Warehouse Automation

Favorable global trends in warehouse automation driving strong growth and investment opportunities

Q4 2022

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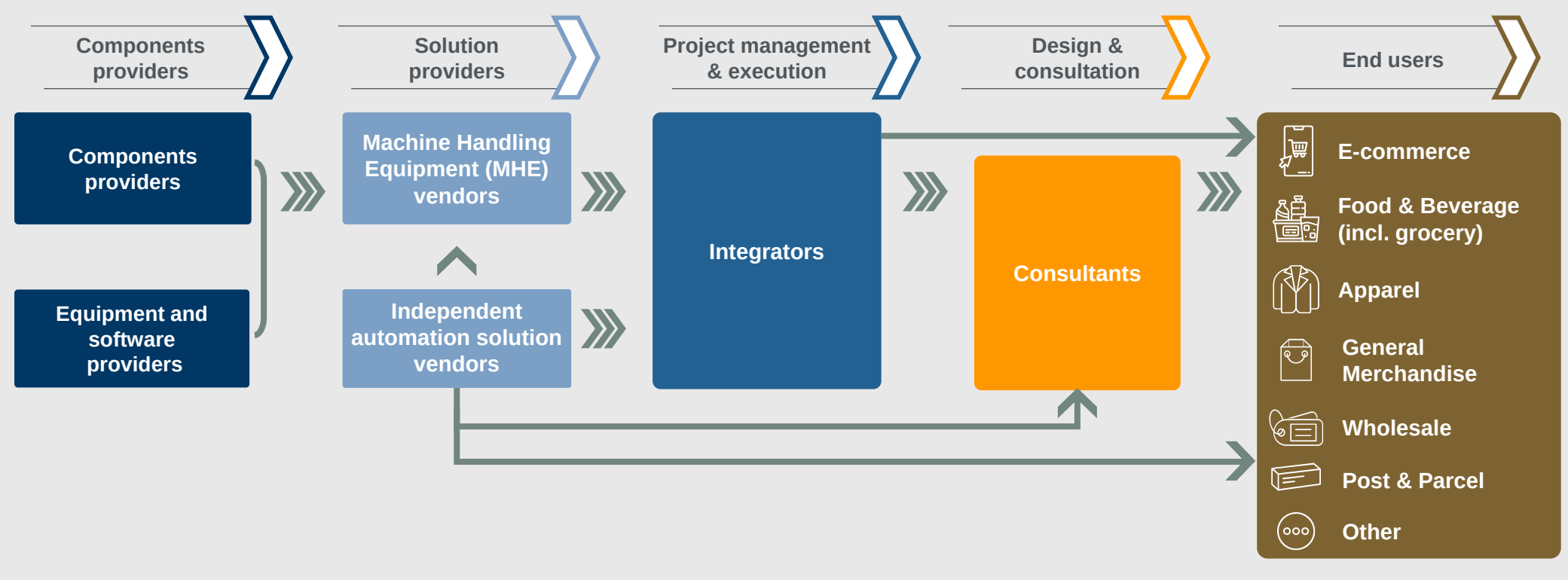
Executive summary

- Investments in automation are prevalent across all industrial markets. Warehouse operators are increasingly looking to automation technologies to boost productivity and minimize time-to-handle. The **warehouse automation** market is anticipated to grow at a double-digit rate in the next five years, and provide a range of opportunities for investment and value creation
- Ever-growing **global e-commerce**, continuing **labor shortages**, **sustainability awareness**, **advances in technologies** and growing emphasis on **operational efficiency and safety** benefit adoption of warehouse automation
- **Surging adoption of IoT and robotics** in warehouse management systems are driving emergence of **new warehouse automation technologies** – these present key market trends and are enabled by new digital technologies (such as artificial intelligence/machine learning, cloud computing, and big data analytics). A wide range of components and systems continue to be in high demand such as pick & place units, conveyor & sortation systems, palletizing units, as well as high-density storage systems
  - Global **e-commerce** sales have **increased significantly,** and future warehouses/fulfilment centers need to be more responsive, resilient and reliable to accommodate the surging e-commerce market demand
  - **E-grocery** growth is one of the emerging favorable trends in warehouse automation, driving a need for **automated Central Fulfillment Centers (CFCs) and Micro Fulfillment Center (MFC) solutions**
  - **Automated guided vehicles (AGVs)/autonomous mobile robots (AMRs) and smart handling robots/cobots** are expected to be the essential technologies to adopt
- **Customers increasingly ask for "end-to-end solutions"** to simplify their production and supply chains, including platform-agnostic offerings, meaning "system integrators" are becoming an integral part of the customer's value chain with high levels of customer stickiness. **Winning companies** have **leading market positions**, **scalable business models** in their respective customer sectors, and strong **ability to deliver** despite supply chain issues
- Overall **M&A and financing activity has been strong** over the last five years with a slight decline in 2020 due to COVID-19 issues. **Recent public offerings** (e.g., Autostore, Berkshire Grey, Symbotic) and **various financing rounds** for innovative warehouse automation companies confirm a **more rapid adoption of robotics and integrated software** in warehouse automation. These trends will cause investors to **continue to look for opportunities** in this space. End customers look for solutions that not only generate cost savings, but also act as growth drivers, allowing their companies to scale independently of labor requirements

Various stakeholders active across the warehouse automation value chain; the end-market mix shift is largely attributed to growth in e-commerce



