Launches CFC in Tel Aviv

- **CommonSense Robotics is an Israeli Startup that launched its first micro-fulfillment center in Tel Aviv in 2018 as a small footprint urban shared 3PL operation for multiple retailers seeking rapid fulfillment capability**
  - 6,000 Sq Ft completely automated urban fulfillment center
  - Facility owned and operated by CommonSense Robotics (as a 3PL) from a downtown parking lot
  - Super-Pharm, Israel's largest drugstore chain is first customer
  - Firm now developing sites for other retailers
  - CSR manufactures its own robots
  - https://www.youtube.com/watch?v=LyUu1W_SZh0

Tesco (UK) Partners With Dematic for Urban Automation

6 Tesco.com CFC Depots Surround London

- **Tesco.com**
  - 4.3 billion/yr turnover; 5.1% of sales
  - Online ordering supported from 300+ dark stores in the UK
  - 1 Million online active customers and 500,000 home deliveries/week
  - 6 dedicated urban customer fulfillment centers (CFCs) surround Metro London
  - 4th Generation dot.com depot is highly automated with Dematic shuttle, mini-load and robotic arm systems supporting a throughput rate of 182 units/hr throughput
  - https://www.youtube.com/watch?v=QONyKR0KdYs



Automation Innovation Renaissance is Happening

Technology Innovators are Shaping the Future of Warehouse Design and Productivity

On Demand Warehousing

- FLOWSPACE
- FLEXE
- STORD
- WARE2GO

Micro Fulfillment Centers

- Takeoff
- ALERT INNOVATION
- COMMONSENSE ROBOTICS
- DEMATIC
- WITRON
- ocado

Autonomous Mobile Robots

- OPEX CORPORATION
- VECNA
- CLEARPATH ROBOTICS
- CANVAS technology

Box Packaging Automation

- Rockwell Automation
- ProShip BY NEOPOST
- WestRock

Collaborative Robots (Cobots)

- LOCUS
- INVIA ROBOTICS
- fetch robotics
- NEXTSHIFT ROBOTICS
- 6 RIVER SYSTEMS

Autonomous Drones

- PINC
- eyesee DRONE INVENTORY BY HARDIS GROUP
- vtrus

First Mover Advantage

- **The average online customer orders from a standard template list of 340 items**
  - It takes time for a consumer to set up their order template into a retailer's online system
  - Customers will tend to repeat order from retailers who "get it right" due to the hassle factor of setting up multiple order templates
- **First Mover Advantage of Micro-fulfillment**
  - Near perfect real time inventory & accuracy of order picking minimizes instant messaging for substitutions for 95% of sales volume picked from the automation system
  - **Less hassle for customer = loyalty = repeat ordering**

Conclusions

- Shortage of Skills, Space and Speed is changing the retail landscape
- % retail sales through the e-commerce channel continuing to increase
- Retailers seeking to move closer to metros markets for faster response times to better compete against Amazon and other competitors
- New demand for efficient, accurate and rapid order fulfillment solutions being driven by Amazon threat after Whole Foods acquisition
- Demand for Micro-Fulfillment Automation solutions is poised to skyrocket as retailers seek to defend market share within the changing market landscape
- MFCs enable grocery retailers to achieve profitable same day service for a full assortment of SKUs if they are established to service store clusters within a metro market
- Micro Fulfillment is not a fad – it is most-definitely a permanent market shift!

Questions?

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