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SORTATION EQUIPMENT 2024

PARCEL & UNIT + LINEAR & LOOP SORTERS | ROBOT SORTATION | UNIT SORTERS | JUN 2024

Authors:

Tom Andersson
Principal Analyst & Co-founder
STIQ Ltd
Email | LinkedIn
M: +44 (0) 7870 210529

Yassir Al-Refaie
Partner
STIQ Ltd
Email | LinkedIn
M: +44 (0) 7728 814834

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V1.0

EXEC SUMMARY: NEGATIVE SENTIMENT FROM 2H22 SET THE TONE FOR 2023 WITH SOME SIGNS OF A RETURN TO GROWTH IN 2024. POSITIVE INPUT FROM KEY END CUSTOMERS

THE FOCUS OF THIS REPORT

- This report focuses on sortation equipment & automation used in "eaches" (pre-packing) and parcels (post-packing)
- Other sortation applications are included, but remain peripheral
- As with many other MHE sectors, the Sortation Equipment sector is complex with many different names for similar solutions
- This report segments the primary sortation equipment used in the marketplace

2023: COVID DISRUPTION CONTINUED

- 2023 was a year with few positives, however, overall the market appeared to remain above pre-Covid levels
- The year was affected by an apparent level of over-investment during 2021 and parts of 2022 which had left more capacity in the market than required
- In the huge Chinese market, a flat or declining year had spurred a few vendors to focus on export markets
- However, few interviews suggested pricing competition from surging Asian exports but rather pointed towards dynamics in the North American market where a few key customers had withdrawn entirely and pushed up competition

2024: SOME RETURN TO GROWTH

- STIQ conversations with various stakeholders have suggested key sortation end-customers had restarted larger projects
- There were indications of a level of thawing of frozen projects from 2022 & 2023
- Based on orders placed up to May 2024, some respondents felt more positive for the year compared to 2023

SORTATION MARKET DRIVERS

- Ecommerce remains a key market driver for the entire sortation equipment market across segments including both units/eaches and parcel sortation
- All forecasts for ecommerce growth point towards a continued positive development across markets, albeit perhaps slower than previously - in single digits up to the end of the 2020's
- Lack of labour continued to be an important market driver as labour costs have increased
- Inhibitors include the cost of money with higher interest rates
- There appeared to have been an increasing focus on brownfield solutions in recent years with linear sorters in particular experiencing important traction

ROBOT SORTATION EQUIPMENT

- Robot Sortation solutions are segmented into Mobile Robot sortation and Robot Arm; each applied to a variety of applications
- Mobile Robot Sortation is experiencing important traction and deployments are growing in scale
- Robot Arm sortation solutions remain nascent although solutions experienced important traction

AI/TRENDS IN SORTATION EQUIPMENT

- Trends include increasing use of AI and vision components to optimise various sort stages
- This appeared to be driven largely by physical (speed) limitations of sortation equipment

FOR BUYERS OF SORTATION EQUIPMENT:
STIQ offers a free 30min debrief/Q&A session for this report as part of the sponsorship. Contact us to arrange a confidential "ask us anything" session

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SORTATION AUTOMATION EQUIPMENT IS DIVIDED INTO PRE-PACKING AND POST-PACKING SOLUTIONS: PRE-PACK SORTATION

SIMPLIFIED OVERVIEW OF SORTATION EQUIPMENT APPLICATIONS IN ECOMMERCE FULFILMENT AND DISTRIBUTION CENTRES

Storage & Picking → **PRE-PACK SORTATION** → Packaging, Labelling, WDS → **POST-PACK SORTATION** → Shipping (Outbound)

NOTE RE PRE-PACKING SOLUTIONS

- Pre-packing sortation solutions are typically suitable for specific order profiles, product ranges, picking strategies, etc.
- STIQ will be delighted to recommend system integrators or consulting firms if you are considering pre-pack fulfilment strategies

PRE-PACK SORTING SOLUTIONS

- Pre-Packing processes are primarily related to picking strategies and processing of “eaches” prior to packing and focuses on three major concepts: Batch Picking, Pre-Loading or Buffering, and Store Fulfilment
- Batch Picking is an order fulfilment strategy where pickers add items from many different orders into the same container which may speed up picking significantly
- A Batch Sorter may be used to sort batch picked items into individual orders
- Pre-Loading or Buffering is primarily related to Pocket Sorters (aka Pouch Sorters) and may be used to speed up fulfilment for particular order profiles
- For example, if a company knows it will sell a larger quantity of a few items, it may be beneficial to pre-load a Pocket Sorter with high volume SKUs
- This may allow pickers to focus on picking additional order items from an ASRS or from shelves and add to the Pocket Sorter system
- Pocket Sorters may also be used to process returns, especially if goods are resold quickly
- Unit Sorters have historically been applied to Store Fulfilment whereby associates inducted product “eaches” manually directly from cases
- Note Unit Sorters are also used in post-packing sortation
- ASRS Systems can also be deployed for sortation and sequencing, but are rarely used exclusively for sortation purpose

ROBOT SORTERS

- Robot Sorters include Picking Robots and Mobile Sortation Robots
- These are relatively new sortation solutions and have tended to be deployed in many different applications as part of experimentation
- For example, Picking Robots were used for sortation induct as well as sortation and Mobile Sortation Robots were applied as roaming pick faces in combination with ASRS systems in addition to being used for sortation

SORTATION AUTOMATION EQUIPMENT IS DIVIDED INTO PRE-PACKING AND POST-PACKING SOLUTIONS: POST-PACK SORTATION

SIMPLIFIED OVERVIEW OF SORTATION EQUIPMENT APPLICATIONS IN ECOMMERCE FULFILMENT AND DISTRIBUTION CENTRES

Storage & Picking → **PRE-PACK SORTATION** → Packaging, Labelling → **POST-PACK SORTATION** → Shipping (Outbound)

POST-PACK SORTING SOLUTIONS

- Post-pack sortation solutions are primarily focused on parcel sortation but also include tote and pallet sortation
- Furthermore, this also includes sortation of irregular items, typically goods that do not fit on standard parcel sortation equipment
- Post-pack sortation equipment can be divided into Linear & Loop Sorters, Wheel Sorters and Conveyor Sorters

LINEAR AND LOOP SORTERS

- There is a wide variety of sorters targeting parcel sortation applications and these may be sub-divided into Linear Sorters and Loop Sorters
- Linear and Loop Sorters use the same or very similar payload carrier configurations, but have different layouts and throughput capacities
- Linear Sorters are configured in a straight line with payload carriers moving above and under the line with chutes on either side
- Loop Sorters are configured in a loop formation where payload carriers run on the top of the loop and circle around with chutes on either side (depending on configuration)
- Loop Sorters tend to have much higher throughput when compared to Linear sorters

WHEEL SORTERS

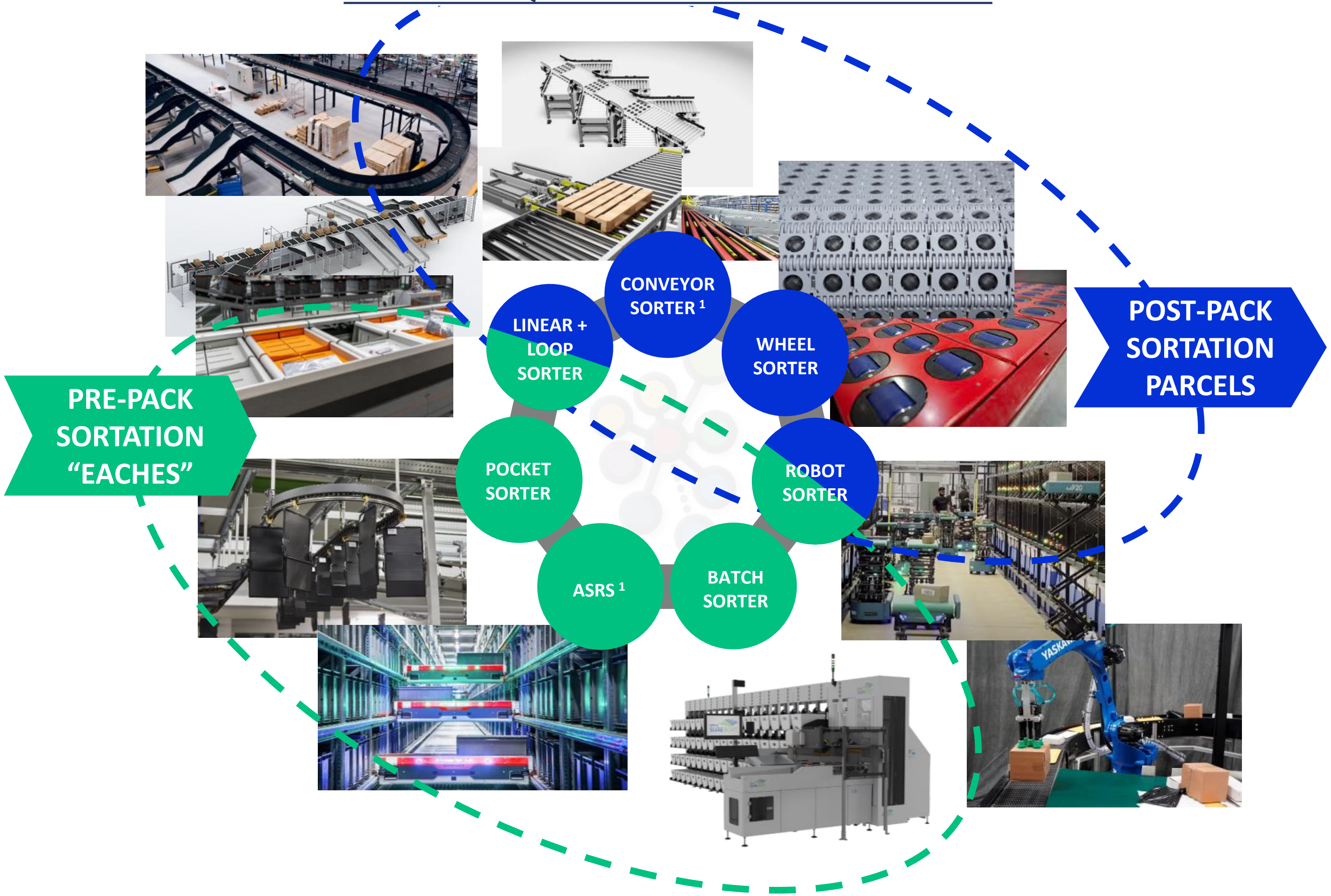
- Wheel Sorters include ARB (Activated Roller Belt) and Pivot Wheel sorters
- ARB's run in a similar fashion to linear sorters, but are belts which include rollers that can divert payloads such as cases
- Pivot Wheel sorters are individual wheels which can pivot payloads in a variety of angles depending on the solution
- Some of these solutions can also rotate (X/Y axis only) cases which can be useful for sequencing and palletisation, etc.

CONVEYOR SORTERS

- Conveyor sorters tend to be relatively basic with low throughput but can also manage large bulky items such as pallets and heavier case loads, etc.
- There are numerous peripherals for conveyor sortation such as narrowband popups, diverters of various kinds, etc.
- Sortation angles tends to be limited to 45° or 90° (variations exist) and typically lead to another conveyor rather than a chute (as with parcel sortation)

SORTATION EQUIPMENT MARKET SEGMENTATION (ACCORDING TO STIQ LTD)

SORTATION EQUIPMENT MARKET SEGMENTATION



SORTATION SEGMENTATION CAVEAT

- Note that this segmentation is a simplified overview of the various solutions available in the marketplace
- Increasing R&D activity and new solutions are coming to the market regularly and the segments in this graphic may change
- Download STIQ's latest reports here to ensure you have the very latest data available

R&D ACTIVITY IN ROBOT SORTATION

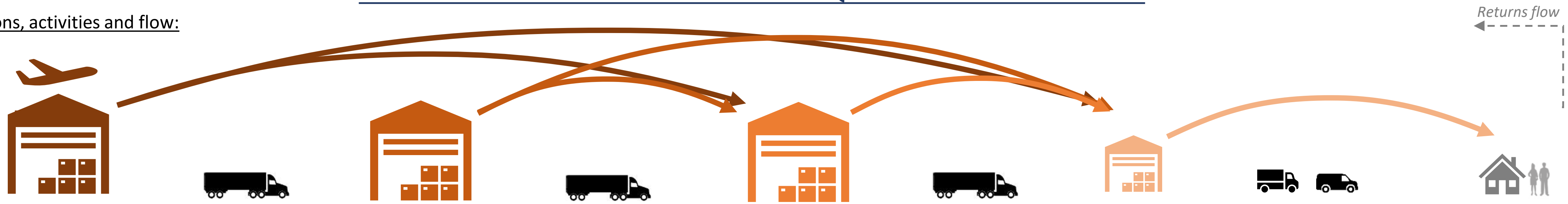
- STIQ interviews have suggested new robot sortation equipment is being deployed in various novel applications, something that may define or open up new segments
- This was combined with STIQ's perceived higher R&D activity and investment flows in the robotic sortation segment

Source: STIQ Ltd Research & Analysis. [1] ASRS sortation processes part of storage solution. Included in STIQs report on G2P Solutions – download free here
Image sources: Clockwise from Wheel Sorter source, source, source, Unbox Robotics, source, source, Gebhardt Intralogistics, ferag, source, Gebhardt Intralogistics, source

DIFFERENT TYPES OF SORTATION EQUIPMENT ARE UTILISED IN LOCATIONS WITHIN THE INTRALOGISTICS VALUE CHAIN. KEY IS THROUGHPUT VOLUME AND SPEED

SIMPLIFIED LOCATIONS WHERE SORTATION EQUIPMENT MAY BE DEPLOYED

Locations, activities and flow:



AIRPORT HUB
- Airport hubs primarily manage parcels sent by air
- International hubs are often equipped with very high throughput sorters and advanced peripherals as parcels have to go through customs, and often have to be delivered within a certain time frame

FULFILMENT CENTRE/ WAREHOUSE
- FC's (ecommerce retailers, 3PLs, etc.) may use a wide variety of warehouse automation solutions
- They are the main location for Pre- and Post-packaging sortation equipment
- High volume shippers may also sort for zone skipping to gain additional cost benefits

SORTING CENTRE (POSTAL/CARRIER HUB)
- Postal and/or courier operators have large centralised sortation centres where they send parcels to be sorted to last mile centres
- Sortation equipment in these hubs are often very large and can manage to sort 20,000-100,000 parcels per hour, sometimes more

LAST MILE CENTRE
- Postal and/or courier operators also have last mile centres (spokes) where they sort parcels into last mile vehicles for delivery to final destination
- Busier locations are increasingly using sortation solutions with smaller footprints and lower throughput

Final Parcel Destination

Sortation equipment (most commonly deployed):

- **Loop Sorter**
- **Loop, Linear, Batch, Pocket, Pivot Wheel, Robot Sorters, Conveyors**
- **Loop, Linear, Pivot Wheel, Robot Sorters, Conveyors**
- **Linear, Robot, ARB Sorters**

Source: STIQ Ltd Research & Analysis

LOCATIONS FOR SORTATION EQUIPMENT

- The primary locations for sortation equipment include Airport Hubs, Fulfilment and Distribution Centres (warehouses), Sorting Centres and Last Mile Centres
- These locations often have different volume throughput and other requirements which means certain solutions are more likely to be deployed than others
- For example, an Airport hub often needs to process a plane load within a few hours to avoid additional charges for storage in customs clearance, or because deliveries were late, and hence deploy very high throughput sortation equipment
- Fulfilment Centres are the only locations with a requirement for every type of sortation equipment, from Pre-pack to Post-pack solutions
- In recent years Last mile centres (spokes) have also been equipped with automated sortation equipment, typically with lower throughput and smaller footprints

THE RETURNS FLOW

- Returns also flow back into the system, often via carriers who insert these into the same or similar flow as outbound parcels depending on volumes, etc.

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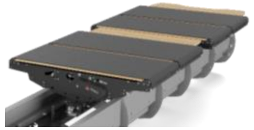
THERE ARE A VARIETY OF "PAYLOAD CARRIER FORM FACTORS" DEPLOYED IN LINEAR, LOOP AND MOBILE ROBOT + BATCH SORTERS

"FORM FACTORS" USED IN SOME SORTATION EQUIPMENT SEGMENTS

FORM FACTOR	CROSS BELT	TILT TRAY	SPLIT TRAY [1]	HORSESHOE [2]	PADDLE/ PUSHER
IMAGE	 *Image source*	 *Image source*	 *Image source*	 *Image source*	 *Image source*
LOOP SORTER	✓	✓	✓	✓	✓
LINEAR SORTER	✓	✓	-	✓	✓
MOBILE ROBOT SORTER [3]	✓	✓	-	-	-
BATCH SORTER [3]	✓	✓	-	-	-

Source: STIQ Ltd Research & Analysis. [1] Split Tray is also referred to as Bomb Bay. [2] Also known as Horse Shoe or Sliding Shoe. [3] Robot and Batch sortation equipment is relatively new and additional form factors may be available

PAYLOAD CARRIER FORM FACTORS

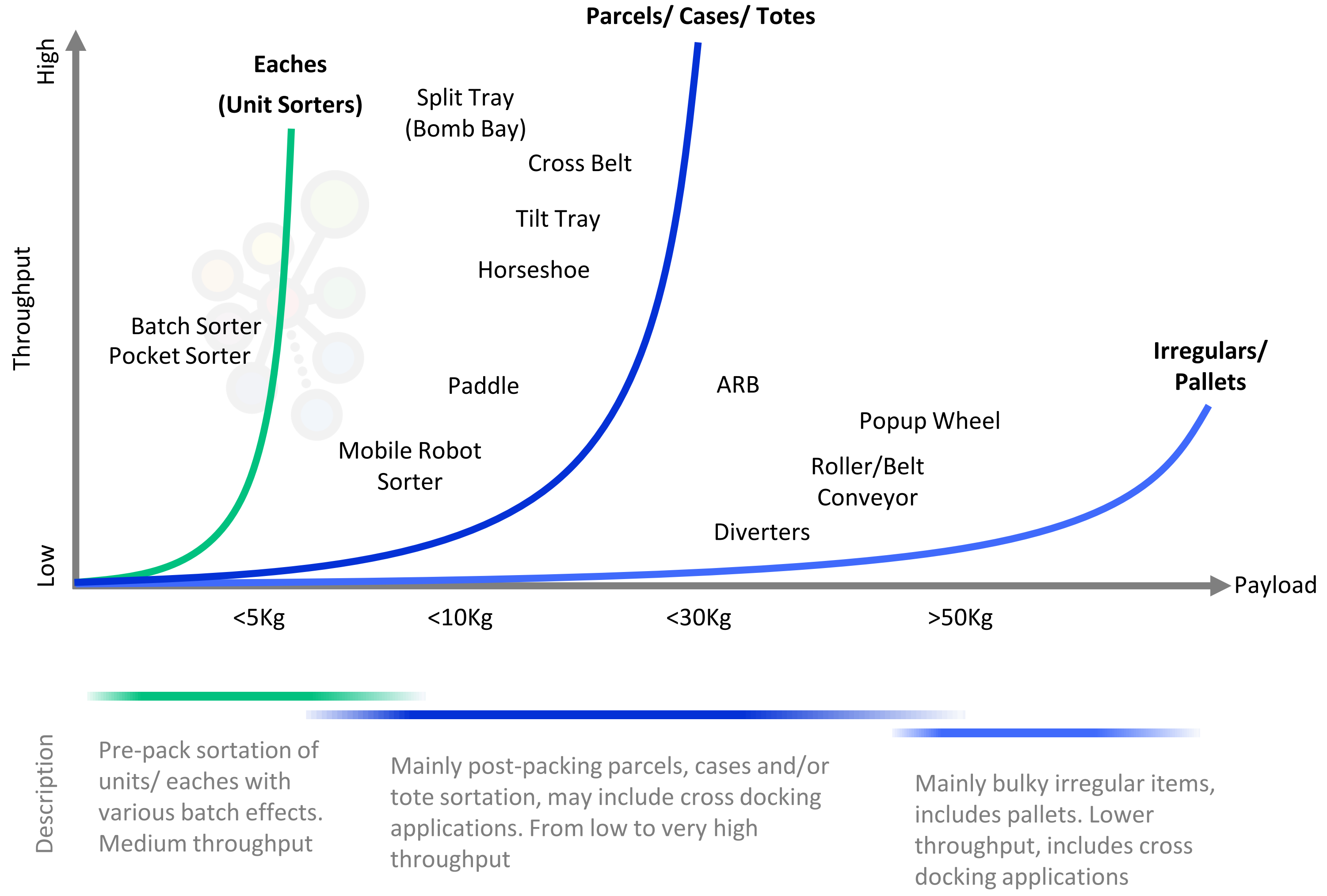
- Payload carriers have evolved in a few primary form factors to fit different applications
- Cross Belt, Tilt Tray, Split Tray and Horseshoe are the primary form factors with Paddle/Pusher primarily applied with conveyor sortation
- Cross Belt and Tilt Tray form factors have also been applied to Mobile Robot sorters and Batch Sorters
- Readers should note there are edge cases and definitions that may cross over form factors, sortation equipment segments, etc.
- Furthermore, Robot Sortation is a quickly evolving sector that may deploy a variety of form factors and sortation effectors

WHAT TO CALL SORTATION EQUIPMENT?

- Sortation equipment is frequently referred to by the form factor or the design, i.e. Cross Belt can refer to Loop Sorter and Loop Sorter to Cross Belt etc.
- However, this is relatively fluid and depends on the context

SORTATION EQUIPMENT CAN BE APPLIED TO A WIDE VARIETY OF APPLICATIONS, TYPICALLY DEFINED BY PAYLOAD AND THROUGHPUT SWEETSPOTS

SIMPLIFIED SORTATION EQUIPMENT SEGMENTATION BY THROUGHPUT AND PAYLOAD



Source: STIQ Ltd Research & Analysis

SORTATION APPLICATION SWEETSPOT

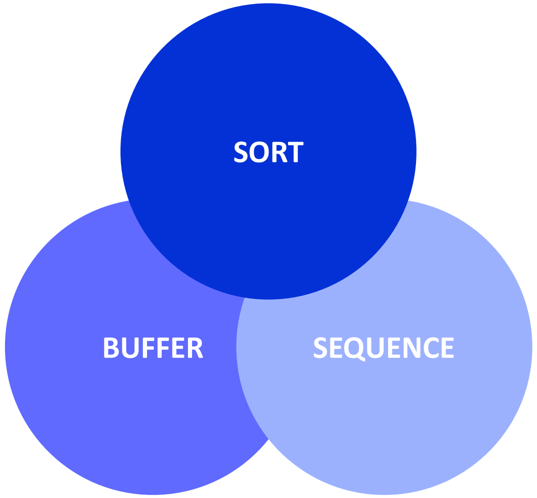
- Sortation equipment is typically deployed in application sweetspots which vary depending on volume requirements and the range of payloads that are sorted
- The application sweetspot can be influenced by many different variables, such as payload size, weight, shape, packaging material, sortation throughput requirement, etc.
- Additional considerations include facility layout and design, floor surface, equipment budget, etc.

SORTATION CAN BE A MOVING TARGET

- Depending on the industry sector, sortation can behave as a moving target
- In a CPG/FMCG warehouse environment it is unlikely cases will change dramatically from year to year and sortation will likely remain static and cover 100% of output
- For ecommerce retailers, product ranges may change from week to week and selecting the optimal sortation equipment can be a less straight forward exercise and may impact the effective range that can be sorted
- Furthermore, changing packaging processes and materials can also impact efficiencies of selected sortation equipment

SORTATION EQUIPMENT CAN ALSO BE APPLIED TO OTHER ACTIVITIES BEYOND SIMPLE SORTATION, INCLUDING SEQUENCING AND BUFFERING

FUNCTIONAL WAREHOUSE CONCEPTS: SORT, SEQUENCE AND BUFFER



Source: STIQ Ltd Research & Analysis

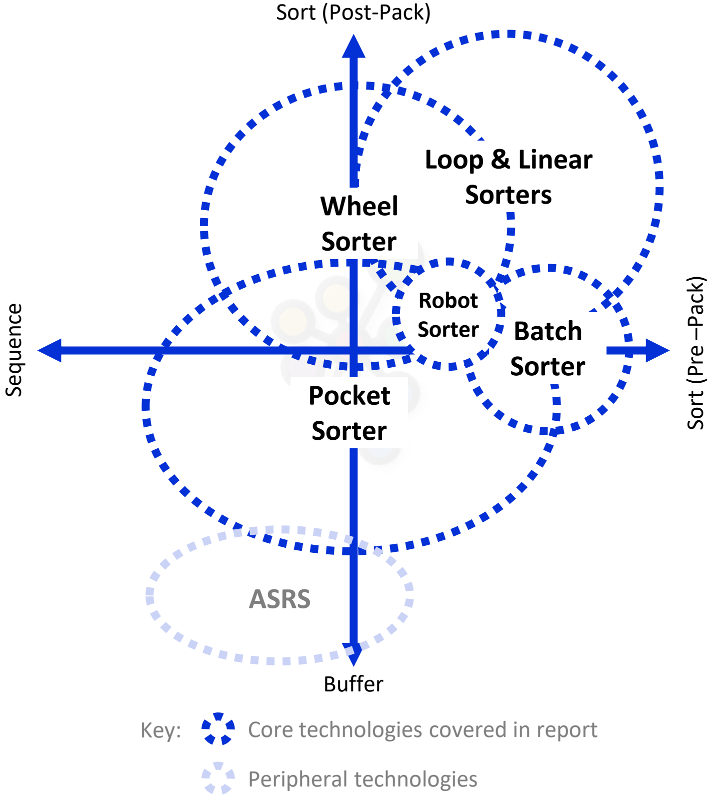
FUNCTIONAL SEGMENTATION OF SORTATION

- Some sortation equipment overlaps easily with other functional warehouse concepts, such as sequencing and buffering
- Note that this can also be influenced by the creativity of system integrators or vendors who may apply sortation equipment for different tasks
- A recent example is the application of mobile sortation robots as a roaming pick face combined with an ASRS system where the sortation equipment acts as a buffer
- This application allows a picker at an ASRS pick station to work with 50-100 open orders (or more) rather than the usual 10-20
- Pocket Sorters are frequently also used as a buffer in addition to its sortation capabilities and may also include sequencing functionality
- More advanced Wheel Sorters (Pivot Wheel, ARB, etc.) can also be applied to sequencing tasks, for example to prepare cases for palletisation by organising these in the right direction and in the right sequence
- STIQ has also heard of sortation equipment being applied to certain cross docking applications

INCREASING FLUIDITY OF DEFINITIONS

- As creative warehouse solution designers find new applications for existing tools, or whenever new equipment comes to market and matures, there will increasingly be grey areas where functions and concepts overlap
- This could also mean the emergence of a fluid market segmentation with increasingly fuzzy edge cases and different design consideration and approaches

FUNCTIONAL SEGMENTATION OF SORTATION EQUIPMENT (ILLUSTRATIVE)