Forecast demand for automation in end markets

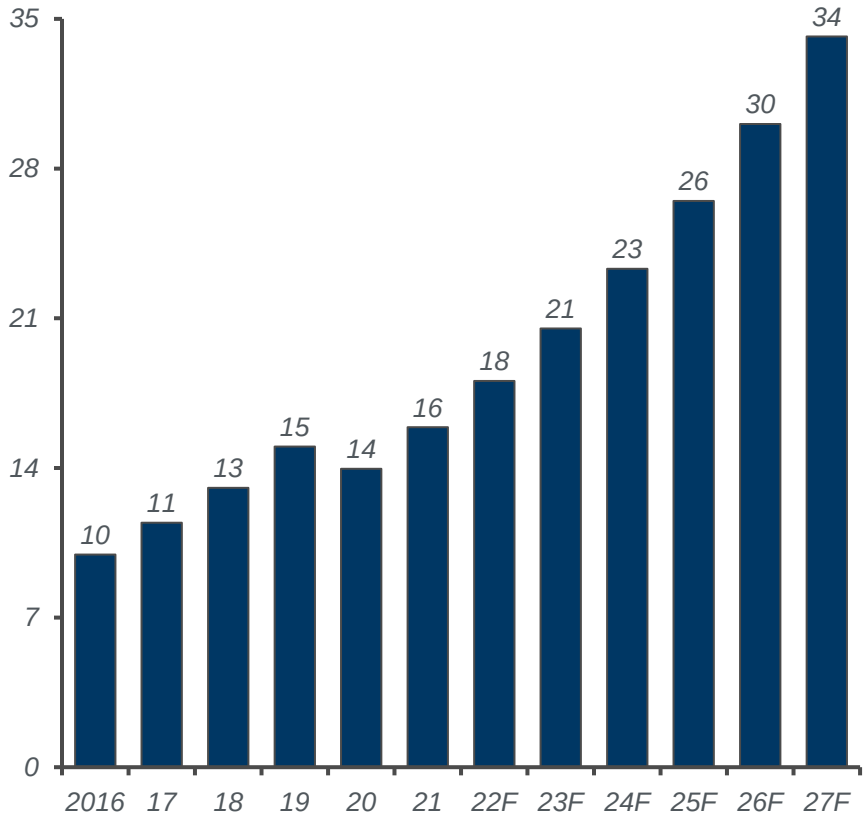
High
High
Medium-High
Medium
Low-Medium
Low
Low

Description				
• Warehouse automation equipment and software providers create the underlying components and modules used in the automation system created by the system integrator • Many equipment manufacturers also have system integration capabilities • Software providers have limited integration capabilities, usually restricted to their own software	• Machine Handling Equipment (MHE) vendors provide physical equipment and associated control software • Independent automation solution vendors provide customized controls and WCS/WES[1)] to enable MHE[2)] orchestration	• System integrators or in-house integrators provide end users with the engineering and design services, consultations, hardware and electrical integration, and aftermarket services • Subcontractor relationships happen regularly and are common in the market	• Consultants help define customer needs, refine solution design, and guide the RFP[3)] and vendor selection processes • End users with limited technical expertise often rely on consultants	• End users initiate new (“greenfield”) and retrofit/expansion (“brownfield”) warehouse projects aligned with their business needs • On brownfield projects, end users often work directly with incumbent vendors

Sources: L.E.K. analysis, Harris Williams analysis
Notes: (1) WCS = Warehouse Control System; (2) Warehouse Execution System; (3) RFP = Request for Proposal

The global warehouse automation market is growing rapidly, forecast to reach c. $34B by 2027

Global warehouse automation market (2016-27F)
Billions of USD



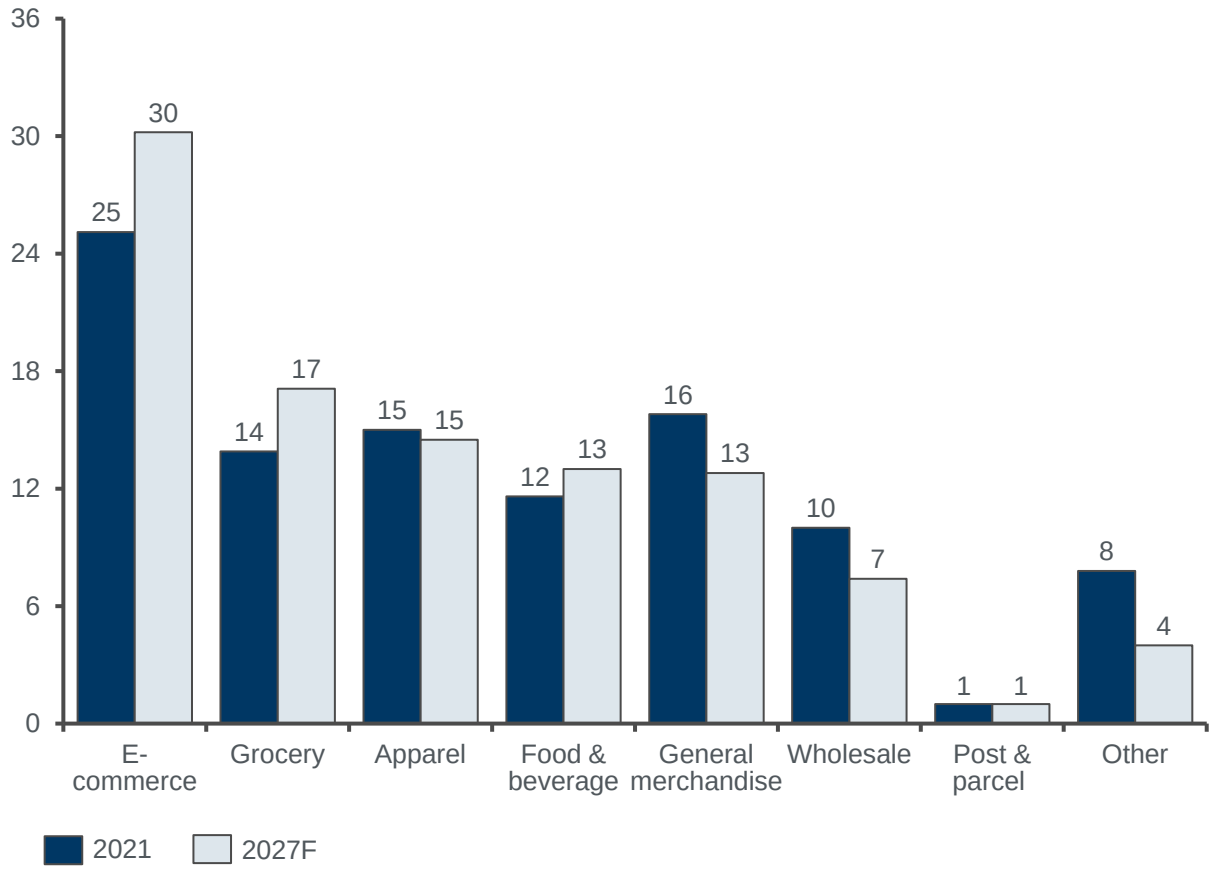
	CAGR% (2016-21)	CAGR% (21-27F)
Total	**9.8**	**13.6**

