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GOODS TO PERSON SOLUTIONS 2023

WAREHOUSE AUTOMATION | ECOMMERCE FULFILMENT INFRASTRUCTURE | MARCH 2023



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EXECUTIVE SUMMARY: 2022 REVENUE REMAINED HIGH. GOOD CONFIDENCE FOR 2023 DESPITE CONFUSING ECONOMIC INDICATORS. FURTHER IPOs EXPECTED IN 2023 & 2024

2022, YEAR OF POST-COVID REVERBERATIONS

- 2022 followed a year of exceptional growth in the G2P sector. However, whilst revenue remained above pre-pandemic levels, YoY growth largely dissipated and bookings more or less returned to pre-pandemic levels
- Younger startups reported
- Supply chain disruption continued apace and some observers hinted at a potential 20-30% revenue impact
- Geopolitically and economically, 2022 was a tough year with Russia's war in Ukraine, inflationary pressures and a general sense of instability
- China retained many Covid restrictions throughout 2022 complicating international ambitions for many vendors

G2P TRENDS IN 2022

- RAAS was a more frequent topic and leading vendors released new pay-per-presentation solutions, however, the most popular RAAS format was Rental RAAS
- Multiple startups appeared to have matured during the pandemic and may have found a niche in the market
- Insurance became a topic in the G2P sector, especially regarding fire protection and prevention
- The trend for larger system integrators to merge into mega-SIs continued, however, there were also signs new integrators entering the sector with very strong customer propositions and engineering pedigree
- Warehouse Execution became a thing in 2022 with plenty of vendors actively marketing software packages as WESs, up from only a handful a few years ago

PROSPECTS FOR 2023

- 2023 revenue was expected to continue at a good level across the sector based on existing order books from prior years
- However, there was also a level of trepidation for order bookings in 2023 with signs some customers were delaying decisions to gain more visibility where markets or retail sales were heading
- Most of the G2P startups were bullish about 2023, but this is to be expected

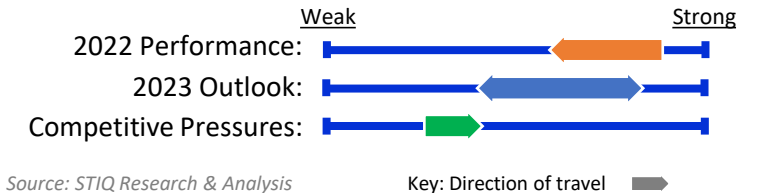
CONTINUED SUPPLY CHAIN DISRUPTIONS

- Supply chain disruption continued throughout 2022 with higher prices and longer lead times causing margin pressures and scheduling problems for vendors and system integrators
- A few interviews hinted at things starting to return to normal, but planning for chaotic disruptions remained difficult

IPO, M&A, ETC.

- M&A activity in the G2P sector increased in 2020 and 2021, however, VC inflows declined in 2022 largely as a result of rising interest rates and geopolitics
- The queue of potential exits contained c.60 startups with 13 companies having raised >\$100m each
- Rumours of potential IPOs always fly around, but these strengthened in early 2023 and STIQ expects at least one startup to go public in the year

STIQ G2P MARKET INDICATORS, 2023



LONG & SHORT TERM PROSPECTS

- The longer term health of the sector was positive despite underlying problems for warehouse operators such as lack of staff and increasing warehousing costs
- In the short term, increased competitive pressures was expected in the North American market as a few large retailers, notably including Amazon, cancelled projects

WANT TO SHARE YOUR VIEWS?

- Talk to our analysts. Feed in your views or get our views on particular topics. Arrange a chat via our [Calendly](#) (please include your details + some background)

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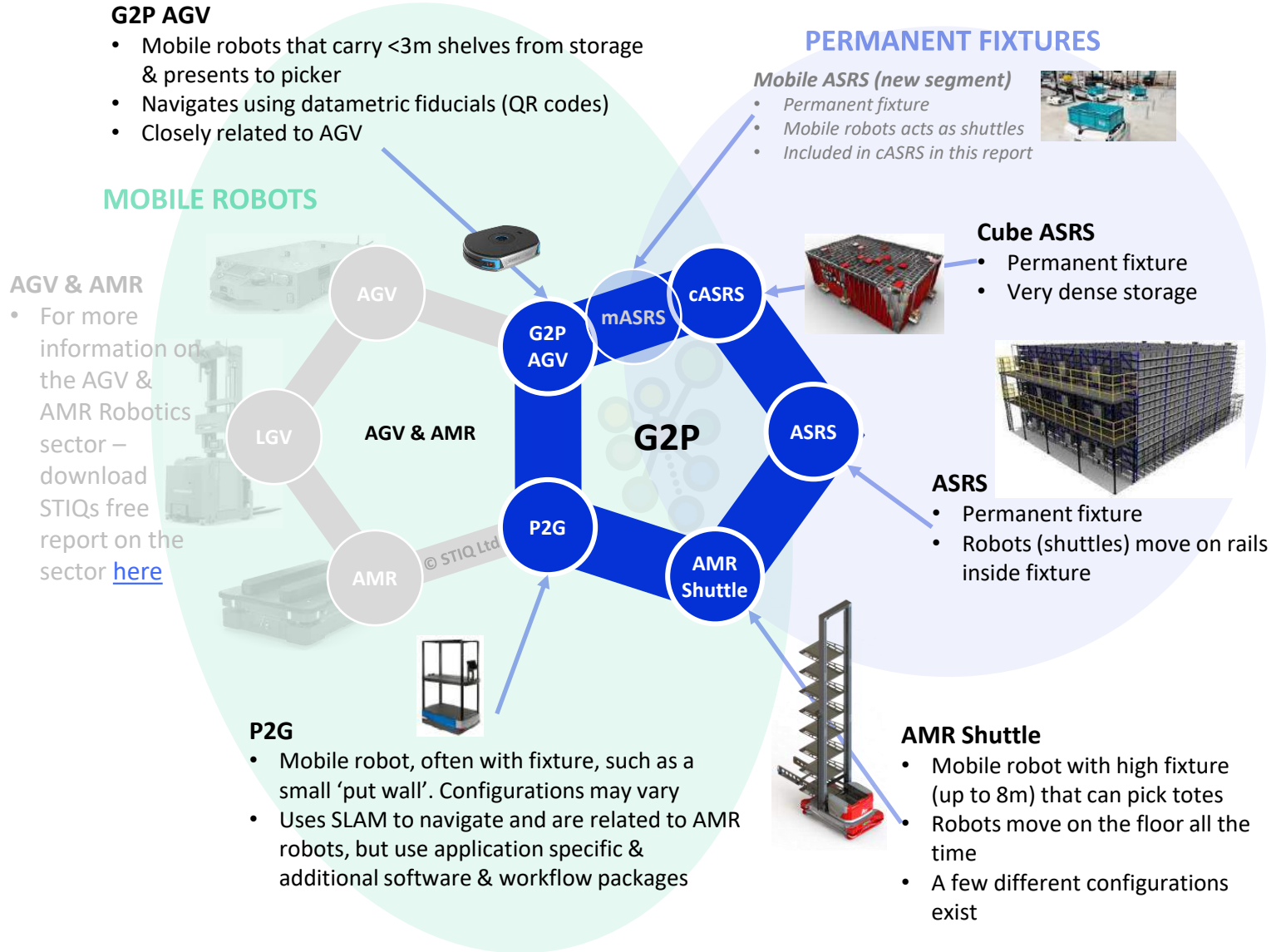
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G2P SOLUTIONS RANGE FROM MOBILE ROBOTS TO FIXED AUTOMATION, ACROSS FIVE MAIN SEGMENTS. HYBRID SOLUTIONS APPEARING

BROAD SEGMENTATION OF G2P SOLUTIONS



G2P SOLUTIONS, UNIT STORAGE & RETRIEVAL

- The G2P (Goods to Person) sector is loosely defined as storage & retrieval systems and solutions deployed to enable single unit picks
- In recent years, eCommerce warehouse fulfilment applications have accounted for the bulk of use cases, however, G2P was also applied in industrial settings, etc.
- The primary reason for this appeared to be the much larger sizes of eCommerce related deployments

NEW INNOVATIONS AND RELATED SOLUTIONS

- The G2P sector remains young and new solutions appeared in the last 12 months that are not neatly included in this segmentation
- Furthermore, other unit storage & picking included Vertical Lift Modules (VLMs), Mini Loads, Cranes, etc., not covered in this report as they were rarely deployed in eCommerce fulfilment applications

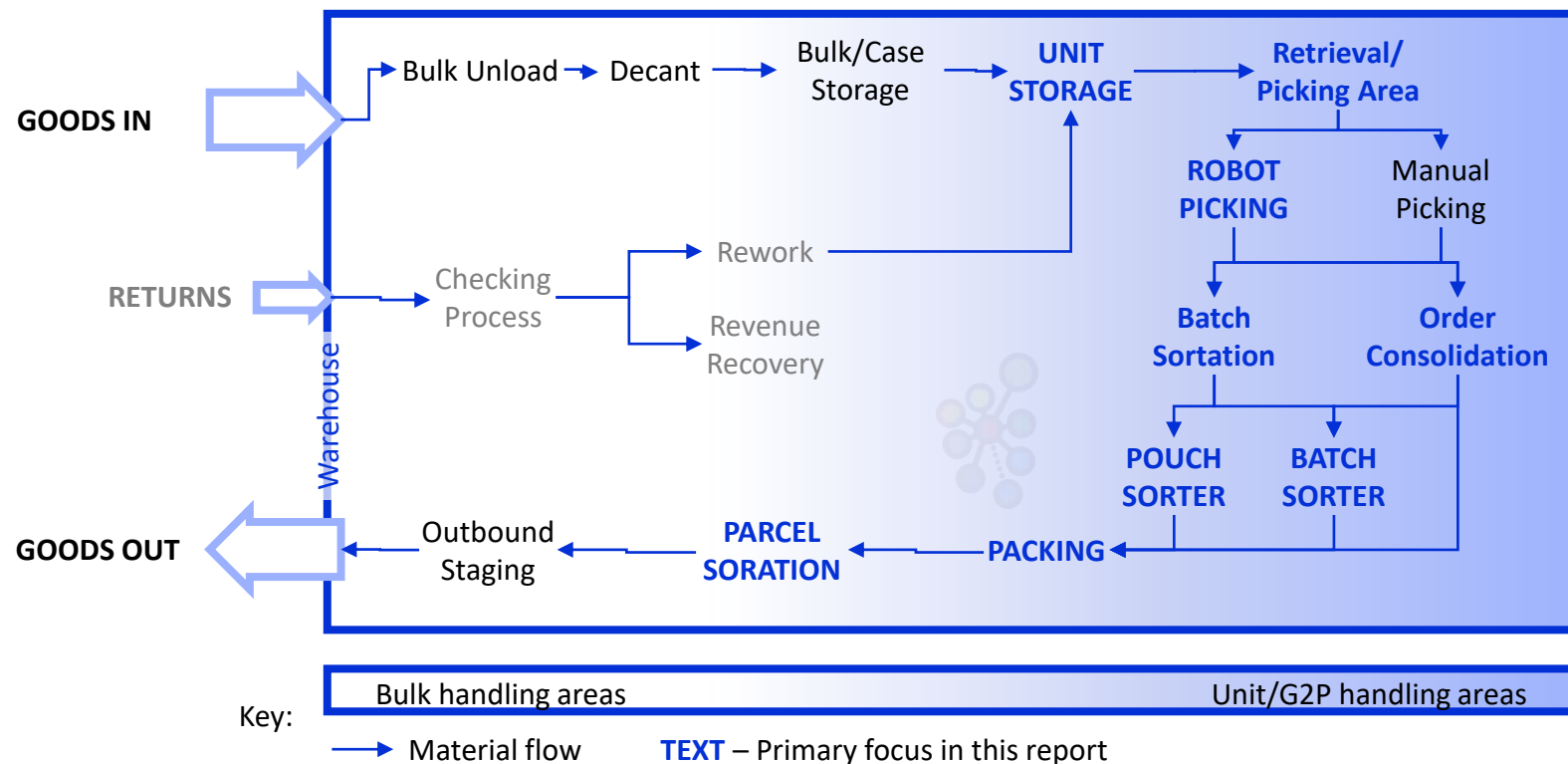
OVERLAP WITH AGV & AMR ROBOTICS

- Some mobile robot G2P Solutions, such as P2G and G2P AGV overlapped with the AGV & AMR Robotics sector, especially in navigation technologies used
- The primary difference was in application specific software packages used and payloads managed



G2P OR 'GOODS TO PERSON SOLUTIONS' ARE FREQUENTLY DEPLOYED IN ECOMMERCE WAREHOUSES¹ TO IMPROVE EFFICIENCIES ACROSS PROCESSES

HIGHLY SIMPLIFIED OVERVIEW OF VARIOUS ECOMMERCE WAREHOUSE PROCESSES²



ECOMMERCE WAREHOUSE SOLUTIONS

- eCommerce warehouse fulfilment applications have accounted for the vast majority of G2P Solution applications in recent years, hence the focus on this particular vertical in this report
- There was a wide range of different G2P Solutions and other systems applicable in eCommerce warehouses
- This report covers storage & retrieval solutions including mobile robots and ASRS solutions, picking robotics, sortation equipment (new STIQ report on Sortation Equipment in June 2023, see [here](#))
- There is also coverage of various software solutions emerging in the sector, such as middleware and WESs
- This report also includes a view of developments in the wider merchant/retailer value chain, such as Micro Fulfilment Centres and in-store solutions, etc.

Source: STIQ Research & Analysis

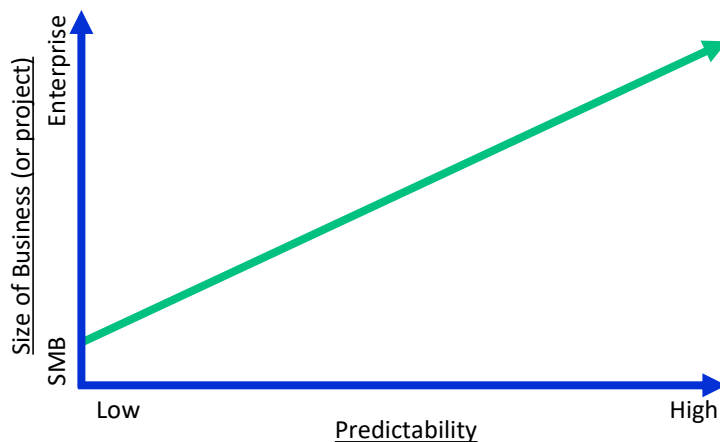
¹ G2P Solutions and processes are not exclusive to B2C eCommerce applications and can also be applied to many other single unit picking applications & industries

² May include solutions that are rarely combined, etc.



SELECTING AN ECOMMERCE FULFILMENT SOLUTION CAN BE A COMPLEX TASK THAT STARTS WITH UNDERSTANDING YOUR LOGISTICS AND INTRALOGISTICS FLOWS

PREDICTABILITY ACROSS G2P CUSTOMERS



Source: STIQ Research & Analysis

EVALUATING G2P SOLUTIONS

- There has been an influx of different G2P solutions with more choice for customers to improve efficiencies

“Warehouse automation is really about one key point which is efficiency... it's a common thread that everybody wants to be efficient.” [Addverb]

- However, this has also added a level of complexity in identifying the best solution

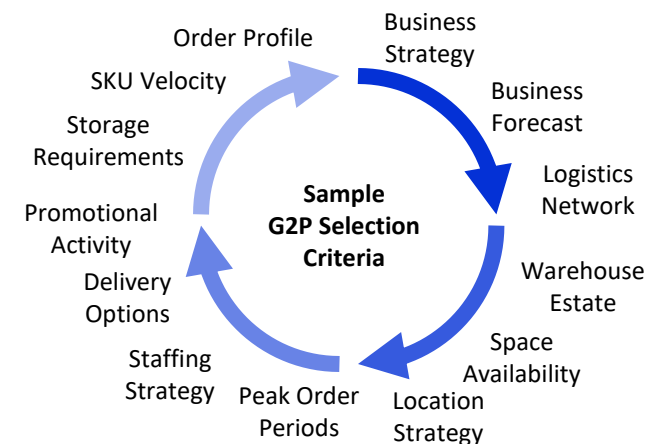
“Selecting a G2P solution comes down to knowing the application and finding the right fit for the application. Because G2P has a couple of different formats and it really depends on what the inventory is, what the turnover is, what the sizing is, how stable is the sizing. If you're a footwear company, you're probably much more stable than an ecom company just as an example.” [Addverb]

- Each situation is different and can vary from a 2hr/day fulfilment operation with 10 SKUs to a 24/7/365 operation with 1,000,000 SKUs across very complex pareto curves
- For enterprise customers, evaluating which G2P solution to buy can be a hugely complex task, often directly connected to where a customer see themselves in the future
- There are multiple variables affecting the type of automation solution that may be suitable, but it is generally easier for smaller customers to identify suitable solutions

“Generally speaking, the higher the level of automation the higher the predictability must be for the future. And that's no different for G2P. But there is a difference if you have a gang of Zippy robots sorting then you're probably a bit less dependent on the accuracy of your forecast compared to if you install an ASRS solution. There is a bit more flexibility in adding, removing or changing bots than if you go for a more fixed structure. On the other hand, some of the fixed structures can have a better return. So it is about the good balance between less and more flexibility and your ROI, based on your forecast and if you can keep your forecast... or do you go for more flexibility because you are not 100% sure?” [Addverb]

- Smaller companies aiming for their first automation solution may go for more flexible solutions compared to a more fixed solution

G2P AUTOMATION PURCHASE CONSIDERATIONS



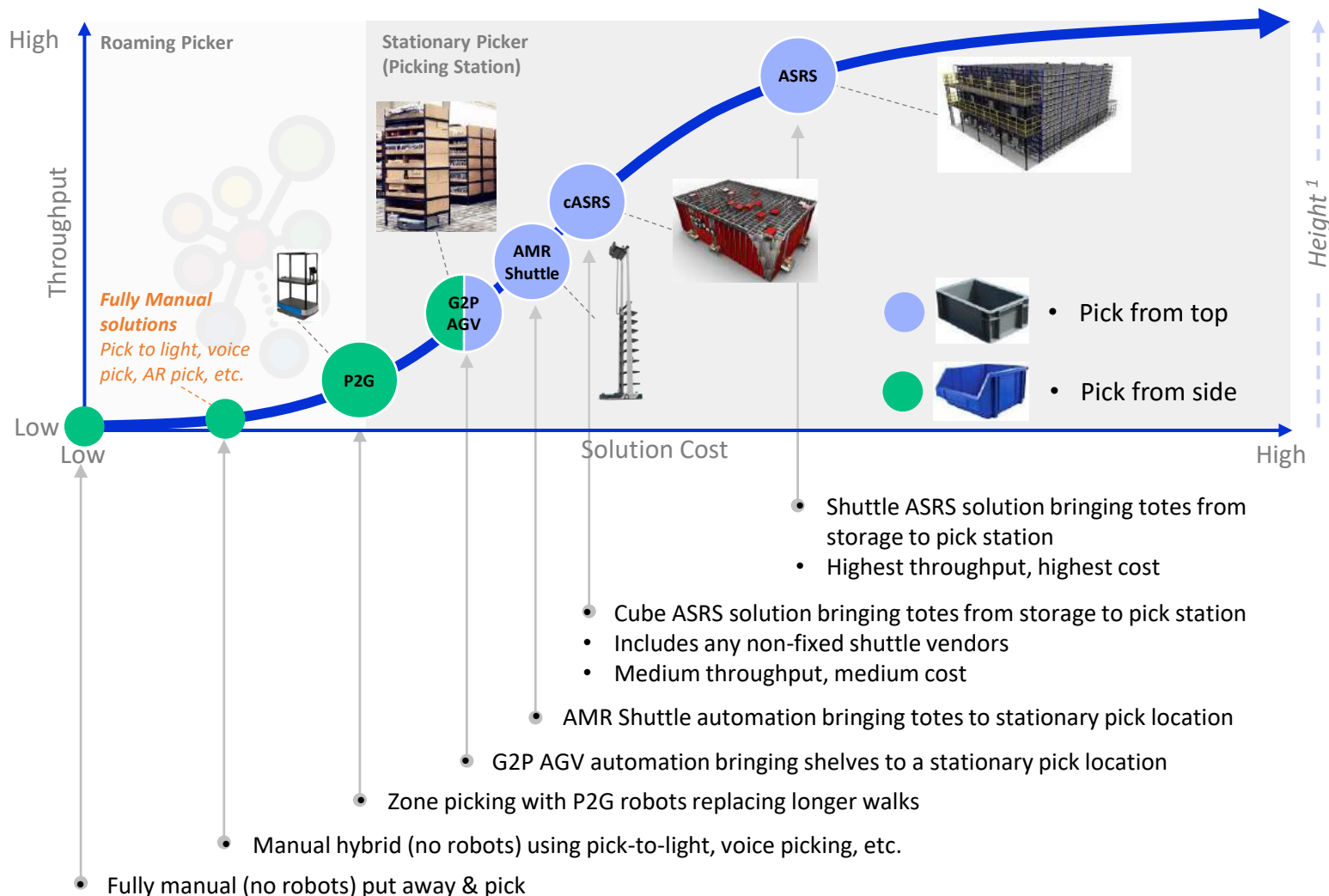
Source: STIQ Research & Analysis. Not an exhaustive list

“In my experience the board rarely gets involved in caring much about why a particular automation system was even selected. They just want to know how much is it? What's the ROI? Do we trust the vendor company? That sort of things. Most commonly, the driver for automation tends to be at the director level where they deal with the day-to-day slow downs and troubles with running the fulfilment center. When they see that the existing system, whether it's manual or legacy automation, is not working well, that's normally when they start looking around. They see and talk to companies like Addverb and that discussion is then taken upwards... and that's where it gets to some kind of a capital approval. And then they hit Capex based on that.” [Addverb]



EACH G2P SOLUTION APPROACHES STORAGE & RETRIEVAL PROCESSES DIFFERENTLY

HIGHLY SIMPLIFIED E-COMMERCE G2P SOLUTIONS THROUGHPUT VS COST



FULFILMENT AUTOMATION SOLUTIONS

- Note that this is a very simplified overview of the various automation solutions available to potential customers, from near manual to highly automated
- The chart focuses on the retrieval or picking process
- In general, there are three picking approaches:
 - **Fully manual** (Roaming Picker): Pickers roam a warehouse and pick any product in any location and transport them to a staging or packing area
 - **Zone picking** (Roaming Picker): A picker is given an area to work and pick in. Picked products may be transported with conveyors or P2G robots, etc.
 - **Picking station** (Stationary Picker): Pickers are given a picking station and goods are moved to the picker ("Goods to Person"). Picked orders are typically transported by conveyors or mobile robots
- Goods are stored differently in each solution and most ASRS solutions (ASRS, cASRS, AMR Shuttle) use a tote with an open top (blue dots)
- Goods in G2P AGV and P2G solutions tend to be stored so manual pickers can pick from the side as in a shelf pick (green dots)
- Picking Robots are primarily deployed with solutions where they can pick from above (blue dots)

Source: STIQ Research & Analysis.