Source: STIQ Ltd Research & Analysis

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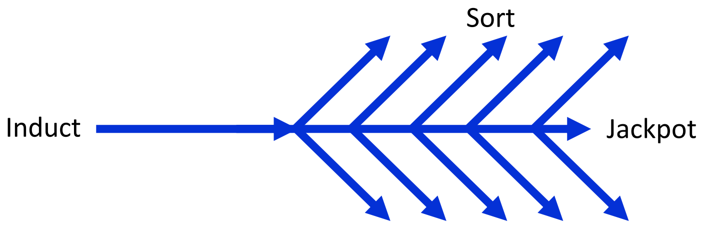
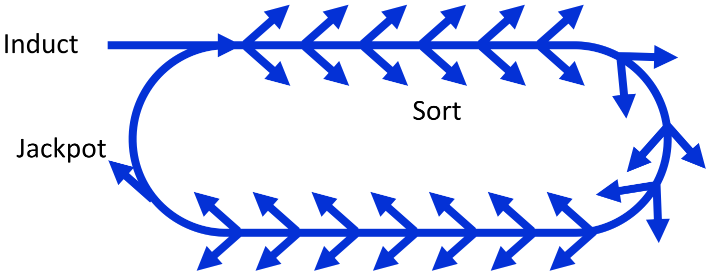
LINEAR AND LOOP SORTERS ARE THE PRIMARY CONFIGURATIONS FOR CROSS BELT, SPLIT TRAY AND HORSESHOE

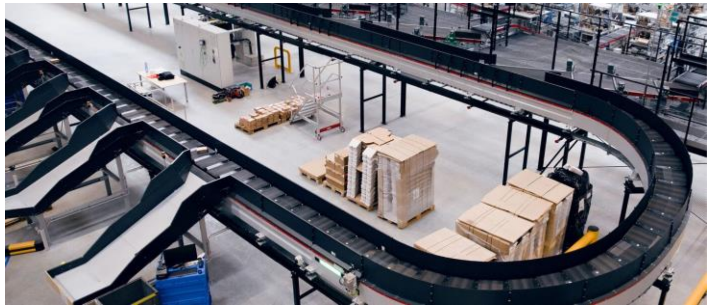
LINEAR SORTER



Source: STIQ Research & Analysis. Image source [Gebhardt Intralogistics]

LOOP SORTER





Source: STIQ Research & Analysis. Image source [Gebhardt Intralogistics]

LINEAR & LOOP SORTERS: DIFFERENCES

- Readers should note this is a simplified version and there may be other options, configurations, etc. available
- Linear Sorter and Loop Sorter are two configurations for a variety of payload carriers, such as Cross Belt, Tilt Tray and Horseshoe
- Note Loop or Linear sorters may also simply be known by the type of payload carrier, i.e. Cross Belt Sorter, Tilt Tray Sorter, etc.

- The primary differences between a Linear and a Loop sorter are throughput, capacity and space requirement
- Linear sorters are often slower than Loop sorters but offer a leaner form factor and are often deployed in brownfield locations where space may be at a premium
- There are also limitations for Loop sorters, i.e. the payload carrier cannot be Split Tray
- Interviews have suggested Linear Sorters have become more popular in recent years

"2021-2022 was definitely Loop Sorters. But from 2023 onwards, the proportion of linear sorters which we launched 5 years ago is growing in our pipeline." [Beumer]

- Loop Sorters are the current gold standard for high throughput/capacity requirements

"The Loop Cross Belt is more suitable for distribution centers which handle large quantities of parcels and have big warehouses that can house the Loop." [Confirmware]

"If you're building a major hub, the volumes are bigger, throughputs are larger, so usually that would need a Loop Sorter solution." [Lodamaster]

IMPORTANCE OF INDUCTION LANES

- It is important not to underestimate the importance of induction, or introducing parcels or units to a sorter
- For example, if you can only induct 20 parcels per hour, you can only sort 20 parcels per hour
- Higher performing sortation solutions may include automated features, such as singulators to separate parcels into single items, 5-sided scanning equipment to allow scanning of labels faster and more accurately

THE JACKPOT AND MANUAL HANDLING

- If an item does not scan for whatever reason, it goes to the jackpot and will require manual handling

HIGH VOLUME TECHNOLOGIES ADAPTING TO LOW VOLUME ENVIRONMENTS. LINEAR CROSS BELT FINDING ITS PLACE IN THE MARKET

HIGHER TECH FOR LOWER VOLUMES

- Interviews suggested a trend of high-performance technologies being adapted to low-mid application, e.g. Linear Cross-Belts

”We launched a linear sorter derived from the Cross Belt, instead of looping around, it loops over and under. The starting cost is lower, and there are several applications that don't really need a loop sorter. For example, if you need just one induction zone, and have low throughputs, then a loop sorter is an over design.” [Beumer]

“We're seeing technologies previously for high performance, 20k-40k parcels per hour and more becoming more available to the mid-market.” [Conductix]

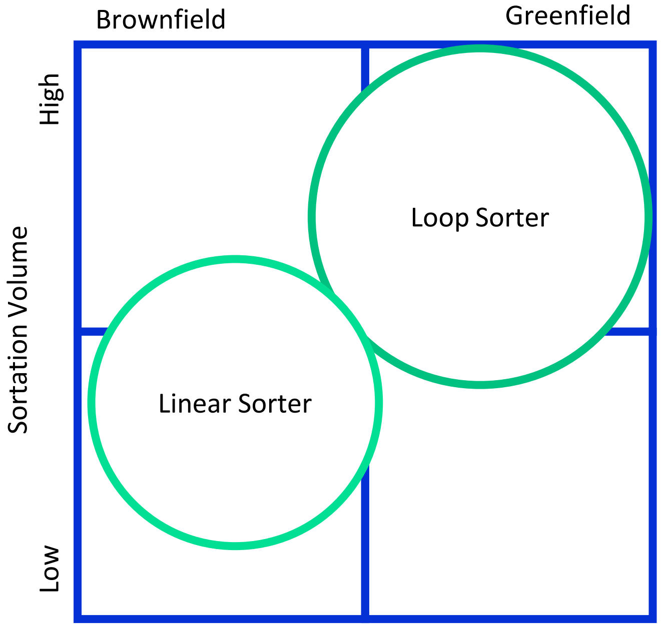
- This trend appeared to be supported by increased demand in the market for lower-volume automation

“We saw a healthy demand out there for delivering technologies at a price point suited to their lower volumes, some as low as 1,500 parcels a day.” [IDParcelandMail]

- The significant price difference was seen as major driver for linear sorter adoption

“The starting average price for a Loop Sorter is higher than what you could get a Linear Sorter for. That means the addressable market is bigger, because you can now target SME type retailers, ecoms, whereas the Loop Sorter was more for very large Fortune 100 companies and large parcel couriers.” [Beumer]

LIKELIHOOD OF LOOP V LINEAR SORTER



Source: STIQ Ltd Research & Analysis

- Increased prevalence of brownfield projects across NA and Europe might further lead to wider adoption of linear sorters over loop sorters

“The Linear Sorter is popular in China since it covers a smaller area and still saves a lot of labor. Then you have something like a Tilt Tray which handles less volume but is much cheaper.” [Confirmware]

THE CROSS BELT = GOLD STANDARD

- Cross Belt sorters remain the gold standard, but have typically come in at a much higher price, albeit not at a huge difference compared to other solutions

“When we pitched for a project with a large European postal company, we were competing against a Shoe Sorter system. They're typically cheaper than a Cross Belt. But Cross Belt sorters are the gold standard for parcel companies for their performance. Maybe smaller companies, or ecommerce could depend on something like a Push Tray or a Divert solution, but in a major parcel hub, you need the Cross Belt from a performance perspective.” [EAE Solutions]

- Interviews hinted at a narrowing price delta between Cross Belt sorters and other sorters currently at around 10-30%

“The loop sorter has been our bread and butter for several decades. In the parcel market, the vast majority of loop sorters we sell are Cross Belt and the rest are Tilt Tray. As the cost difference has shrunk to low double digits, the preference is moving towards the Cross Belt since you get a similar functionality but with fewer moving parts.” [Beumer]

“The difference is less than 30% between a Cross Belt and a Tilt Tray solution.” [Mantissa Corp]

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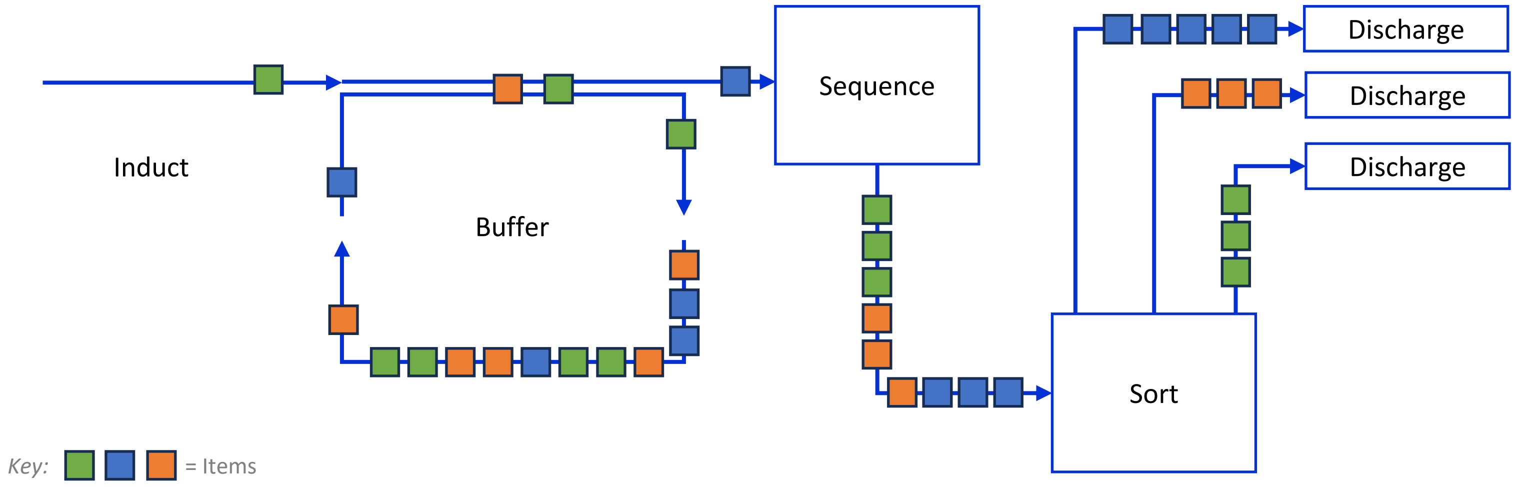
INHERENT SEQUENCE-SORT FLOW A SELLING POINT FOR UNIT SORTERS. BUFFERING AN ADDED ADVANTAGE FOR POCKET SORTERS

SIMPLIFIED ITEM FLOW THORUGH POCKET SORTER SYSTEM



Source: STIQ Ltd Research & Analysis

BUILT-IN BUFFERING

- Several vendors indicated that Pocket Sorters are uniquely positioned because of the inherent buffering and sequencing built into the architecture

"I think the split trays, and Cross Belt sorters, they'e all systems that can compete with a pouch sorter, but they have some constraints with for example, number of destinations. The main thing is that a pouch sorter can work as a buffering, sequencing and transportation system, so we've had requests from customers asking for these systems in production supply lines. They might want a specific sequence of screws, followed by cables at a specific stage in the production process." [TGW]

PAIRING WITH STORAGE

- Vendors were much more cognizant of the limitations and benefits of Pocket Sorters, optimizing them for higher turnovers

"The two numbers that describe the size of a pouch sorter system are throughput, and stock holding. If you divide one by the other, you get a turnover rate, so if you have 50k items and 10k per hour movement, you have a turnover of 5 hours. If the stock sits there for days, then it becomes a storage location which becomes very expensive. I believe the market is moving away from those 100,000 pocket sort systems we've seen because the pouch sorter is great for high-throughput sequencing." [TGW]

- Pairing a Pocket Sorter with an ASRS was seen as an effective way of keeping the fast movers agile, and slower movers in cheaper storage systems

"In North America, fast fashion is still growing quite a bit and there you don't have a strong pareto, the typical 80:20. You have something like 50:50, 60:40, it's all over the place, and those imbalances are generally solvable if you pair a pocket with an ASRS." [Vanderlande]

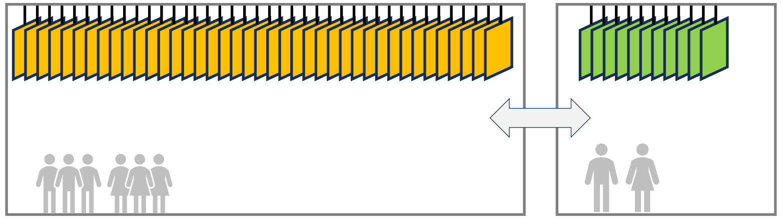
RETURNS HANDLING

- Sequencing allows unit sorters to very easily bring returns back into inventory and to offload stagnant products into SKU pure storage locations

"The advantage for returns is you can receive them unsequenced and unsorted, so you get a green shirt, blue trousers, red shoes etc. Say there are now 10 red shirts after a day sitting in the pocket sort system from returns but they're not selling, you can sort them through the pocket sorter and construct a SKU pure tote for your ASRS easily. We're targeting a turnover of 6 hours, that's where we believe the strength of a pocket sort system is." [TGW]

POCKET SORTER: PROJECTS TEND TO BE LARGE AND INFREQUENT. MINIMUM SIZE REQUIREMENTS POTENTIALLY INHIBITING MARKET GROWTH

SMALLER AND MORE MODULAR POCKET SORTERS POTENTIALLY ENTERING THE MARKET



Source: STIQ Ltd Research & Analysis

POCKET SORTER OR POUCH SORTER?