- "Stay-at-home" policies during COVID-19 had a lasting effect on B2C channels as consumers shifted to **online purchasing,** resulting in **a surge in demand for e-commerce warehouse** and distribution services
  - This prompted warehouse operators to accelerate their timetables to deploy automation and robotics to improve productivity, reduce manual input, and simultaneously create a safer workplace
- Some degree of automation has become a necessity due to globalization of supply chain networks, increase in omni-channel sales, greater order fulfilment needs, increasing same day delivery demands, and lasting labor shortages
- End users are increasingly looking for **best-in-breed automation solutions** that enable orchestration across operating platforms
- Third-party logistic companies (3PLs) tend to have slightly less automated warehouses than retail and e-commerce and are expected to increase capacity to manage global trade flows
- **New business models such as Robots-as-a-Service (RaaS)** facilitate the adoption of robotic systems in warehouses due to low upfront costs. End users are charged a subscription fee with varying rates depending on picks per hour/day, processing volumes or other performance-related tasks
- There has been **a rise in acquisition and consolidation activities** by material handling equipment providers of technology leaders as a way of positioning themselves in response to changing market trends

Sources: Statista; L.E.K. analysis

Almost 50% of global warehouse automation is expected to come from e-commerce and grocery end markets by 2027, with a geographic focus in the U.S. and Western Europe

Estimated warehouse automation breakdown by end markets (2021,27F)
Percent of total



Estimated warehouse automation by geography

- The United States, China, and Germany are the largest markets with **more than 50% of the warehouse automation market share**
  - North America accounted for the **largest share** of the market during the projection period (2022 - 2027)
  - Increasing order fulfilment complexity and technology shifts such as the rise in multi-vendor warehouse design, artificial intelligence, and robotics are driving rapid growth in the North American warehouse automation market
- Western Europe accounts for **c. 30% of the overall global market** with Germany accounting for c. 35% market share in the region
- Most of the **fastest-growing markets are concentrated in APAC,** in particular India and Southeast Asia, where the adoption of robotics automation is forecast to match GDP growth
- The Middle East is another exciting opportunity and well suited geographically, with European players looking to expand their offerings in the region

Sources: LogisticsIQ; Statista; L.E.K. analysis

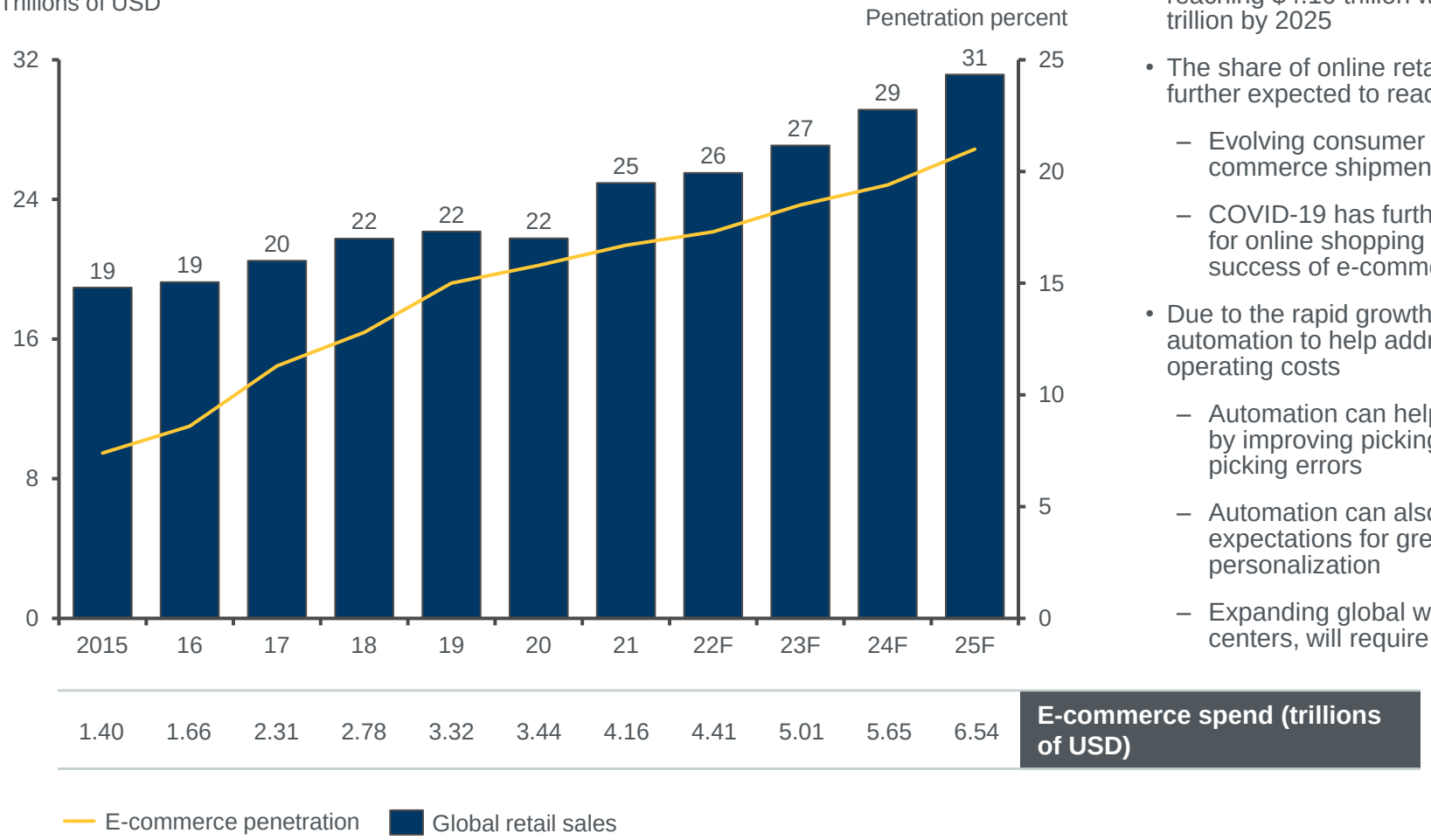
Multiple tailwinds are driving increased warehouse automation – the market is experiencing an accelerating adoption cycle and offers room for substantial growth