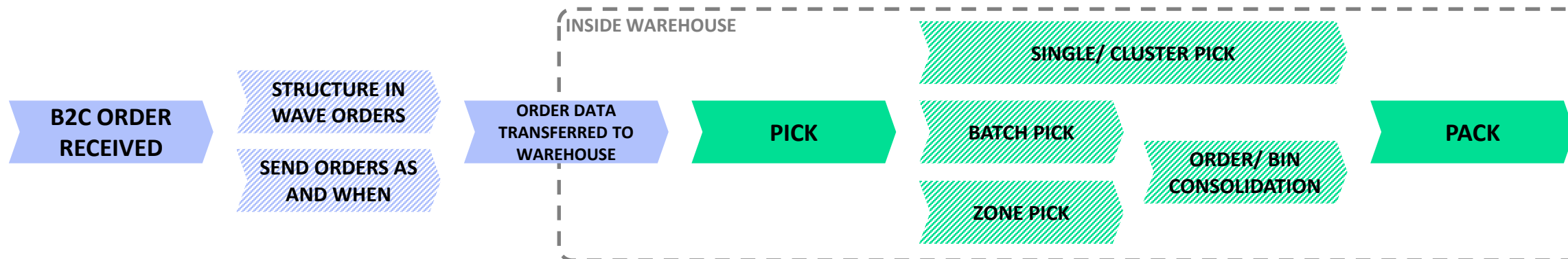
Note: Throughput depends on configuration

¹ AMR Shuttles exist that can store & pick from up to 8m height and G2P AGV solutions are increasing in height management



A VARIETY OF RETRIEVAL/PICKING STRATEGIES EXIST. DIFFERENT STRATEGIES EXIST FOR SENDING ORDER DATA TO WAREHOUSE AND TO FULFIL ORDERS (PICKING)

SIMPLIFIED ORDER FULFILMENT MANAGEMENT, PICKING STRATEGIES AND CONCEPTS



Source: STIQ Ltd Research & Analysis

PICKING STRATEGIES

- There are a few distinct strategies for picking orders and these can sometimes be combined and mixed depending on a variety of factors, such as how incoming orders are managed and released to the warehouse, type of products, type of automation available, etc.
- **SINGLE ORDER PICKING**
 - As it sounds, one order comes in and one picker goes around and picks the goods for that order. Once finished, a new order is picked and so on
 - Typically where online fulfilment starts
 - Often executed in automation solutions with up to 12-20 open orders at a time in a 'pick wall'

- **BATCH PICKING**

- Multiple orders are picked at the same time and mixed in a single container. These items are later added to a unit sorter which separates items into particular orders
- Note the batch picking can also be done directly into a sortation solution for order consolidation

- **WAVE PICKING**

- Orders are released to pickers and picking areas in waves rather than one by one as they come in
- Can be a good way of managing higher priority orders, i.e. faster delivery time orders are added to the front of each wave
- The alternative can be that orders are sent to warehouses as and when they are placed by consumers

- **CLUSTER PICKING**

- A picker with a large-ish trolley goes around and picks multiple single orders at the same time. This can be as many as 20-40 orders

- **ZONE PICKING**

- Zone picking is primarily a way of dividing pick areas into zones where a picker or team of pickers are responsible for picking items
- Also known as "Pick-and-Pass" when picks executed in one zone are passed on to another zone

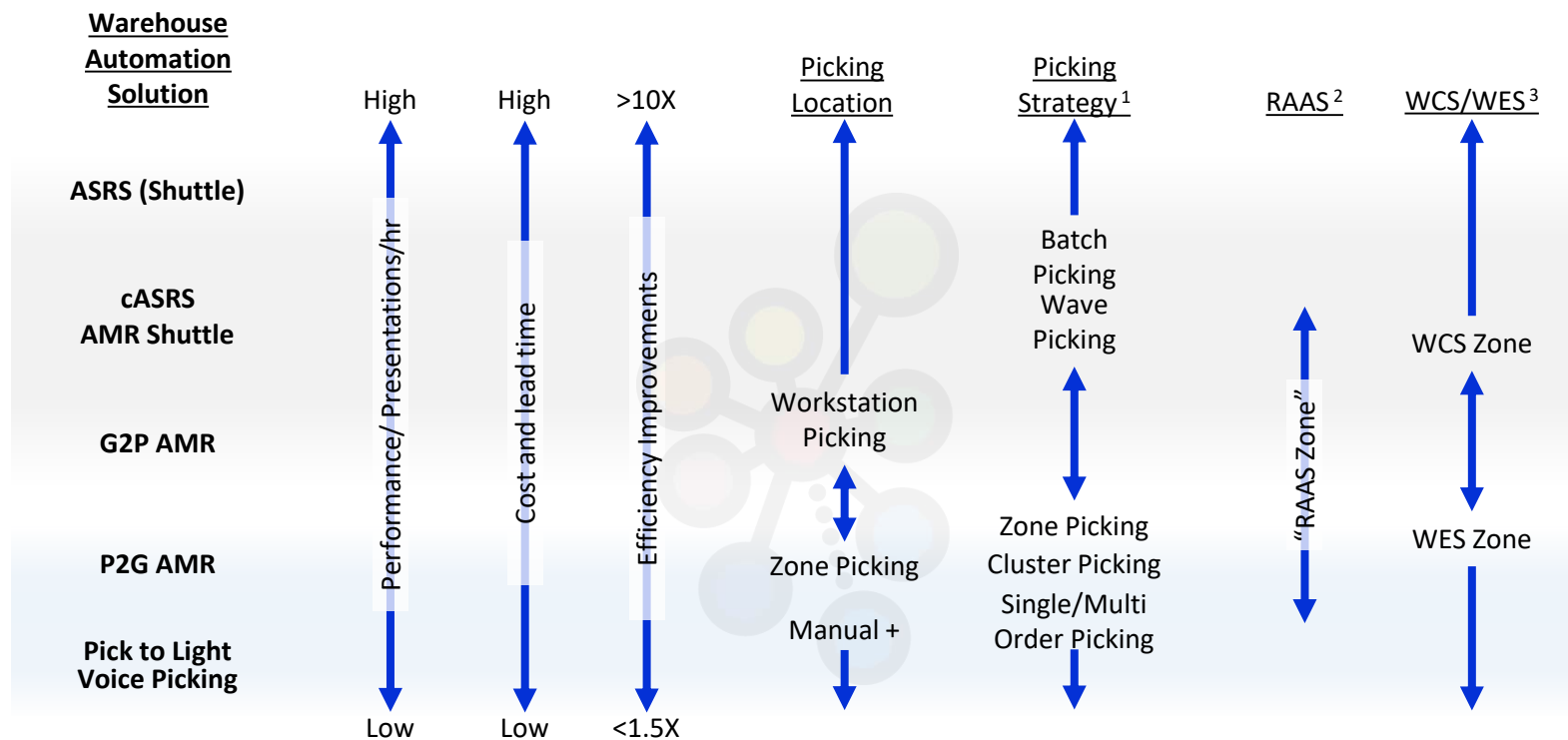
- **DYNAMIC ZONE PICKING**

- If there are zones with higher demand, the zones can be managed and staff be sent from one zone to another or execute changes in zoning areas



ALTERNATIVE SEGMENTATION OF WAREHOUSE AUTOMATION AND G2P SOLUTIONS

ALTERNATIVE SEGMENTATION (STIQ LTD) OF G2P SOLUTIONS



Source: STIQ Ltd Research & Analysis

¹ Picking strategies can vary across manual and automated solutions. Use only as indication and contact a consulting firm to evaluate suitability for your application

² RAAS of various formats was increasingly offered by vendors of P2G, G2P AGV, AMR Shuttle and Casrs. The current state of the sector, likely to change/evolve

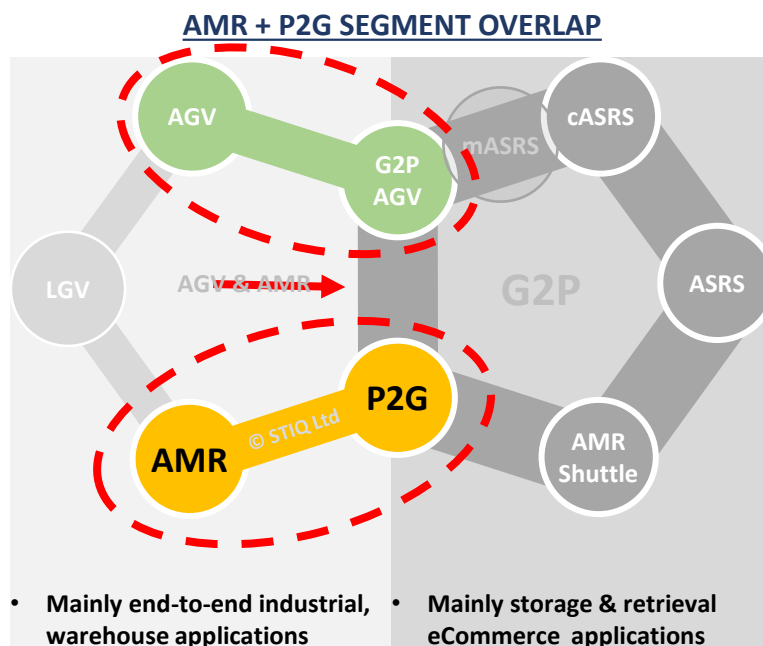
³ WES was increasingly used with non-stationary/fixed solutions such as mobile robots and people whilst WCS primarily control PLC level solutions, conveyors, ASRS solutions, etc.

EVOLVING G2P SOLUTIONS SEGMENTATION

- STIQ has covered the sector annually in depth since 2018 (download all annual reports [here](#)) and experienced many different developments and dynamics at play
- The wider G2P Solutions sector remained relatively young and continues to evolve from year to year with additional layers of complexity
- Many new vendors continue to emerge with hybrid solutions which do not always fall easily into previous year's segmentation
- Furthermore, existing vendors have experimented with different business models including RAAS offerings whilst others are changing GTM strategies and some pivoted more into software vendors
- **NOTE:** If you are a potential or existing customer of G2P solutions, in the process of evaluating G2P solutions, constructing a new warehouse, talking to insurance companies for your automation equipment or just starting to think about the possibility of automating your warehouse – we want to talk to you and share our insights on, and feedback to, the sector
- This can be as a very informal chat or more structured as you wish. Contact tom@styleintelligence.com for an anonymous chat on warehouse automation equipment



DIFFERENCES BETWEEN G2P/P2G AND AMR & AGV SEGMENTS INCREASINGLY ERODING



Source: STIQ Research & Analysis

ECOMMERCE GROWTH ATTRACTIVE

- The G2P Solutions and the AGV & AMR Robotics sectors overlapped significantly in terms of technologies deployed, with the primary differences in software and orchestration
- Fast growth in the eCommerce segment appeared to be attracting more competition from a variety of adjacent sectors, such as AGV & AMR Robotics

“We want to do projects outside of the regular intralogistics sector... and we already did a couple of G2P projects, so we know where the issues are. I think we can do small projects with 10’s of robots to start with.”
[Anonymous AGV & AMR Vendor]

AMR AND P2G CLOSELY RELATED

- AMRs and P2G mobile robots use broadly the same kind of navigation and obstacle avoidance technology
- The primary difference between AMRs and P2G are the missions they perform
- AMRs have tended to focus on moving goods A-to-B missions whilst P2G has focused on Zone Picking strategies

ZONE PICKING APPLICATIONS

- Interviews have suggested an increasing use of AMRs in Zone Picking applications similar to P2G
- These appeared to be driven by either internal software teams at the customer side or by WMS players

“In one case, we just automated how they already worked. They walked around with this source trolley. And they split it out to the customer cart, but now they don't do the walking anymore. The transportation of roll cages we take care of and we simply put the PDA on the roll cage and the bot stops, the picker takes the item on the screen and scans it and the bot goes to the next location. The software is the clients own and we helped to orchestrate the robots.” [Lowpad]

ALTERNATIVE APPLICATIONS FOR G2P SOLUTIONS



Image source: Screenshot from CNET coverage of IronOx ([link](#)). Example of G2P use in greenhouse

- Other applications were also being developed with WMS players using AGV & AMR robots as a G2P solution

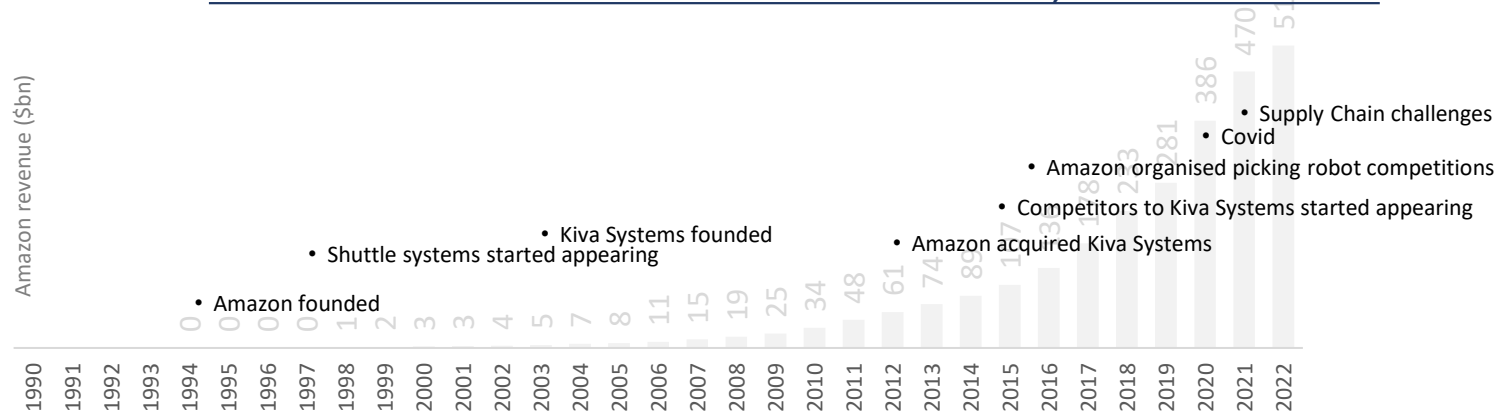
“One of our customers is not storing the stock in the G2P system, but they're storing orders. When products come in, they sort them out to the orders. And that's stored in these cabinets. And once a week or something when the customer asks for the order to be delivered, the cabinet is moved forward and they pack all the goods for delivery.” [Lowpad]

- Early success had encouraged some of the AMR vendors to develop software for P2G type Zone Picking applications



G2P SECTOR EVOLUTION: DIFFICULT TO UNDERSTATE AMAZON'S INFLUENCE ON THE ENTIRE SECTOR. CONTINUED GROWTH IN ECOMMERCE, A PRIMARY DRIVER

THE EVOLUTION OF G2P: AMAZON AND ECOMMERCE GROWTH, TWO KEY INFLUENCERS



GOODS TO PERSON, A QUICK HISTORY

- It is easy to forget the G2P sector as a whole remained relatively young with shuttle systems appearing at the end of the 1990s

“The very first shuttle systems were designed in the end of the 90s and most of the time they had batteries onboard. By doing an electrification continuous electrification you could downsize the shuttles and reduce the weight.” [Conductix-Wampfler]

- The relative youth of the sector is mirrored in low penetration levels in warehouses

“The rate of adoption is in the low teens in terms of number of automated warehouse facilities and distribution centres. It doesn't take a lot for that number to double, triple even more in the next 5-10 years.” [Hai Robotics]

- Online shopping has been a key driver for evolution of automation equipment
- Prior to eCommerce, the main automation solutions were pallet- or case-based for wholesale distribution

“In the past 15 years, ASRS shuttles have scaled. The early 2000s was still dominated by traditional systems like cranes. And there's one very important shift in the businesses that drove that development and that is the shift from brick and mortar retail towards ecommerce and multi-channel.” [Conductix-Wampfler]

eCommerce requirements pushed new innovation with higher throughput and storage capacity requirements

“Going back a long time, if you got 100 dual cycles or 100 pallets in and out, that was really good. And then that got stretched to probably 200 and physics got in the way. With shuttle technology throughput you talk 1,000 an hour...”

... Mini loads used to be really good for specialty parts operations and those kind of things. Where you had a storage and a throughput problem and so on... that played into the sweet spot of shuttle technology, Cube technology and AMR's kind of really turned that around. You can now have systems with relatively low numbers of SKUs, but a lot of throughput and you can design for that quite easily.” [Atypical Consulting]

- Amazon's acquisition of Kiva Systems was transformative for the G2P sector; it confirmed Kiva's approach and it was also the first time a retailer had acquired a warehouse automation vendor

“The G2P sector has changed massively in a decade. Obviously new technologies that have come out have had a significant role in that. If we talk historically, automation had to be a three shift... and if you weren't running at least two shifts, if not three, you'd really struggle to get an ROI to stack up. But nowadays I'm aware of customers who use sites for three hours a day, and there's still an ROI. The cost of automation has come down.” [Atypical Consulting]

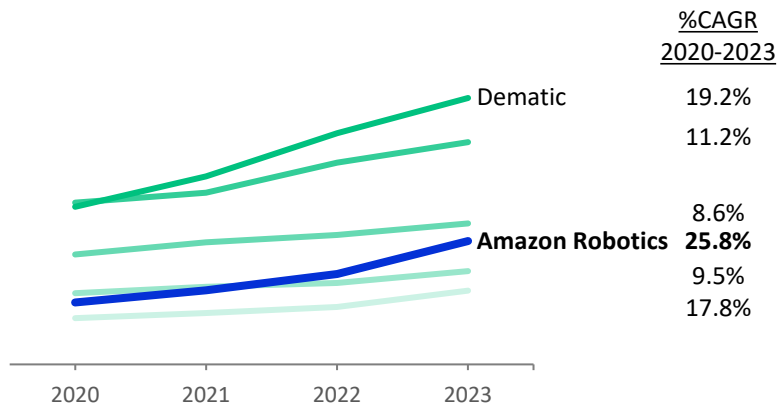
- A more recent trend was a growing demand for faster and faster deployments

“I think the days of 18 month lead times are probably gone. For us that was never the case because we could always deploy in a matter of months. But I think the industry is being pushed to be more reactive, more on demand with capacity.” [6 River Systems]



AMAZON CONTINUE TO INFLUENCE THE WAREHOUSE AUTOMATION MARKET. THE INTERNAL TEAM AT AMAZON ROBOTICS NOW AS BIG AS SOME TOP SYSTEM INTEGRATORS

AMAZON VS TOP GLOBAL SYSTEM INTEGRATORS



Source: STIQ Research & Analysis. Based on LinkedIn numbers in 1Q every year

AMAZON ROCKETING AHEAD

- Amazon continued to be the big elephant in the warehouse automation sector and interviews suggested they may have accounted for as much as 10-15% of all business in recent years

“Amazon do \$bns in warehouse automation and may account for low double digits of the whole market.”
[Anonymous]

- This might exclude any Amazon Robotics (formerly “Kiva Systems”) related work such as building and deploying their internal G2P AGV solution
- Amazon Robotics ([LinkedIn](#)) increased staff count by 25.8% CAGR 2020-2023, at a faster rate compared to all leading global system integrators tracked by STIQ

SCALING BACK AMBITIONS

- Around Sep 2022, Amazon announced cancellations and/or delays of a large chunk of its warehouse construction and automation activities ([source](#), [Source](#))
- In early 2023 there were also rumours that Amazon Robotics was affected by wider company layoffs ([source](#))
- This affected a few of the larger system integrators with significant exposure to Amazon

“Both Dematic and Intelligrated probably suffered from Amazon’s pullback.” [Anonymous]

“A large share of Dematic’s business is Amazon. Dematic even set up an internal team at Amazon to serve them alone.” [Anonymous]

“Reduced investment in warehouse automation capacity leads to demand trough in 2023.” [Honeywell, FY Report 2022, SPS/Warehouse Automation]

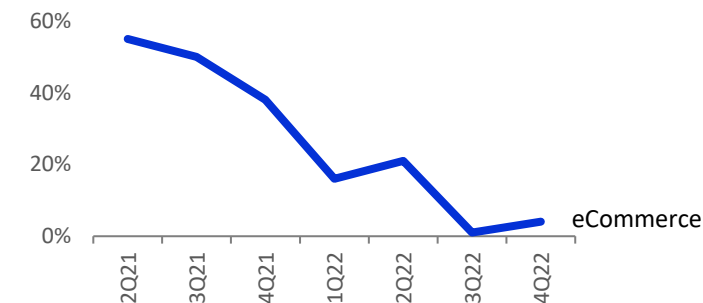
- Amazon’s cancellations will have released capacity back into the market which has the potential to cause a more competitive environment in the short term

“There will be increased sector competition, especially in North America, because some vendors there now have overcapacity.” [Anonymous]

“The market might get a bit more competitive because most likely some of these companies are suddenly stuck with a lot of people and its tricky to pick up a billion somewhere else.” [Addverb]

“Some of the competitors that have lost significant work may fight more for other work to keep their people busy. It could become a more competitive market.”
[Anonymous]

KION (SUPPLY CHAIN SOLUTIONS SEGMENT) ECOMMERCE SHARE OF BOOKINGS, 2Q21-4Q22 (%)



Source: STIQ Research & Analysis. KION. Data based on Order Intake for the Supply Chain Solutions segment. Amazon was a Dematic customer

POSSIBLY MORE BROWNFIELD PROJECTS?

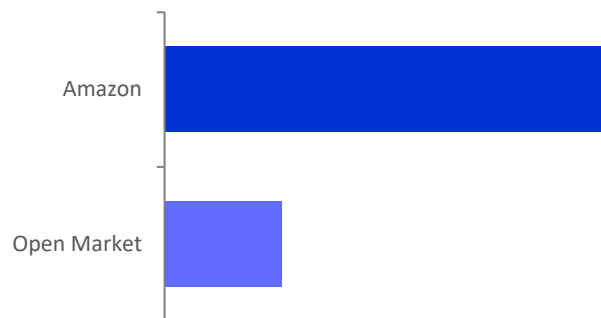
- Interviews suggested that one effect may be a bigger focus on brownfield projects versus recent greenfield

“The landscape within our space is going to change. Amazon was always going to reach some type of critical inflection point where they just didn't need to run at the rate they did anymore. Even they only have so many customers. So what are they going to do? Put a warehouse in everyone's backyard eventually? What you're going to see at the top level is more of an evolution vs. an expansion. That means some of the technology Amazon used 5-10 years ago may now become obsolete. So I think we're going to see a lot more brownfield projects than greenfield projects at the top level.”
[Anonymous]



AMAZON MAINTAINED A SIGNIFICANT LEAD ON THE OPEN MARKET WITH THE KIVA ACQUISITION. OPEN MARKET DEPLOYMENTS GROWING

COMPARATIVE SIZE OF DEPLOYMENTS, AMAZON VS OPEN MARKET



Source: STIQ Research & Analysis.

AMAZON FACTS

- Amazon had deployed 520,000 robots across its warehouse estate in the summer of 2022 ([source](#)), up from 200,000 in 2019 ([source](#))
- A typical purpose built “Amazon Robot Warehouse” was populated with 6,000 Shelf to Person G2P AGV robots
- Each Robot Warehouse had 4 floors with 3 of these dedicated to G2P AGV robots
- On each of the 3 floors there were 2,000 robots divided into 2 cages with 1,000 robots in each cage

G2P PROJECTS GROWING IN SIZE

- Interviews suggested G2P projects have increased in size in recent years

“A \$5m project used to be a large project. With some of the newer vendors, projects are increasingly at \$10-15m. We also have a project right now that's over \$100m and there's several that are in the \$60m to >\$100m range, because they're using multiple technologies. We may need to use multiple technologies to get all their SKUs in storage. Those systems are also getting larger.” [KPI Solutions]

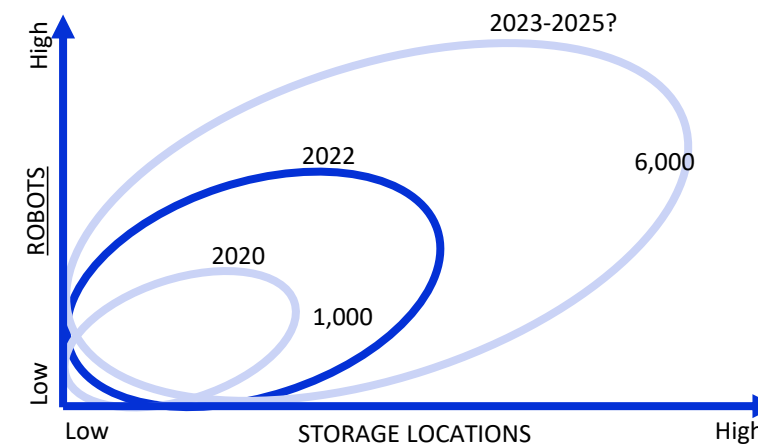
- The number of robots and storage locations can vary massively between customer requirements and different solutions such as P2G, G2P AGV and cASRS, but STIQ used # robots as a way to gauge market evolution

“The number of bots per site is increasing... and customers are buying for more sites, which I believe is a general trend of adoption levels of this technology. Customers are making a bigger bet on automation and they're more comfortable with the thought of robots doing some of the work.” [6 River Systems]

- Very few customers appeared to require installations above 1,000 G2P AGVs currently, but this may change

“Very few clients in Europe or the US require >1,000 robots... when you talk about non-Amazon customers. There has not been any opportunities for 1,000+ robots elsewhere... yet. We have clients that work with 600-800 robots.” [Anonymous]

GROWING SIZE OF G2P DEPLOYMENTS



Source: STIQ Research & Analysis.

- Interviews suggested bigger deployments are coming
- “The biggest individual AutoStore deployment today is c.600 robots. But we have even bigger ones already sold in the pipeline.” [AutoStore]
- At these larger sizes it was paramount to offer a competitive solution
- “G2P is a very competitive sector. Sometimes there are projects with 300-500 bots and the buyers have strong negotiation capacity, so you need to be really competitive. It's a very, very competitive market and that's the key reason you need to be fully prepared with your go to market strategy.” [ABB]



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CUSTOMER FEEDBACK #1: PANDEMIC HANGOVER CAUSED NEW AUTOMATION REQUIREMENTS. LARGE REQUIREMENTS MAKE SOME VENDORS UNEASY

THE PANDEMIC HANGOVER

- The pandemic was all hands on deck which has changed back to a more normal pace which is still growing

“During the pandemic, things were great and then now in 2022 it’s more of a hangover fix. There is a new pace, the whole the e-commerce environment, everything exploded and then it just went down again. If you look across three years, it’s pretty normal growth for e-commerce. It was just that during the pandemic, it was a lot. And then it vanished in 2022. Overall it’s ok, but it’s still a different pace and I think we need to adjust how we’re thinking in 2023. So if we panicked in 2021 trying to figure out how we would grow our logistics drastically... that panic is not there anymore. Now it’s more how do we work with our existing logistics to make that as efficient as possible. How do we make sure that we have a 5 year plan not as aggressive as before, but as something that we need to look at. So what does expansion look like three years from now or five years from now, or 10 years... because we’re still growing.” [Anonymous Retailer]

CHANGING AUTOMATION REQUIREMENTS

- Post-pandemic market dynamics has also meant changing warehouse and automation requirements

“I think we calculated we would run out of space in 2024 if we were going with the pandemic pace. Now, it’s more like 2025-26 something like that. Still, we at least need to have a good and solid plan for this expansion.” [Anonymous Retailer]

RETAILER INTERVIEW, WAREHOUSE DESIGNER #1

- Expansion brings new challenges and part of this may mean opening warehouses in other locations for a variety of reasons

“So we have a few major automation deployments at our current site. The local government will not allow us to expand this site any more. So we need to look at our next site. But that is a logistics road map that we’re trying to figure out, like where to go and how to go and what will the automation look like?” [Anonymous Retailer]

- Whilst the finance team likes higher average order sizes, this can often translate into increased complexity for warehouse automation operations

“Our finance team loves higher average order value which often means more items per order. It’s really a question of weighing the increased automation complexity for consolidating your picked items versus a higher delivery cost if you don’t consolidate. You want to have the best customer experience as well.” [Anonymous Retailer]

XLARGE AUTOMATION REQUIREMENT

- Some larger retailers are happy to work with more recent entrants as there may be an opportunity to grow together and influence the solution

“There are some smaller vendors that will be interesting if we can grow with them... there are some solutions out there that are actually fairly interesting to see. Some solve things like fire protection and the scaling in new ways and that would be fairly interesting to see if we could scale that up. But then it would probably be that we start with a smaller installation and do a proof of concept, evaluation and so on.” [Anonymous Retailer]

- At a certain size, planning new warehouse automation becomes challenging

“We need to build big and it’s not like we’re going to build a solution with 10,000 bins. When we talk to vendors, whoever it is, we told them we need an installation with 1,000,000 bin, how would you do that? And many times they’re... ‘yeah, we haven’t done it yet’, so... and that’s our first hurdle, that not many has really built at this size. So it’s a matter of us questioning a lot... will this work when you scale up your solution or will it just collapse? And a lot of the companies say ‘we’ll fix it, it is not a problem’... but yeah, ok, how can you guarantee that because we need it working 24/7/365?” [Anonymous Retailer]

- And talking to sales people is one thing which may mean the engineering conversation becomes awkward

“When we talk to salespeople they’re always like, yeah, yeah, we can do that. And then you talk to the technical people and they say we’ve never done this before. So it’s a mix of who you talk to. I think in general vendors are fairly aware of the problems that we would run into.” [Anonymous Retailer]



CUSTOMER FEEDBACK #1: SUPPLY CHAIN PROBLEMS REMAIN, RAAS FOR SMALLER RETAILERS, IMPORTANCE OF FIRE PROTECTION & INSURANCE

MERCHANTS WANT TO FOCUS ON RETAIL

- eCommerce retailers may not want to tie up cashflow in buildings

“It's more about finding a property partner because we don't want to own the building. You lock up a lot of capital if you do that and there are other companies that are way better at operating a warehouse than we are.”