- Note STIQ use Pocket Sorters to include Pouch Sorter in this report

POCKET SORTER ORIGIN IN GOH SPACE

- Pocket Sorters originated in the GOH space with apparel as the primary target
- While GOH has declined sharply, there were still projects for combined solutions with GOH and pockets

"We did a project recently with a GOH module so you could manually hang garments but still have it sequence and sort out, with really long garments on the same rail with Pocket Sorters as well." [Element Logic]

POCKET SORTER PROJECTS

- Due to the nature of the current crop of pocket sorters, there has been a relatively high threshold for starting projects which take advantage of these solutions

"There's kind of a chicken and egg situation in pocket sorters. The market is small, but that might be because no-one has offered a viable system for smaller projects. To get the full benefit of traditional pocket sorters, you'd first install a unit with 7,500 pockets, and then upgrade it in steps of 7,500. Imagine a smaller business that wants to install a pocket sorter, they're immediately starting with 7,500 units and that's a huge project." [TGW]

- Projects are typically in the region of 10's or 100's of thousands of pockets

"The size of pocket sorter projects can vary a lot but tend hover around 50-150k load units or pockets. However, there are much larger projects with 500-800k load units in the market." [Schoenenberger]

- A result of this dynamic has been that the segment is typified by large and relatively infrequent projects

"Pocket Sorter projects are not that consistent and spread over many years. All of them are for retailers and typically support ecommerce fulfilment." [Element Logic]

"Projects for pouch sorters tend to be large and infrequent. In Europe we've had pouch sorters for a few years now, and there is a steady pipeline of projects. We brought it to North America where we've seen some steady demand. The business case tends to be weaker for smaller projects, it really kicks in at around 4k pieces/hr and gets stronger towards 5-digit units/hr." [Beumer]

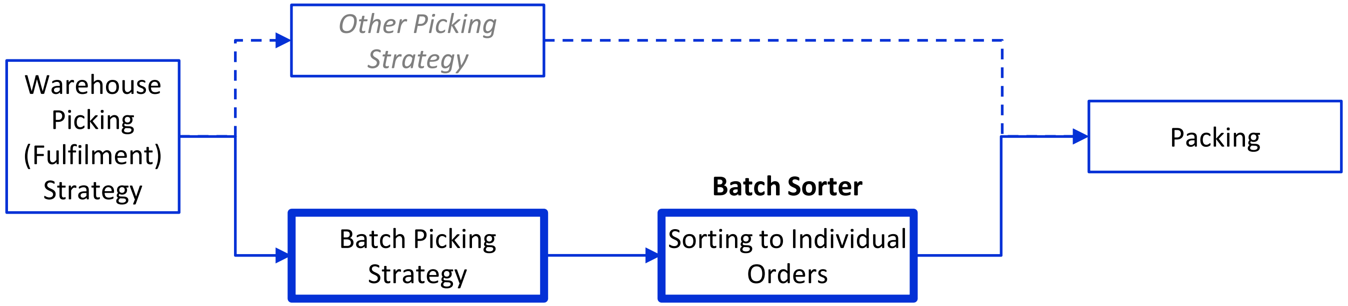
MARKET DEMAND FOR SMALLER PROJECTS

- Despite this, interviews suggested there was a lot of interest in the market for smaller pocket sorter solutions,

"We continue to see interest in smaller pocket sort systems in the market, perhaps not as much as last year. But projects tend to be mainly at the bigger retailers or ecommerce players." [Schoenenberger]

USE OF BATCH PICKING STRATEGIES HAS DRIVEN UPTAKE OF UNIT SORTATION EQUIPMENT

BATCH SORTERS CAN BE DEPLOYED WHEN USING BATCH PICKING STRATEGIES



Source: STIQ Ltd Research & Analysis

PICKING STRATEGY (UPSTREAM)

- There are multiple fulfilment picking strategies in warehouses, sometimes depending on what equipment is available, order profiles, SKUs, etc.
- Batch Picking is a strategy where a picker collect items in many different orders into a single container
- For example, there could be 300 different products for 100 orders in the same container
- Batch Sorters may be used to sort these 300 items into the correct orders

HANDLING EACHES KEY TO BATCH PICKING

- Unit sorters were specifically designed to deal with a wide range of product “eaches” which often may not have any secondary packaging, making handling easier

”People who want to consolidate their orders do batch picking. If you bring the tote to the sorter, you can now do 50 orders off that SKU, and depending on the amount of sort locations you have, you can have that order sitting there for while. On a regular put wall, you can't do that, you'll blow the put wall out, so now imagine you have 500 locations, that's essentially a huge put wall. A key advantage is the range of raw eaches that unit sorters can handle.” [OPEX]

ROBOT SORTERS IN BATCH PICKING

- Robot Sorters increasingly being applied as part of a batch-picking strategy
- RPC are being adopted to pick SKUs directly out of storage into order totes to be sorted out

“Robotic sortation can amplify the throughput of an ASRS, again this goes back to the idea of batching. When an ASRS presents a bin, typically you're picking that to maybe 3 or 4 orders. With a robotic cell feeding a robotic sorter, you could be picking to 120 or 240 orders per module so now you're emptying those bins faster, you replenish them more often and so the performance of the ASRS increases, sometimes reducing the required ASRS size by 30% with the same throughput.” [Berkshire Grey]

- Mobile sorters are being used to increase the batching effect by picking directly onto them and sorting the eaches into a larger number of exits/totes that a facility can pick against

“The biggest industries that we serve are pharma and healthcare, retail and then parcel handling. In particular, we're seeing our AMR sorters combined with any ASRS, where the ASRS brings a tote out, and the operator places items picked onto our robots for a few hundred to 5,000 of stores or orders, and robots sort to the right destinations. We're do this a lot with all kinds of ASRS systems. We take a large batch pick and sort each them to the store or ecommerce order, or whatever application you want sorted.” [Tompkins Robotics]

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UNBOX ROBOTICS

ROBOTIC PICK CELLS AND MOBILE SORTERS ARE THE TWO MAIN FORMS OF ROBOT SORT

EXAMPLE OF ROBOTIC PICK CELLS AND MOBILE SORTERS

Robotic Pick Cells

Mobile Sorters

Source: Berkshire Grey Robotic Pick Cell (Source), Unbox Robotics Mobile Sorter (Source)

ROBOT SORT

- While there are many variations of robotics in sortation, this report will focus on the two primary groups
- **Robotic Pick Cells** are robotic arms that are placed along a sortation line and are typically used for induction, batch sorting and singulation. They can be used in Pre-Pack and Post-Pack sortation
- **Mobile Sorters** are AGV/AMR platforms with a carrier such as a Tilt Tray or Cross Belt, and typically take inducted packages to a sorting destination or chute. These are used primarily in Post-Pack sortation

ROBOTIC SINGULATION AND INDUCTION

- RPCs have seen widest adoption in singulation and induction, aiming to replace labour intensive manual processes

"We have induction systems where basically we take items from a customer container or directly off a belt and essentially singulate those items into another part of the warehouse for the customer." [Berkshire Grey]

"We need to not only reach into the bin and grasp at items, but to know that I've picked up two. Singulation is necessarily a part of piece picking." [Ambi Robotics]

MOBILE SORT FLOORS

- Sort floors with dense exit counts are currently the main application of Mobile Sorters, intending to reduce secondary sort flows

"Our AMRs are more suited to deal with 200-2,000 exits." [Unbox Robotics]

"Parcel handlers traditionally have 150-200 destinations, but they have to sort to 800 destinations which means they have to do a secondary sort at the end of the chute." [Addverb]

INCREASED PREFERENCE FOR BROWNFIELD PROJECTS AN OPPORTUNITY FOR ROBOT SORT VENDORS

MORE OPPORTUNITIES FOR ROBOT SORT

- Increasing brownfield opportunities have pushed the evolution of linear sortation solutions, but this could also prove an opportunity for robot sortation, which may use more flexible space

"I think conventional sorting has almost reached its physical barrier. That's why I think robotic sorting has a lot of opportunity especially because of the flexibility." [Lodamaster]

"Aside from potential downtime when extending your sort line, you also need to think about the space, when instead you could get a robotic sorter that's smaller, and can even squeeze in between other machinery, and it's all Opex." [Ambi Robotics]

"Robotic Sortation is often just in brownfield application because you can adapt and nowadays that's quite important because it's very difficult to get permits for new builds. If you go for these larger systems, more often than not those are greenfield." [Addverb]

"With the economic slow down, retail has been focusing more on the brownfield improvements… Conveyor changes, sortation changes, pick optimization, whether that be cubic ASRS, AMR, those sort of things." [TREW]

- Interviews suggested robot sortation offers scalability advantages when compared with traditional sortation equipment, albeit with lower throughput

"First you don't need to design a project with the volumes you plan in 5 years. You can design for this peak season's needs and if there's space, extend it, add more robots. Then if you're done with the warehouse, you can uninstall in two weeks and move to a new site." [Lodamaster]

- Use of robots with systems like put-walls and shuttle sorters were said to yield favourable throughput/sqft

"Customers are increasingly focused on footprint and scalability in addition to throughput. And the solutions have to be drop-in and deployed quickly since most installations are brownfields. This is helping lead the charge toward modular systems like robotic put walls and shuttle sorters which achieve similar throughput in as little as half the space and with less labor." [Berkshire Grey]

- The potential to sort to a much greater number of destinations in an equivalent area was also highlighted

"The area required is much more a function of the number of exits you're sorting for rather than the throughput of the system. That really dominates the space requirements of a system. Comparing a traditional conveyor with 1,000+ exits, you're looking at much more density with AMRs. At less than 50 exits, conveyors are competitive if number of exits remain constant." [Unbox Robotics]

"We're typically placed near a high-speed primary sorter which may have something like 100 chutes, but they need to sort to many more destinations. So that's where we mainly operate, basically providing a bin expansion capability." [Ambi Robotics]

- This might improve sortation by removing the need for secondary and subsequent sorting processes but would depend heavily on carrier network designs, etc.

"Parcel handlers traditionally have 150-200 destinations, but they have to sort to 800 destinations which means they have to do a secondary sort at the end of the chute." [Addverb]

- Further, the use of robotic arms could improve the ROI, potentially being viable despite a sub-optimal sort ratio

"In manual environments, you'd have 4-6 people working at the bottom of a chute, moving to 80 locations. With a robotic arm, you'd need 1 person to support it, feeding the bins, or emptying sacks. From an ROI perspective, instead of hiring 4-6 people, it's just 1 person and they can now run multiple shifts." [Ambi Robotics]

- Labour pressures and volatility were seen as a potential driver for increased investment in robotic processes

"One customer told me if they need 100 people for a shift, they often need to invite 130-140 to be sure that 100 people show up. But then sometimes they all show up which becomes a financial problem because they now have to pay all 130-140. That's why they're looking to more robotic solutions." [Addverb]

INNOVATIONS APPEAR INCREMENTAL

- Some interviews suggested that Mobile Sorters had seen some stagnation in innovation within Sortation use-cases

"I think a lot of innovations and interesting concepts are still coming from the AMR market where there are new products coming to market. But they're kind of incremental, it's focused on a certain niche with some smart ideas here and there, but it's not a major departure." [Conductix]

- There was also a sense of the market saturating with similar companies, and that consolidation was inevitable

"I believe that there're so many companies now eventually they'll start merging because there isn't enough room for all of them, it's impossible." [RN Logistik]

WHILE STILL A NICHE IN SORTATION, END-USERS INCREASINGLY EVAULATING ROBOT SORT SOLUTIONS

ROBOTIC SORT PART OF THE CONVERSATION

- Interviews showed a continued interest in Robot Sort technologies, with an increasing presence in RFQs

"We're seeing AMRs be brought up more in RFQs or customers questioning if they're a better solution for them." [FMH Conveyors]

"We see the most traction in Robotic Sortation. You see clearly that people are looking for scalable solutions, even movable solutions as well." [Addverb]

"I'm seeing FOMO on AMRs for sortation. Maybe 18 months ago, I lost a 10k per hour sort project to an AMR solution, and these solutions quoted 4k per swarm so how did I lose? Then it was clear that OK, the idea is you can deploy multiple swarms." [Anonymous]

- Mobile Sort continued to show growth primarily in APAC, with increasing interest from NA and Europe

"The AMR market at large continues to grow at a moderate rate, with sortation a relatively small niche within that. We've seen new deployments mostly in Europe and APAC." [Conductix]

"Currently, we have more sites in the India and Europe, but we're also seeing growth in the US over the next 12 months." [Unbox Robotics]

- Robot Sort projects were still relatively small, with the largest projects ca. 10x smaller than traditional sortation

"Generally, our robots do 60-120 sorts per hour, averaging 80 sorts per hour. We plan for deployments with a throughput of around 5k-10k parcels per hour. Anything less than 5k would be a small project, 5k-10k are mid-scale, 10k plus are the large scale setups for our system." [Unbox Robotics]

- There was also some adoption in typically low-wage countries, with emphasis given to quicker go-live times

"We offer an AGV sort floor and did an installation with a client in Brazil. First the commissioning time was about two or three days compared to one year from their previous solution, which they had a really bad experience with." [RN Logistik]

- Despite the benefits of AMRs pitched towards SME, Mobile Sort projects still appeared skewed to large scale, automation savvy companies

"The vast majority of our customers are larger companies, multi-billion dollars in size that are skilled at operating automation. We're not typically in companies that are $250m in revenue doing their first foray into automation." [Tompkins Robotics]

CONVENTIONAL VENDORS DABBLING

- Conventional Sortation vendors also signalled interest in participating within the Mobile Sort space, focusing on effector designs

"We saw with robotic arms that the arms themselves became a commodity and the differentiator became the end of arm tooling. So, to that end, instead of developing AMRs we developed conveyor tops that integrate on top of existing AMR platforms." [Interroll]

ROBOT SORT VENDORS INVESTING IN COVERING MORE APPLICATIONS ON THE SORT LINE

FROM PRODUCT TO PORTFOLIO

- Labor intensive manual induction appeared to be limiting Mobile Sort adoption and retention