	Description	Impact
E-commerce growth	• Future warehouses need to be more responsive, resilient, and reliable to accommodate the surging e-commerce market	• Greater **shift toward e-commerce** among retailers ("Amazon effect") has led to a greater need to optimize costs in the supply chain, driving significant growth in warehouse automation • The boom in e-commerce and omni-channel sales is also compounding the major labor challenges faced by the global logistics industry by requiring more logistical work per item than traditional retailers
Labor shortage	• Shortages due to an aging workforce, recruitment challenges, and resulting knowledge losses	• Overall economy, changing demographics, and **increasing complexity of the supply chain** all contribute to the shortage of available skilled warehouse workforce, which leads to upward pressures on wages and turnover rates • As companies **struggle to attract and retain talent**, increasing demand and competition require automation solutions to offset insufficient warehousing capacity
Advance in technologies	• Increased technologies in connectivity, computing power, data analytics, and robotics	• Increased use of **IoT technologies** enable real-time data transfer, flexible communication, cloud-based solutions and Big Data analytics • Advance in **robotic technologies** such as AGV & AMR provide the technological foundations for more automation in warehouses
Operational efficiency	• Continued focus on sustaining and improving profitability by reducing operational cost	• Automation solutions applied in warehouses produce **higher output** and more accurate order fulfilment than manual setups to meet customers' increasing demand for faster delivery, larger volume of products, and greater customization of products/services • Companies deliver **higher margins** by reducing operating costs through automation and increased use of 3PL
Environmental sustainability	• Increasing regulatory requirements and consumer sentiment around environmental impact	• Growing shareholder and consumer pressure to have **sustainable delivery processes** • Minimize employees' exposure to dangerous environments and **reduce risk of physical injury**

Sources: L.E.K. analysis, Harris Williams analysis

1 Global e-commerce sales have increased significantly, driving demand for increased warehouse capacity in an environment where automation is the only viable solution to labor shortages

Global retail sales demand and e-commerce penetration (2015-25F)



- Global e-commerce sales have grown at a CAGR of 20% over the last decade, reaching $4.16 trillion worldwide in 2021, and are expected to grow to $6.54 trillion by 2025
- The share of online retail sales has gone from 7.4% in 2015 to 18.5% and is further expected to reach 25% by 2025
  - Evolving consumer purchasing patterns are expected to continue to drive e-commerce shipment volumes in place of brick-and-mortar purchases
  - COVID-19 has further accelerated growth in this industry, fueling the need for online shopping and virtual experiences – delivery is crucial to the success of e-commerce businesses
- Due to the rapid growth of e-commerce, companies are applying warehouse automation to help address increasing logistics demands while curtailing operating costs
  - Automation can help e-retailers handle high volumes of daily online orders by improving picking speed for efficient order fulfilment and minimizing picking errors
  - Automation can also be leveraged to address evolving customer expectations for greater accuracy, lower cost, faster delivery, and shipment personalization
  - Expanding global warehouse footprint, along with the rise of fulfillment centers, will require a 50% increase in staffing by 2025

Sources: Oxford Economics; Statista

2 Automation in e-grocery presents a substantial opportunity in the market

E-grocery growth is one of the emerging trends in warehouse automation

- Online grocery retail is expected to gain significant traction in the near term with a rise in the ultrafast grocery delivery space
  - Recent research found that c. 23% of consumers globally are purchasing groceries online for home delivery, accelerated by COVID-19
  - Retailers are shifting toward Micro-Fulfilment Centers, and the battle for the last mile is becoming crowded
- Grocery distribution center operations are among the most labor intensive of any industry
  - It is not a sustainable or profitable business model for retailers or delivery service providers to deliver orders manually, leaving room for more automation

"… robotics and automation can give grocery retailers the edge they need to take on some of the giants in the industry and meet surging demand. Depending on the solution, automation provides up to four times the efficiency and speed of delivery compared to a human workforce. As we continue to envision and shape the future of e-commerce, robotics technologies will transform order fulfillment and shopping behaviors"
- Food Logistics (July, 2021)

- E-grocery automation represents an opportunity worth c. $5B by 2026 with c.18% growth rate
- Companies adopting automation strategies are seeing productivity and profitability gains that they otherwise would not have experienced

New technologies are applied in grocery logistics

- To ensure the freshness of their products, online grocery stores leverage urban micro-fulfillment centers, prime settings for emerging automation technologies such as AGVs/AMRs, as well as increased deployment of automated storage and retrieval systems (ASRS) and end-of-line pick & place solutions, enabled by advanced, AI-based software and often using smart, stationary robots/cobots
- The deployment of these new technologies/systems are driven by an emerging number of online grocery stores such as Weee!, Amazon Fresh, Instacart, Flink, Getir, and Uber Eats as well as traditional grocery stores offering online delivery services
- There are also pockets of opportunities in refrigerated warehouse automation (cold storage)
  - Demand for automation in other areas of the Food & Beverage sector is expected to be strong but somewhat lower

Source: L.E.K. analysis, Harris Williams analysis

3 Automated guided vehicles (AGVs)/autonomous mobile robots (AMRs) are emerging products within warehouse robotics and will remain the key technology to adopt

AGV/AMR are mobile robotics solutions that automate warehouse transport functions, primarily driven by e-commerce

AGVs

- **AGVs follow fixed routes** in a warehouse, denoted by electrical wires, magnets, lasers, or other markers
- **AMRs are self-guided** vehicles that navigate through warehouses using sensors and digital maps without external guidance

AMRs

- AGVs can be up to ~40% more expensive than AMRs due to larger form factors and required installation of fixed routes in the floor
- Compared to AGVs, **AMRs are better designed to work collaboratively with human operators**, maneuver facilities with small footprints, and execute complex tasks

AGVs & AMRs

- AGVs/AMRs automate transportation activities and **complement existing warehousing solutions**
- AGVs/AMRs offer flexibility and can be **rapidly deployed** making them a **highly attractive automation solution** in e-commerce
- Growth in micro-fulfilment centers, demand for greater throughput/faster turnaround time, and ROI relative to fixed robotics and labor are expected to drive adoption of AGVs and AMRs in e-commerce

Key drivers of e-commerce AGV/AMR adoption

Growth in last-mile fulfilment centers

- E-commerce companies are increasingly building relatively small fulfillment centers in urban settings, and AGV/AMR solutions are uniquely able to capitalize on this development due to their **agility and flexibility,** which enables them to **navigate the relatively cramped conditions**