[Anonymous Retailer]

SUPPLY CHAIN DISRUPTION STILL PRESENT

- Some supply chain issues remained in the market

“We have some conveyors that we probably need to invest in. They had very long lead times. We're talking 6 months plus. You can still feel the supply chain problems, but it's not as apparent as in 2021 when everyone started with that - you know we have supply chain issues. Ok, fair enough everyone had that. Now it feels like it's coming back to normal. I think customers are also more aware there are supply chain problems. One of the first questions we ask is how fast can you deliver things.” [Anonymous Retailer]

UNIT PICKING ROBOTICS WILL HAPPEN

- Picking robots will happen, but prices may have to come down and performance has to come up

“Picking robots is a matter of the ROI. If we put that Capex in and we can't really see it working for a big volume, then it starts to become you know... why should we do this? I think the solution is out there, and it's just a matter of time before someone solves this in a great way.”

[Anonymous Retailer]

RETAILER INTERVIEW, WAREHOUSE DESIGNER #1

RAAS MAKES SENSE FOR SMALLER RETAILERS

- The rental model with standard products made sense for smaller companies, but at a certain scale you may require a bespoke solution to gain important advantages

“I completely understand smaller e-commerce companies they just want to have an out-of-the-box thing because they reap the benefits of all the other customers, bigger customers that provider has so that's fine. But when you reach a certain scale and if you're using the same systems as everyone else, then you lose your competitive edge as well.” [Anonymous Retailer]

IMPORTANCE OF FIRE PROTECTION

- Fire protection and insurance has shot up the agenda for automation customers

“Insurance is a big topic when it comes to automation. There were fires in the UK in a highly automated warehouse and the cause was the automation itself. This in combination with the extremely high dense item capacity per square meter makes this a very sensitive topic. There are tons of items in very little space and a fire there will have a great impact on the operations. We have talked to all the global insurance companies and made lots of fire protective efforts but it is just on the edge of being approved. This needs to be addressed by the automation suppliers. We need better collaboration between insurance companies and suppliers in order to reach consensus.” [Anonymous Retailer]

ARE YOU A BUYER/POTENTIAL BUYER OF AUTOMATION? STIQ offers free debriefs and Q&A sessions and provide our views on various solutions, connect you with vendors, other buyers, etc. AND, we also want to hear about your automation journey, if you have made any particular combinations, if you think some solutions need to change, etc. [contact us here](#)

Feedback from a recent debrief with \$24bn company: “Thank you for the call. I have received from positive feedback from the attendees and they now have a greater appreciation for the technology and how it may help us.” [Project Manager]



CUSTOMER FEEDBACK #2: ECOMMERCE HAS CHANGED. WHOLE NETWORK PLANNING TAKES TIME. FIRE PROTECTION MEASURES. DELAYS OCCURING FOR A & B CUSTOMERS

THE ECOMMERCE BUSINESS MODEL IMPACT

- As eCommerce has evolved to meet consumer demand, plenty of merchants have often multiplied the number of SKUs on offer

“About a decade ago, we had about 5,000 SKUs in our online store. Now we have around 30,000 SKUs... so we have increased our SKUs by 6X from the original. This gives our intralogistics a much higher level of complexity.”

[Anonymous Retailer]

- However, a wider range of SKUs has often come hand in hand with lower inventory count of each SKU, especially for long tail and slower items

“We’re increasing our SKUs, but with less amounts per SKU already from the inbound process. We have to store and handle smaller and smaller volumes for each SKU. And that's the reason we also decided on the pouch system where we can do the single piece handling as a buffer.”

[Anonymous Retailer]

- The business model can also be an important influencing factor

“We have frequent promotional activities and a single SKU can sell 1,000’s today, but tomorrow perhaps only 1. Understanding your order profile and your business model is very important when you select your solution.”

[Anonymous Retailer]

LARGE SCALE PROJECTS, YEARS OF PLANNING

- Very large projects often take many years of planning

RETAILER INTERVIEW, WAREHOUSE DESIGNER #2

“About four years ago we made a deep warehouse network analysis and restructure with external consultants and also with several internal workshops together with board members. As a final outcome, we have decided to reconfigure our warehouse properties”
[Anonymous Retailer]

- For vendors, exhibiting at key trade shows can often elicit new ideas among customers about how to execute warehouse designs and flows

“I first saw pouch sorters at Logimat years ago and thought this looks great. We did all the calculations and got approval for the final solution.” **[Anonymous Retailer]**

IMPORTANCE OF FIRE PROTECTION

- Fire protection requirements have changed which can also affect projects

“And not to forget for all automation systems, the sprinkler requirements are quite extensive... We learned a lot, paid a lot of extra money for all those rack pipes, sprinkler pipes... And partly last year all across Europe sprinkler heads were completely sold out.” **[Anonymous Retailer]**

- Contacting insurers should be one of the early considerations for any size of project

“Contact your insurance company very early on... it could not be early enough to go over the very first exchange with your insurance company/some risk managers to understand what would be required in terms of avoiding fire in your solution. Because it is the law. The laws in the EU are stronger and harder than before.” **[Anonymous Retailer]**

PLENTY OF DELAYED PROJECTS

- There appeared to be multiple projects running behind schedule

“We have heard from the market there are other projects with 9-12 month delays.” **[Anonymous Retailer]**

PANDEMIC PREVENTED REFERENCE VISITS

- Having planned the warehouse design and started talking to vendors when lockdowns occurred, it was difficult to visit important reference sites

“One issue was we couldn't see so many reference sites due to travel and visitation restrictions during Covid time.” **[Anonymous Retailer]**



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RAAS BUSINESS MODELS MORE COMMON IN THE G2P SOLUTIONS SECTOR. PLENTY COMPANIES WITH RENTAL RAAS, BUT TRANSACTIONAL RAAS ALSO ON OFFER

CAPEX AND OPEX BUSINESS MODELS¹

MODEL	SOLUTION OWNER	DESCRIPTION	SOLUTION PAYMENT	MAINTENANCE, SERVICE, ETC.
Capex	CUSTOMER	<ul style="list-style-type: none"> The customer buys the solution from vendor 	<ul style="list-style-type: none"> Up front payment for solution 	SEPARATE
LEASE	CUSTOMER/ FINANCING COMPANY	<ul style="list-style-type: none"> The customer agrees a leasing package with a finance provider with the possibility of buying the solution at the end of the agreement 	<ul style="list-style-type: none"> Monthly pre-agreed charges with a final payment to own the solution 	SEPARATE
RENTAL RAAS	VENDOR	<ul style="list-style-type: none"> The customer agrees a contract period with a vendor (typically 3-5years) with some charges for software integration if required 	<ul style="list-style-type: none"> Set monthly fee 	INCLUDED
TRANSACTIONAL RAAS ("PAY-PER-PICK")	VENDOR	<ul style="list-style-type: none"> The customer agrees a contract period with a vendor (typically 3-5years) with some charges for software integration if required 	<ul style="list-style-type: none"> Variable monthly fee, pay-per-pick or pay-per-presentation, etc. 	INCLUDED

Source: STIQ Research & Analysis.. ¹ STIQ recommends to double check with vendors as RAAS is currently evolving and T&Cs may differ

RAAS INCREASINGLY COMMONPLACE

- Interviews suggested RAAS was a more frequent offering from vendors, especially with more recent entrants
- However, RAAS remained relatively new and there was a lot of flexible approaches from many of the startups

"We are flexible in our Opex or RaaS models. We just closed a deal with one customer on a charge-per-package model, which is kind of related to the number of robots we need. Our default offering is a per-month fee varying based on the number of robots." [Unbox Robotics]

"We offer a rental option and we also do a 'Solution as a Service' where you don't have to have any upfront and you get the entire solution 'as a service'. It depends on the client and what they're looking for. We can charge per presentation or it can be done by pick." [Attabotics]

"We offer cost per pick or rental RaaS as well as Capex... dependent on Customer preference." [Brightpick]

THE RAAS 'RENTAL' OPTION

- The rental RAAS option was offered by most P2G vendors and increasingly also by G2P AGV vendors

"We offer the rental and the Capex model and we see a pretty even split between these two." [6 River Systems]

"Think of our RAAS offering as a subscription... our customers have a rental agreement with us. We own all of our robots. We're not selling these to our customers on a Capex basis. We maintain ownership of the robots." [Locus Robotics]

"Bots are on a per bot per month pricing. For the software we have a license cost per user." [GreyOrange]

- RAAS tends to be offered with more flexible G2P solutions that can scale up & down relatively quick

"We have major accounts that will flex up as much as 50% around peak season. We also have other accounts that will flex up 10%, but then we allow them to flex back down. By the way, customers do tend to keep about 25% of the robots that they get for peak." [Locus Robotics]

- Whilst there were pronounced drivers towards RAAS, the drivers were not clearly understood and could be influenced by the current macro economic environment

"We see customers who have been given mandates to eliminate CapEx in 2023, which is good for us because we can deliver out system without CapEx. We can deploy a fully OpEx solution. We think this will benefit us. One of the things to watch for this year is the rate of continued e-commerce growth...we'll see how that plays out." [inVia Robotics]



TRANSACTIONAL RAAS RECEIVED A LIFT WITH PIO. BUT ISSUES REMAIN, ESPECIALLY WITH STORAGE WHERE A PRESENTATION CAN INCLUDE MULTIPLE PICKS

TRANSACTIONAL MODELS APPEARING

- There was an increasing number of vendors appearing

“We offer a pay per presentation model. But this is only for the service fee. You have to buy the whole system and after it's just pay per presentation for the service fee.” [Storojet]

“We started RAAS in 2022 and have some contracts signed in 2023 and will get that off the ground big time. It is the transactional model based on per item sorted with a minimum.” [Tompkins Robotics]

- For example, PIO (sister company of AutoStore) launched at NRF in New York in Jan 2023 with a hybrid RAAS per transaction offering at \$0.60 per tote presented, however, customers have to do an up front Capex investment for the grid and bins

“We released a pay per pick commercial model. Customers pay an upfront fee for the grid and bins and then there is a pay per pick subscription that cover the cost of robots and software. And it's based on volume.” [AutoStore]

TRANSACTIONAL COMPLEXITIES

- The Transactional RAAS model appeared to be work in progress and vendors tried to understand if there should be a Capex part or how big it should be, etc.

“Most projects include a Capex part even with a SaaS/RaaS model. But even with pure ‘X-aaS’ there is still a cost involved and while it might not require board level approval, there will still be some kind of sign off process, perhaps with local directors.” [Addverb]

TRANSACTIONAL RAAS, COMPLEXITIES IN STORAGE

<u>SYSTEM</u>	<u>PICK OR SORTATION</u>	<u>STORAGE</u>
Fee Based Action	Pick or Sortation	Bin Presentation
# Units involved	One unit per action	<u>At least</u> one unit, potentially more if many lines or SKUs in one bin
Ease of calculating RAAS fees	Very easy	Complex

Source: STIQ Research & Analysis

- It was far easier to determine costs in Picking and Sortation systems where one action only affects one unit
- This was more complex in storage solutions where one bin presentation can offer multiple unit picks

“Paying per tote presentation means you can have multiple picks in a tote. This is where it becomes fuzzy. And that's a challenge we see, because with any G2P system, whether you're bringing a tote or a rack to the operator to pick, the economics can vary widely according to how many picks you get. If I'm charging you \$0.60 from a tote and you're picking 10 items from that tote, that's \$0.06 per item. But if I'm giving you a tote and you're picking one item out of it, that's 10X the price. That's generally been where we are trying to reconcile how the industry would behave to something like this and whether it is viable in a dynamic environment like ours.” [GreyOrange]

“The rental model is quite attractive for customers. It is easier than pay-per-pick, because what exactly is a pick? If the assortment changes or the order structures change then it immediately gets more complicated. There are challenges to the pay-per-pick model.” [Addverb]

- Larger system integrators were tracking developments and have considered implications of the various RAAS models

“RAAS revolves a lot around the product. In a rental environment, you need to prove that your product can be reused. We are still driven by customer demand and are producing customer specific and optimized products and solutions that are not easily reused afterwards. That is one of the topics. Then it's a calculation topic, insurance, taxation. How to handle the warehouse. How to handle implementation and extraction. It's a completely new business model. It's not only as if you only want to change the financing. So it is really diving into new business models for the provider as well. But this is where we try to gather now first experiences on how that works, how well it is perceived by the customer, and how well that business model is going.” [SSI Schaefer]

- At the end of the day, though, some customers just wanted the flexibility of different payment options

“What I have found with RAAS is people just want flexible financial models. Customers just want to shift money from their Capex to their Opex buckets.” [Hai Robotics]

“We are not asked about RAAS very often. We have done a few lease deals, but is not so much of a customer request and tends to be more of a financial modelling request.” [Exotec]



THE EMERGENCE OF THE WAREHOUSE EXECUTION SOLUTION (WES) SOFTWARE

WES, AN EMERGING WAREHOUSE SOFTWARE

- The term 'WES' has become very popular in the G2P space, but was invented fairly recently

"The term WES was coined about 7 years ago." [RightHand Robotics]

- However, it appeared other WMS vendors had been offering similar functionality since the early 2000's

"It was around 2017-19 when one WMS vendor said 'we are the first provider of a WES solution'. But we have had this functionality since 2003 as an integrated part of our WMS. Our WMS can manage handling of transports to AGVs & AMRs, conveyor systems and also integrating directly with crane systems. With some of our customers we have been doing this already for more than 20 years." [Consafe Logistics]

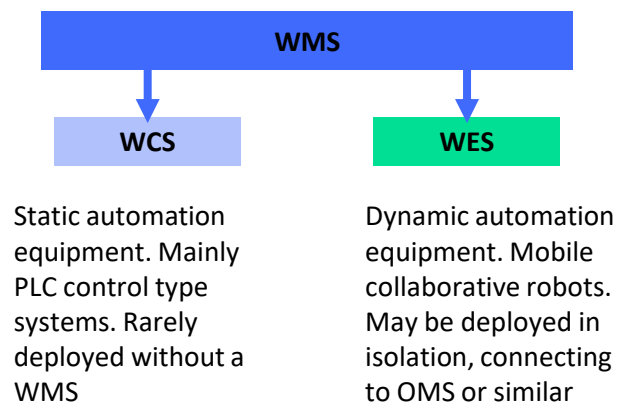
WES DEFINITION CONSENSUS

- There was some confusion around the actual definition of WES, however, the consensus from interviews was that WES manage robots and labour inside warehouses

"The definition of WES changes depending on who you speak to. The way we look at is WCS and WMS have been around for a while. The WES is almost like a bridge between these two software stacks." [GreyOrange]

"The WCS tells a specific piece of equipment what to do. Above that is the fleet software. The fleet software helps to orchestrate all of the moving objects that are maybe not centrally located, moving objects like AMRs or humans. Above that is WES which orchestrates orders and release the bifurcated orders throughout the different fulfilment paths." [RightHand Robotics]

WAREHOUSE SOFTWARE RELATIONSHIPS



Source: STIQ Research & Analysis

"We view the WMS as the inventory or record and the WES physically moves the product whereas the WMS is sort of saying here's where the product is, here's how much of it you have, here are the orders that are coming in and the WES executes on that. We extend the WMS functionality." [inVia Robotics]

- The WES also included other interesting applications

"Some companies need to replace their existing legacy WMS solutions or a module from the ERP or something they made themselves 20-30 years ago when they added automation. In these cases we can bring in our software solutions and act as the WES to connect to their existing legacy system. The next step would be to replace or exchange the entire legacy WMS." [Consafe Logistics]

"We have deployed our WES in dark stores where there is no WMS, taking orders directly from the OMS, doing all of the processing for fulfilment within the Dark Store, including running the automation and getting the goods out." [GreyOrange]

P2G VENDORS AND THE WES

- Most P2G vendors have developed their own WES but may name it differently

"We have developed our software stack over the last few year and we refer to it as FES, Fulfilment Execution System. This software essentially extends and enhances the WMS." [6 River Systems]

- In some instances just deploying a WES without P2G robots could also impact productivity

"You can just deploy the WES software first to give you a productivity boost. And then you can add the robots later to get even a higher boost. We've seen a lot of customers that have just signed up for the software first to optimize the labour they have." [inVia Robotics]

- However, some P2G vendors may have built their solutions around their robots

"Many of the automation players may have built their WES around their own technical solution. Our WES is really embedded within our WMS. It's individual modules, but they all exist. We sell it as part of our WMS package and we don't sell it as a standalone WES package." [Consafe Logistics]



POTENTIAL FOR CONFLICTS IN MULTI-VENDOR ENVIRONMENTS. WHY AUTOMATION MAY TRIGGER A CHANGE OF WMS

POTENTIAL FOR SOFTWARE CONFLICTS

- In environments with more than one robot and/or automation vendor, there is potential for conflict between the various systems

“Vendors with their own sophisticated systems, want to draw the border to the WMS. We can do that, but the problem is that if you buy first from vendor A, then from vendor B, vendor C... how do you put them into the same package to optimise operations? That's where we think many of these companies don't have that full solution, at least yet and where there could be some potential for system conflicts.” [Consafe Logistics]

- However, conflicts between various different warehouse software systems and hierarchical issues appeared to be relatively common in the sector

“Conflict between different warehouse system components is nothing new. There has always been an hierarchical conflict between different systems and how to optimise. I think this will continue with robotics vendors as well. For example, if a robot is running with a 10% battery charge, the robotics control system may say it should go and charge. However, if you know there will not be more demand before the robot is ready, the overall system may ask the robot to run down to 2% just to clear all orders.” [STIQ G2P Solutions, 2020]

IMPORTANCE OF THE WMS IN AUTOMATION

- Installing new or adding to existing automation can often be a trigger for upgrading an existing WMS

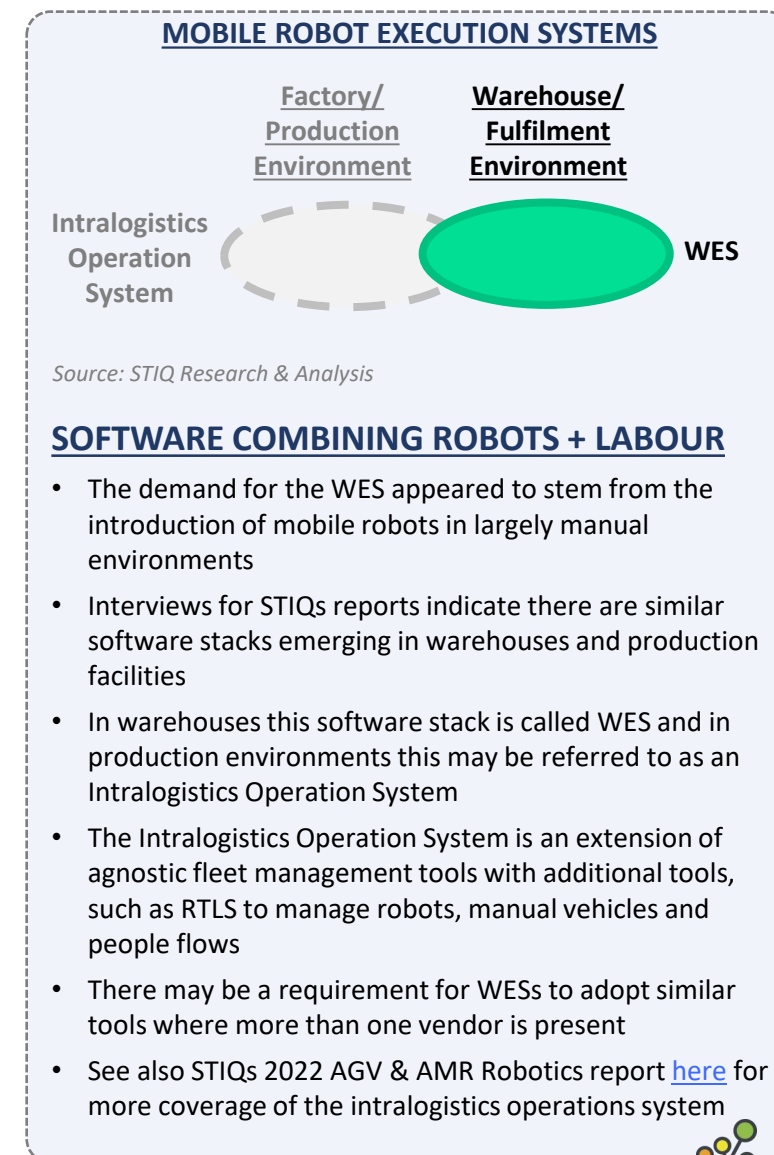
“When customers start thinking about automation, this sometimes also triggers a change of WMS. Quite often a customer wants to optimize warehouse processes, but realize the existing ERP or WMS lack some capabilities, so they need to do something there as well. That happens quite frequently that the introduction of automation triggers a change of WMS. Other reasons for upgrading the WMS may be to optimize material flows, control what goes inside the automation and what stays outside and where you pick what SKUs and so on.” [Consafe Logistics]

- This is also why most system integrators also offer their own WMS stacks

“The WMS area is very interesting to us, as we noticed customers appreciate our full software portfolio. We also do standalone WMS deployments, for example at Reliance Retail. We do a lot of projects that are software only. That's an area where we add the most value. For the projects that I'm quoting and especially a bit larger ones, often we also include the WMS. Of course, we are then also competing with the Blue Yonder's, the Manhattan's and so on, but at a different cost level.” [Addverb]

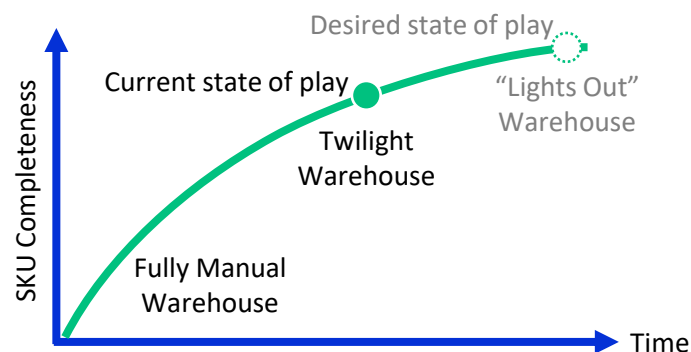
NEW UPCOMING WMS REPORT FROM STIQ

- Note that STIQ Ltd will be publishing a new report on **WMS Solutions** in 2023 – follow our newsletter and social media to keep up to date (pre-order copy to be released in Apr 2023) check [here](#)



PICKING ROBOTICS SKU COMPLETENESS WITHIN REACH, SOME VENDORS PIVOTED INTO CASE & CARTON PICKING, DE-PALLETIZATION, ETC.

PIECE PICKING ROBOTICS EVOLUTION



Source: STIQ Research & Analysis

PIECE PICKING ROBOTICS & "LIGHTS OUT"

- Interviews with retailers suggested a keen interest in developments in the piece picking robotics segment especially with the potential for future "Lights Out" warehouses
- Plenty of piece picking robots have been deployed globally, but some key issues remained for the sector to truly inflect
- For merchants with smaller SKU ranges and those with a majority of package goods, such as pharma and/or cosmetics, piece picking robots is very near lights out
- However, for merchants with very large SKU counts and often very different types of products, a functionality gap remained that was often managed by separating goods into robot pick and manual pick ports
- However, this could add consolidation issues which many SIs appeared reluctant to engage with

- Most picking robotics companies have been targeting a number of verticals

"The key areas for us are the e-commerce/electronics, general merchandise, fashion and grocery... and then you also have the do-it-yourself, electrical products and construction verticals." [Nomagic]

"There is a race for order completeness in the picking robotics segment... How can I get my order 100% picked with 100% of SKUs in that order with out going to another station or robot. You've got to be able to complete an order and that's the interesting part. A lot of the times people just shove everything at the robot and say it doesn't do everything, so therefore it doesn't work and on the other hand some system integrators don't want to have to deal with the complexity of multiple release strategies, multiple merge strategies, multiple lines intersecting together, and the timing of all of that... that's hard math. So it falls upon our capabilities in a product segment, like apparel, and do it in a rapid fashion, like we've successfully done today." [RightHand Robotics]

ALTERNATIVE APPLICATIONS

- Some vendors have noticed an uplift in case and tote picking

"Regarding piece picking... there is now a boom of the tote based AMR Shuttle and many different similar variants. And we're seeing this is a start or good signal of ramping it up for piece picking robots." [XYZ Robotics]

- Interviews with picking robotics companies has also suggested singulation and/or induction to sorting machinery could be an important application

"We currently have two product lines called "justPick", which is focused on picking from ASRS such as AutoStore, and "justInduct" focused on inducting to sorters or packing machines." [Nomagic]

- However, carton or case based picking had proven very good in the last 1-2 years

"Actually over the past 18-24 months we have done significantly more carton box or case based picking over piece picking. So depalletizing of carton boxes, totes, bags, barrels, anything that is usually stored on a pallet. Those have been growing very quickly, at least in China." [XYZ Robotics]

SEGMENT INFLECTION, A FEW YEARS OUT?