“We're seeing some of the major companies moving away from AMR sortation floors because they're too labor intensive. The robots are manually loaded, so people need to be there putting items on the sorter bots.” [Interroll]

- It was suggested that autonomous induct would not only remove labor pressures, but could also improve the throughput of the system

“Sorter induction can be limited by singulation. With our shuttle sorters, multiple items can be picked simultaneously from a donor container and placed all at once into an order container. This no-singulation approach has led to 2 to 3 times faster order sortation.” [Berkshire Grey]

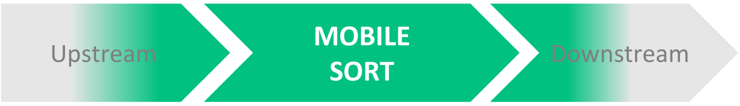
- Mobile Sort vendors were developing new products to capture more of the up/downstream, with induct being a particular focus

“We're still focusing on the elemental sorting. It means that there isn't one product that conducts the continuous sort, instead you have lots of robotic systems with different roles. We are trying to build solutions that go from induction to the end of sortation.” [Libiao]

- This was also seen as a method for capturing customers that might previously have been out-of-scope

”We want to be more of a one-stop shop for sortation for our customer base. You get your foot in the door with your customers for example with last-mile, then when the operation expands you can support them.” [Tompkins Robotics]

MOBILE SORT VENDORS EXPANDING ALONG SORTATION PROCESS



Source: STIQ Ltd Research & Analysis

ROBOTIC PICK; A NEW HOPE FOR SORTABILITY

- It was suggested that robotics might help bridge the gap, and improve the ratio of sortable packages, an important metric for ROI

“I think everybody’s wanting to get rid of more packaging. You've got Cross Belts and Tilt Trays that deal with some items better but there are still challenges. The industry is figuring out where robotics fit in, whether for loading and unloading trucks, or on these sort lines. Robotics seem to be the solution for a lot of things, but from a technology standpoint, what's out there for sortation, people are trying them, but we haven't heard of any major successes yet.” [FMH Conveyors]

- In particular, the application of robotic systems with put-walls and shuttle sorters was an increasingly popular combination

“Goods replenishment continues to move toward an eCom model where orders are much less than case level and very diverse. You now need to handle SKU’s that are small, odd-shaped, unbagged, porous, both when inducting and when sorting, with high accuracy. As a result we see a lot of customer interest in robotic put walls, shuttle sorters, and pick cells that offer a very high level of SKU coverage.” [Berkshire Grey]

LIMITED RAAS ADOPTION, PRESENTLY

- Interviews suggested there was some demand for RaaS models, particularly in high-wage regions

“We have both RaaS and a purchase model. The RaaS is a monthly fee based on the number of robots and a one time fee for the non-robotic equipment to be integrated. This doesn't work so well in India because of the long payback time, but in Europe and America its a very strong model with fast ROI.” [Unbox Robotics]

- More novel business models like unit-based pricing were being trialed, but the value proposition was still unclear

“We’re trying a cost-per shipment model, so far, we've tried with one customer, but we aren't so sure if that will be a preferred model for us. It's very hard to arrive at the sweet spot price that works for both the customer and ourselves. We need to spend more time in the market and make sure nobody is losing.” [Unbox Robotics]

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SORTATION SOFTWARE AND CONTROLS BECOMING CORE IN DRIVING FURTHER OPTIMIZATION AND TAILORING SOLUTIONS TO CUSTOMER NEEDS

SOFTWARE AS A DIFFERENTIATOR

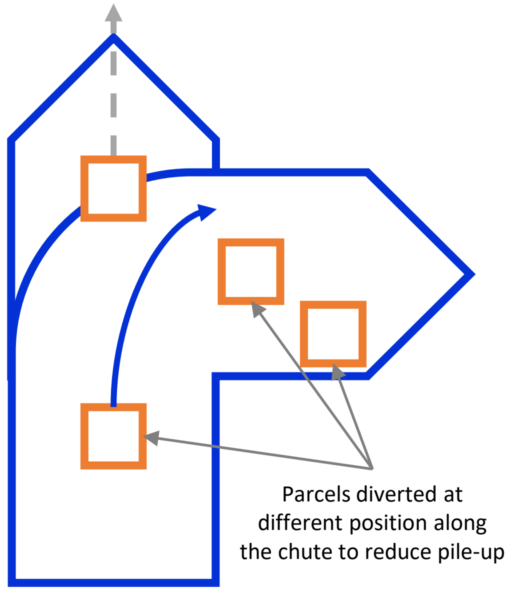
- While there are still differences from vendor-to-vendor, sortation mechanics appear to be commoditizing
- The differentiation between two equivalent solutions could come down to the software and controls

"The mechanical aspect is almost a commodity at this stage, so we're seeing a lot of differentiation on the software and control side. For example, when you divert a parcel, you'll typically divert at the same point on the chute, causing them to pile up on one side. Using vision technology, it's like Tetris, where we identify where along the chute is the best point to divert the product to maximize the used space. When you have wide chutes, say 1 meter long, then you can really be smart with the software." [EAE Solutions]

- Software could allow vendors to tailor the performance and behavior of sortation equipment to squeeze out additional benefits for their customers

"When it comes to throughput, it's very heavily software dependent. Most pouch sorters say they can do 10k units per hour, and that's the mechanical rate, you're assuming every pouch is in every available slot. In reality, you can see slots that have no pouch, and that's the opportunity for the software. It's specific to each operation, and that's where you can make software changes to get that additional optimization out of the system." [Element Logic]

SOFTWARE ENABLED BALANCED DIVERT



Source: STIQ Ltd Research & Analysis

- Vendors were increasingly investing in their software and controls development to meet the demand for sorting intelligence

"A lot of the systems were just transportation, you know, you turn it on, and it moves the items which are then sorted manually. We're investing more into PLC and control since we're seeing a lot of those systems are moving to more intelligence." [FMH Conveyors]

COMPLEXITY AND INTEGRATIONS

- Sortation projects are becoming more complex, with integration needed between multiple sub-systems

"After the mechanics is the complete software, and that's what's needed to really integrate the solutions into the customer's network." [Prolistic]

- Software contributed 10%-30% of a standalone sortation project

"For any project we have three main breakdowns - mechanical installation, electrical installation and controls. Software is probably 20% of a project, especially for standalone sort projects that we've done." [Anonymous]

- Proportion of software was said to decrease beyond a certain size of project
- This could be a consequence of software scaling more from complexity i.e., the integrations of sub-systems, and less from the scale e.g., the number of destinations

"In smaller projects, the share is maybe 20-30%, and in larger projects, it's something like 10% of the project is software. At some point the software doesn't scale, it doesn't matter if you have 100 gravity lines as a buffer, or if you have 300." [Anonymous]

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING OFFERS A POTENTIAL OPPORTUNITY FOR EVEN SMARTER SORTERS

WHAT MAKES A SORTER SMART?

- Interviews suggested that there is a need for software beyond the PLC level driven by the need for more intelligence and integrations between sub-systems

"Our activities end at the PLC, from the WCS and above, we work together with partners that know our systems, the sorting intelligence and how to integrate into the customer's systems." [Schoenenberger]

- However, it wasn't clear whether this was the responsibility of the WMS, WCS or WES
- Our previous interviews for the 2023 WMS Report suggested that this is not unique to the sortation space, but is industry wide and a result of increasing complexity

"WMS can handle high-speed sorters, when you do a second divert off of a high-speed plant sorter down another lane, our system is a lane. When you want to pick directly from an ASRS onto our sortation systems belt, then the WMS is going to have to handle the assignment of the bins much faster for the order. WES is better for these kinds of processes, they've been doing that for decades, they're great at optimizing the execution around waves." [OPEX]

"Typically, there is a break between the WMS and the WCS coming from the customer side so if something isn't working then the WMS and WCS vendors point to each other." [Schoenenberger]

- For more analysis on WxS and the responsibilities of each layer, read STIQ's 2023 WMS Software report or pre-order STIQs 2024 WMS Software report

LEGACY MACHINES NEW TRICKS

- STIQ interviews around AI and Machine Learning indicated a knowledge gap with end-users that resulted in a harder sell

"The customer didn't know they had a problem, nor that there was a solution other than more humans. This is a common issue with machine learning solutions. We went to a site, we saw there was a problem, and we worked on it ourselves, and presented it to the customer." [Tenivus]

- Initial applications included detection of doubles, and hazard label detection, with positive early results

"We deployed it to 48 test sites, and during that short evaluation period, we detected 22.5m doubles. We're impacting 1.5% of the customers overall US volume, and we aren't even in 50% of their facilities." [Tenivus]

"We include AI in some of our products. We have deep learning that does hazard label detection with different test decks for different companies, whether it's lithium-ion batteries, or chemicals, so it's important that we're able to learn on the fly and add to the test deck." [Vitronic]

- As AI solves downstream processes, opportunities upstream could be identified such as early detection of defects with automated packages, reducing the problem at source rather than downstream on the sort-line

"Defects with packaging, like glue sticking together is a machine error that I've been trying to get the customer for the past two years to put dedicated AI detection systems after the packaging gets closed but since there's such a lack of understanding of the technology is and what it can do, it hasn't come to fruition yet." [Tenivus]

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CLEAR GEOGRAPHIC DIFFERENCES IN ADOPTION OF SORTATION EQUIPMENT. CROSS BELT IS SEEN AS THE MOST VERSATILE BUT SHOE SORTERS STILL HOLDING THEIR GROUND

EUROPE AND NORTH AMERICA DIFFERENCES

- Interviews suggested strong regional preference for particular form-factors and technologies
- A plurality of interviews suggested that North American buyers evaluated sortation technologies differently to European buyers

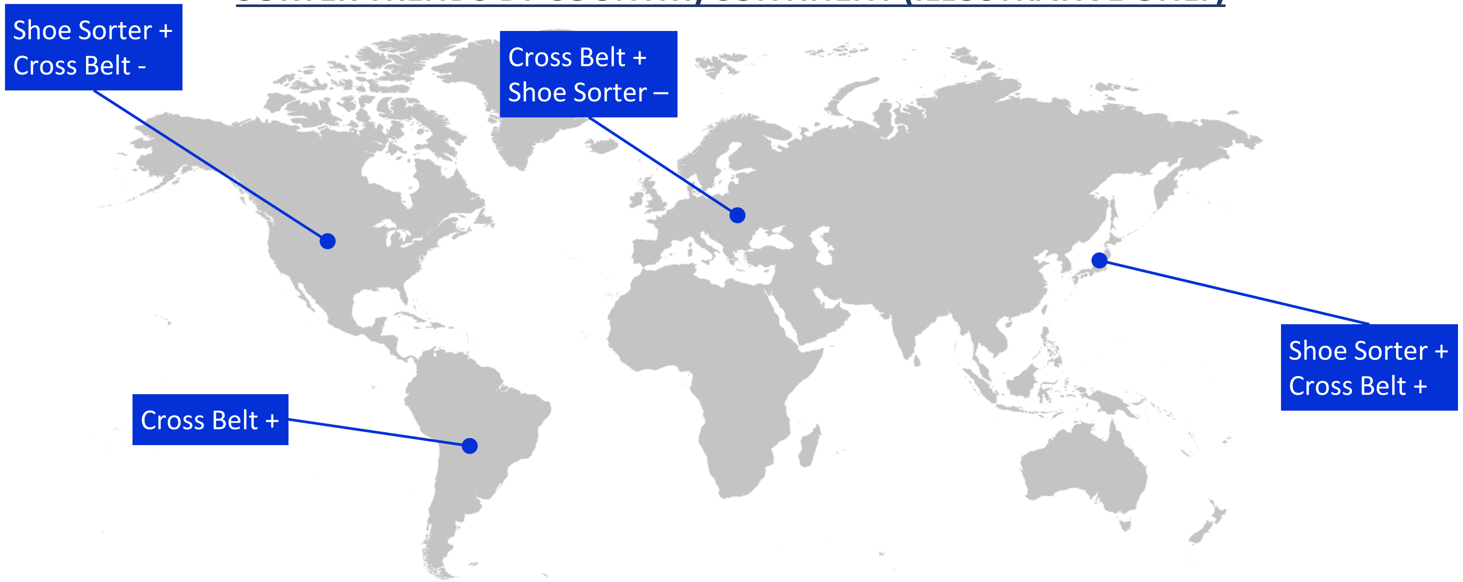
"Shoe Sorters are not well received in Europe. It's too heavy and loud, and there is competition in this market that we see as much more efficient, like Narrow Belt Sorter, which are more flexible and much less noisy. Shoe Sorters are quite well received in the US. Big players like DPD or DHL use them. We started to focus a bit on Shoe Sorters in Europe, but we didn't find much interest." [Prolistic]

- APAC and South America seemed to be somewhere between Europe and North America with their preferences, although tilting towards the Cross Belt

"In Japan, we see that the Shoe Sorters and Cross Belts are the most popular solutions here. In particular we see Cross Belts adopted with parcel couriers, apparel, ecommerce and even food industries." [Bowe Japan]

"In South America, Cross Belts are very popular. We also offer a Push Tray system which is particularly popular with couriers, fashion and shoe brands." [RN Logistik]

SORTER TRENDS BY COUNTRY/CONTINENT (ILLUSTRATIVE ONLY)



Source: STIQ Ltd Research & Analysis, Map (Source)

- As packaging shifts further towards polybags in North America, the Shoe Sorter may face more competition from Tilt Trays and Cross Belts

"The change in packaging is important. Companies that were once handling 70% cartons have shifted to 20% cartons and 80% bags which Shoe Sorters don't handle as well, whilst Cross Belts and Tilt Trays don't really care." [Mantissa Corp]