Peak season demands can often justify investment in AGVs/AMRs

- Demands for **higher volume and shorter turnaround time** during peak seasons drive e-commerce companies to invest in AGVs/AMRs, which can be **easily deployed on short notice** and be configured to execute various tasks without permanent or costly alterations to facility infrastructure

Brownfield automation projects are often a trigger point for AGV/AMR adoption

- **E-commerce businesses frequently invest in warehouse automation** upgrades or expansions to improve throughput and reduce labor costs; AGVs/AMRs are highly attractive during such projects due to their **scalability, flexibility, and short deployment time**

AGVs/AMRs provide cost-effective solutions to drive incremental benefits

- The low cost of AGV/AMRs relative to fixed robotics as well as the ROI relative to hiring labor during peak seasons enable e-commerce vendors to cost-effectively scale operations

Source: L.E.K. analysis

Leading companies share common themes and strengths across segments

Which companies make money and why?

- Automation solutions that can help address key **trends underpinning structural growth** across key geographies and technologies
- **Innovation leaders** typically have **high levels of IP**, more **specialized product offerings,** and therefore command higher margins, as they can protect and grow their leading market positions
- Customers increasingly asking for **"end-to-end solutions"** to simplify their production and supply chains, **including platform-agnostic offerings,** meaning **"system integrators"** are becoming an integral part of the customer's value chain with high levels of customer stickiness
- Companies with leading market positions, scalable business models in their respective customer sectors, and strong ability to deliver despite supply chain issues **command higher prices and have stronger customers relationships**
- While **U.S., Germany and China** have the largest share of the global warehouse automation market, the **South and Southeast Asia** share of the overall market will grow rapidly over the next five years, so companies with a strong position and good access to the markets should be successful

13%+
global warehouse automation market growth 2021-27

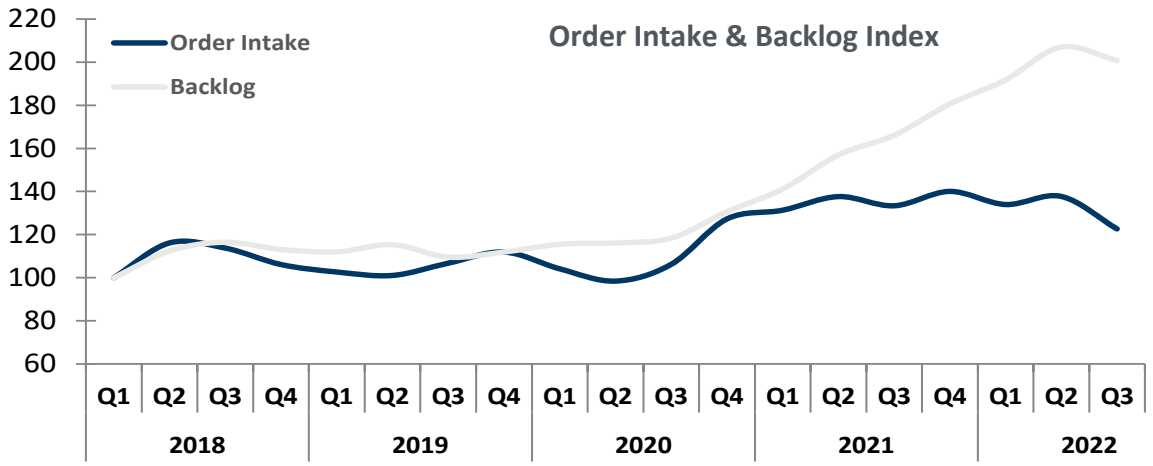
~85%
companies using robotics and automation technology in warehouses worldwide, by 2030

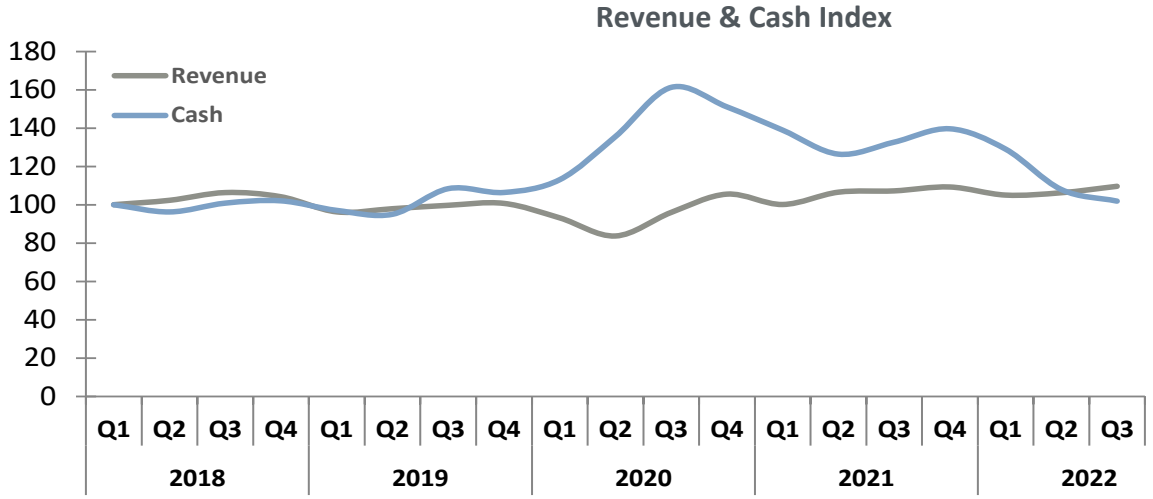
~80%
of global warehouses do not have any automation

~21%
global retail sales forecast to be e-commerce by 2025 (up from ~17% in 2021)

Sources: Harris Williams analysis, L.E.K. analysis

Strong momentum across the warehouse automation industry with record levels of order backlog along with slowing order intake in the first three quarters of 2022





Strong Q3 2022 Commentary

"We had a solid order intake of USD 161.3 million, partly impacted by prevailing market conditions […] . Meanwhile, our order backlog increased to USD 477.6 million, up 66.1% year-over-year [emphasizing solid demand] across regions, end-markets, and warehouse categories"