- One interview suggested segment inflection is still a few years out

"We're not even close to inflection in the picking robotics sector. I'm going to be brutally honest, we're still in the early adoption phase and I see that we're still 3 more years into our climb. Because it's not just being able to pick something. And it's not just able to place something. It's about order completeness. It's package densification, outbound package densification. It's that Tetris puzzle, if you will that needs to be solved as well." [Anonymous]



NEW WAREHOUSE AUTOMATION SYSTEM INTEGRATORS EMERGING, DRIVEN BY ACCESS TO A FAST GROWING MARKET, SECTOR CONSOLIDATION AND NEW TECHNOLOGIES

WHY NEW SYSTEM INTEGRATORS?

- Several multi-\$bn system integrators have been created in M&A over the last decade driven partially by sustained and continued growth in e-Commerce
- Many of these new 'monster SIs' rarely worked on projects smaller than \$8-10m, often served by smaller SIs
- Over the last 5 years there has also been a huge influx of new, hungry and capable G2P tech vendors in the sector happy to work on smaller projects with greater flexibility requirements
- Some of these new vendors have now matured into contenders with additional flexibility in partnering with companies offering either engineering knowledge or a ready-made customer base

PANDEMIC OPENING FOR NEW ENTRANTS?

- The pandemic highlighted the interest in and need for automation from the eCommerce/warehouse sector

“Around 2020-2021 we started seeing some of our Fortune500 customers adopting robotics. We saw them buying robotic automation and thought it could be from us, because if they are already buying RFID and AIDC technology from us why not also other automation equipment?” [Barcodes Inc]

- The type of companies entering appeared to be able to exploit their existing relationships or business models to pivot or diversify into intralogistics integration

MARKET DRIVERS FOR NEW SYSTEM INTEGRATORS

Sector Consolidation

- Many new very large SIs created in the 2010's have created opening in smaller projects

New Technology

- Recent technologies and multitude of vendors have made it relatively easy to start an SI

Growing Market

- Overall sector growth of 8-12% CAGR in the last decade likely to continue in the next decade

Source: STIQ Research & Analysis

“A large part of our customer base is in manufacturing and warehouse distribution. So it really fits well with robot solutions.” [Barcodes Inc]

“Hoermann Group has several factories dedicated to serving the automotive sector. But this sector can be a bit volatile as experienced during the pandemic and the strategic decision was to stay in this business, but also to use the size of the company, use the knowledge of the company and to go into more interesting fields for the future and one of these is intralogistics automation.” [Hoermann Intralogistics]

- Some of these new SIs already were resellers of ASRS and warehouse solutions, but only recently reorganised with a stronger strategic purpose targeting the wider warehouse & intralogistics sector

“We founded the Hörmann Intralogistics company in early 2022 as a daughter company of the Hörmann Group, an intralogistics integrator since 35 years. We have now started to build up the team and are ramping up the organization. We are following quite an ambitious growth path.” [Hörmann Intralogistics]

“We are a new system integrator for AMRs and mobile robots. Our launch was in February 2023. Our background is in AIDC and we are a top integrator of Zebra and Honeywell. We talked to some of our customers about doing robots and the response was amazing. We have a large and loyal customer base... and what we've seen is that many customers don't want to go to 10 different vendors for 10 different things. They want to stick to a single integrator to do the one stop shop for all their automation requirements.” [Barcodes Inc]

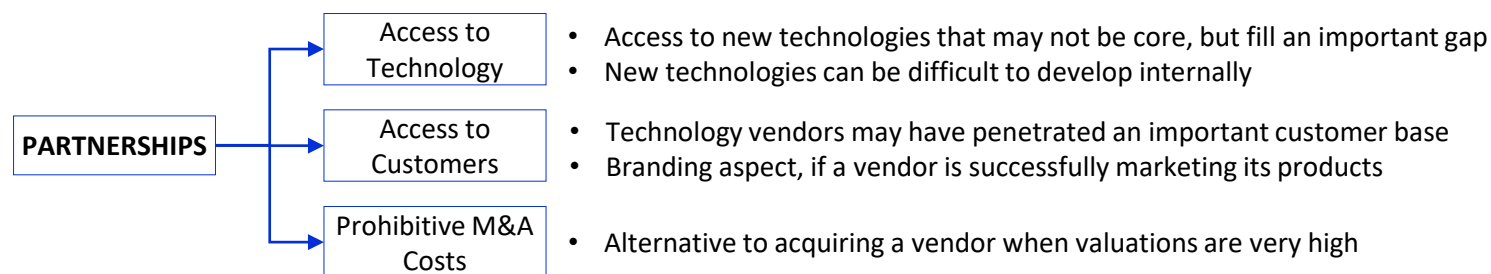
SYSTEM INTEGRATOR SECTOR IN 5-10 YEARS?

- How will the System Integrator market be impacted by these “new” entrants and what are the dynamics that will change the sector as a whole?
- What will the system integrator landscape look like in 5-10 years?
- **Should STIQ write a new report on the System Integrator market sector? Let us know your [thoughts](#)**



PARTNERSHIPING CONTINUED APACE. LARGER SYSTEM INTEGRATORS ACTIVELY INVOLVED IN RECENT YEARS

DRIVERS FOR PARTNERSHIPS



Source: STIQ Research & Analysis

PARTNERSHIP DRIVERS

- interviews have highlighted partnerships are paramount to maximising revenue potential in the wider warehouse automation and material handling sectors
- There were three primary drivers for partnerships and one of the most important was access to technology that was prohibitively expensive to develop internally or where vendors had already acquired important IP

“Especially in the last years, we have seen a rapid development in different areas of technology. As a global player with a wide portfolio there is value in complementing the portfolio through cooperation with experts in special fields.” [SSI Schaefer]

- High market valuations were a third driver, i.e. companies may elect to partner instead of acquiring the vendor

“Today's world is all about partnering up on different levels, different kinds of functionalities. So it's not all about marrying up or anything else, but it's about other technical qualities that may complete our solution package.” [SSI Schaefer]

- A number of more recent technology vendors placed partnerships at the core of their GTM strategies

“2022 was a pretty good year for us in some aspects and with some challenges as well. We kickstarted the year with getting our first sales partner and they made their first sale after two weeks. So that was really good and we have now completely implemented our sales strategy around partners.” [Blue Robot Company]

“We use a blended GTM strategy. In China and a lot of the Asia Pacific market integrators aren't as big as they are in the EU and the US. So Hai was built around a direct model in APAC but in the US so many end users prefer to leverage the integration model and have such strong long-standing relationships.” [Hai Robotics]

INDIRECT MARKET DRIVER

- Interviews suggested that traditional ASRS shuttle technologies were excluded from some larger projects which could indicate a renewed focus on partnerships as ASRS shuttle technology was typically supplied by the larger system integrators

“There has been a huge increase in the tote to person, so the AMR Shuttle and our PopPick. I have seen many tenders where big clients have excluded shuttle suppliers and directly asked for an AMR based solution. This is because they don't want to have inflexible automation with conveyors and everything bolted to the ground. They want to be scalable, flexible use... use rental options, and integrators can't provide this to them. You have cube storage and companies including Geek+. But you do not have the top integrators with their shuttles. Some projects have become a competition between mobile robot companies and cube storage vendors.” [Geek+]

PARTNERSHIP PROCESS

- Partnering with new vendors is often not a simple “lets do this”, but requires some analysis of where the vendor sits in the marketplace, what functionality voids they fill at a system integrator, etc.

“We've worked to make sure that our partners have a strong installation base. We also try to evaluate their fit in the market and in terms of what types of projects they can be most competitive on, where they're going to fill some of those voids.” [Bastian Solutions]



SYSTEM INTEGRATORS INCREASINGLY INTERESTED THE COMPLETE RETAIL VALUE CHAIN OFFERING UP- AND DOWNSTREAM LOGISTICS AUTOMATION SOLUTIONS

LOGISTICS VALUE CHAIN AUTOMATION

- Automation vendors and system integrators were increasingly considering merchants' efficiency pain points when developing new automation solutions for intralogistics and logistics problems

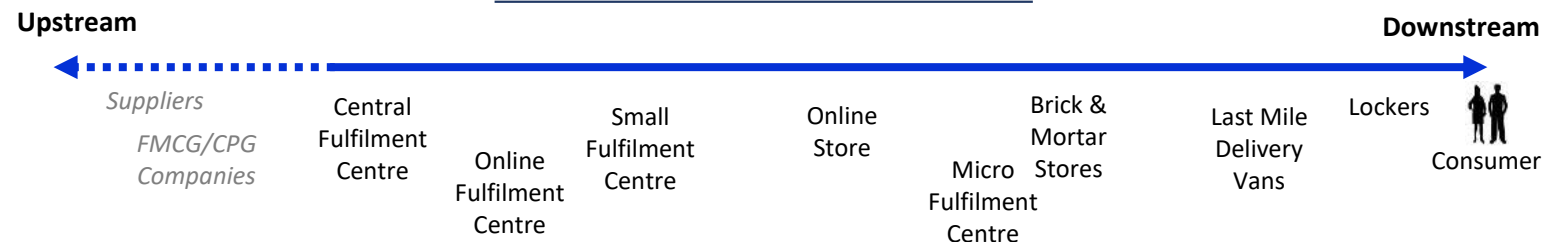
“We have solutions for the whole value chain and now we think about how we can support our customers in this way to be successful with them. For example, the control of the transportation, how does the point of sale look and how would this be integrated in an omni-channel network, possibly even including nano fulfilment centres. We call this the ‘Intelligent Network’.” [Knapp]

“Absolutely, we want to come with a global solution, committing to manage all the supply chain from warehouses to stores. And from an order point, to be able to say, ok, this order can be fulfilled from this store or from this warehouse.” [SAVOYE]

- eCommerce dynamics have forced many merchants to rethink fulfilment strategies

“You have to create different steps in the value chain because, for example, the SKU range is changing and customers didn't expect their SKU range to explode to 100,000 SKUs from 20,000 just 5-10 years ago. They want to have the choice of a wider range of SKUs but it might not be possible to keep it centralized and it's not possible to have it in each regional storage area. One of the most important things in e-commerce is that you must combine. So an order is no longer fulfilled only in one point. Perhaps it starts in the centralized point with C & B movers and then this is combined with A movers stored nearer customers, for example.” [Knapp]

RETAILER SUPPLY CHAIN & VALUE CHAIN



Source: STIQ Research & Analysis

- This has also challenged traditional warehouse automation wisdom and new strategies have emerged

“There is a warehouse strategy of reducing the number of times you touch an item and some of our customers also investigated this topic. They made some calculations and came to the conclusion that sometimes it's better to touch the article 1-2 times more to improve the customer experience.” [Knapp]

- The driver for this was the customer relationship and maintaining this in a world where Amazon and others are increasingly improving customer SLAs, delivery

“The most important thing for merchants the future, is the relationship with their customers.” [Knapp]



MFCs INCREASINGLY BLURRING DIFFERENCES BETWEEN FULFILMENT CENTRES AND VENDING MACHINES

ALTERNATIVES CLOSER TO CONSUMERS

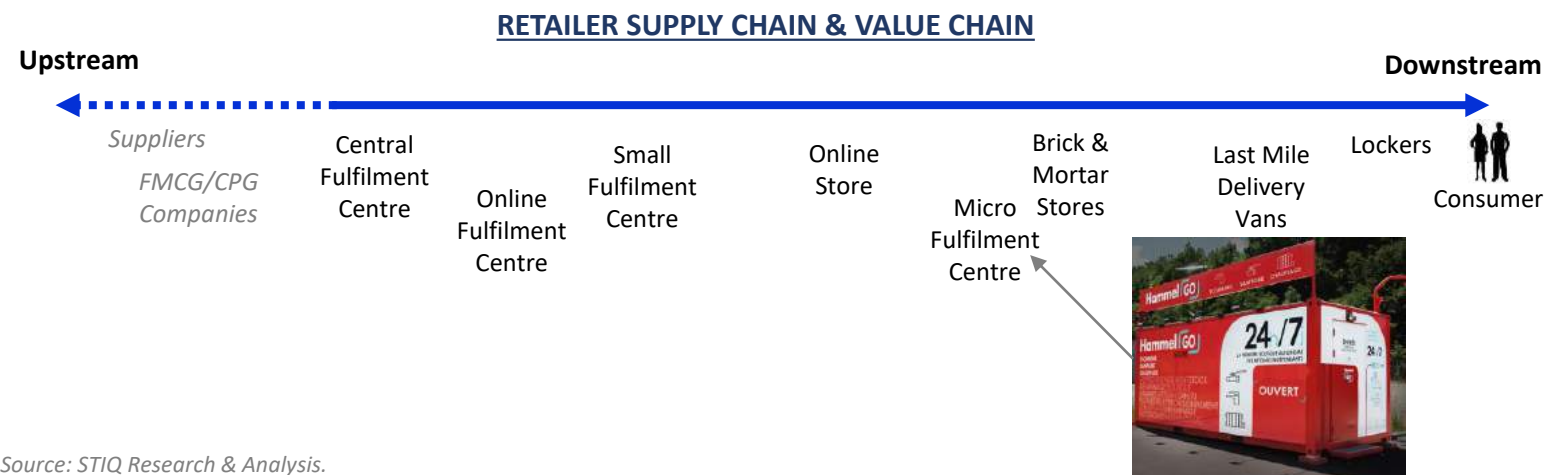
- MFCs are primarily discussed in relation to Online Grocery retail, but have also been deployed in general merchandise store environments

“The evidence is we are really at the starting point of the MFC. Because the market is also changing. All of our customers see that they must do something for the future and the bigger companies have done a lot of investigations and planning for the future where we see the total combination of small and large.” [Knapp]

- Whilst “Amazon Go”-type technologies have primarily focused on B2C grocery environments, interviews highlighted similar technologies were also being deployed in B2B retail environments

“The store we have deployed in is used for plumbers. The vendor wanted to have a flexible sales point. With this container they made the choice to go closer to the construction areas and perhaps it will be moved in six months. They also leverage this as a communication tool, ok, we are close to our customer 24 hour days, seven days a week. And it's more efficient with auto invoicing because they already know the customer, it's easier for everyone. Replenishment is easier because they have a live view of what's out of stock.” [Belive]

- Similar solutions were also deployed in industrial B2B “micro warehouses”



Source: STIQ Research & Analysis.

Image source: Hammel, Belive [\[link\]](#)

“We provide inventory tracking and all the operational tools, and have implemented this in an autonomous warehouse, or a frictionless warehouse if you will. In some factories they don't supply products themselves and have a fulfilment company like a Fastenal or a Grainger to operate a warehouse with screws, nuts, bits and so on... Our product is used to track components going out from these fulfilment locations, ‘ware rooms’.” [AWM Tech]

- A few G2P vendors had also released consumer facing pick faces to be used as MFC pickup locations

“Recently we released ‘pickup port’ which is a module intended to address MFCs and in-store applications, specifically around retail. Up to now, our solutions required trained personnel to operate the system. But with the pickup port, anyone can retrieve a product or a finished order directly from the system.” [AutoStore]

- There appeared to be demand for this type of solution
- “The demand comes from the fact that customers are more and more thinking on how to integrate physical and online stores as one, how to facilitate returns and click and collect within the same system.” [AutoStore]**
- Additional system integrator offerings also included OMS software

“We are now promoting our omni channel platform offer - SoCloz. Currently we have only had activity with this in France and we are trying to expand this. We acquired the company in 2020 and have connected the functionality to our logistics OMS permitting retail customers to have a unified visibility of inventories in warehouses and stores.” [SAVOYE]



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ECOMMERCE REMAINED A TOP G2P CUSTOMER DEMOGRAPHIC. GROWTH ACROSS MANY OTHER VERTICALS AND APPLICATIONS

ECOMMERCE KEY CUSTOMER INDUSTRY

- eCommerce, including 3PLs, remained the most important vertical for G2P vendors

“eCommerce accounted for c.70% in 2020-21 and we continue to see strong demand in this sector.” [AutoStore]

- There was no single application or industry that stood out as more positive (or negative) than any other

“Our robots sort nearly all things that are in an ecommerce order. And by sectors it's mainly e-commerce, store replenishment and pharmacy.” [Tompkins Robotics]

“Because it's a small size fulfilment location, we focus on high rotation products.” [Belive]

- Interviews suggested growth across many different industries, such as pharmaceuticals, electronics, automotive and others

“Our largest industry sectors by revenue would be pharma, electronic distribution, electronic components distribution including PCBs and raw parts stuff and then the automotive sector.” [XYZ Robotics]

ONLINE GROCERY GROWTH

- Online grocery was increasingly important for many different vendors in the sector, in particular for cASRS and ASRS vendors and system integrators

“Our AutoStore sales have also been growing. In particular we saw a lot of growth in the eGrocery sector. What we did see is probably a little bit of a slowdown in US eGrocery roll outs, but certainly in Europe we see that gaining momentum.” [Swisslog]

- STIQ cover Grocery Fulfilment in our eGrocery Infrastructure reports available free [here](#)

ECOMMERCE, PARCELS SECTOR

- Various parcel handling sectors, including eCommerce, were also a core component for many solution vendors

“We are also able to address use cases with throughput requirements of 2-5,000 packages per hour with good ROI. These throughputs are lower than lets' say 15-20k packages per hour, which a typical cross belt sorter or our large-scale systems can do.” [Unbox Robotics]

- Note that STIQ will cover Sortation Equipment in more detail in our Sortation Equipment reports [here](#)

AUTOMOTIVE AND INDUSTRIAL USE CASES

- G2P concepts and solutions could be applied in different sectors & industries; automotive is interesting

“We do G2P in the automotive space but we call it ‘Goods to Supermarket’. For example, a kitting area, where you prepare and put together some parts for a car. And then that goes to the line supply.” [ABB]

“In terms of sectors we target, we have never had automotive in this early stage of the company in our mind, and now we have two of these contracts... It's kind of a niche. It's not our main focus, because the automotive area is quite difficult and we had to do some adjustments. But still, at the end of 2023 we will have two automotive references which is good for us. The rest of our customers are in fashion, e-commerce, industrial environment. I'm still looking for an application in the beverage area.” [Rocket Solution]

- However, RFPs could often be very ‘comprehensive’

“We could have much more moving RFP's, we just don't participate in some automotive tenders. And the reason for that is the very complex tender documents they put out. These are really onerous and take a lot of time to digest.” [Anonymous]

- There was also increasing signs of reshoring activities and heightened demand in the electric vehicles sector as the automotive sector continues to switch production

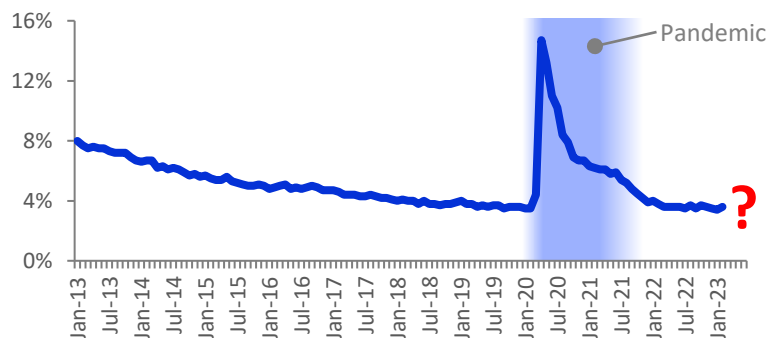
“Perhaps that e-commerce has slowed a little bit. But we're seeing significant growth in reshoring in various manufacturing sectors in the US right now. A better term may be nearshoring. There's particular growth in EVs.” [Bastian Solutions]

“Currently we are focusing on intralogistics applications, not on e-commerce This is aligned with our step by step go to market strategy. It doesn't mean we will not focus on e-commerce in the future and it will be added in coming years. Currently we're focusing more on the industry and logistic products.” [ABB]



LACK OF LABOUR REMAINED A TOP AUTOMATION MARKET DRIVER FOR CUSTOMERS. UNEMPLOYMENT REMAINED LOW DESPITE GEOPOLITICAL ISSUES AND INFLATION

**MONTHLY US UNEMPLOYMENT RATE 16YO+,
JAN 2013-FEB 2023 (%)**



Source: US Bureau of Labour Statistics ([link](#))

THE LACK OF LABOUR DEBATE

- Vendor have always described “lack of labour” as a key automation market driver but STIQs view has been that if you pay more, there will be labour
- However, the pandemic appeared to have tilted this relatively simplistic view with accelerated labour costs and declining labour pools
- This affected not only North America and Europe but also many “lower cost” countries

“There is a real problem of labour shortages. A lot of our customers want to future proof themselves and not be dependent on resources that may not be available. That’s one of the things. But then 40% of this is we bring in good ROI and some of our partners brings us like a six month ROI which is great. So if you can justify an ROI, it’s a no brainer business case for our customers to just adapt to robotics.” [Barcodes Inc]

“Labour shortages is the one of the biggest things affecting our customers.” [Knapp]

“One thing that is clear is that labour remains constrained. Space isn’t typically a major issue here in the US... but it is if you’re trying to stay in the same building.” [KPI Solutions]

“We’re finding that it is incredibly hard for our clients to find labour... harder than it’s ever been. But also the rates are going up. So clients are hit with two dimensions; labour’s hard to get, which is no secret, and secondly, wage rates are going up. I spoke to a 3PL recently and they said their rates had increased by 25% compared to a year ago.” [Locus Robotics]

“Consumer spending habits might slow down and companies may be more cautious. But they will still have the same challenges, rent for buildings going through the roof, access to labour and salaries is a challenge. They need to offset all of those items.” [Attabotics]

- Investing in automation could also be a necessity rather than a search for additional efficiencies

“There’s quite a lot of uncertainty for companies to invest right now. Is there a recession or not? Should we hold off a bit more? On the other hand, a lot of companies do not have enough staff and cannot find labour. That’s a dilemma for the people making investments decisions. Do we dare to invest? Actually we have to invest because how can we otherwise run our business... specifically we see a lot of requests from 3PLs. They are very eager to look into options.” [Addverb]

CALCULATING ROI, INCREASINGLY COMPLEX

- ROI used to be an easy excel thing comparing current and future costs, but has become more complex including retention and training costs, etc.

“ROI used to be a simple calculation. But, these days customers include staff retention and other soft items in these calculations. So you have a system that is easier on the operators. They don’t have to lift as much so it’s easier on operators, they stick around longer. And, ROI used to be 3 years, but now some are accepting 5 years and even 7 years because they simply cannot find the labour and it has become a survival thing.” [KPI Solutions]

“There’s absolutely no arguing that labour is tight for warehouse operators. There’s also a lot of labour turnover, and you have to train that labour to be effective.” [Addverb]

- Interviews with buyers indicated ROI calculations were changing, but possibly that persuading finance departments could sometimes be difficult

“We still try to bring in as much automation as possible... even if ROI is the same as manual or even a bit worse, we would try to bring it in because... usually we calculate our ROI still very old school, mainly around the labour cost. But nobody usually uses the retention risks or the costs to finding new labour, which is usually not included in ROI calculations.” [Anonymous 3PL]



GEOGRAPHICAL DIFFERENCES/ DIFFERENT AREAS OF THE WORLD

NORTH AMERICA, VERY ACTIVE

- Interviews suggested North America was a very active market with plenty of opportunities

“The US has been a real high point for Addverb. Anybody would recognize that the US is an unusual market in that we've got a lot of eCommerce and it's just a busy market for any kind of warehousing or automation. It's a very organized market. It's pretty mature and we tend to lead a lot of trends as opposed to following them. Our first year operating in the US has been absolutely amazing which has been great. I think it really stands on our software, the quality of our software.” [Addverb]

“The US market is extremely hot. In Europe, we're all looking a bit around and waiting for what's going to happen.” [Anonymous]

- North American warehouse operators were potentially more acutely affected by a lack of labour

“I think if you look at the US versus Europe, there are less highly automated warehouses in the US. So what I mean by that is there are more opportunities for us to go into a non-automated warehouse and offer them a solution that doesn't require us to bolt onto another piece of tech. It's a stand alone thing like or kitting solution, our robotic put wall or even maybe our de-palletizing solution that can sit isolated of anything else.” [Covariant]

CHINA REMAINED HUGELY COMPETITIVE

- The Chinese domestic market remained a large and highly influential market, but was also very competitive, especially in the G2P segment

2022-23 GLOBAL COMMERCIAL TEMPERATURE, WAREHOUSE AUTOMATION/ G2P SOLUTIONS



Source: STIQ Research & Analysis. Illustrative only

“The Chinese domestic market remains very very competitive. In 2022, we mainly focused on the overseas markets. The majority of our revenue was contributed by overseas markets.” [Mushiny]

- Profitability in the domestic market appeared to be limited and the attraction of overseas markets often associated with higher margins
- However, Covid lockdowns combined with travel restrictions in China had limited or disrupted companies overseas expansion plans
- The removal of Covid restrictions in January 2023 meant Chinese vendors were again able to travel easily and promote themselves in overseas markets

“Due to Covid we were not operating outside of China and have not been aware of what has happened in Europe and the US. This will change this year. We see the opening up as a great thing for sure. We will be exhibiting at Logimat... not Promat, because we didn't know the country was opening and couldn't register in time.” [XYZ Robotics]

- Chinese vendors were highly optimistic about overseas markets, especially APAC and North America

“We are very optimistic about the global market, especially in Japan and America. For the China market, I think it's a bit difficult and customers make their investments pending and they just need a bit of time to really think or get well prepared. But we have a huge order book from the domestic markets. So actually last year we were extremely busy to deliver many many projects.” [Mushiny]

AUSTRALIA STILL EXPANDING

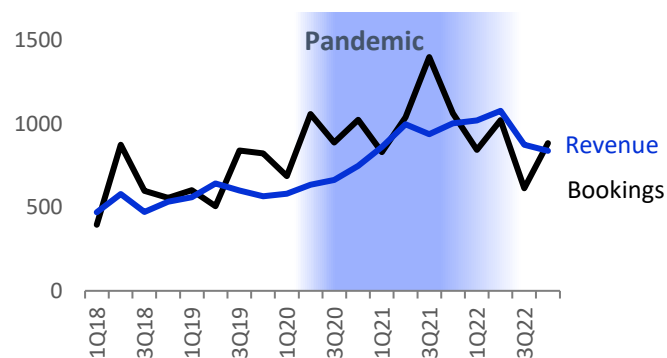
- The Australian market appeared to have caught up with the global demand for G2P

“The Australian market is still expanding quite quickly. Historically, we lagged the rest of the world. I think that's turned around in recent years. Around 15 years ago a lot of the systems in the market were very much conveyor based transport systems and they achieved ROIs but pretty low technology levels compared with what's going on today. Today, we see robotic each picking, AMRs and a wide variety of highly automated solutions. We're still seeing the market growing over here, but it's been playing catch up a little bit but is still kind of expanding.” [Atypical Consulting]



LISTED COMPANIES REPORTED 2022 REVENUE ABOVE PRE-PANDEMIC LEVELS WHILST BOOKINGS RETURNED TO PRE-PANDEMIC LEVELS¹

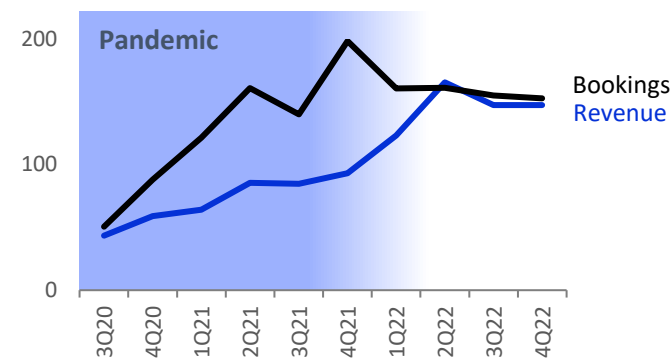
KION (SUPPLY CHAIN SOLUTIONS SEGMENT) QUARTERLY RESULTS, 1Q18-4Q22 (€m)²



Source: KION. Data for "Supply Chain Solutions" segment

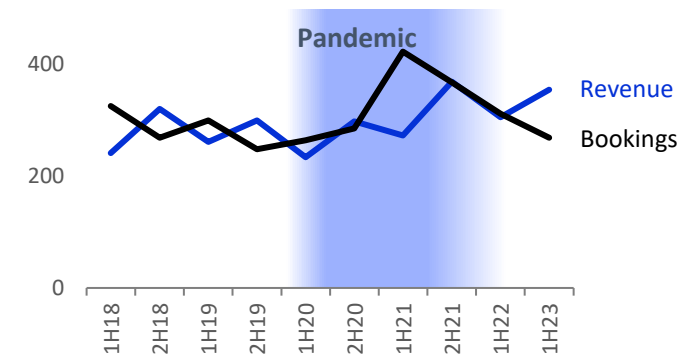
Note: STIQ assumes pandemic effects lasted to 1H22

AUTOSTORE QUARTERLY REVENUE, 3Q20-4Q22 (\$m)



Source: AutoStore. No quarterly data before 3Q20.