- Although there was a sense that SDGs might drive packaging away from polybags and back in the direction of cardboard flats, reducing the burden to move away from Shoe Sorts

"We went from corrugate boxes to polybags in the US. Although in Europe that's less so because of regulations around recycling. We don't have that in the US, but that's also changing. We're seeing more of the carboard flats coming into the US market now because of the sustainability angle." [Interroll]

- Ultimately, the unpredictability of packaging might lead to wider adoption of technologies like Tilt Trays, Cross Belts etc.,

"The Cross Belt has more flexibility of package types that it can handle, and that flexibility is what our buyers want, especially since you can't predict what type of packaging will be used in the future." [Vanderlande]

CHINESE VENDORS HAVE BENEFITTED FROM A LARGE DOMESTIC MARKET. INCREASED DOMESTIC COMPETITION MEANS EXPORT MARKETS ARE MORE ATTRACTIVE

CHINESE VENDORS INCREASINGLY EXPORTING

- Domestic parcel volumes in China are massive and the sortation sector has evolved fast to cope with huge demand

"A couple of years ago the Chinese vendors were fully focused on the domestic market, with some very big sorter manufacturers. They also have very big volumes because of the rate of growth. More than 50% of all parcels globally are sent & received within China. But now it looks like the Chinese companies are starting to see projects in Southeast Asia and other emerging markets." [Conductix]

- However, it seemed intensive domestic competition in the Chinese domestic market has meant many of these vendors now look abroad for business

"We work with a lot of Chinese companies, and we see that due to the very hard competition in China, they're more interested in European and North American markets. So they're increasingly approaching us with partnership deals and competitive offers. Technically they are also very interesting, even a medium-sized Chinese sorter could have more reference sites than an old European company." [Lodamaster]

- The size of the Chinese parcel market is huge and the volume of deployments have followed

"International buyers sometimes think that a Chinese company means a cheap price. But that's not necessarily true. How we can differentiate though is the number of reference sites. Just in our city of Hangzhou, we have over 200 facilities using our technology. We are also getting more international reference sites." [Confirmware]

SOME LEVEL OF INCREASED COMPETITION

- Interviews suggested Asian vendors may be increasingly competing in some sortation segments, countries, etc.

"I have seen many more Chinese companies entering the sortation industry and trying to disrupt the market." [Anonymous]

- However, others suggested there was currently little evidence of competition in mainland Europe

"We're not seeing much competition from Chinese vendors in North America or wider Europe. We see them in Eastern Europe more often, and usually in the mid-to-low volume sorters. For the big systems, customers would still rely on the big suppliers because of their reputation." [Vanderlande]

- Sortation projects could include extensive customisation which appeared to act as an inhibitor in the market

"We haven't seen that much penetration from Asian competitors. Mainly for 2 reasons. One is lead times, we work locally with our customers and always try to provide the best lead times. The second is that you'd be surprised at the number of configurations that customers want. The less standardized a solution is, that leads to less of an import product." [FMH Conveyors]

- There appeared to be a level of "home buying"

"We usually only see Asian competitors where the parent company of the company that we're bidding for is also Asian. Sometimes we've seen situations where they've been forced to work with a specific supplier." [EuroSort]

SOME HESITANCY WITH "MADE IN ASIA"

- STIQ conversations hinted at some level of discomfort with made in Asia solutions

"China is getting much more involved in the space. We've also identified that the mechanics, the physical quality of products coming out China and Asia in general are good quality. However, in Europe, people really don't want the software or controls coming from Asia." [Anonymous]

"There is a certain resistance to made in Asia in the US unless there is a compelling reason. If you're making a multi-$m dollar decision on acquiring material handling systems that's the backbone of your operation and it fails… that's a career-ending decision. Savvy customers look past flashy presentations and dig deeper - what's your installed base? Where are your service personnel? How quick can you respond? How are you sourcing spare parts? And all that requires a large infrastructure in the US. Just because you have a product, doesn't mean that you can sell the product." [Anonymous]

ASIAN VENDORS, SUPPORT LOCATIONS

- Growing interest in Europe has also pushed some Asian vendors to set up more local customers support teams to improve service levels

"We also have a subsidiary in Turkey in order to localize our laborers around the Middle East, Europe and Russian markets. In the future we hope to have more subsidiaries close to our customers, which is important for them to feel like they can receive support on-time." [Confirmware]

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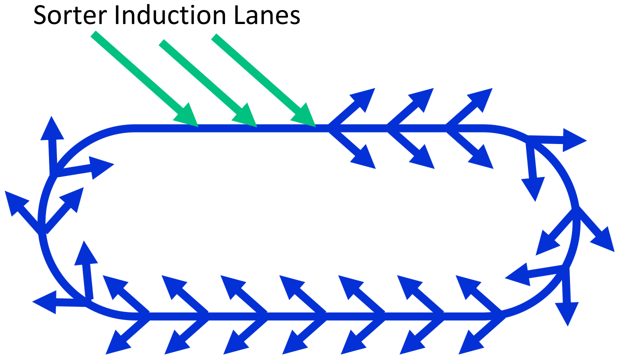
SORTATION EQUIPMENT PERFORMANCE CAN BE RESTRAINED BY OTHER VARIABLES IN THE PROCESS, SUCH AS INDUCTION AND SCANNING SPEEDS

INDUCTION PROCESSES CAN BE AS IMPORTANT AS THE TYPE OF SORTATION EQUIPMENT



Source: STIQ Ltd Research & Analysis

INDUCTION + SORT = CHAIN PERFORMANCE

- The machine rate of sortation equipment tends to leave out the importance of induction
- If you only induct at 500 parcels/hr, your sorter can only reach 500/hr rather than 10,000/hr

"Cross Belts and Shoe Sorters quote very high throughputs. But to reach those numbers, you need to have a very long high-density buffer line to accumulate sorts. This could require 3hrs in the morning for the system to accumulate. And then once you hit that button, it can sort them at 15,000/hr." [Itoh Denki]

"You've got to consider the people, process and equipment, not just machine speeds and feeds. You can buy the best conveyor in the world and still not get the throughput that you need." [TREW]

"Machine rates can reach something like 10k-11k items per hour but in a typical operation, depending on how they're staffed and how efficiently the packages are coming into the equipment, usually the rates are peaking at around 7k per hour, and in normal daily operation, they may be operating at 4k per hour." [Intralox]

- Upstream processes, in particular induction, have a significant impact on the rate a sort line can run at (operational rate)

"Our system can do up to 2,400 an hour, customers are always asking for more, but realistically the operators are the bottleneck. If they can figure out a way to automate the upstream, then we might end up being the bottleneck, but for as long as humans are in the loop, that will be the bottleneck, they get tired, they get worn out. A human may have bursts and dips, but sustained you'll get 1,700 an hour." [OPEX]

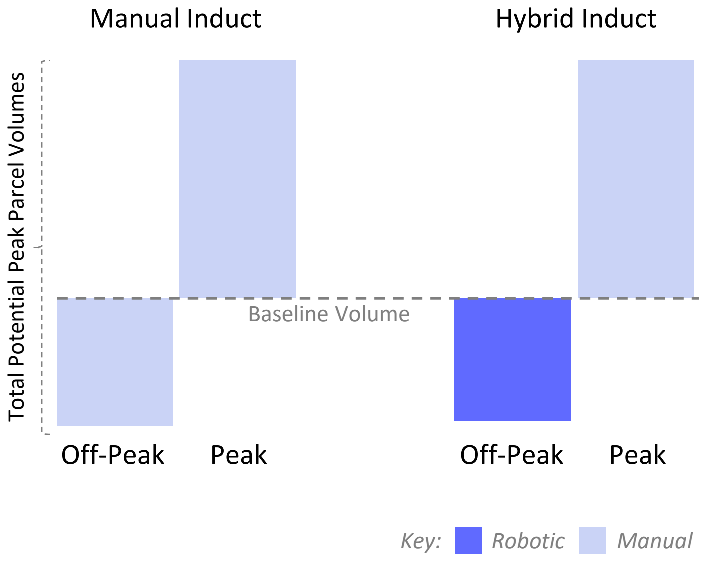
- The steps and the technologies used in WDS are also important to the operational rate

"Using a barcode scanner instead of a camera means you're really maxed out at 450 per minute on your belts." [Vitronic]

"If you do it manually, you measure the size and weight of the parcel, then input the address for distribution by hand, and that takes time. Instead, all this can be done automatically. We have a laser scanner that measures the volume and a scale that measures the weight. The camera focuses on the address, finds it in a database, and creates a sorting plan to sort the parcel into the right basket for posting." [Prolistic].

ROBOTIC INDUCTION SEEING EARLY SIGNS OF ADOPTION. HYBRID INDUCT MAY HELP EASE END-USERS INTO ROBOTICS

PICKING ROBOTS USED FOR INDUCTION



Source: STIQ Ltd Research & Analysis

INCREASED POTENTIAL, ROBOT INDUCTION

- Interviews suggested increased interest in trialling Robot Induction

"We developed an item pick solution with our partners which is now deployed inducting parcels onto a sortation line." [AWL]

- The ability to adopt Robot Induct appeared to be influenced by the homogeneity of SKUs on a sort-line, i.e. more homogeneity increases the viability of Robot Induct

"Induction is typically manual, but we have some customers right now that are piloting robotic induction. The problem is if you're a customer that runs the same types of SKUs it's great, but when you have a wide range of SKUs, it won't work as well. One of our customers that has pretty much the same type of SKUs is partnering with a piece picking company and that pilot should be able to hit the machine throughput." [OPEX]

HYBRID INDUCT A STEPPING STONE

- Hybrid Induct strategies were being piloted where Robot Induct is used during non-peak periods, and is supplemented with manual induction during peak seasons
- This was particularly interesting for highly seasonal companies where volumes are concentrated to specific periods in the year

"We're moving to bulk flow with one of our customers and are going to introduce robotic induction. It's harder to design for because they want to see payback in 3 months out of the year because that's when they have volume. I could use robotic induction which will cover them for 9 months of the year, I don't need any people there because the volume isn't that high. At peak when they're pushing 90,000 bags through this thing, we'll then just supplement the robot with 2 people. It's a huge win, now 30% of that volume is going to be done by the robot. " [SJF]

PACKAGING CAN OFTEN INFLUENCE SORTATION PROCESSES AND EQUIPMENT USED. LABEL HANDLING AND VISIBILITY IS KEY

PACKAGING DESIGN SORTATION IMPACT

- STIQ interviews indicated trends in packaging, influencing the types of technologies developed or adopted in the industry

“The changes in applications of sorters come from changes in packaging design. We went from corrugate boxes to poly bags, but polys also have issues, the load inside the bag can shift, so on divert, the load in the bag might fall between the matrix of wheels and fail to divert properly, so that's why full contact Cross Belts tend to be superior for sortation.” [Interroll]

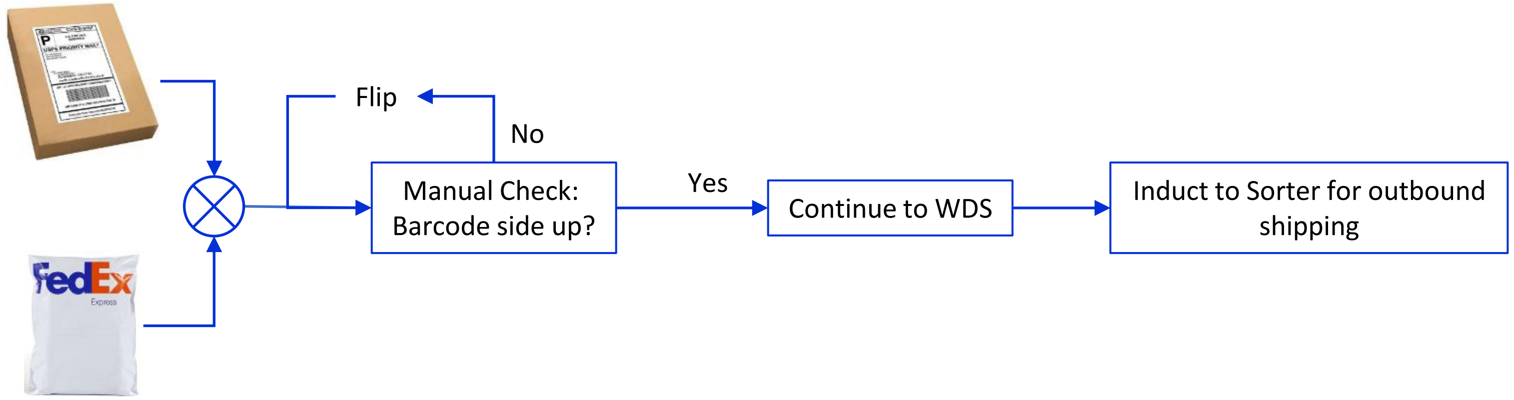
“You have to make sure the packages you have fit well on the carrier that you use. Very often companies make a choice of carrier and then when they want to change packages, they find out that the specs of the package doesn’t meet the requirements of the track that you initially selected. It's important at the beginning to have your specs well defined to get the right solution.” [M&M Beheer & Advies]

- Package type also dictated the processes needed upstream from sortation, i.e. need to ensure Polybags are barcode up

“When you're shipping poly bags, the whole issue has been to get it label up. Even if they have an auto bagger, they don't really have a good method of getting that label up every time. There’s also the fact that when you put something in a polybag, it doesn't come out square, it’s balled up. What they do right now is to have someone stationed there to just look at everything and flip it label up.” [SJF]

ITEMS MAY REQUIRE MANUAL HANDLING TO PREPARE FOR WDS

Parcel from manual pack station



Polybag from Auto-bagger

Source: STIQ Ltd Research & Analysis

- Other factors may also influence sort rates and sortability

“In sortation it's always important to have good labels, good quality of labels, good scanners and a good mechanical process in place to do the right sorting.” [M&M Beheer & Advies]