AutoStore

Karl Johan Lier, CEO – Autostore

"[…] both of our largest businesses are seeing double-digit orders and backlog growth, which will headline growth and profitability in 2023. This will be offset by lower demand in warehouse automation volumes which we believe will trough next year"

Honeywell

Greg Lewis, CFO – Honeywell

"[despite challenging market conditions] incoming orders for all business fields – new truck business, short-term rental and used equipment, as well as after-sales services – in the reporting period was on a par with the previous year's level at 3,594 million euros"

JUNGHEINRICH

Press Release, Q3 2022, IR – Jungheinrich

"Order intake enjoyed strong development in 2021 with 45% yoy growth. The resulting order backlog of EUR367m, which increased to EUR437m at the end of H1 [2022], provides improved visibility against a less supportive macroeconomic environment. We forecast […] heading into 2023, customers potentially delaying investments into automation technology"

KARDEX

Equity Research, (Oct. 2022), Gerhard Orgonas – Berenberg

"We are excited to end the third quarter of fiscal 2022 with $412 million in cash and cash equivalents, zero debt, and contracted orders valued at $11.3 billion. This provides clear visibility towards our future growth"

symbotic

Tom Ernst, CFO – Symbotic

Sources: CapIQ, Company websites (IR), Press releases, Quarterly earnings reports, Earnings Call Transcript, Broker Research
Note: Warehouse automation peer group includes Autostore, Berkshire Grey, ABB, Daifuku, Honeywell, Interroll, Jungheinrich, Kardex, Kion, muRata, Scott, Symbotic, Teradyne, and Toyota; Please note that Honeywell, Scott, Symbotic and Teradyne have been excluded from the Order Intake & Backlog Index due to lack of data

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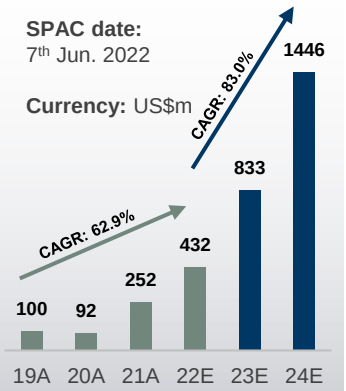
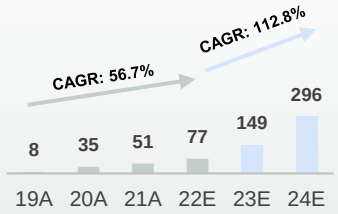
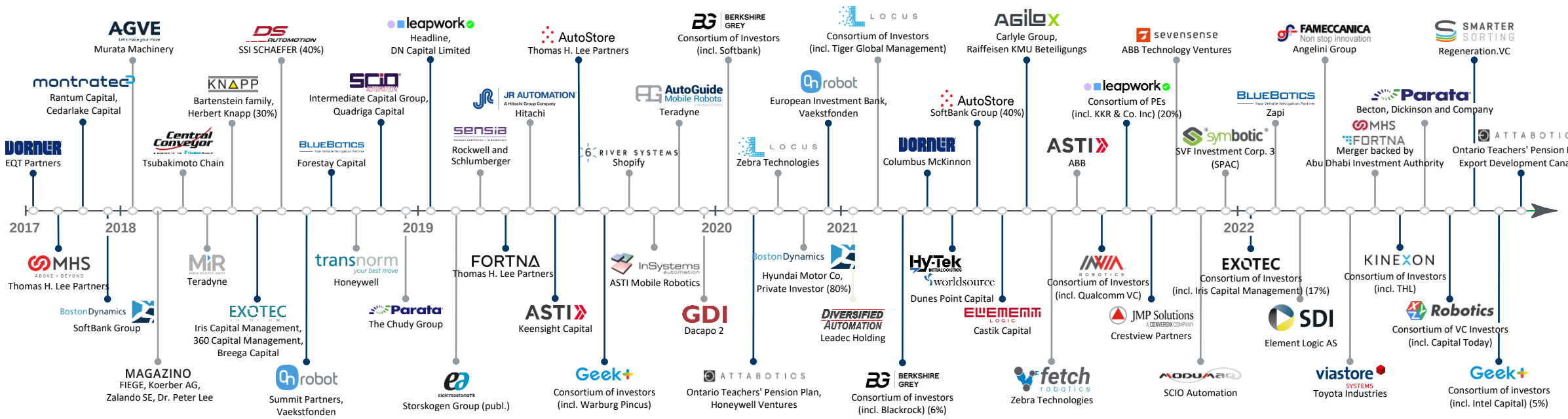
Recent public offerings and financing rounds confirm more rapid adoption of robotics and integrated software in warehouse automation

	symbotic	AutoStore	BERKSHIRE GREY
Total Revenue	**SPAC date:** 7th Jun. 2022 **Currency:** US$m 	**IPO date:** 20th Oct. 2021 **Currency:** NOKm 	**SPAC date:** 20th Jul. 2021 **Currency:** US$m 
Market Cap @ IPO/SPAC date	$5.5bn	NOK103.5bn	$2.3bn
Amount raised	$725m[1)]	NOK20.7bn	n/a
Total funding Pre-IPO / SPAC	n/a	NOK16bn	$413m
Pre-IPO range	n/a	NOK27 - NOK31	n/a
Initial offer price	$10	NOK31	$10
Chg. 1st trading day vs. offer price (in %)	+111%	+11.9%	+19%
Order backlog/growth (Q3-2022)	$11.4bn >100% yoy	$470m 37% yoy	$91m 7% yoy

Date	Round	Company	Lead Investor	Amount raised	Funding to date	Valuation (Post)
Nov-22	Series F		Goldman G2 Venture	$117m	$429m	$2bn
Nov-22	Series C1	ATTABOTICS	OTTP	$72m	$147m	n/a
Oct-22	Series B	ambi ROBOTICS	Tiger Global	$32m	$67m	n/a
Aug-22	Series E	Geek+	Intel Cap.	$100m	$473m	$2bn
Feb-22	Series C	RIGHTHAND	Undisclosed	$25m	$125m	$245m
Jan-22	Series A	VIMAAN	Neotribe Ventures	$25m	$32m	$57m
Jan-22	Series D	EXOTEC	Goldman	$329m	$441m	$3.2bn
Sep-21	Series F		Tiger Global	$50m	$312m	$1bn
Jul-21	Series C	INVIA ROBOTICS	Qualcomm Ventures	$30m	$60m	$150m
Jul-21	Exit	fetch	Zebra Tech.	n/a	$94m	$301m
Jun-21	Series A	GIDEON	Koch Disruptive	$32m	$45m	n/a
Jun-21	Growth/ Expansion	AGILOX	Carlyle	n/a	n/a	$112m
Sep-20	Series B	MAGAZINO	Jungheinrich	$25m	$50m	$130m
Aug-20	Public Grant	ATTABOTICS	SEDC	$27m	$75m	n/a
Oct-19	Exit	6 RIVER SYSTEMS	Shopify	n/a	$47m	$394m