INTERROLL HALF-YEAR RESULTS, 1H18-2H22 (CHFm)



Source: Interroll. No quarterly data.

THE END OF THE PANDEMIC BOOM

- Whilst the longer term outlook for the warehouse automation and material handling sectors was positive, publicly available figures for listed companies suggested that pandemic fuelled growth had now returned to organic levels
- Bookings in 2020 and 2021 would continue to drive up revenue in 2022 and to some extent in 2023
- Leading equity analysts had a positive view of the longer term growth prospects for the warehouse automation/material handling sector with strong fundamentals

- Although some short term turbulence may be expected **"AutoStore reported a solid year of growth in their 4Q22 update. The lack of significant movement in the share price has probably more to do with the very high expectations on the company to continue at 40% growth per year. We see next year as largely positive. Perhaps there are some questions around 2024 but the sector fundamentals are there and we have a positive view on the longer term growth."** [Anonymous Equity Analyst]

PROSPECTS FOR 2023 AND 2024?

- Interviews suggested a number of warehouse automation projects had been postponed due to declining eCommerce order volumes in the end of 2022 and beginning of 2023
- A number of merchants also delayed decisions in 2023 to gain additional accuracy on their forecasts
- This could potentially deflate 2023 bookings, but vendors also reported a high level of incoming inquiries

¹ Excl. AutoStore, no pre-pandemic data available and the company remained in a growth phase. ² Dematic is here KION Supply Chain Solutions segment.



PRIVATELY OWNED VENDORS RATED 2022 REVENUE DEVELOPMENTS FROM GOOD TO VERY GOOD

OVERALL, 2022 WAS A GOOD YEAR

- Despite geopolitical impacts and apparent slowdown, a few vendors posted very high order intake and others showed record order intake in 2022

“Our 2022 order intake is currently our record... we have never experienced so big order intake as during this year. All our offices were growing in 2022.” [SAVOYE]

“Revenue in 2022 increased by high double digits YoY and our pipeline is very healthy.” [KPI Solutions]

“Our order intake for last year in 2022 was the highest ever.” [Consafe Logistics]

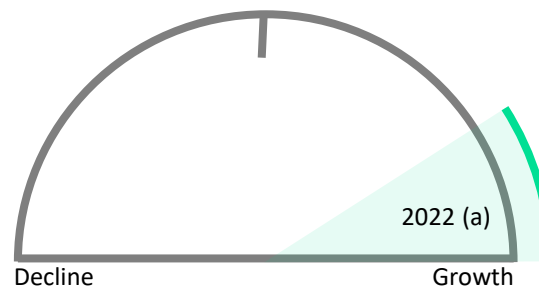
“We definitely grew our order intake YoY in 2022 in Europe. Revenue growth in 2022 was huge.” [Geek+]

“2022 was another good year of growth with top double digit order intake compared to 2021. And that was globally in each region. So the order book looks really strong.” [Exotec]

“At a high level, 2022 was a very good year. We were definitely up on a bookings perspective and posted record year over year.” [6 River Systems]

“For us 2022 was good, certainly we were we saw growth in 2022 vs 2021 and it was quite significant growth. We’re certainly on track to meet our long term target earlier than expected. So yeah, we had a good year.” [Swisslog]

G2P SECTOR, 2022 PERFORMANCE INDICATOR (BASED ON RESPONSES IN JAN/FEB 2023)



Source: STIQ Research & Analysis.

Key: f=forecast, e=estimated, a=actual

“I think like a lot of the players in this space, we've definitely seen a tremendous amount of growth in 2022. There's no shortage of opportunity out there for sure.” [GreyOrange]

“In 2022 we came in right around where we expected to at nearly 100% growth. That's very robust growth. And we're anticipating a similar development in 2023.” [Tompkins Robotics]

“We have installed many, many more systems in Q3 last year than in any time of our life at BG.” [Berkshire Grey]

- The rate of adoption has not slowed down among customers with significant potential remaining in the market

“Growth is still very substantial because the rate of adoption hasn't slowed down. Although the top \$ revenue may have slowed or peaked a little driven by the Amazon's of the world, the percentage of companies that are adopting automation is increasing due to things like low unemployment and rising wages. The cost of automation has become much more justifiable. There's just a much bigger plate for everybody due to that rate of adoption increasing.” [Hai Robotics]

- Component suppliers have also benefitted from significant sector growth

“In terms of market growth, we have had a continuous growth of double digits per year and our target is also to keep this growth in our roller business. Regarding the business unit conveyor & conveyor assembling, we just started last year with a few local projects. We are the producer and are selling the product to final customer.” [Damon Group]

2022 BEGAN ON A HIGH NOTE BUT SLOWING ECOMMERCE, GEOPOLITICAL EVENTS INFUSED A LEVEL OF HESITATION FROM 2Q22 AND A SLIGHT DECLINE IN 4Q22

POST-PANDEMIC GROWTH

- The pandemic condensed, brought forward and accelerated many warehouse automation investment decisions which led to record bookings in 2021
- Market developments in and throughout 2022 should be viewed in that particular context

“2020-22 brought forward a lot of investment in ecommerce and automation.” [Atypical Consulting]

“Demand in the end of 2020 and 2021 was absolutely crazy. I believe it was sort of panic buying because raw material availability was very limited.” [Damon Group]

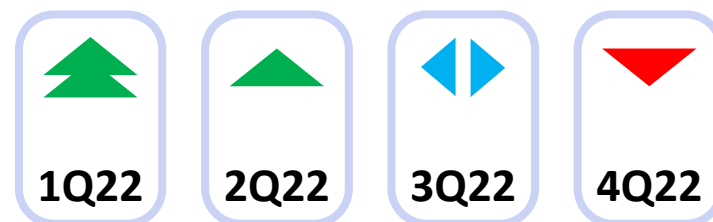
“We had a 32% increase in revenue in 2021 with particularly significant growth in warehousing. Largest proportion of orders from food, fashion and general merchandise.” [Vanderlande]

HEADWINDS STARTED APPEARING IN 2H22

- The overall response from interviewees was that 2022 started strongly and that a level of decision hesitancy materialized around 2Q22

“We have seen an unprecedented boom in end of 2021 which was really the peak with an incredible level of activity. In the course of 2022, especially in the second-half of 2022 there was a slowing down. And we have seen that across regions.” [Conductix-Wampfler]

2022 G2P SOLUTIONS MARKET GROWTH SENTIMENT



Source: STIQ Research & Analysis

“In the beginning of 2022, things were on an uptick and then things happened... macroeconomics, impacted people’s decisioning. Since then there has been some longer decision making. Customers delaying parts of projects because they want to see what is going to be happening in the next 6 to 8 weeks.” [Attabotics]

“In the summer of 2022 we had some concerns whether we would make our budgeted growth, but we had a couple of big orders in 2H22. US and Japan are doing very well. Europe is a bit struggling now. But then again, we also had double digit growth in the last 2-2.5years.” [Fives]

- Some of the FOMO market behaviour appeared to have completely dissipated

“I saw instances where 3PL’s jumped directly to automation... where they built a new building and automation would go into it before they even opened it for the very first time. A lot of that is quickly dried up.” [RightHand Robotics]

“We had pretty good growth in 2022 which was about double over 2021. And, we think that will happen again in 2023. Obviously there are some headwinds or the promise of headwinds. The main thing about this year is uncertainty. I heard someone coin it as the year of the great hesitation because everyone’s sort of waiting.” [inVia Robotics]



SUPPLY CHAIN PROBLEMS CONTINUED ACROSS THE WHOLE G2P SECTOR WITH LONGER LEAD TIMES, INCREASED PRICES IN MANY CASES ALSO IMPACTING PROFITABILITY

DISRUPTIONS ACROSS THE G2P SECTOR

- Supply chain disruptions were primarily component level delivery delays and increased prices which occurred globally and often across product types, some more affected than others
- The combination of delays in the delivery schedules with a very hot market for G2P Solutions led to huge complications for vendors and delayed projects for many customers

“Supply chain problems basically impacted us like all the other companies. We had some challenges with lead times of certain components. And also the prices of steel for racking. That's really been a challenge.” [Anonymous]

“Like everyone else, we faced supply chain challenges... on aluminum, getting access to components for products which triggered some work in R&D. But we were able to maintain delivery of products. Temporarily we had longer lead times, now back to 20 weeks. We have always been able to deliver what we promised.” [AutoStore]

“Last year, our business was affected by disruptions in the supply chain, by spiralling costs for materials, energy, and logistics, and in some cases also by a decline in demand. This decreased demand among some customers is based on a reticence in starting new investment decisions. Inefficiencies resulting from the lack of availability of key parts at project sites led to delays in the Supply Chain Solutions (SCS) segment. As more new projects were ramping up in parallel, the availability of skilled labour, especially in North America, became a limiting factor due to high demand from other industries.” [KION, 2022 Annual Report]

2022 SUPPLY CHAIN DISRUPTION IMPACTS

COGS



PROFITS



LEAD TIMES



Source: STIQ Research & Analysis. Use of emojis illustrative of vendors emotions re supply chain disruption impacts

COST INFLATION

- Sharp price increases combined with volatility affected all parties

“The only real impact from supply chain issues was the shipping cost for us which affected our robot shipments. We buy racks in Europe, so we are not affected by this. But, shipping was a problem, with costs up to €20,000 for a 40” container where it was €2,000 before the pandemic. This has come down now which is very useful for our prices.” [Geek+]

- Quite a few projects were also postponed during the worst shipping price increases which returned to more normal levels recently

“We had to postpone a project as shipping of the parts increased by 10X to \$400k.” [Anonymous 3PL]

- Profit margins across the sector took a hit and vendors increased prices to offset this impact

“The corresponding adjusted EBITDA margin was 37.2% (50.0%), with the margin decline primarily being linked to continued cost inflation for key components as a result of global supply chain challenges in 2022. Mitigating actions, including price increases and a temporary aluminum surcharge, are expected to bring margins back to historical levels during 2023, as projects move from backlog to recognized revenue.” [AutoStore, 3Q22]

SUPPLY CHAIN IMPACT ON TOP LINE, 20-30%

- Mirroring findings in STIQs Nov 2022 AGV & AMR Robotics report ([here](#)), interviews for this report indicated vendors could have lost out on as much as 20-30% additional business due to supply chain disruptions

“Without the supply chain issues, I think we certainly could have done more business in 2022. I would say as much as 20-30% more.” [Anonymous]



COMPONENT LEAD TIME EXPANSION LED TO SEVERE CAPACITY CONSTRAINTS ACROSS THE SECTOR WITH CAREFULLY CRAFTED DEPLOYMENT SCHEDULES RIPPED UP

EXPANDED COMPONENT LEAD TIMES

- Interviews suggested lead times expanded from a few weeks to half a year and in some cases even longer

“Delays were in the range of if its normally 1 month delivery, it was all of a sudden 6 months. So we invested a lot of time of our R&D team to qualify new components from other vendors and generally just to diversify our capabilities regarding components. It had an impact across the business of course.” [SAVOYE]

DISRUPTED DEPLOYMENT SCHEDULES

- Supply chain disruptions caused problems across the sector, also with deployment schedules

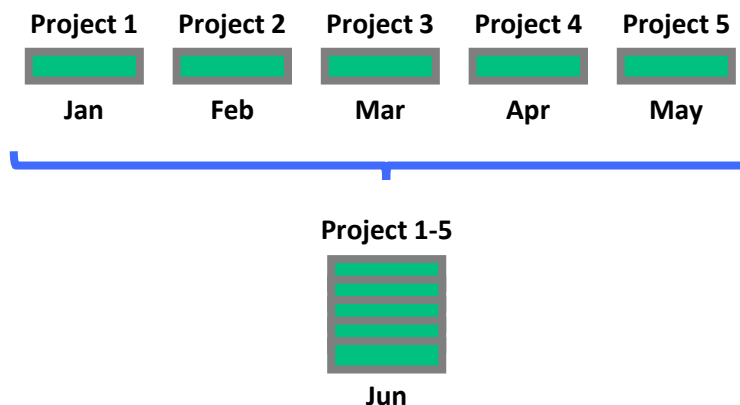
“2022 was difficult to plan regarding shortage of components, supply struggles with motors, PLCs and even plastic cables. Anyway, this affected everyone... so we experienced some difficulties to transforming the backlog into revenue in 2022. Some of that will transfer to 2023.” [SAVOYE]

“Our initial thinking back in 2019 in terms of lead time and project time that is, yeah, that changed by 180 degrees. We are currently working on five projects in parallel. This is due to the delivery crisis. All of these projects were once perfectly aligned after each other...” [Rocket Solution]

- For more recent entrants, component delays added further stress

“Inflation and supply chain problems meant we had to postpone our launch a little bit into this year... But we have now secured a site for the first launch.” [TARQAN]

LEAD TIME DISRUPTION: PROJECT SCHEDULING IMPACT



Source: STIQ Research & Analysis. Illustrative only

“We got hit by the component situation and were delayed with our first industrial installation as a result.” [Blue Robot Company]

“There are few words to describe 2022. So all the delivery delays were a pain in the ###, especially when you launch a new product and you encounter a lot of new things where you have to do some adjustments and have to do some replacements and what usually took 2 weeks now took half a year and that was very difficult. That meant we had to improvise to get everything up and running...” [Rocket Solution]

- Project delays were likely to continue well into 2023 and extend into 2024 in some cases

“There are delays across the industry. For a substantial number of providers, what used to be a 12 month project is currently an 18 or 24 month project. I do think the companies are doing better now than we were in 2021 at articulating this to the market. In 2021 you had the bottle effect from Covid projects which didn't die, but they all just stopped. And then once everyone realized the world wasn't ending, all of a sudden you had four quarters worth of orders in half a year... No one knew how to pivot, adjust, or even just change the narrative fast enough to say like, yeah, that thing we quoted you for 12 months is now up to 18. I think it's going to be a 2-3year kind of slug where you just pound through those projects with sweat, blood and tears...” [Hai Robotics]

CANCELLATIONS & POSTPONED PROJECTS

- Delays were rumoured to have led to cancellations and margins were likely to have suffered across the sector

“The bigger vendors in the market all have the same issues, even cancelled project due to delays... and of course a lot of companies struggle with pricing. But of course we also suffer from increased prices. You know we sell a project only to find within a couple of months there are 10-15% increase in costs. That takes so much gross profit out of your business.” [Anonymous]



MANY VENDORS INCREASED INVENTORY OF KEY COMPONENTS. SOME RAAS [RENTAL] VENDORS BUILT ROBOTS TO STOCK AND AVOIDED ANY MAJOR SUPPLY CHAIN IMPACTS

VENDORS INCREASED INVENTORY LEVELS

- As in other sectors covered by STIQ, there was a level of buying safety stock among vendors, sometimes simply to cover short term forecasts

“During the year we have also invested quite a bit in components to leverage the situation where components are still quite scarce. So we are getting to a very comfortable level of inventory.” [Blue Robot Company]

“What we saw was certain projects were impacted by longer lead times. At kind of the component level it remains a challenge even though some areas have improved. We've taken steps to address our own supply chain by increasing inventory levels and work in progress in our production... to kind of compensate for some of those challenges that remain in the market.” [Swisslog]

“We're maintaining our lead times. We have done a little bit of hedge buying of some of our components knowing that opportunities are going to be coming. But not everything. You just can't buy millions of dollars in inventory. It doesn't work with any business.” [Attabotics]

NOT BUILDING TO DEMAND/RENTAL MODEL

- Vendors working mainly on a RAAS/Rental basis experienced less disruption as these companies produced mainly to inventory with few, if any, bespoke components or designs

“We've had close to zero disruption. There was a slight increase in raw material costs, but this is where being part of a larger company can be a big advantage as we leveraged our purchasing strengths.” [6 River Systems]

“We're building to stock and we do that not just for the orders that we anticipate... and we have a really good look ahead with our accounts because of our land & expand strategy. We have very good visibility into how much business we're going to be booking.” [Locus Robotics]

“We definitely had some chip shortages and delays. But we had built up a pretty good inventory of robots. So we weren't building to demand. Had we been, that might have been a little bit more difficult for us.” [inVia Robotics]

OUTSOURCING MANUFACTURING?

- A few vendors have outsourced manufacturing and appeared to have been less impacted by supply chain issues when compared to other vendors, but this could also be related to the business model

“We use a contract manufacturer for our bots and they were very good with minimising any supply chain disruption impact. In fact we didn't have any.” [6 River Systems]

“We had next to no impact because of supply chain issues. Call it fortunate or lucky that we have blanket orders with our suppliers in advance, we understand our volumes, where they're going to be. So we place blanket orders well in advance and as a result really have had very, very few issues regarding supply chains.” [Locus Robotics]

- Some vendors are constantly evaluating outsourcing manufacture, but there are also advantages to keeping manufacturing in-house

“We constantly evaluate the advantages of outsourcing and potential benefits. But there's also an obvious advantage of doing it yourself when it comes to feeding back to R&D and having this close feedback loop. So there's pros and cons on that evaluation really.” [AutoStore]

“We did not want to be reliant on others to manufacture our product and so we have suite of manufacturing equipment, CNC, laser cutters, etc. We manufacture and assemble various components for our structure... quality is really critical for us. We make sure that anything leaving our factory is meeting our standards.” [Attabotics]

SIGNS OF IMPROVEMENT

- Interviews were largely positive re improvements to disruption, however, it was often not possible to forecast new disruption

“Our general impression that supply chain issues are improving. But we are still not where it was before Covid, it's still way off. But in comparison to 2022 it's improving.” [Rocket Solution]

“Steel material meaning tubes, shafts and other raw materials had a limited availability and we had a situation with prolonged delivery times to 3-4 months. Production capacity was not a problem. But in 2022 the delivery came back to 3 weeks and we had very nice growth.” [Damon Group]



SURGING DEMAND, SCHEDULING DISRUPTIONS LED TO CAPACITY CONSTRAINTS AND STAFFING ISSUES FOR G2P VENDORS. CONTINUED UPWARDS PRESSURES ON SALARIES

HUMAN RESOURCE/CAPACITY CONSTRAINTS

- Extensive delays in combination with record breaking order books throughout the sector added another disruption in human resources
- Attracting people, in particular experienced talent, was an issue for most companies

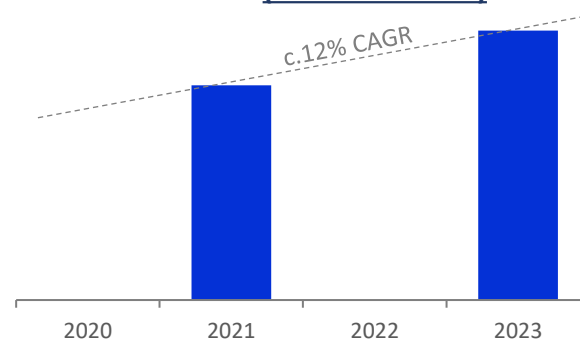
“I think the whole market is constrained by resource, finding people, engineers. And the challenge is that it is impacting delivery when some of the players are at capacity.” [Swisslog]

“Some projects go longer than expected... there is a finite number of resources and as people will not be able to be released from project #1 until finished, it's hard for them to start up on project #2... and we see that across the entire industry, whether it's controls and software type or mechanical and electrical installation resources.” [Bastian Solutions]

“The main challenge we are facing right now is to manufacture enough AMRs and hire enough people to do the deployments that people want us to do, rather than the other way around.” [Brightpick]

“Everybody struggled with finding enough staff for automation. Many vendors including Addverb saw big big growth and that was the same for many of the customers. So on all sides. This situation has improved slightly now.” [Addverb]

HOURLY SALARY MECHATRONICS ENGINEER (US) (EXAMPLE ONLY)



Source: STIQ interviews

UPWARDS PRESSURE ON REMUNERATION

- Inflation and demand is pushing up salaries for G2P vendors

““In the Netherlands many companies offer inflation and energy compensation to their employees.” [Vanderlande]

“We could source a mechatronics engineer that knew robotics and installation at \$47 an hour in 2021. This is now more like \$58-59 an hour in 2022-23. That's a sizable difference especially if you contracted a few years ago.” [Anonymous]

“Inflation is very high in Turkey. Just to give you an idea, salaries have increased 105% in one year. Employees get two raises per year.” [Anonymous]

INDUSTRY TALENT ALSO A CUSTOMER ISSUE

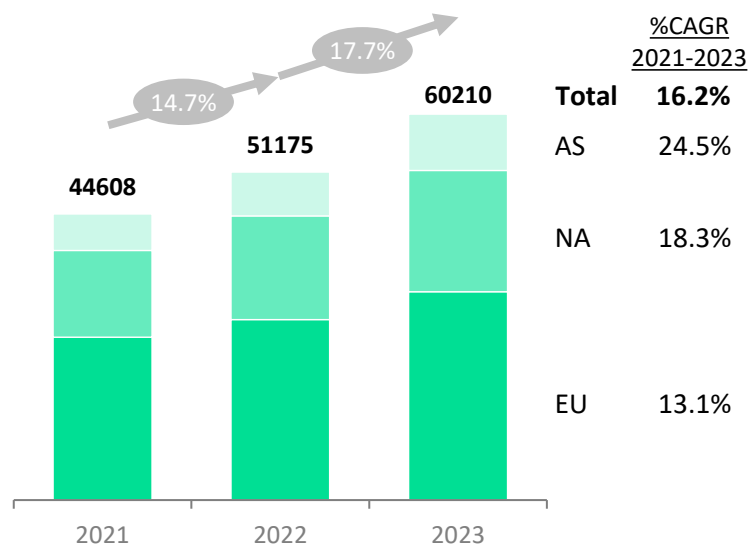
- Such resource constraints also impacted projects from the customers side as well

“Customer bandwidth can be an issue. Recently I heard of a project which was put on hold because the customer didn't have the bandwidth to implement the project. So there can be different reasons for delays.” [Addverb]



G2P SECTOR HEADCOUNT GROWTH ACCELERATED FURTHER IN 2022/23. DOUBLE DIGIT GLOBAL GROWTH IN EMPLOYMENT ACROSS NEARLY ALL SEGMENTS

G2P HEADCOUNT BY CONTINENT (#)



Source: STIQ Research & Analysis, LinkedIn. Note that LinkedIn changed access to their platform in China in 2H21 and numbers for Asia should be viewed in this context

HEADCOUNT BY CONTINENT

- STIQ has tracked headcount for companies covered in this report since 2018, collecting numbers annually in Jan/ Feb (representative for the previous 12 months)
- This has focused on European, North American and Asian companies to date

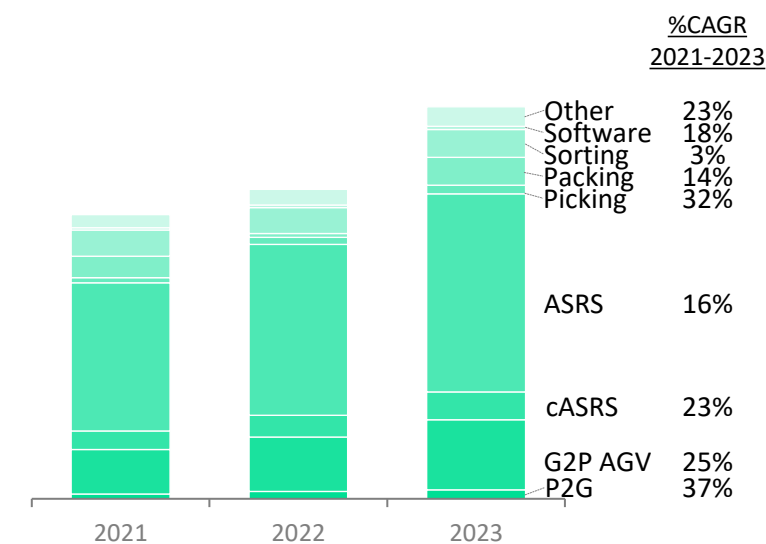
DRIVERS AND EUROPEAN CONCENTRATION

- Increased demand from eCommerce customers was the primary driver for growing staff numbers across companies in the sector
- Funding inflows also enabled an accelerated increase in FTEs among startups, at 2-3X the wider sector
- STIQs employment tracker indicated 14.7% growth in 2021-2022 with a further acceleration to 17.7% in 2022-2023
- Europe had the highest concentration of G2P related warehouse automation employment and represented 57% of industry employees in 2021, declining to 54% in 2023
- North American vendors increased employment by 18.3% CAGR 2021-2023 and represented 31% of sector employment, up from 30% in 2021
- Asian vendors experienced the fastest growth at 24.5% CAGR 2021-2023 but also represented the smallest share at 13% in 2021 and 15% in 2023