NEW STIQ PACKAGING AUTOMATION REPORT

- STIQ Ltd will publish a new report on Packaging Automation in 4Q24 – sign up to our newsletter to get updated when this report is issued

SORTATION EQUIPMENT APPROACHING PHYSICAL BARRIER. OPPORTUNITY FOR NEW TECHNOLOGIES TO PUSH BEYOND THE LIMIT

THE EDGE OF SORTATION PHYSICS

- Parcel and case sorting equipment relies on gravity keeping parcels on belts and when dropping into chutes
- While this has caused very few problems with cases and parcels, flat packages such as polybags or flat cardboard packages apparently have a tendency to glide off sort lines at higher speeds

“One of the issues with flat cardboard packs like you see with Amazon is they have the propensity to ‘take flight’ when you sort them at high speeds. That can make it very difficult if you're using a sensor on a destination to confirm the divert, as the package will often slide under or float above it. Then the system won't register whether the package got to where it needs to be.” [Interroll]

- While throughput per location has been moving above 100,000 per hour at larger sort centers, it was suggested that anything above 500,000 sorts per hour would become riskier for customers at this moment

“Sorting 1m parcels/hr is not out of reach, you just wouldn't do it in one location, that's too much risk to absorb into a single sortation line. A single location won't go too much above 500k sorts/hr. Technology wise, we're really approaching the limits of speed at which you can sort before product begins to fly off the sorter.” [Vanderlande]

THERE ARE SIGNS OF A SATURATED MARKET IN CERTAIN SEGMENTS. COMMODITISATION LIKELY WITH GROWING IMPORTANCE OF VENDOR BRANDING

MARKET SATURATION IN SOME SEGMENTS

- Interviews with vendors suggested there is a level of saturation, particularly in the Shoe Sorter segment

“We didn't develop a Shoe Sorter because the market is saturated. Plus, our linear Cross Belt sorter already fulfills that market need..” [Interroll]

“China is a very competitive market, there are so many suppliers that build similar products who focus on specific technologies like Tilt Trays, Cross Belts etc.” [Confirmware]

“We never got into Shoe Sorters as we saw the market was too saturated. It would be difficult to bring something unique to the market.” [Mantissa Corp]

- In particular, the European market was said to be saturated with Sortation vendors, forcing newer players to look at specific geographies for expansion

“We're looking at the UK market because it looks like the European market is already full, there are too many companies there, whilst the UK market is a bit harder to penetrate.” [Sortcon]

BRANDING INCREASINGLY IMPORTANT?

- In a highly saturated and commoditized sector, brand building can be an important aspect

“European companies don't think about price first, they think about the brand. European companies have a long history in these market, which is a big advantage for them. We exhibit at LogiMAT to show potential customers and partners who we are, and step by step build that trust so that they might work with us.” [Confirmware]

- Note that STIQ’s publications are a very good option to reach important decision makers and influencers globally with >26,000 downloads since 2020
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STIQ LTD MEDIA PACK FOR GLOBAL LEAD GENERATION, BRAND BUILDING

Source: STIQ Ltd screenshot, May 2024

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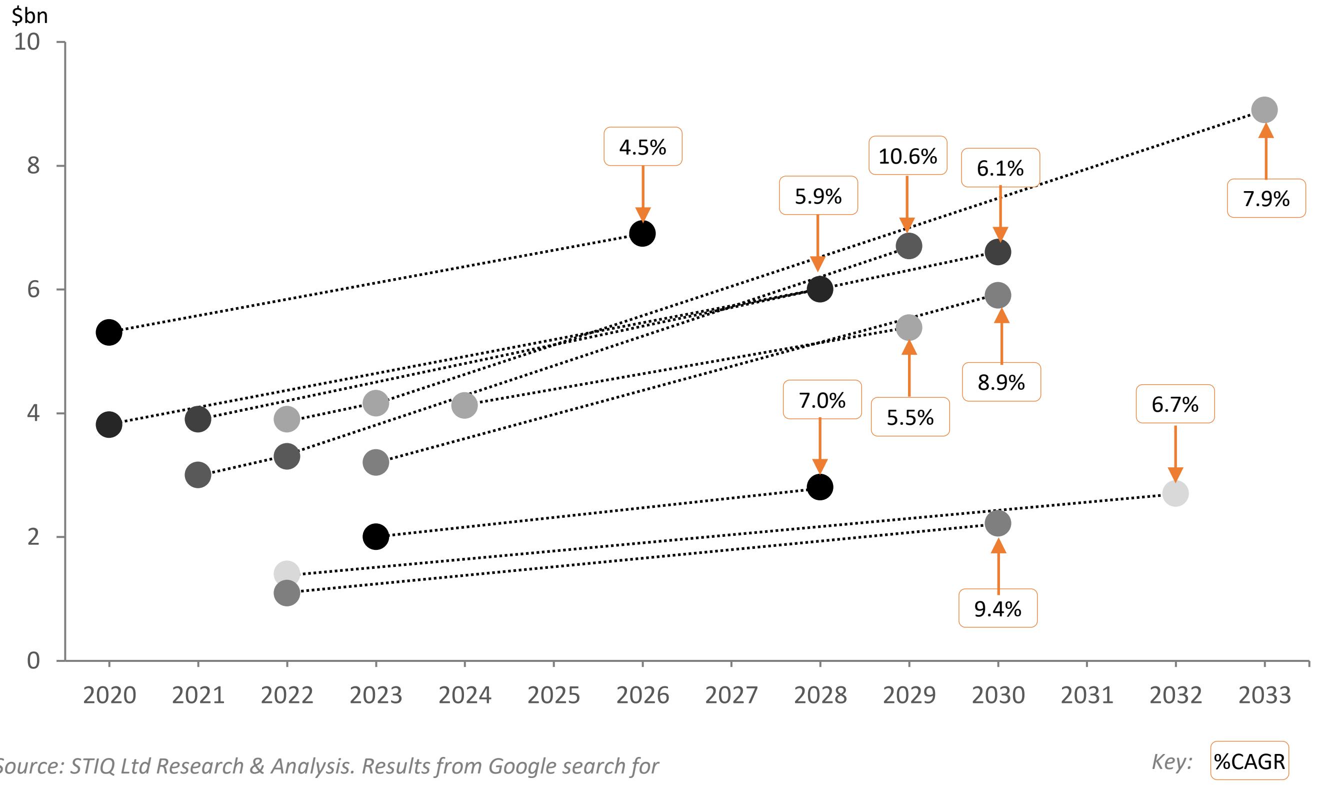
WIDE VARIETY OF MARKET RESEARCH AVAILABLE ON PARCEL SORTATION EQUIPMENT, FORECASTS CRYSTALLISE AROUND 5-10% CAGR WITH LITTLE VARIATION

PARCEL SORTATION EQUIPMENT MARKET SIZE FORECASTS, 2023 ($BN)



Source: STIQ Ltd Research & Analysis. Results from Google search for "Parcel Automation Equipment Market Size" in May 2024. Data points from Polaris Market Research, Grand View Research, Future Market Insight, Markets & Markets, Market Data Forecast, Fact.MR, Fortune Business Insight, Vantage Market Research, Skyquestt, Mordor Intelligence, Fairfield Market Research

NO VENDOR ENDORSED BY STIQ LTD

- Note that STIQ does not endorse any of the market research studies and or institutes/companies mentioned on this page

AVAILABILITY OF PUBLIC MARKET SIZE DATA

- STIQ Ltd searched google for "Parcel Sortation Equipment Market Size" and quickly identified multiple reports offering data on the global parcel sortation equipment market
- The chart on this page displays extracted data from 10 of these reports
- While the reports varied by a factor of up to 6X in market size, the variation in CAGR was relatively muted between 4.5-10.6%
- Note that a partial explanation of the differences between these companies may stem from various approaches to estimating market sizes, equipment definitions, etc.

2023: COVID EFFECTS CONTINUED TO AFFECT THE MARKET PARTICULARLY AS ECOMMERCE AND RETAIL FIND A NEW EQUILIBRIUM

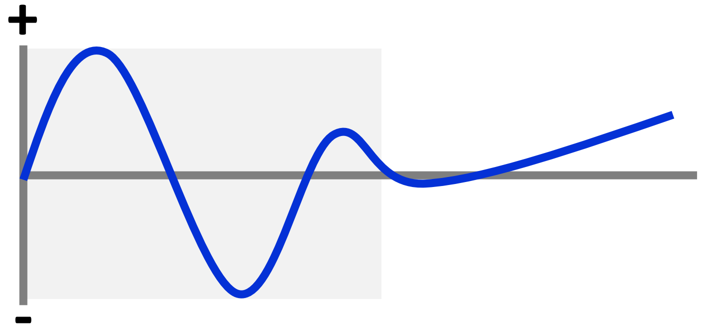
COVID EFFECTS STILL REVERBERATING

- Covid disrupted the world and caused a huge mismatch between demand and supply in various industries which still reverberates globally, albeit with some return to normal
- Interviews suggested most of the volatility attributed to supply chain/over investment issues has disappeared, but that we might now have entered a bullwhip market effect with some resemblance of normality

"In 2023 we were coming out of a supply chain crisis where lead times for orders were long with very high demand since 2022. Customers had stocked a lot of material, often more than they needed for the projects at hand, so when demand went down, people stopped ordering, which may have presented to the market as a larger decline than there actually was because of that effect. Now those inventory levels are back to normal and so more recurring orders are coming back, and thus there's more healthy activity again." [Conductix]

"Frankly speaking, 2023 wasn't a good year. I think the whole intralogistics sector was about the same. 2023 suffered because many companies had over-invested in 2021-2022, so they mostly stopped investment in automation and new facilities over the last 18 months. Add on top of that inflation and the political situation, the mood for investment wasn't great." [Itoh Denki]

MARKET VOLATILITY DURING COVID



Source: STIQ Ltd Research & Analysis

RETAIL AND ECOMMERCE REBALANCING

- During and after Covid the market has registered some huge swings in demand between channels

"Covid was a crazy time, one week we'd lose a massive project, and then by the end of the week have two new projects that made up for that. It was really wild times. Retail companies were no longer fulfilling orders to their stores, but their shipping volumes still grew 5X, as 25 item orders to stores, were replaced with 25 single item orders shipped direct to consumers. Apparel, footwear and office supplies were big for us during that time." [Mantissa Corp]

"In 2023, ecommerce was going through a crisis because of the over investment during Covid that peaked in 2022, which saw a lot of sorters being deployed." [Conductix]

"In the past 4yrs I've witnessed a very interesting change. At first ecom was the top market and was followed by parcel companies. Then suddenly it flipped and postal companies started to look for more solutions. This year we've seen it shift back again." [Lodamaster]

- Some interviews also suggested there had been potentially more fundamental changes to ecommerce order behaviors which retailers were perhaps trying to get to grips with as well

"Since the pandemic, customers have changed their order profiles. They feel much more comfortable ordering one item." [Vanderlande]

"2021 was a record-breaking year, but then 2022, there was a realization that people aren't going to stay at home forever so buying habits would change, and so that was a soft year. The first half of 2023 was soft as well, but the latter half, we saw a lot of that pent up demand coming through so 2023 ended up better than 2022." [Beumer]

2023: HOWEVER, A CERTAIN LEVEL OF VOLATILITY IS ON PAR FOR THE MATERIAL HANDLING EQUIPMENT SECTOR

STANDARD MHE SECTOR VOLATILITY

- Readers should note Covid disruption was also combined with standard MHE sector volatility where winning (or losing) often whale-sized projects can change fortunes over night

"2023 was better than expected. We won two projects from fashion companies, which was something we didn't expect. The willingness to invest is usually there, but decision making takes a while. But they decided very quickly." [Schoenenberger]

"In North America, we quoted and sold twice as many sorters in 2023 than we did in 2022. But even though 2X sounds like a huge number, to be fair in 2022 there was a huge downtick in sales of sortation equipment because of the huge implementations in 2021. So, it would make more sense to compare 2023 to 2019 and then our 2023 was slightly better." [Vanderlande]

PROJECT DELAYS

- STIQ noticed projects across the MHE industry started getting postponed from mid-2022 and part of the reason for that was increased interest rates with some customers apparently postponing to wait for improved cost of money

"Things just kept getting delayed in 2023. Projects weren't getting cancelled, they were just getting pushed back." [EuroSort]

"We saw a little bit of pullback from some of our customers last year, a lot of it due to the increased cost of capital so there were a lot of delays in POs." [FMH Conveyors]

- Looming elections was also a potential cause

"We saw projects getting postponed in 2023 rather than cancelled. Customers are more cautious; cost of living is increasing which impacts consumer behavior, and in our main market the US, you've got an election year which typically brings uncertainty." [Omnia Wheels]

- Postponements had an effect on growth, despite increased inquiries and LOIs

"In 2023 we saw lot of people sign LOIs to hold their spot in the line, but we also saw a lot of people come back and say - hey, let's hold for now. If that didn't happen we would have spiked up, but instead it was a diagonal growth." [OPEX]

SALES CYCLES EXTENDING INTO 2024/5

- Postponed projects could be reassessed as things may have changed during extended sales processes where sales lead times can be very long in normal circumstances.