Source: CapIQ as of 20 November 2022, Company websites (IR), Press releases, Harris Williams analysis
Note: (1) Transaction expected to raise $725m in gross proceeds including $200m in committed capital from SoftBank and $205m in a PIPE from a selected group of strategic and institutional investors including Walmart

Warehouse automation assets with high-growth business models driving M&A and investment activity



Notable Transactions

Target	MHS	transnorm	JR Automation	AutoStore	AutoGuide Mobile Robots	JMP Solutions	Element Logic	viastore systems	
Buyer	THL	Honeywell	Hitachi	THL	Teradyne	Crestview	Castik Capital	Toyota	

Financial investor transactions Strategic investor transactions

Sources: Mergermarket, Press releases
Note: Select transactions and financing rounds in warehouse automation

Investment and M&A activity in warehouse automation continue to flourish

M&A Trends

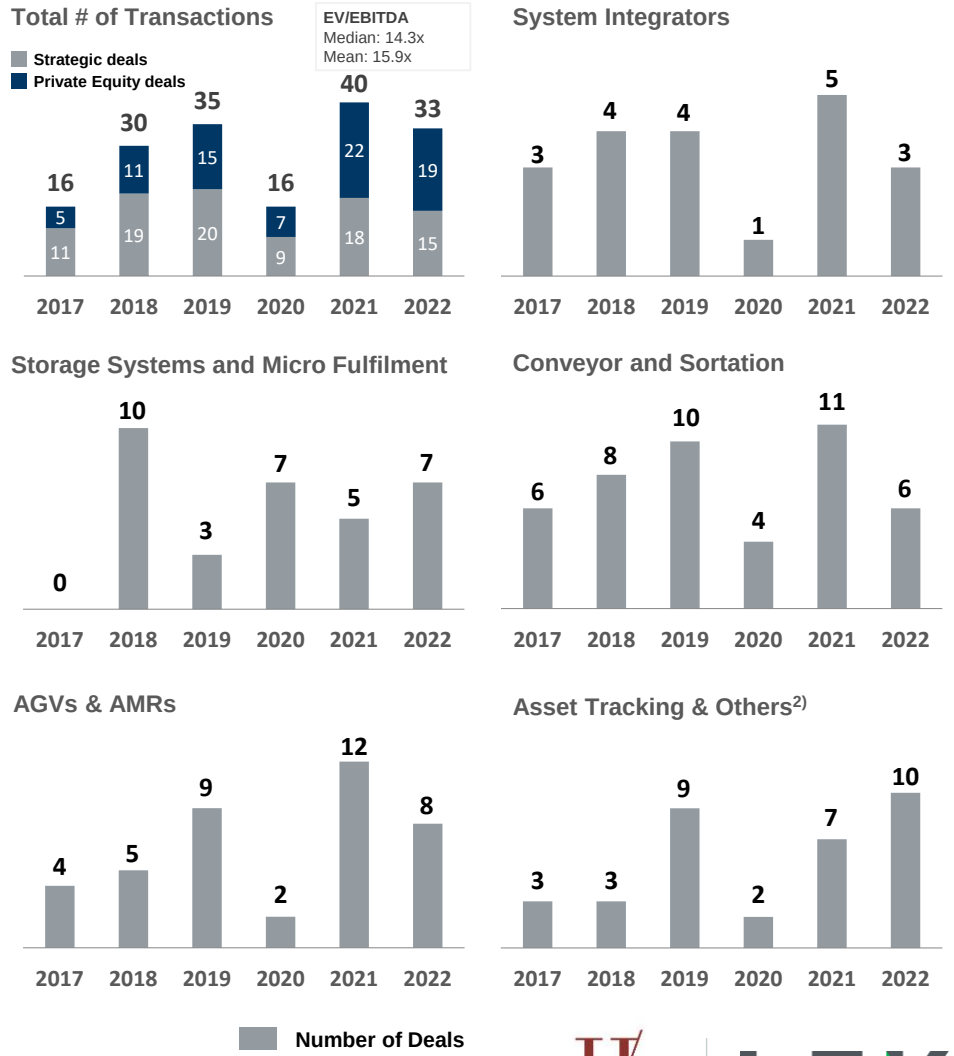
- Warehouse activities are still **primarily manual and labor-intensive processes** and the increasing **demands on efficiency and throughput** will attract investments across warehouse segments. The most attractive segment has been **storage systems and micro fulfilment, as well as AGVs & AMRs,** which have seen **high valuations and rich funding rounds** in the last several years

- Beside strategic investors, there is a **high interest from private equity and venture capital** in the warehouse automation space with **more than 50% of all transactions ending up with financial buyers**. Financial investors are especially **focused on investments in AGVs & AMRs, Conveyor & Sorting, and Storage System & Micro Fulfillment**, representing ~70% of all PE/VC investment in the last five years

- **Innovative business models providing holistic solutions** including hardware and software such as computer-controlled warehouse systems for fully automated operations or WCS/WMS[1)] software are in high demand. End customers look for solutions that **not only generate cost savings, but also act as growth drivers,** allowing their companies to scale independently of labor requirements

- We expect an **increased level of M&A activity** in the warehouse automation space over the next 12-18 months (depending on geopolitical developments) driven by **increased investments** across all segments and applications. Given the decrease in public valuations in 2022, there will be interesting upcoming opportunities in the warehouse automation space