HEADCOUNT BY PRODUCT

- Note: Headcount by main product should only be used as an indicator of wider growth by product in the sector
- STIQ used the primary product from vendors to produce the top-right chart whilst many vendors produce multiple products
- More recently, as many of the startups (or recent entrants) have matured and raised larger funding rounds, they have also become very successful at attracting senior management staff from leading vendors

G2P HEADCOUNT BY MAIN PRODUCT (#)



Source: STIQ Research & Analysis, LinkedIn

Note: Main product used to segment vendors. Many vendors offer multiple products. Numbers to be used with caution

STRONG GROWTH CAUSING HR PROBLEMS

- Growth levels experienced in recent years and, in particular, during the pandemic were unprecedented and have caused issues with staff retention
- More competition for talent in the G2P sector is likely to continue with both customers and vendors hiring



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PLENTY OF CONFIDENCE FOR 2023 REVENUE, BASED ON ORDER BOOKS. STARTUP DNA INCLUDES BEING BULLISH, BUT WITH IMPORTANT PANDEMIC INFUSED MARKET TRACTION

OVERALL CONFIDENCE FOR REVENUE IN 2023

- There was significant optimism on 2023 revenue among the more established companies in the sector which also reflected record order intake in prior years

“Order books are probably at the highest level they've ever been in terms of things that are committed. So 2023 will be a good year whatever happens.” [Swisslog]

“In revenue terms, we are really confident for 2023.” [SAVOYE]

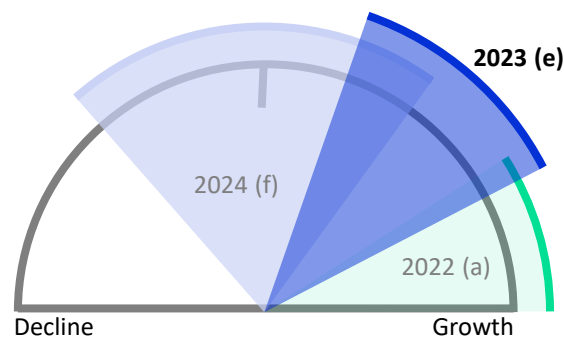
“We still firmly believe that 2023 will be a pretty strong year for order intake. But I really have no idea what 2024 will be like... and I think a lot of it has to do with how aggressive the Fed gets in the next several months.” [Bastian Solutions]

“We certainly are seeing growth again in 2023. Probably not at the same level as in 2022, but we'll certainly grow. I think this year will be overall positive to flat. But I don't see it declining yet. We keep asking our customers and everybody we touch what are you hearing, what are you seeing in? And there's a mixed bag right now.” [KPI Solutions]

- Some listed companies were unable to provide numbers but hinted at maintained volumes in 2023 compared to 2022

“The volumes we are seeing in January are the same volumes we saw in peak. We expect a good 2023 with customers placing repeat orders and high volume of requests from new customers.” [Berkshire Grey]

G2P SECTOR, 2023 GROWTH CONFIDENCE INDICATOR (BASED ON RESPONSES IN JAN/FEB 2023)



Source: STIQ Research & Analysis.

Key: f=forecast, e=estimated, a=actual

STARTUPS BULLISH FOR 2023

- Whilst startups are bullish in their DNA, they mirrored prospects for 2023 by the more established businesses
- This could also reflect the relative growth prospects for many of these companies at >50-100%+ per year due to their current size

“We're projecting 100% growth in 2024 and 2025...and we believe those are conservative numbers.” [Tompkins Robotics]

“At the moment the requests are very good and we are getting more requests for our solution. We think 2023 will be good.” [Storjet]

“Growth is expected well into 2023 and beyond.

Companies that saw G2P as exotic a few years back are now adopting along with other automation solutions like P2G, sortation and intralogistics. We are starting to go mainstream as these technologies are critical to enable retailers to grow.” [GreyOrange]

“We believe that in 2023 we will see some really good growth. We are seeing a lot of potentials coming in now after we rolled out our two first deployments. So we see a lot of interest now and also the component situation is at least easing a little bit.” [Blue Robot Company]

- Some of the more recent entrants experienced moves into a new tranche of larger project sizes

“We are looking very positively at 2023. So we definitely want to be very successful in order intake and have a good mix between small and big projects. We are also getting requests for projects now in the area of €15-20 million. This is big. A small project would perhaps be \$500,000 €3m.” [Geek+]

- Recent system integrator entrants were also very positive on growth potential in 2023

“Our pipeline is being signed right now... I can put on a happy face because this quarter and next quarter are really the one... you know in robotics how it is, for a few quarters, you don't sell at all, but then a few quarters things just explode. It can be uneven. Sales cycles are long, and we are seeing success now. Obviously when you start, its mainly 1's and 2's but now it's through the roof and we are very confident.” [Barcodes Inc]



CUSTOMERS TAKING LONGER TO MAKE DECISIONS, POTENTIALLY TO IMPROVE ACCURACY OF FORECASTS

SLOWER DECISION MAKING PROCESSES

- Interviews suggested customers had slowed down their decision making journeys due to market uncertainties

“The journey until the decision is made is sometimes postponed because companies are to a certain degree uncertain about the investments and the future adjustments that may be needed. We’ve seen through the pandemic, that business models can change from one day to the other. So there is some caution.” [SSI Schaefer]

- This appeared to be partially based on gaining additional visibility of what is happening in the wider economy

“We see some behaviour changing in 2023. Customers are delaying purchase decisions further into the year as they’re trying to get more accurate numbers.”[6 River Systems]

- Interviews emphasised overall demand remained high and that any perceived slowdown was primarily related to slower decision making

“We’re seeing some slowdown... but I wouldn’t call it an intense slowdown. Orders have been kind of where we predicted they would be. So we were pretty much in line with where we thought we’d be. I feel like the markets are trying to do their best to slow everything down, but I just don’t see it coming to a screeching halt.” [Bastian Solutions]

“We do see a little bit of a slowdown being honest. But this is a slowdown in the sales cycle. Companies are being more careful. They are not saying oh, well, there’s an economic downturn we’ll just wait to automate. It’s not what we’re hearing from the market and from other partners. The slowdown is in the decision making process, not in terms of the demand. Demand is still there and we think it will increase.” [SVT Robotics]

“Amazon’s cancellations mixed with economic uncertainty and some of the geopolitical factors.. It didn’t kill business, but it definitely gave folks a pause. And you saw a lot of people take a little bit longer before signing up. Previously you’d send a proposal and they’d give you a contract within a month.” [Hai Robotics]

MORE CAREFUL INVESTMENT DECISIONS

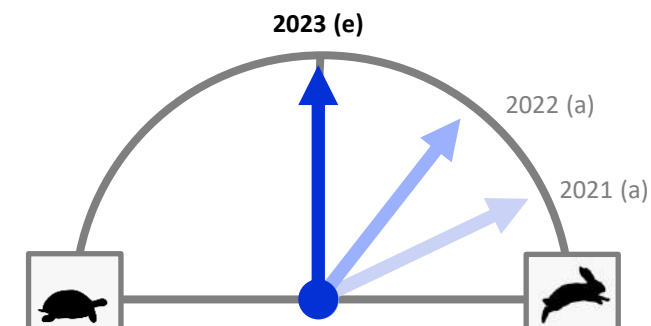
- Interviews suggested there may be more hurdles for Capex approvals, but investments continued

“It’s a little bit harder to get capital approved than what it probably was maybe a couple of years ago. But we’re still seeing companies making significant investments in automation to further their business.” [Bastian Solutions]

EXPECTATION OF SHORTER LEAD TIMES?

- Customers always wanted projects to be realised very fast, but there appeared to be a new sense of urgency to capitalise on current conditions

CUSTOMER DECISION MAKING HAS SLOWED DOWN



Source: STIQ Research & Analysis. Illustrative only

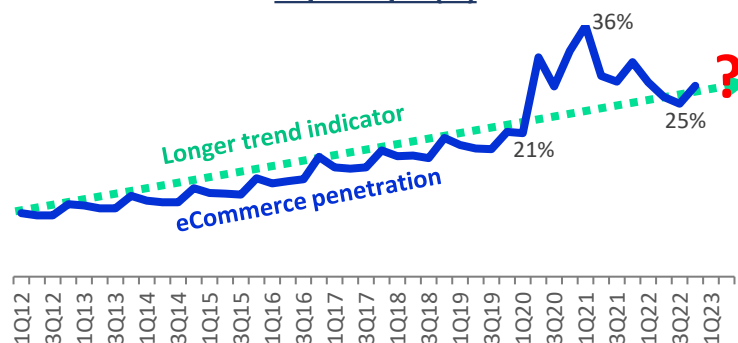
- This could potentially add more pressure on system integrators to improve deployment speeds

“We are in an interesting situation right now. Once you make the investment decision, you want it really quick. But lead times have been prolonged for nearly everything. This has really intensified because once the decision was made, they want to benefit as soon as possible... There are technologies with shorter lead times from an order to ramp up. This urge to look for scalable and fast ramp up semi automated and fully automated solutions really intensified and that is something what we of course need to answer as well out of our perspective.” [SSI Schaefer]



POST-PANDEMIC ECOMMERCE SALES DECLINE, GEOPOLITICAL VOLATILITY, HIGHER INFLATION AND INTEREST RATES HAS INFUSED A LEVEL OF UNCERTAINTY

UK QUARTERLY ECOMMERCE SHARE OF ALL RETAIL, 1Q07-4Q22 (%)



Source: ONS, "Internet sales as a percentage of total retail sales (ratio) (%)" ([link](#))

ECOMMERCE PENETRATION

- According to the UK ONS (Office of National Statistics), the eCommerce share of all retail peaked at 21% just prior to pandemic lockdowns in 1Q20
- This increased to 36% in 1Q21 but fell back to 25% in 3Q22 only to bounce back to 27% in 4Q22
- Whilst the longer term growth trend appeared relatively clear, interviews suggested merchants were concerned about short term potential for some kind of correction in 2023

"The growth in the e-com journey is not finished. Maybe it will not grow that fast anymore in a VUCA world. But there is certainly growth potential also going forward. Perhaps there will be a bit of hesitancy now. But I see this as a temporary situation and believe it's going to continue growing." [SSI Schaefer]

"Traditional business like parcel and distribution will continue to grow. Maybe at a reduced pace compared to before. But we see that projects are in the pipeline for our customers and these include eCommerce. Growth will restart but perhaps we have to wait till Q3 before seeing an idea of what customers will do. This year maybe will be a bit quiet for eCommerce." [Fives]

- There appeared to be some expectation of a crunch due to extensive media coverage of a potential recession that had not yet materialised

"People are waiting for a crunch but they just don't know when it's coming and that is affecting buying behaviour. Usually you see a strong uptick in Q1-Q2 because what people do the second-half of the year is to be ready with their board approvals. And then the board approval in December says, ok, let's reserve the money for next year and then they invest in the first half. That's usually the cycle that we've been seeing. Right now there's less activity than previous years." [Anonymous]

"There's lots of opportunities right now. But, customers are just coming out of peak season and going into January with everything that is going on and are wondering what things are going to look like." [Attabotics]

- Some speculated 2023 may follow the ketchup bottle principle, similar to 2021

"2H23 may happen as it happened in 2021 in June or July and everybody got crazy..." [Damon Group]

2023, NOW WITH ADDED VOLATILITY

- Interview responses suggested an increasing level of volatility in customer behaviour

"We have seen some customers decide that they don't want to do projects. On the other hand, we've seen other customers want to do even larger projects." [KPI Solutions]

"Our pipe right now is at a record high and it's filling up. An interesting dynamic, more than ever perhaps, we've seen that we have higher order intake some months but then also lower order intake months. It's definitely not consistent month to month. But I don't know if that has anything to do with anything or what it might mean. It could just be timing. If I could figure out a way to control customer spend and do it when I want them to spend I'd obviously be a hero..." [Bastian Solutions]

"There is a bit volatile situation right now. Some customers are postponing but others are doing well and keep investing. There continues to be quite a significant number of G2P orders and we still have high interest for G2P systems .. and also for automated case picking systems." [Vanderlande]

- And, customers that postponed projects occasionally returned with larger projects

"A little problem was Covid. Many companies started planning new systems but then they stopped planning because they said, yeah, ok, there's not enough money anymore or they say we have so much money we just grow and need a bigger warehouse. So we don't make a solution with 300sqm, we now need a solution with 1,200 sqm." [Storobjet]



THE SHORT TERM MAY BE A BIT CHOPPY. INTEREST RATES LIKELY TO REMAIN AT AN ELEVATED LEVEL AND STARTUPS MAY FACE ISSUES WITH FUNDRAISING

WHAT IN STORE FOR 2024?

- During interviews for this report, STIQs impression was that any negative market developments would potentially be delayed to 2024

“This industry lags behind the general market in terms of major global events, recessions, these sort of things. The impact is generally 12-18 months beyond the initial kind of shock. Projects that have already been signed off continue and people who've got money to spend, they want to spend it. It's the very early stage projects that kind of maybe get put back a little.” [Swisslog]

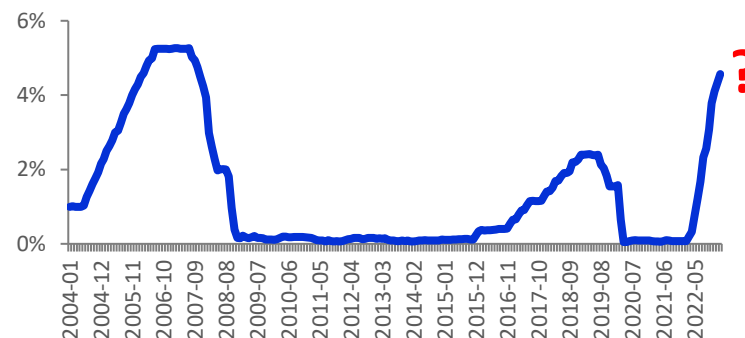
- Naturally, there was a lack of visibility on 2024 and views diverged a bit more

“We are in line with the orders, but now there is a lack of visibility on 2H23. And of course there is no visibility of 2024 at all. But from the contact we get from customers, we forecast the same 20% increase in comparison with 2022 in our budget for 2023. And I'm confident that we can achieve it based on our pipe at this moment.” [Damon Group]

“We think it's going to be a tough market in 2023 but I also think everybody's going to survive 2023. The question is what's going to happen in 2024.” [Nomagic]

“I don't think that 2024 is going to decline. I think we will move even faster. We want to keep the quality high, so we make sure that we don't kind of overload ourselves as well. But our objective is to grow in high double digits CAGR.” [Exotec]

US MONTHLY INTEREST RATES,
JAN 2004-FEB 2023 (%)



Source: US Federal Reserve, Federal Funds Effective Rate ([link](#))

CONCERNS FOR HIGHER INTEREST RATES

- US respondents in particular, were concerned about the Fed potentially pushing interest rates higher

“The reality of the macro environment we are currently in is driving a few delays. I heard someone postponed a complete warehouse for 3 years. They had already placed the order with one of the larger integrators. And they pushed that to 2025 instead of starting in 2022. The client had a whole team of people they let go as well.” [Anonymous]

“I think 2022 was challenging for everybody. I think 2023 is going to be good as long as we don't see further degradation in interest rates, etc.. 2023 is going to be a very positive year for the industry in general.” [Attabotics]

“The first two quarters might be a little rocky. People are still going to be a bit hesitant. And I think 2H23 starts to look better because e-commerce is going to keep growing... It'll just be a question of at what pace.” [inVia Robotics]

“The only way I can conclude right now is neither the Fed nor the bankers nor me... I don't think we understand the post Covid economy very well to be honest.” [Berkshire Grey]

FUNDRAISING MAY BE DIFFICULT

- Increased interest rates also had a chilling effect on risk capital inflows in the G2P sector

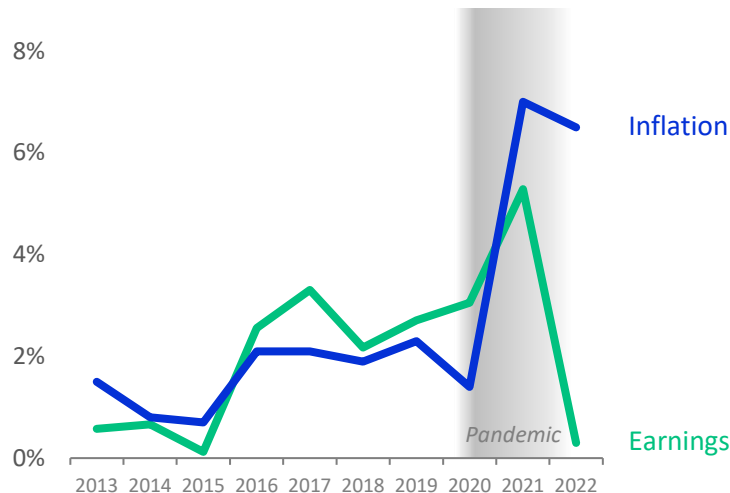
“We raised just before Russia triggered the war in Ukraine, so as we started to see bad things happening and interest rates rising, we still had some chance to adjust our burn rate over the next few years and extend our runway. Others may not have this luxury especially if they did not raise recently.” [Nomagic]

“Another major change in 2022 vs. 2021 for the robotics industry is it is incredibly hard now for any business, particularly robotics businesses without scale to raise capital... really hard. We were fortunate to be able to get a big round done... The net of this is there's going to be a lot of consolidation, we think, in the industry over the next several years. Because a lot of these companies cannot get funding. And that's a big change over the last several years.” [Locus Robotics]



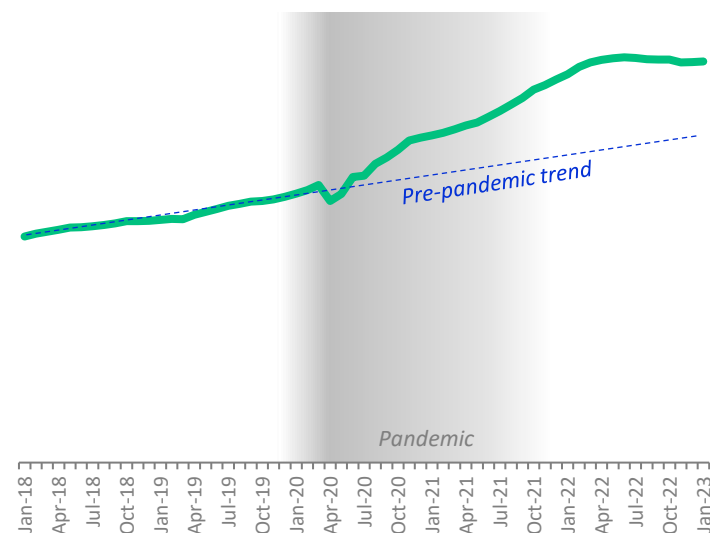
SALARY/EARNINGS GROWTH BACK TO <1%. CONTINUED INFLATION PRESSURES. RECORD WAREHOUSE OCCUPANCY LEVELS. FREIGHT COSTS BACK TO PRE PANDEMIC LEVELS

**US AVERAGE HOURLY EARNINGS GROWTH¹
VS INFLATION, 2013-2022 (%)**



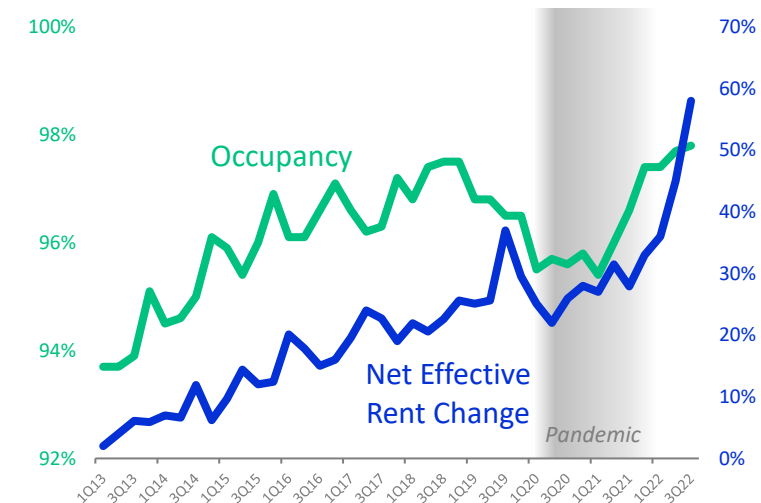
Source: US Bureau of labour Statistics (* Warehousing & Storage, NAICS 493, [source](#)), [usinflationcalculator.com](#) ([link](#))

**US WAREHOUSING AND STORAGE EMPLOYMENT
JAN 2018 - FEB 2023 (#000's)**



Source: US Bureau of Labour Statistics ([link](#))

**PROLOGIS OCCUPANCY RATE & NET EFFECTIVE
RENT CHANGE, 1Q13-3Q22 (%)**



Source: Prologis Inc accounts. End of quarter figures. 2022 figures estimated

ECONOMIC INDICATORS ALSO DISRUPTED

- The pandemic caused huge disruption in supply chains that continued to affect component supply, shipping, pricing, etc.
- However, the overall impression from interviews was that supply chain issues were improving
- However, such improvements appeared to be due to stagnated (albeit very high) demand as merchants and other automation customers seek to understand the many fluctuating economic indicators

INDICATORS MOVING DIFFERENT DIRECTIONS

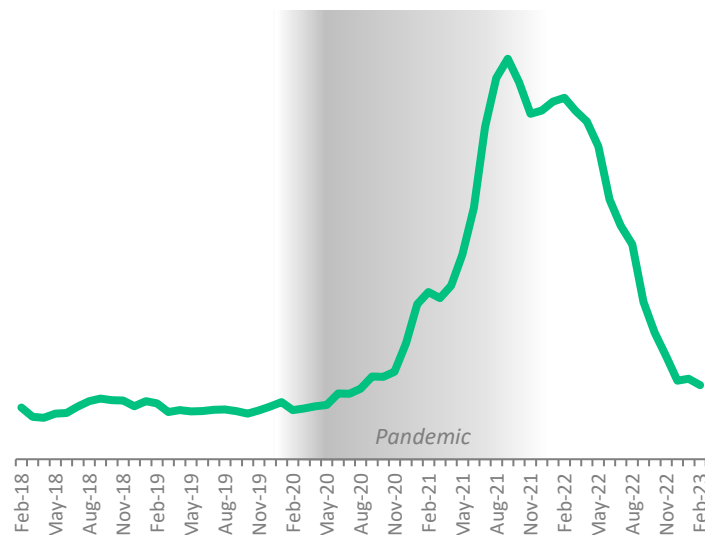
- There is likely to be some turbulence in the markets as economies return to a new post-pandemic normal
- Navigating such volatility will not be an enviable task
- Earnings growth for warehouse employees in the US has dropped to levels not seen since 2015 whilst inflation remained at high levels
- Sector employment in the US remained at pandemic levels, despite a slowdown in new recruitment

- Warehouse occupancy levels dropped slightly pre-pandemic but returned to record levels in 3Q22 alongside effective rent increases



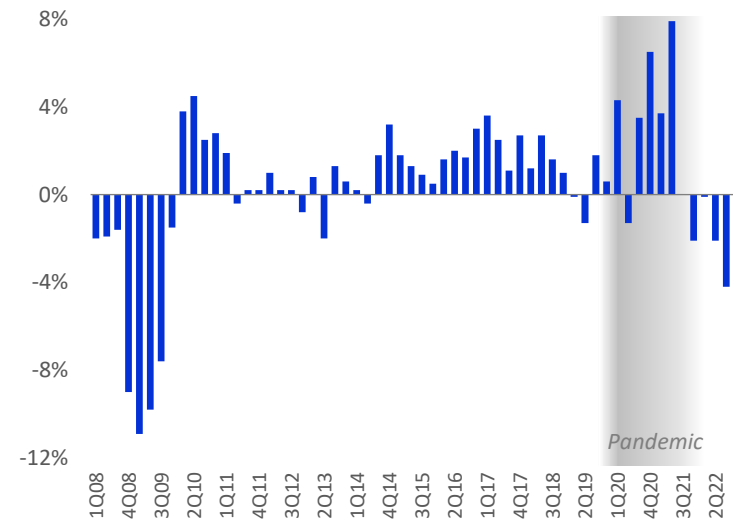
ECONOMIC INDICATORS POINT IN ALL KINDS OF DIRECTIONS. PLENTY OF CRYSTAL BALLS ON MAINTENANCE AS FORECASTING HAS BECOME ANYONE'S GUESS

GLOBAL CONTAINER FREIGHT RATE INDEX, FEB 2018 - FEB 2023 (\$)



Source: Freightos ([link](#))

US ACTUAL BOX SHIPMENT QUARTERLY % CHANGE



Source: FBA, KeyBanc Capital Markets Inc., from Freightwaves - [link](#)

THE CHANGING NATURE OF FINANCIAL FORECASTING



Image source: Screenshot from FT.com, 16 Feb 2023 ([link](#))

LEADERS UP TO THE TEST?

- The lack of a clear immediate and medium term future may be a test for even the best and longest serving executives in the sector
- This is especially true for public companies that produce guidance on future revenue

"We always debate whether it was better before. I used to always argue it is better now. This time we tended to agree it was better before," he said. "The risks, the uncertainty, everything that used to be in a 'risk matrix file' is more or less happening . . . We laugh about the time when we were doing one-year budgets, and how we would be right or wrong by 0.3 per cent." [FT.com, 16 Feb, 2023 [source](#)]

- Container freight appeared to have settled at a "manageable" cost that represented c.50% above 2019 levels (c.\$2100 in Jan/Feb 2023 vs c.\$1360 monthly average in 2019)
- Some media outlets reported freight rates had returned to pre-pandemic levels ([source](#))
- However, indicators have to be contextualised to be understood and actioned

- For example, quarterly cardboard demand declined in 4Q22 at -8.4%, a level not experienced since the recession in 2009
- However, whilst there was a decline, inventories also remained at relatively high historical levels ([source](#))

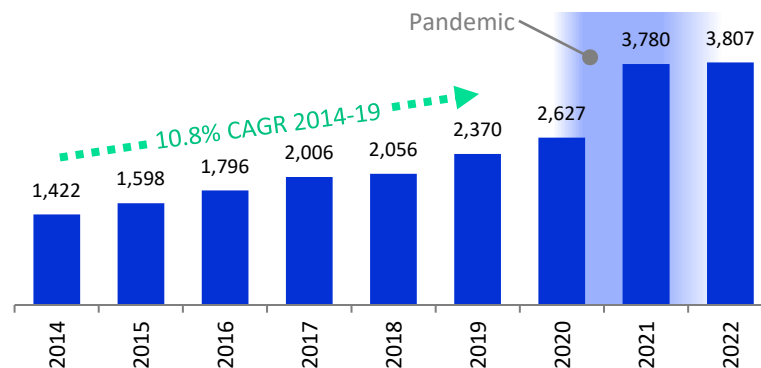
PREPARING FOR A VUCA WORLD?

- VUCA is short for Volatility, Uncertainty, Complexity and Ambiguity
- Here's a few notes from Harvard Business Review on how to approach a VUCA world for executives ([source](#))



DESPITE SHORT TERM POTENTIAL FOR CHAOS, THE MEDIUM TO LONG TERM OUTLOOK FOR WAREHOUSE AUTOMATION REMAINS UNCHANGED WITH 8-12% ANNUAL GROWTH

KION, REVENUE SUPPLY CHAIN SOLUTIONS SEGMENT, 2014*-2022 (\$M)



Source: KION. Data for "Supply Chain Solutions" segment

* Note: Estimated CAGR due to FY date correction after KION's acquisition in 2016. Using original 2013-2019 numbers = 8.9% CAGR

SHORT TERM VOLATILITY TO BE EXPECTED

- However, short term volatility could be expected after two years of unprecedented and record growth in 2021 and 2022

"This sector is really used to years and years of boom, so it's not like everybody is expecting the end of the world. I think we can be confident that growth will return. The only question is how long it will take. There is still some uncertainty in the markets." [Conductix-Wampfler]

"Looking forward to 2024 orders placed in 2023. I think it might be a bit more challenging market in 2024... but that's also from a very high peak." [Swisslog]

"Shopping habits have changed as the pandemic has started to ebb. There may be a softening of demand but that's by no means a big decline." [Addverb]

"2022 was not the same pace as in 2021 and let's say we are now very curious to see what happens in 2023." [Fives]

POSITIVE MEDIUM TO LONG TERM OUTLOOK

- Underlying demand drivers for automation in warehouses remained

"We expect sector growth to continue because there's still the scarcity of labour and space. Prologis just reported warehouse rents increased by 30%. The market will stabilize or be flat in 2022-2023. After that we expect growth of around 8% per year based on our own internal forecasting model." [Vanderlande]

- Some interviews suggested there may be more demand than the sector can manage

"If you look at data over not just the past few years, but you go back 8-10 years... what I see is a continuing increase in the robotics market YoY. And we believe that the industry's ability to execute and deploy and integrate all that technology is actually the limiting factor. You're not seeing the limit in demand. Sales timelines and those things will shift but it's going to continue to increase. I don't believe we will see a sudden downturn in the demand for automation. Maybe it will level off a little bit." [SVT Robotics]

- Historical evidence combined with remaining market drivers pointed to a positive longer term future in the wider warehouse automation sector

"We remain very bullish going forward. If you look at the penetration of automation in the c.140,000 brownfield buildings out there today, it's way less than 5%, way less. If it was 80% we would look at the market differently. But it's such a nascent market, so much new business out there. Folks have to automate despite all the negative things are happening in the economy because it's a very under-penetrated market right now and you know over the next several years... based on all the math, everything we're seeing in our funnel, that 2-3% penetration, whatever it happens to be will be significantly greater. So we're not impacted a lot by all the negative things in place and all the other things are happening in the marketplace." [Locus Robotics]

- Interviews hinted at a high degree of confidence in the longer term health of the warehouse automation market

"We stay on our longer term business goals. The market is going to recover and we see some really nice projects in the pipeline. We are also winning nice projects so this I can say with a smile on my face. I think we will stay on our growth path and probably we have to reshuffle it a little bit with some minor changes because project structures are changing... and also the lead times you can do now is also not the same which was possible before the pandemic because global supply chains have changed dramatically, so this also affected the timeline of our projects. But these are minor changes. So we keep on going. We keep on pushing in the market." [Hoermann Intralogistics]



MARKET VOLATILITY COULD INCREASE THE EMPHASIS ON RISK MANAGEMENT BY G2P VENDORS

THE ART OF RISK MANAGEMENT

- Interviews suggested risk management may become a more valued management tool in volatile times

“Solution business is a high risk business and to earn money with the risk more or less under control... or let's say if you can do this business with the lowest possible risk, then you are really good. You must understand when your sales managers just focus on order intake or revenue, this is mistake #1. To make order intake or revenue, this can be done by anybody.” [Hoermann Intralogistics]

- Price and lead time volatility added an additional level of risk management to contracting processes

“From a sales perspective, supply chain issues has made it very challenging to contract. Because you go into a contract with the best knowledge that you have, but the situation is still volatile... although the volatility has decreased compared to 12 months ago. But we are still seeing long lead times on manufacturing of automation which drives overall project durations to be longer.” [Bastian Solutions]



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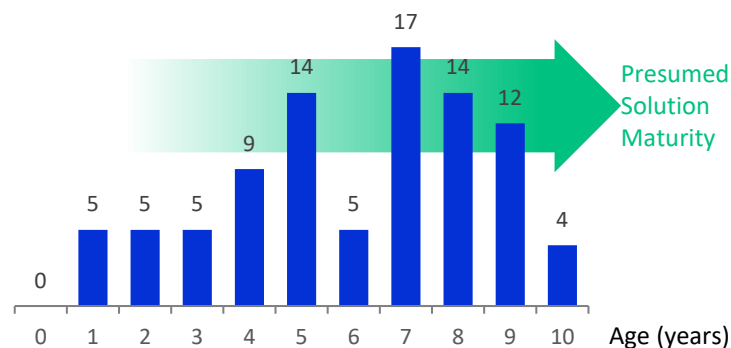
Human | Robot | Possibilities

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INCREASED MARKET ACCEPTANCE OF MORE RECENT G2P TECHNOLOGIES. SOME STARTUPS MATURING INTO CONTENDERS

SECTOR STARTUPS IN THE LAST DECADE BY AGE



Source: STIQ Research & Analysis.

Note: Age of company implies maturity, however, individual conditions apply to each company and product. Year 6 possibly an anomaly

PLENTY OF MATURING STARTUPS

- In 2023 there were 90 companies that could be considered 'startups' aged up to 10 years in the G2P Solutions sector
- A growing number of these companies had experienced significant traction and there appeared to be a more widespread awareness of these solutions
- A key market driver for this has been an increased demand for flexible automation, often a key selling point of many new vendors

"The majority of G2P customers are still first time buyers. But with the bin to person, people already know some of the vendors and it has become much more accepted... it's not such a novel thing anymore." [Anonymous]

"I think a general trend is the move towards more flexible automation which can scale up and down. Especially in retail and e-com environments. So that's why you see more robotics AGVs, etc. That's a common trend, which is now supported by the fact that ok, there's a potential economic downturn, so let's kind of limit the investments and look for more flexible automation where the initial investment is lower and where we can scale up when needed." [Consafe Logistics]

"From the number of projects we have seen in G2P, I think we can say... from a market perspective, it was quite good. But I also heard that there are now less requests for traditional G2P systems like shuttles. So maybe the big system integrators see fewer RFP's for G2P systems, because the projects are smaller than before." [Geek+]

G2P, A MATURING TECHNOLOGY

- Historically, most technologies have found a market niche and so, it seems, have more recent technologies

"This is also something we noticed when we started with the shuttle and the AMR business. In the beginning it was half an expectation oh, here comes something new, which is going to replace everything else on the market. But most of the time it was not true because it created an a new niche. ASRS has for years been a very stable market in different regions. And now the AMRs have come along with G2P solutions... Each technology has found a certain niche and a best use case, and there are still plenty of use cases where you use a different technology." [Conductix-Wampfler]

GROWING INTEREST IN MIXING G2P

- STIQs conversations with retailers, 3PLs and vendors indicated an increased level of interest in more recent G2P technologies which also included an increased interest in mixing various technologies

"We're seeing a lot of requests to mix different types of automation together. Customers are more used to G2P system and they're like, well what else is out there? A G2P system doesn't solve every issue that I've got so what other technologies can I blend in?" [KPI Solutions]

"We also see more and more that customers request to integrate AMR in total solutions for shipping sortation or internal transport." [Vanderlande]

WMS PLAYERS ALSO INCREASINGLY ACTIVE

- Increased traction for G2P solutions had also elicited an increased interest from WMS players, often a central component in any warehouse automation project

"Over the past year we've seen WMS companies both tier 1+2 vendors coming to us and saying yes, we want to be part of your platform. We want you to be part of our strategy for being able to integrate to lots of different technologies. This is partly the product maturing and partly I think there's also an element of understanding that comes from seeing a live demo." [SVT Robotics]



A CONTINUED STREAM OF STARTUPS ENTERING THE SECTOR, SOME SPURRED ON BY PANDEMIC INFUSED INTEREST IN WAREHOUSE AUTOMATION

YOUNGER STARTUPS WITH EARLY TRACTION

- Younger vendors gained important early traction

“2022 was a maturing year. Now we have support, tooling, the support structure, etc. in place. We’re now at the point where we’re starting rolling out more and more.” [Blue Robot Company]

“Last year was more of establishing our system in the Indian market. This year, we are scaling up deployments in India and entering the overseas markets. We have several new sites getting finalised for automation with our existing customers. For overseas markets, we are forming partnerships with partners/ system integrators in the US, UK, EU and several other markets.” [Unbox Robotics]

VARIOUS ORIGINATION BACKGROUNDS

- There were a variety of backgrounds for startups to enter the warehouse automation sector

“One of the companies in the group make machines. Intellistore was founded in 2022. From there we sold the first machine and that's what we currently installing. The first project started as a drawing and the customer was very interested and said, well, let's go for it. We're bringing this system operational now and it looks good. We have had it here in our factory for a year.” [Intellistore]

“We come from a 3D machine vision background and bin picking has always been part of our core product set. We developed AI based picking 4-5 years ago and this really broadened applications from industrials to logistics... in particular piece picking for order fulfilment. But we don't want to be a component provider, we want to be a solution provider. So we took the picking technology and developed our own mobile robotics platform and combined them into a solution.” [Brightpick]

- The pandemic proved an accelerant for R&D activity
- “Traditionally in the hanging garment industry, everything is done completely manual. So that created a lot of demand when labour was not available during the pandemic. That pushed us to do develop our new robot picker for picking individual SKUs. At the moment we are in the final R&D stage and we just sold our first system which is going to be deployed in Spain in this year in 2023.” [Planiform]

MATURING A SOLUTION CAN TAKE TIME

- Productizing a solution can be an exhaustive process

“Moving from R&D to productization is a very exhausting process. This is probably where many companies have dropped out from the market.” [TARQAN]

- Even incumbents need to go through the various stages with new products

“For our robot sorters, I can tell you that in 2020-2021 we passed from promotional stage of the AMR technology... and we have seen that customers are now passing from the test stage... proof of concept to proper application of this technology as proven to their systems.” [Fives]

- Partnering with system integrators can often be the ultimate prize, but getting there can take time

“Our strategy is to go step by step and reach out to system integrators a bit later. First we need more customers to create an installed base and then we see also a good business model working with integrators.” [Intellistore]

- Part of productizing a new product is also to chose the right go to market model and being flexible with how you do go to market

“Originally our product was the brain. Now we also buy the robot arm, we develop the end effector and we also manufacture the shelving, the conveyance, any of the mechatronics that need to go in and around systems to make it work, the lifts, etc. This is not our long term goal. We want to allow partners to make money from our brain.” [Anonymous]

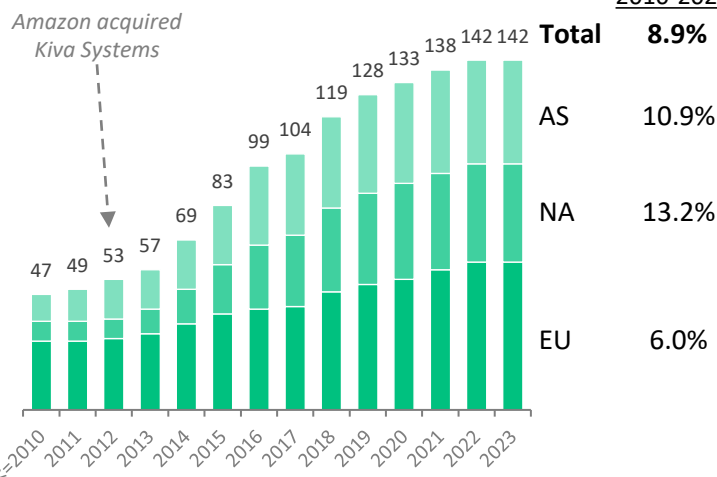


CONTINUED STARTUP ACTIVITY IN THE PAST FIVE YEARS. FUNDING INFLOWS ROCKETED DURING THE PANDEMIC BUT MONEY TAPS MAY HAVE TIGHTENED

G2P STARTUP ACTIVITY BY CONTINENT, 2010-2023

(#, AGGREGATED)

%CAGR
2010-2023



Source: STIQ Research & Analysis. Company foundation year
Note: A vendor may have added G2P solutions post company foundation year

- STIQ attributed the primary driver for the increased activity 2013-20 to Amazon’s outside influence on the sector following their 2012 acquisition of Kiva Systems
- However, Amazon’s influence appeared to have primarily affected Asia and North America where vendor numbers increased by 21.1% and 25.8%, compared to Europe at 11.5% CAGR 2013-2020

G2P STARTUP ACTIVITY BY CONTINENT

- Asian G2P Solution vendors increased by 3.8X between 2010-2021, North American by 5.0X and European by 2.1X
- The lack of growth of European vendors could be related to its relative dominance in the sector up to 2010 when Europe represented 60% of all sector vendors; This declined to c.42% in 2023
- Furthermore, European entrants have traditionally lacked the funding flows available to hardware-related startups in North America and Asia

SECTOR MATURITY & BARRIERS TO ENTRY

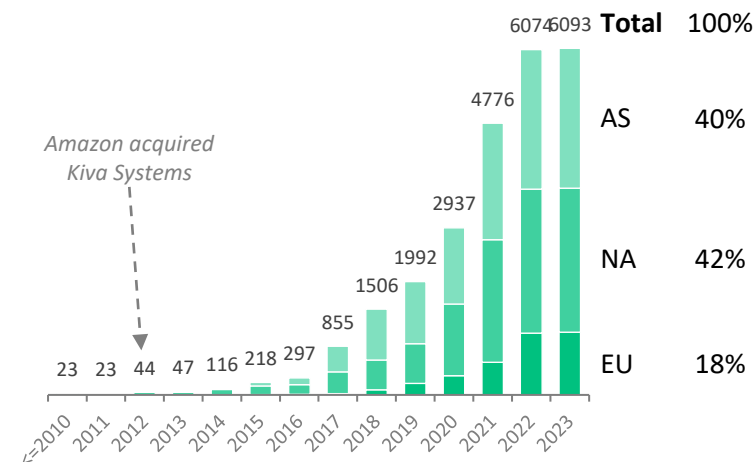
- New vendors in the sector slowed down somewhat during the pandemic, however, STIQ expects more new startups and those in stealth to emerge
- There also appeared to be an increased willingness among established/legacy vendors to innovate and bring out new solutions, which would not affect these statistics
- Some level of startup stagnation could be expected as barriers to scaling a new business were rising

STIQ WAREHOUSE AUTOMATION COVERAGE

- STIQ has covered the warehouse automation/ material handling sector actively since 2018 and track 1,000’s of vendors in the space
- About 140-150 of these were relevant to this report
- The bulk of startup activity occurred between 2013 and 2020, with a slowdown at the onset of the pandemic
- This slowing down may be temporary as there has been renewed interest in warehouse automation following the pandemic

G2P FUNDING ACTIVITY BY CONTINENT, 2010-2023

(\$M, AGGREGATED)



Source: STIQ Research & Analysis, Crunchbase
Note: “Related” companies only (STIQ definition/segmentation applies), may differ from previous G2P reports from STIQ. Publicly known funding only

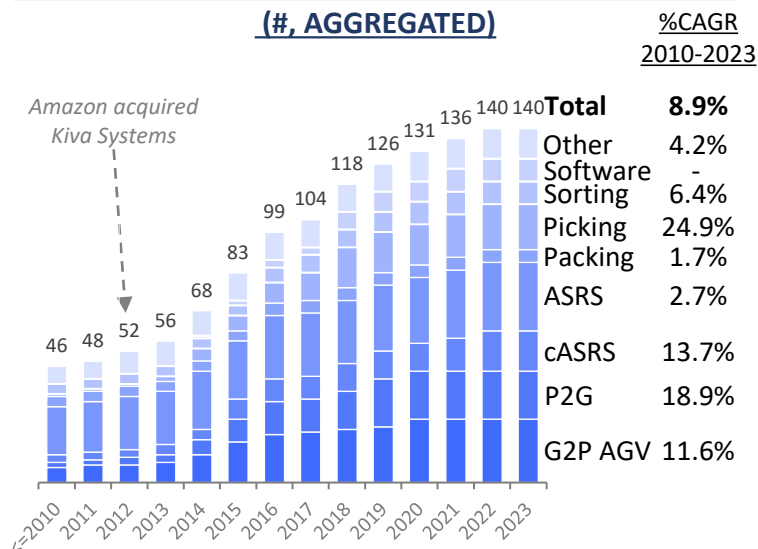
FUNDING COMES TO A HALT?

- VC funding came to a halt in 2Q22 and was likely to affect venture capital inflows in 2023
- Note that this report is published in March every year and based on limited data to end of Jan/Feb and a like-for-like comparison can be misleading, especially as the segmentation has transformed
- However, funding for 2023 was \$19m compared to \$335m in 2022, \$150m in 2021 and \$322m in 2020



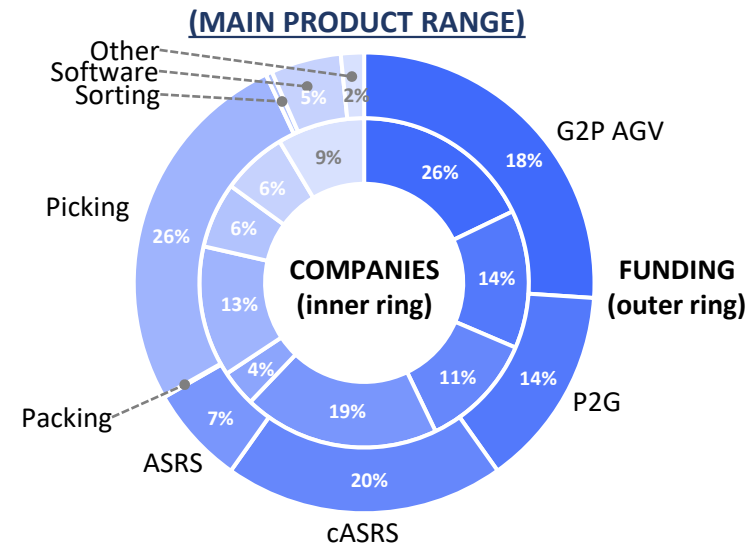
GROWTH AND FUNDING BY PRODUCT SEGMENT: PICKING ROBOTICS COMPANIES ATTRACTED AN DISPROPORTIONATE LEVEL OF FUNDING

G2P STARTUP ACTIVITY BY MAIN PRODUCT, 2010-2022



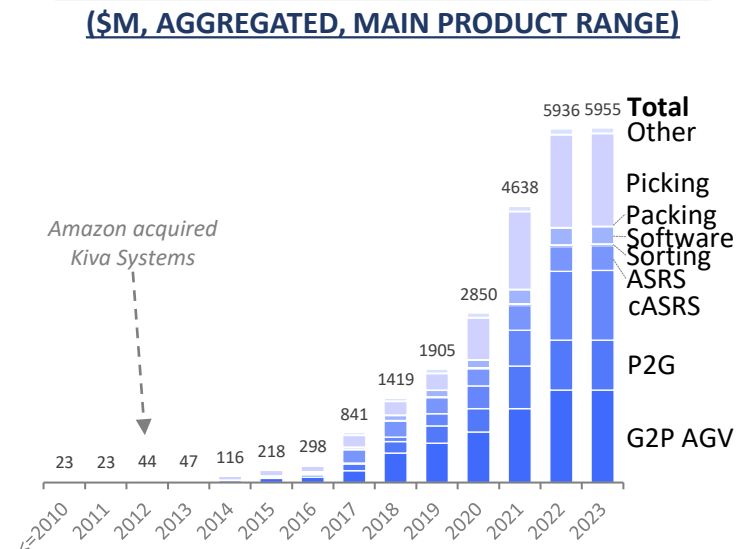
Source: STIQ Research & Analysis. Company foundation year. Focus on main product, may differ from total # companies if a single company has 2 or more products

G2P COMPANIES & FUNDING BY PRODUCT TO 2023



Source: STIQ Research & Analysis. Company foundation year, main product range. Chart indicates as a share of all companies, all known funding. Rounded numbers used for simplicity

G2P FUNDING ACTIVITY BY PRODUCT, 2010-2023



Source: STIQ Research & Analysis. Funding by primary product. Will differ from data by founding year

STARTUP ACTIVITY BY TYPE OF PRODUCT

- The data on this page focuses on the main product and may be different to other charts
- ASRS and Packing segments were considered mature segments recording the lowest new vendor growth
- Picking Robotics vendors evolved in the 2010's and grew by 24.9% CAGR 2010-2023 compared to other new segments such as P2G at 18.9%, cASRS at 13.7% and G2P AGV at 11.6%

SHARE OF VENDORS VS SHARE OF FUNDING

- By share of companies in the sector and by share of all public funding, Picking robot companies have been the primary benefactors and represented 13% of companies and 26% of all funds raised¹
- This was followed by cASRS vendors which accounted for 11% of vendors, but 20% of funds raised

FUNDING ACTIVITY BY TYPE OF PRODUCT

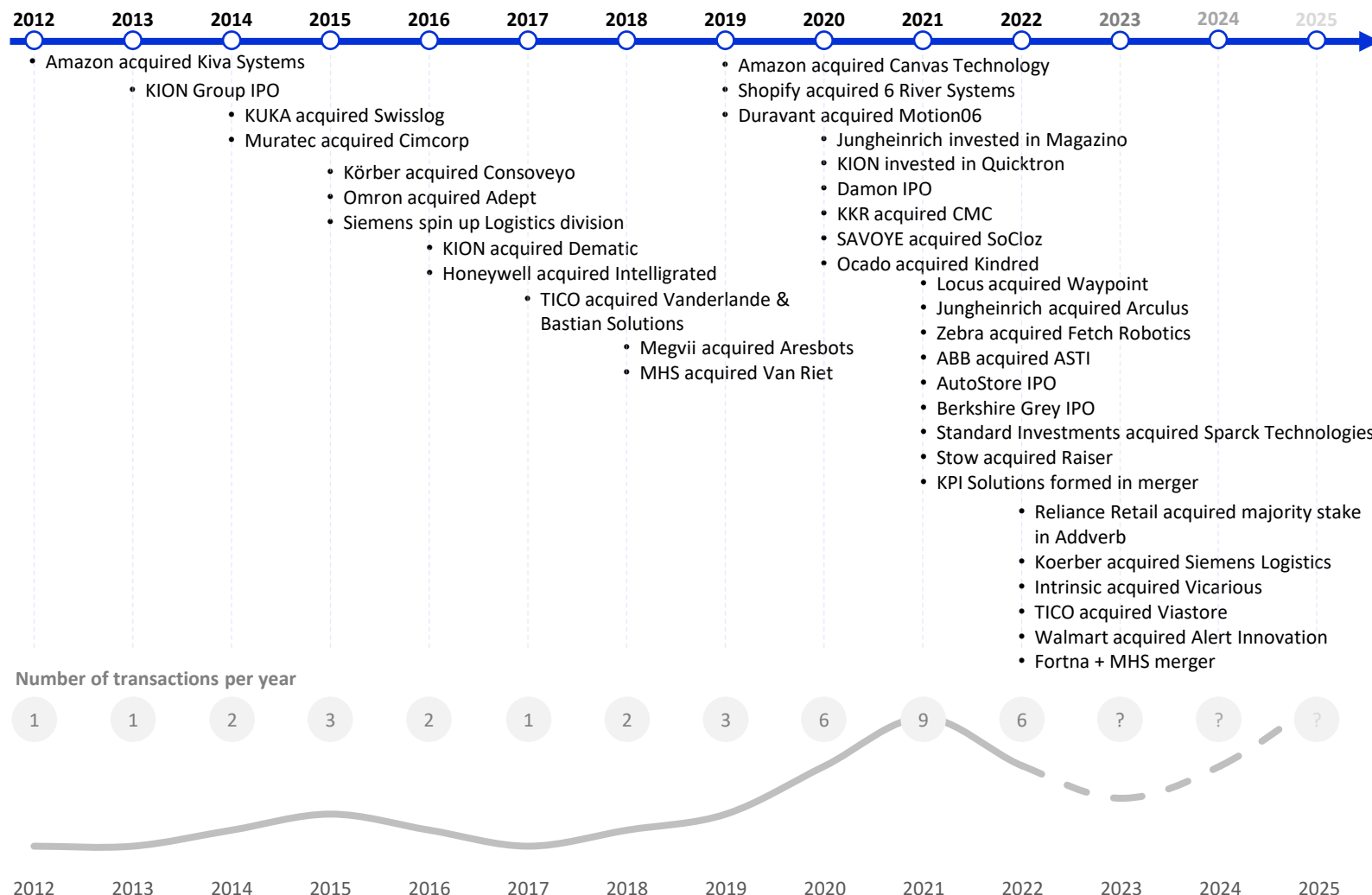
- Sector funding accelerated around 2017 and appeared to have come in waves by segment, starting with G2P AGV in 2018, followed by Picking robots in 2020, P2G in 2021 and cASRS solutions in 2022
- Note that this market behaviour was also influenced by increasing fundraising rounds (and valuations)