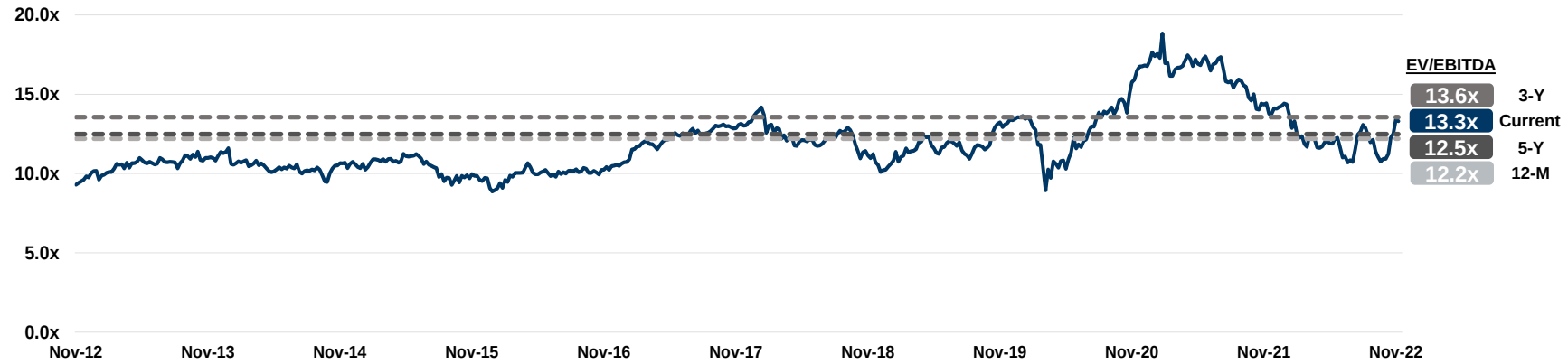
- Warehouse automation companies' valuation levels have continuously increased over the last decade **with median valuation levels of 14x EBITDA.** For **innovative business models,** private equity and venture capital have also considered **valuations based on revenue multiples** as seen by recent listings of Autostore, Berkshire Grey, and Symbotic



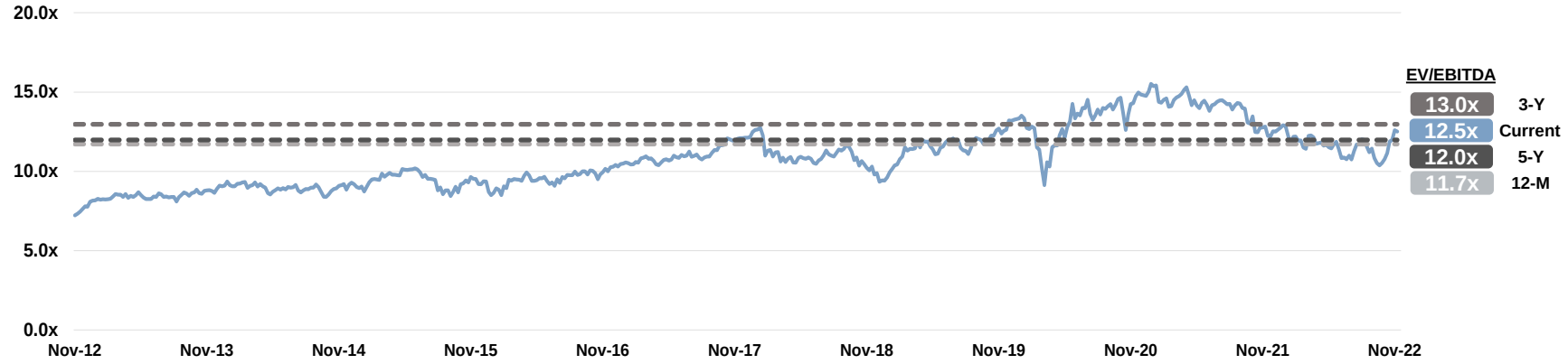
Sources: Mergermarket (includes all transactions until November 2022)
Notes: (1) WCS = Warehouse Control System, WMS = Warehouse Management System; (2) Others include deals in Data Capture, Software, Drones, and Machine Vision

Over the last five years, publicly listed companies active in the warehouse automation and material handling segment have traded at median levels of 12.5x LTM EBITDA and 12.0x NTM EBITDA

EV/EBITDA LTM



EV/EBITDA NTM



Warehouse Automation & Material Handling

ABB
DAIFUKU Automation that Inspires
Honeywell
INTERROLL
JUNGHEINRICH
kardex
KION GROUP
muRata INNOVATOR IN ELECTRONICS
SCOTT
TERADYNE
TOYOTA INDUSTRIES GROUP

Source: CapIQ as of 29 November 2022
Note: Due to limited availability of historical data, Autostore, Berkshire, and Symbotic are excluded in the analysis

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Harris Williams and L.E.K. are leveraging unique insights from market-defining transactions and executive conversations to distill critical trends in industrial automation

Industrial automation

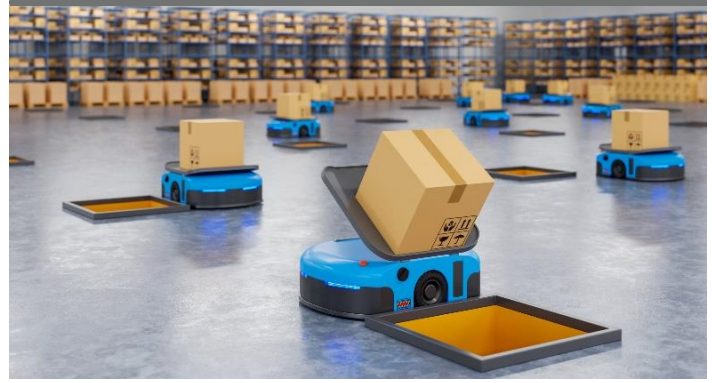
Process industry automation

December 2021

Discrete (factory) automation

Summer 2022

Warehouse automation



We are a global network of experts and look forward to connecting with you to share our experience in the automation sector

Harris Williams / GLOBAL M&A ADVISOR

8 INDUSTRY GROUPS
With Robust Experience Across the Globe

3 DECADES
Providing Award-Winning M&A Advisory Services

1 UNIFIED TEAM
Bringing Firmwide Dedication to Every Engagement

Select industrial technology transactions

- Arsenal Capital Partners has acquired ECKHART, a portfolio company of LFM capital
- ATI Industrial Automation has been acquired by Novanta
- Grohmann Engineering has been acquired by Tesla
- team technik Production Technology (Poland) has been acquired by TDJ
- AutoGuide Mobile Robots strategic advice Palm Ventures

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