¹ Note there were two >\$50m funding rounds announced in March 2023 for picking robotics companies – not included in this report



INCREASED VENDOR PROFITABILITY & HEALTHY ORDER BOOKS ACCELERATED M&A ACTIVITY. THIS TREND IS LIKELY TO CONTINUE IN 2023 AND 2024

SELECTED G2P SOLUTIONS SECTOR TRANSACTIONS, 2012-2021



Source: STIQ Ltd research & analysis

2022 M&A ACTIVITY

- There was a high level of M&A in 2020-2021 driven by continued low interest rates and pandemic-fuelled growth in the warehouse automation equipment sector
- Activity in 2022 was more muted as a result of inflationary pressures accelerated by geopolitical instability and increasing interest rates
- However, there was a renewed appetite for larger system integrators with two large mergers: KPI Solutions (Kuecker + Pulse) and Fortna (Fortna + MHS)
- Bolt-on acquisitions also continued apace with a variety of corporate acquisitions: ABB + ASTI, Zebra + Fetch, TICO + Viastore
- There were also a few acquisitions that appeared to be opportunity driven and potentially backed by investors to increase valuations: Locus + Waypoint, Stow + Raiser
- In 2022 there were also two transactions by non-traditional acquirers: Walmart + Alert Innovation and Reliance Retail + Addverb

FUTURE M&A LIKELY AT ELEVATED LEVELS

- STIQs view is that sector M&A will continue at elevated levels when compared to pre-pandemic activity
- Some of the short term activity may be driven by potential bargain or opportunity acquisitions as VC funding has dried up somewhat
- There is also an increasingly long queue forming of potential prospects for IPOs with some of these likely to opt for an acquisition



DIVESTMENT VALUATIONS HAVE VARIED SIGNIFICANTLY BY EXIT OPTIONS. TRADE SALES TO CORPORATE BUYERS TEND TO ACHIEVE A LOWER MULTIPLE COMPARED TO IPOs

SELECTED EXITS SINCE 2012 ¹

COMPANY	ACQUIRER	EXIT YR	EV ²
Addverb	Reliance Retail	2022	\$270m
ASTI	ABB	2021	\$190m
Fetch Robotics	Zebra	2021	\$305m
Berkshire Grey	SPAC IPO	2021	\$2.7bn
AutoStore	IPO	2021	\$12bn
6 River Systems	Shopify	2019	\$450m
SAVOYE	Noblelift	2018	€32.3m
Vanderlande	Toyota (TICO)	2017	\$1.2bn
Intelligrated	Honeywell	2016	\$1.5bn
Dematic	KION	2016	\$3.3bn
Swisslog	KUKA	2014	\$357m
Kiva Systems	Amazon	2012	\$775m

Source: STIQ Research & Analysis

¹ There were four sector IPOs since 2012, STIQ has excluded two as they are not relevant: KION (2013) and Damon (2020)

² Note that STIQ has rounded a few numbers. Includes partial exits

³ Checked mid day on 14 Feb 2023

VARIOUS EXIT OPTIONS

- Exit options for owners include IPO, Trade Sale (typically a corporate buyer), Secondary Buyouts, Management Buy Outs, etc.
- These typically come with different enterprise valuations, i.e. the multiple an investor can realise from an equity or company sale

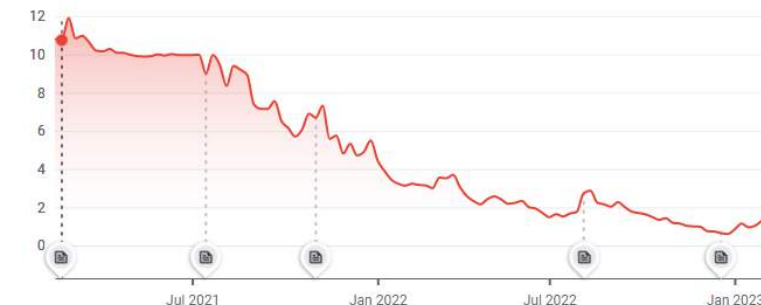
THE IPO

- Many investors viewed IPOs as the gold standard where high exit multiples can be achieved; This option includes a standard IPO and/or a SPAC IPO (SPAC [explainer](#))
- However, two recent IPOs in the G2P sector (AutoStore, Berkshire Grey) have not performed well and both companies, listed in 2021, traded below their listing price in Feb 2023
- AutoStore's share price was NOK21.70³ in Feb, 2023, compared to the listing price of NOK31, which represented a 30% drop and c.50% down from a historical high of c.NOK45
- Berkshire Grey's market cap was c.\$330m³ in Feb, 2023 compared to the IPO valuation at \$2.7bn which represented a near 90% decline

[NEW] SPAC OPPORTUNITIES

- SPACs suffered from declining values ([source](#)) during 2021, 2022 and the option may no longer seem as appetizing for investors seeking an exit
- Lower valuations had also led to interesting M&A activity of/among SPAC companies

BERKSHIRE GREY SHARE PRICE HISTORY



Source: Screenshot, [Google](#) on 14 Feb 2023

- For example, Velodyne and Ouster (both listed via SPACs) announced merger plans in Nov 2022 ([source](#))
- In Feb 2023, less than two years after its original IPO, Berkshire Grey received an approach from SoftBank to take the company private ([source](#))
- The reason for taking Berkshire Grey private appeared to be a continued depressed share price despite an equity deal with FedEx and a partnership with Locus

SOFTBANK & WAREHOUSE ROBOTICS

- SoftBank was involved in the IPOs of AutoStore and Berkshire Grey and remained a significant investor in both companies
- SoftBank also had a large-ish portfolio of non-exited robotics companies ([source](#))
- STIQs view is that if SoftBank's take-private offer is successful they could potentially merge a few of their robotics/automation businesses and return to public markets in a few years



THE EXIT QUEUE INCLUDES NEARLY 60 COMPANIES WITH SOME LEVEL OF PUBLICLY KNOWN VENTURE FUNDING

TOP 15 COMPANIES BY PUBLICLY KNOWN FUNDRAISING (JAN 2023)¹ (ORDERED BY TOTAL RAISED)

COMPANY	COUNTRY	FOUNDED	TOTAL RAISED (\$m) ¹	STATUS	LATEST RAISE ²	LATEST ROUND / NOTE
Geek+	China	2015	534.6	Private	2022	\$100m
Fabric	Israel	2015	476	Private	2022	\$140m
Exotec	France	2015	446.2	Private	2022	\$335m
Locus Robotics	US	2014	416	Private	2022	\$117m
GreyOrange	India	2011	393.1	Private	2022	\$110m
Hai Robotics	China	2016	331	Private	2022	\$100m
Dexterity	US	2017	196.2	Private	2021	\$140m
Attabotics	Canada	2015	193.4	Private	2022	\$71m
Covariant	US	2017	156.5	Private	2021	\$85.2m
Quicktron	China	2014	145.4	Private	2021	\$100m
RightHand Robotics	US	2014	119.3	Private	2022	\$66m
Nimble	US	2018	115	Private	2023	\$65m
ForwardX Robotics	China	2016	109.9	Private	2021	\$69m
XYZ Robotics	China	2018	103	Private	2022	\$40m
Osaro	US	2015	96.3	Private	2021	\$30m
Average	-	2015	253.7 (total 3,805)	-	-	\$103.4m (total \$1,551m)

Source: STIQ Research & Analysis. Crunchbase

¹ Publicly known funding raised to March 2023. ² When the funding was publicly announced

CIRCA 60 VENTURE FUNDED COMPANIES

- In Jan 2023 there were c.60 venture backed companies in the wider G2P sector that remained privately owned with a potential view on an exit in the short term
- The top 15 companies had raised a combined \$3.8bn in Jan 2023 with c.40% of this raised in the last two years
- These 15 companies had an average age of c.8 years and had raised from \$535m to \$83m
- As a side note: when Kiva Systems was acquired, they had raised \$18.1m, backed by Bain Capital Ventures ([source](#))

GROWING INVESTOR IMPATIENCE?

- In 2022 and 2023 a few venture backed startups and companies in the sector replaced C-suite management
- There also appeared to be a new level of hiring highly experienced warehouse automation talent into some of the younger companies
- STIQs view was that some of these instances were driven by investors growing impatience with a lack of traction among portfolio companies

IPO RUMOURS

- In March 2023 there were rumours of at least two of the companies in the list exploring appetite among institutional investors for IPOs
- STIQs impression from this gossip was there would be at least one IPO in the sector in 2023



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VENDOR PROFILES: 1-B

ADDVERB



ADDVERB

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IN | 2016 | NL,US,SG,AU

- Provides end-to-end customized fixed and flexible automation solutions with in-house manufactured hardware and software in India. Addverb's vast offerings include a versatile range of AMRs, ASRS, AGVs, Picking Solutions by Light, Voice and Vision, WMS, WCS, WES, and Fleet Management System.
- Majority stake acquired for \$132M by Reliance, a Fortune 500 multinational conglomerate based in India.
- Customers – Reliance, Unilever, PepsiCo, Coca Cola, Amazon, Johnson & Johnson, Panasonic, Diageo, Colgate Palmolive, Janio Asia, Flipkart, ITC, Marico, Dabur, and others.

1M Robotics

**IL | 2021 | -**

- Provides a nano fulfilment solution

6 River Systems

**US | 2015 | CA,DE**

- Provides a P2G solution
- Acquired by Shopify in 2019

ABB

**ES | 1982 | Global**

- Provides a G2P AGV solution.
- ABB acquired ASTI Mobile Robots in 2021

Abiman Engineering

**KR | 1980 | US,JP**

- System integrator with range of material handling solutions
- Subsidiary of Yudo Corporation

Agilon

**FI | 2013 | Global**

- Provides a G2P solution
- Division of Kone Cranes

Alog Tech

**IN | 2016 | -**

- Provides a P2G solution

Amazon Robotics

**US | 2002 | Global**

- Does not offer G2P solution to external customers
- Amazon acquired Kiva Systems (founded in 2002) in 2012, renamed to Amazon Robotics
- Disclosed total deployed robot s >500,000 robots in 2022

Attabotics

**CA | 2015 | -**

- Provides a cASRS solution

AutoStore

**NO | 1995 | US,FR,DE,ES,KR,UK,JP**

- Provides a cASRS solution
- IPO in 2021

AWM

**US | 2016 | -**

- Frictionless checkout solution for warehouses

Barcodes Inc

**US | 1994 | CA**

- System integrator



VENDOR PROFILES: B-D

Bastian Solutions



US | 1952 | n/a

- System integrator
- Acquired by Toyota Industries (TICO) in 2017

Belive.ai



FR | 2019 | -

- Provides an in-store AI solution

Berkshire Grey



US | 2013 | UK,NL

- System integrator with range of material handling equipment
- IPO in 2021

Blue Robot Company



NO | 2018 | -

- Provides a cASRS solution

Brightpick



US | 2013 | -

- Provides an AMR hybrid with an integrated piece picking robot

Caja Robotics



IL | 2014 | US

- Provides an AMR Shuttle type solution

CMC



IT | 1980 | -

- Provides automated 3D packaging machines
- Acquired by KKR in 2020

Company Profiles: How to read?



US(HQ) | 2017(founded) | JP(other offices)

- = links to:
- W = company website
 - in = LinkedIn profile
 - Cb = Crunchbase profile
 - > = YouTube profile
 - = interviewed for this report

Conductix-Wampfler



DE | 1902 | Global

- Component supplier

Consafe Logistics



SE | 1978 | PL,FI,NO,NL,DK

- Provides a WMS

Covariant



US | 2017 | UK

- Provides a picking robot solution

Damon Group



CN | 1997 | Global

- Provides sortation and conveyor equipment + rollers
- IPO in 2020

Daifuku



JP | 1937 | Global

- System integrator with range of material handling equipment

Dematic



US | 1900 | Global

- System integrator with range of material handling equipment
- Acquired by KION in 2016

Doog Inc.



SG | 2012 | JP

- Provides a P2G robot



VENDOR PROFILES: E-G

Eiratech Robotics



IR | 2014 | -

- Provides an G2P AGV solution

Enfon



CN | 2012 | -

- System integrator with ASRS solution

Exotec



FR | 2015 | US

- System integrators with ASRS solution

Fetch Robotics



US | 2014 | Global

- Provides a P2G robot
- Acquired by Zebra Inc in 2021

Find & Order



FR | 2015 | -

- Provides mapping software

Fives



FR | 1812 | Global

- System integrator with range of material handling equipment

Fizyr



NL | 2014 | -

- Provides a picking robot solution

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 - = interviewed for this report

Fortucky



CN | 2014 | -

- System integrator with ASRS solution

ForwardX Robotics



CN | 2016 | US

- Provides a P2G robot

Galaxis Tech



CN | 2014 | DE,RU,AT

- System integrator with ASRS solution

Gebhardt Intralogistics



DE | 1952 | UK,DK,CH,PL,US,SE,AT

- System integrator with range of material handling equipment

Geek+



CN | 2015 | US,UK,DE,SG,KR

- Provides G2P + P2G solutions

Grenzebach



DE | 1960 | Global

- Provides a G2P AGV solution

GreyOrange



US | 2011 | IN,DE

- Provides G2P + P2G solutions



VENDOR PROFILES: G-K


Guozi

[W](#) [in](#) [cb](#) [▶](#)

CN | 2010 | -

- Provides an G2P AGV solution

Hai Robotics

[W](#) [in](#) [cb](#) [▶](#) 

CN | 2016 | US

- Provides AMR Shuttle solutions

HIKRobot

[W](#) [in](#) [cb](#) [▶](#)

CN | 2001 | Global

- Provides an G2P AGV solution
- Part of HIK Vision group


Honeywell Intelligated

[W](#) [in](#) [cb](#) [▶](#)

US | 2001 | Global

- System integrator with ASRS solution
- Acquired by Honeywell in 2016

HÖRMANN Intralogistics

[W](#) [in](#) [cb](#) [▶](#) 

DE | 1987 | PL

- System integrator

Huazh

[W](#) [in](#) [cb](#) [▶](#)

CN | 2011 | AT

- System integrator with ASRS solution

i-Collector System

[W](#) [in](#) [cb](#) [▶](#)

NL | 2012

- Provides a hybrid ASRS solution

Company Profiles: How to read?

[W](#) [in](#) [cb](#) [▶](#) 

US(HQ) | **2017**(founded) | **JP**(other offices)

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-  = interviewed for this report

Informrack

[W](#) [in](#) [cb](#) [▶](#)

CN | 1997 | -

- System integrator with ASRS solution

Instock

[W](#) [in](#) [cb](#) [▶](#)

US | 2020 | -

- Stealth


Intellistore

[W](#) [in](#) [cb](#) [▶](#) 

NL | 2020 | -

- Provides a cASRS solution

inVia Robotics

[W](#) [in](#) [cb](#) [▶](#) 

US | 2015 | -

- Provides a G2P AMR hybrid, WES

JD Logistics

[W](#) [in](#) [cb](#) [▶](#)

CN | 2007 | Global

- Provides a range of MHE & G2P solutions
- Division of JD.com

Jungheinrich

[W](#) [in](#) [cb](#) [▶](#)

DE | 1953 | Global

- Provides MHE, including G2P solutions

Knapp

[W](#) [in](#) [cb](#) [▶](#) 

AT | 1952 | Global

- System integrator with range of material handling equipment



VENDOR PROFILES: K-O

KPI Solutions



US | 2021 | -

- System integrator
- Formed in merger between Kuecker and Pulse Integration in 2021

Libiao Robot



CN | 2016 | -

- Provides a sortation robot solution

Locus Robotics



US | 2014 | NL

- Provides a P2G solution

Logtopus



IL | 2021 | -

- Stealth startup

Lowpad



NL | 2017 | -

- Provides a range of AMRs

Lyro Robotics



AU | 2018 | -

- Provides a picking robot solution

Magazino



DE | 2014 | -

- Provides an AMR Shuttle solution

Malu Innovation



CN | 2015 | -

- Provides G2P AGV solutions

Mytra



US | 2022 | -

- Stealth startup

Mushiny



CN | 2016 | -

- Provides G2P AGV solutions

Nimble



US | 2018 | -

- Provides a picking robot solution

Nomagic



PL | 2017 | CH,DE

- Provides a picking robot solution

Noyes Technology



DE | 2020 | -

- Provides a cASRS solution

OPEX Corporation



US | 1970 | -

- Provides an ASRS solution

Osaro



US | 2015 | -

- Provides a picking robot solution



VENDOR PROFILES: O-R

Ottobo



TR | 2016 | -

- Provides a P2G solution

Packsize



US | 2002 | DE,SE

- Provides automated 3D packaging machines

PAL Robotics



ES | 2004 | -

- Provides a P2G solution

Panotec



IT | 1986 | DE

- Provides automated 3D packaging machines

Pickr



NO | 2016 | -

- Provides a picking robot solution

Planiform



CA | 1967 | -

- Provides a hanging garment (GOH) ASRS solution

Plus One Robotics



US | 2016 | -

- Provides a picking robot solution

Prime Robotics



US | 2018 | -

- Provides G2P AGV solutions

Prime Vision



NL | 2003 | -

- Provides a sortation robot solution

Quicktron



CN | 2014 | -

- Provides G2P solutions

Rapyuta Robotics



JP | 2014 | -

- Provides a P2G solution

Rightbot



IN | 2020 | -

- Provides an AMR Shuttle solution hybrid

Righthand Robotics



US | 2014 | -

- Provides a picking robot solution

Robust AI



US | 2019 | -

- Provides a P2G Solution

Rocket Solution



DE | 2019 | -

- Provides an ASRS solution



VENDOR PROFILES: S-S

SAVOYE



FR | 1950 | Global

- System integrator with range of material handling equipment
- Acquired by Noblislift in 2018

Scallog



FR | 2013 | -

- Provides an G2P AGV solution

Servus Intralogistics



AT | 2005 | -

- Provides an ASRS solution

Sokul Automation



US | 2020 | -

- Provide an AMR Shuttle hybrid solution

Solystic



FR | 1955 | BE

- Provides a sortation robot solution
- Acquired by Northrop Grumman in 2001

Sparck Technologies



NL | 1924 | US

- Provides automated 3D packaging machines
- Previously known as “Packaging by Quadient”

SSI Schaefer



DE | 1937 | Global

- System integrator with range of material handling equipment

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Staxel



UK | 2022 | US

- Stealth

Storjet



DE | 2018 | -

- Provides an ASRS hybrid solution

STOW Robotics



DE | 2019 | BE

- Provides an ASRS hybrid solution
- Division of Stow Group

SVT Robotics



US | 2018 | -

- Provides an integration software stack

Swisslog



CH | 1898 | Global

- System integrator with range of material handling equipment
- Acquired by Kuka in 2014

Syncware



SG | 2021 | -

- Provides an integration software stack

Syrius Robotics




CN | 2018 | -

- Provides a P2G solution



VENDOR PROFILES: T-X


TARQAN

[W](#) [in](#) [cb](#) [▶](#) 

TR | 2020 | -

- Provides a G2P AGV solution

Template Systems

[W](#) [in](#) [cb](#) [▶](#) 

DE | 2022 | -

- Stealth

TGW

[W](#) [in](#) [cb](#) [▶](#)

AT | 1969 | Global

- System integrator with range of material handling equipment


The Rubic

[W](#) [in](#) [cb](#) [▶](#)

CA | 2020 | -

- Provides a G2P AGV solution vendor


Tompkins Robotics

[W](#) [in](#) [cb](#) [▶](#) 

US | 2017 | -

- Provides a sortation solution

Unbox Robotics

[W](#) [in](#) [cb](#) [▶](#) 

IN | 2019 | -

- Provides a sortation robot solution
- Customers: None disclosed

Vanderlande

[W](#) [in](#) [cb](#) [▶](#) 

NL | 1949 | Global

- System integrator with range of material handling equipment
- Acquired by TICO in 2017


Wellwit

[W](#) [in](#) [cb](#) [▶](#)

CN | 2015 | -

- Provides G2P + P2G solutions

XYZ Robotics

[W](#) [in](#) [cb](#) [▶](#) 

US | 2018 | CN



- Provides a picking robot solution

BUYERS - BOOK A DEBRIEF

[W](#) [in](#) [cb](#) [▶](#)

- Do you want to know more about the sector, vendors, how some solutions are being used to get new ideas, etc?
- Or, perhaps you just want to chat about your own set-up?
- [Contact us](#) to set up an informal conversation

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CREDITS, INTERVIEWS, TRADE SHOWS AND GLOSSARY

A BIG THANK YOU TO OUR INTERVIEWEES:

- Anonymous Retailer #1 [Online Retailer]
- Anonymous Retailer #2 [Omnichannel Retailer]
- Atypical Consulting (AU) [Consultancy] [WEB](#)
- Cognibotics (SE) [Robot Arm] [WEB](#)
- OPLOG (TR) [3PL] [WEB](#)
- Spexal (TR) [Contract Mnfr] [WEB](#)

STIQ SPOKE TO THE FOLLOWING VENDORS:

- 1M Robotics (IL) VP Sales
- 6 River Systems (US) Co-founder
- ABB /ASTI (ES) Director of Product Management
- **Addverb (US)** **CEO Americas**
- **Addverb (NL)** **CEO EMEA**
- Attabotics (CA) SVP Global Sales
- AutoStore (NO) CPO
- AWM Tech (US) CEO
- Barcodes Inc (US) Product Manager, AMRs
- Bastian Solutions (US) Director of Corporate Strategy
- Belive (FR) Head of Customer Relations
- Berkshire Grey (US) VP of Products
- Blue Robot Company (NO) Director of Board
- Brightpick (SL) CEO
- Conductix-Wampfler (DE) Global Market Director, IA
- Consafe Logistics (SE) Product Manager
- Covariant (US) Head of Global Partner Strategy & Channel Sales
- Damon Industrial (RO) General Manager
- Exotec (FR) CRO
- Fives (IT) Applications Director
- Geek+ (DE) VP of Solutions Engineering
- GreyOrange (US) VP Product Marketing
- Hai Robotics (US) VP Sales, Marketing & Solutions
- Hörmann Intralogistics (DE) Managing Director

- Intellistore (NL) Commercial Director
- inVia Robotics (US) CMO
- Knapp (AT) Portfolio Manager Value Chain Solutions
- KPI Solutions (US) VP Sales
- Locus Robotics (US) CEO
- Logtopus (IL) Founder
- Lowpad (NL) Business Development Manager
- Mushiny (CN) CMO
- Nomagic (PL) Chief Strategy & Co-founder
- Planiform (CA) Sales Director
- Quicktron (CN) Sales & Marketing
- RightHand Robotics (US) Head of Sales & Strategic Business Development
- Rocket Solution (DE) Managing Director
- SAVOYE (FR) Marketing Manager
- SSI Schaefer (DE) VP Product Line Material Flow
- Staxel (UK) Co-founder
- Storojet (DE) Account Manager
- SVT Robotics (US) SVP of Product
- Swisslog (UK) VP Global Business Acceleration
- TARQAN (TR) CEO & Founder
- Tompkins Robotics (US) President
- Unbox Robotics (IN) CEO & Co-founder
- Vanderlande (NL) Sr Manager Strategy & Market Insights
- XYZ Robotics (CN) CEO

TRADE SHOWS & EVENTS VISITED

- Groceryshop (Las Vegas, US) [WEB](#)
- Hannover Messe (Hannover, DE) [WEB](#)
- Logimat (Stuttgart, DE) [WEB](#)
- Modex (Atlanta, US) [WEB](#)
- NRF Big Show (New York, US) [WEB](#)
- Promat (Chicago, US) [WEB](#)
- STIQ Robotics Meetups (London, UK) [WEB](#)

GLOSSARY

- 3PL Third Party Logistics
- AGV Automated Guided Vehicle
- AMR Autonomous Mobile Robot
- AS Asia, including India, Australia, Korea, Japan, China, etc.
- ASRS Automatic Storage & Retrieval System
- CAGR Compound Annual Growth Rate
- cASRS cube ASRS
- COGS Costs of Goods Sold
- CPG Consumer Packaged Goods (US, see also FMCG)
- DC Distribution Centre
- EU Europe, including Israel (in this report)
- EV Enterprise Valuation
- FMCG Fast Moving Consumer Goods (UK, see also CPG)
- FOMO Fear Of Missing Out
- FTE Full Time Employee
- G2P, GTP Goods to Person
- G2P AGV “Kiva Type” System (datametric navigation base)
- M&A Mergers & Acquisitions
- MFC Micro Fulfilment Centre
- MHE Material Handling Equipment
- NA North America
- OEM Original Equipment Manufacturer
- P2G Person to Goods
- PA-AMR Pick Assistant AMR
- POC Proof Of Concept
- RAAS Robotics As A Service
- ROI Return On Investment
- ROW Rest of World
- RTLS Real Time Location System
- SI System Integrator
- SKU Stock Keeping Unit
- SMB / SME Small & Medium Businesses (US / UK)
- SPAC Special Purpose Acquisition Company
- WCS Warehouse Control System
- WES Warehouse Execution System
- WMS Warehouse Management System
- XAAS “Something” as a Service (compare to RaaS)



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