"Delayed projects started in 2023 and have carried into 2024 because these systems aren't sold in 30 days, these projects take a lot longer." [IDParcelandMail]

"It's one of those things where it depends on what part of the sales cycle people are in. In 2024, there are some large customers that we've been working on for years that seem ready to buy, but you never know, it could get delayed to next year. The long sales cycles means it's like a wave, it goes up, then it goes down." [EuroSort]

"2023 was a little soft compared to the 2022. Quite a few projects were being pushed out to 2024-2025." [Mantissa Corp]

"In 2023, some of the customers that had multiple projects planned from 2022 decided they didn't want to conduct them in 2023 and pushed them out to 2024 or even later. So, looking at the opportunities, 2023 was a little bit lower than 2022." [Lodamaster]

2023: GENERAL SENTIMENT HAS BEEN POSITIVE ALTHOUGH A FEW AREAS SAW LITTLE GROWTH. STARTUPS INDICATED POSITIVE DEVELOPMENTS IN 2023

2023 A GOOD YEAR OVERALL

- Readers should note that most of the market remained above 2019 levels and that 2023 growth is compared to 2022 (and perhaps 2021) with huge growth levels
- The 2023 experience in the sortation equipment sector was very mixed with no majority consensus on market direction and there also appeared to be some bifurcation in demand

"Our direct sales, when we provide the turnkey solution to our customers, actually went up in 2023. However, when we work with OEMs, that declined because of all the big players having a really tough year due to customer reluctance to invest in large projects. We still saw growth in-line with pre-Covid growth, but it was lower than 2022." [EAE Solutions]

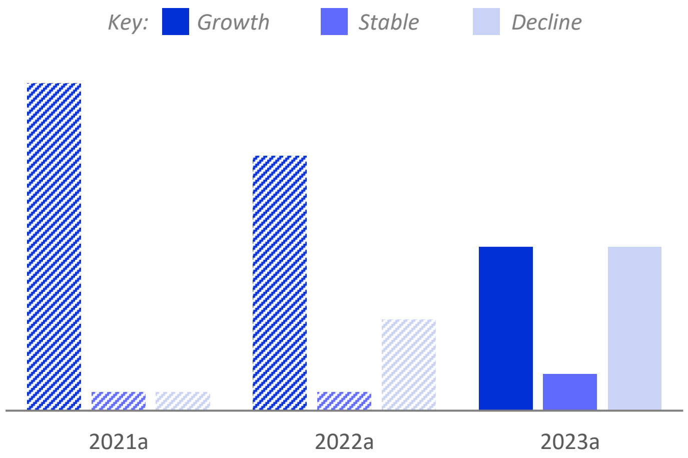
"From 2022-23, orders almost doubled. 2024 has slowed a bit because a lot of companies are implementing projects vs. starting new ones, so 2024 appears to be running at a lower gear thus far." [Vitronic]

- Startups are generally super positive with growth, but it appeared there had been good traction for many of these companies in 2023

"We met our expectation for ARR growth at XX% which for 2023 was a very legitimate growth level given how rough the year was for the whole robotics space." [Ambi Robotics]

"2023 was really good comparing with 2022, we would say it was almost double. With our new 3D sorter, we completed XX projects around the globe." [Libiao]

HISTORIC MARKET GROWTH CONSENSUS (FROM STIQ LTD INTERVIEWS)



Source: STIQ Ltd Research & Analysis

"Our market presence is greater so we're getting more opportunities, we're being asked to be part of evaluations, so the brand presence is leading to new customers." [Tompkins Robotics]

BUT A SOFT YEAR FOR SOME NICHES

- While few companies indicated stable revenue between 2022-2023, there were individual countries where such experience was prevalent, for example in the Japanese market

"Our revenue was the same for 2023 compared to 2022, which is better than down. We've seen some projects pausing, but we haven't seen many cancellations." [Bowe Japan]

- This was not isolated to sortation equipment in particular, but across the globe and other MHE sectors

"2023 was not good year for us in South America. I heard that Europe also wasn't doing great." [RN Logistik]

- There were also individual company circumstances such as M&A activity impacting growth prospects

"We went through an acquisition so our 2022-2023 may not represent the market. We had access to new products and services so could work on projects with our customers that we couldn't do before, so it was a good time for us." [Anonymous]

MORE POSITIVITY FOR 2024

- While 2023 may not have turned out great, there were positive signs things could change in 2024

"2023 was a tough year, but we're seeing people talk about projects again, expanding sites, some even talking about big projects with VNAs and ASRS systems, so it looks like people are starting to spend again." [Sortcon]

"2023 was definitely a down year, but we are starting to see things open back up." [EuroSort]

THE PRIMARY GROWTH MARKET IN 2023 APPEARED TO BE NORTH AMERICA. SOME LEVEL OF INCREASED INTEREST FROM EUROPE. ASIA AND SOUTH AMERICA DIFFICULT

DIFFERENCES BY COUNTRY/CONTINENT

- STIQ conversations with stakeholders have suggested the primary difference between Europe and North America is the far smaller sortation volumes in Europe
- There is greater fragmentation and differences between countries in Europe versus North American markets
- A generalised view is that sortation projects tend to be bigger in the US. European sortation volumes have tended to be max 60-65k sorts/hr whereas in the US this could easily go to 100k sorts/hr
- Interviews confirmed this general view

"The biggest difference between North America and Europe is the speed that these sorters are running. North America is much faster, and I think that comes down to the types of sorters used in Europe, and the fact that volumes at each hub are lower there because it's more spread out whereas in North America we have fewer of these giant hubs. You saw in the news, the postal office is trying to go from 200 hubs to 76 massive hubs." [Vitronic]

- There are also other differences such as the speed of decision making – once a project has been defined

"We noted some difference between decisions made in North America and projects in North America with headquarters in Europe. The sales cycles are slower with the European entities, which could come down to the difference in sentiment in the market in North America compared to Europe." [Beumer]

GLOBAL GROWTH SENTIMENT BY CONTINENT, 2023

Key: ↑ strong growth ↗ some growth → flat ↘ some decline ↓ strong decline

Source: STIQ Ltd Research & Analysis, Map (Source)

- continued inflows of cross border parcels from more recent and fast-growing ecommerce giants, such as Temu and SheIn could also force automation adoption

"Large enterprise customers are a bit concerned about overcapacity and the economy so they're still a bit cautious. However, given that it's very hard to find people, and concerns around the injection of parcel volumes into the US market from Chinese retail platforms like Temu and SheIn… every building I've been in, it's just a huge amount of these parcels coming in and I think this will be the point that forces companies to adopt more automation. How else will they keep up?" [Ambi Robotics]

EUROPEAN MARKET

- Interviews suggested the US remained an important market but that there was an increase in interest from Europe

"We are seeing increased interest from Europe. But right now, the US is our biggest market." [Omnia Wheels]

- Some vendors with HQ in Europe may naturally also see most of their business from the local market

"The majority of our projects are in Europe, with the bulk coming from Germany and Benelux. We also have installations in Australia, South Africa and the US." [EAE Solutions]

- Europe may be a bit more conservative with new technologies compared to US, but perhaps less so compared to Japan and other countries

"Europe is a bit more conservative than the US, and strong with standardization. US customers have more interest in new technologies, stronger than in Europe. And sometimes people jump to the new technology they can try and perhaps become the only winner. Japan is mainly watching US and Europe carefully, with some good venture companies, etc. But Japan could be a bit slow in terms of accepting new technology." [Itoh Denki]

ON THE WHOLE, EXPECTATIONS ARE FOR A RETURN TO GROWTH IN 2024

BUSINESS RETURNING IN 2024?

- Interviews with component suppliers suggested they noticed an increased demand from sortation equipment vendors, likely indicating some return to growth

"In the end of 2023, beginning of 2024, we can certainly see that business is returning. Manufacturers of sorters are back, they're ordering and projects are getting planned or executed again." [Conductix]

- Vendors also confirmed relatively good levels of business in the start of 2024

"I see 2024 as a good year, in fact, it has already been a good year so far. One of our major clients is doing well, and there are many other projects in Brazil and overseas, particularly in 3PL, ecommerce and CEP." [RN Logistik]

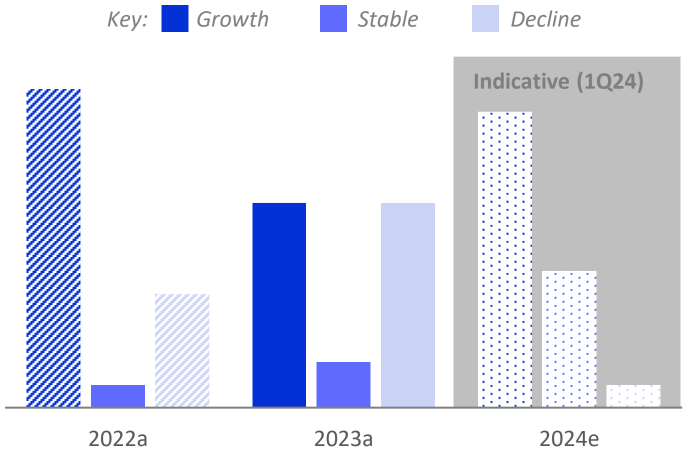
"Based on the orders we've closed so far, 2024 is going to reflect the increased investment we're seeing. The theme we're hearing from customers is that they have capital budget approved for these projects, so what they're working through now is what can they roll out." [OPEX]

"2024 is looking like it's holding its own against 2023, maybe even growing a little bit, but that's hard to predict." [IDParcelandMail]

- End-customers appeared to be transmitting positive signals again in early 2024

"We've received a lot of positive feedback from our customers, and we have a positive expectation for the next 2-3 years." [Bowe Japan]

MARKET GROWTH/DECLINE CONSENSUS (FROM STIQ LTD INTERVIEWS)



Source: STIQ Ltd Research & Analysis

"We're cautious but on the whole, I'd say we're optimistic about the future, in the end, people are buying more things online, and logistics companies in the end are planning to scale to handle that demand." [Omnia Wheels]

THE SEASONAL ASPECT IN SORTATION

- There is a seasonal aspect to MHE orders, but 2024 was looking good for vendors, in particular on expansion with existing customers

"Most customers don't want to deploy during the peak end of year period due to potential disruption. However, if the deployments can be done in parallel to existing operations, in adjacent areas or on mezzanines, the concern is minimized, and then we don't see otherwise typical Q1 slowdowns. 2024 looks good, the number of orders, particularly expansion of existing customers is good." [Berkshire Grey]

"Orders that want to be fulfilled before the Christmas rush come at the beginning of the year. 2023, we didn't see those October go-Live projects materialize so they're coming into 2024 now." [Mantissa Corp]

SOME CAUTION ON THE 2024 FORECAST

- Some vendors remained a bit cautious with their 2024 forecast, but seemed overall positive

"2024 will be an OK year, we won't crash and burn. I don't think we're going to set the world on fire. It's hard to predict for 2024 because of a few factors, first we had over-building from Covid. You have elections and no-one knows how that's going to turn out. There's some hesitance in investing." [Anonymous]

"2024 might slow down because this last mile thing hasn't been adopted widely. The companies already doing it can't continue to invest at the rates they've been. Once they've built their networks, they've built it. We think it might slow down. This year is about identifying the next opportunities." [Intralox]

"2024 won't be double like 2023." [Libiao]

MARKET BULLWHIP EFFECT SUPPORTS GROWTH ALTHOUGH THERE MAY BE SOME SLIPPAGE INTO 2025. TALK THAT AMAZON HAVE RESTARTED SORTATION PROJECTS AT SCALE IN 2024

BULLWHIP EFFECT COMING BACK

- Customers that invested a lot during Covid may have pulled back too much and were restarting projects

"2024 is already better, we're seeing a greater demand from our customers, especially the big ones. They pulled back a little too much last year, so they're reinvesting now and looking at different ways that they can automate, new ways they can handle products. Some of them might even try a totally different facility design this year so that's also driving a lot of business. They're looking at package distribution in totally different ways and that's what you see a lot in the ecommerce market." [FMH Conveyors]

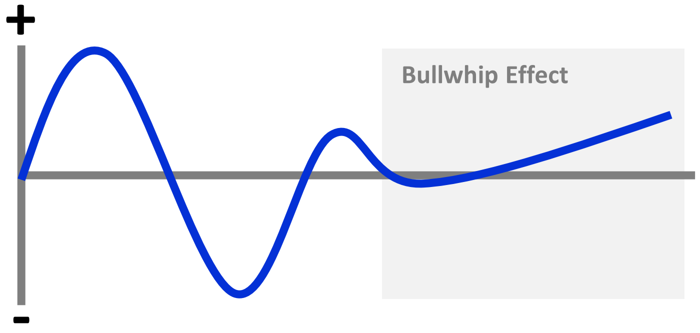
"So far in 2024, we've gotten more orders compared to the same period in 2023. We've seen that after the withholding of investment, companies began to realize that, if they don't invest sooner or later, they'll fall behind, especially with the pressure of wage inflation and lack of labor." [Itoh Denki]

"For customers that started investing during Covid, they made a lot of the big decisions back then, they found the locations, constructed the buildings, and now they have these buildings. They have pressure to move forward with their intralogistics processes because nobody wants to have an empty building. The other project was simply that the customer was surprised the business came back so fast so they had to invest." [Schoenenberger]

POSTPONED PROJECTS RESTARTING

- Re-engagement of postponed projects could indicate customers see a more positive immediate future

MARKET VOLATILITY DURING COVID



Source: STIQ Ltd Research & Analysis

"We saw a lot of cancellations or postponements 2 years ago, but now a lot of the customers who cancelled 2-3 years ago have re-engaged with us and that's why we feel comfortable. It means the dust has settled, customers feel more comfortable in the future of the market, and they feel more comfortable in their own data and numbers in terms of what they expect their growth to be." [Vanderlande]

- Some interviews hinted that 2024 could be similar to 2022 as projects were exiting hibernation

"A lot of the sales cycles that started in 2023 and that we were expecting to close in 2023 are closing now the beginning of 2024. So 2024 is already looking, year to date to be better year than all of 2022." [Beumer]

- However, there was still some customer hesitancy, with extended decision times and rescaling of projects

"2024 feels a little bit better than 2023. On the European side of the market, we see some moves, but we do still see some customers still not making decisions, maybe shrinking the projects or postponing to 2025." [Lodamaster]

"This year is already better than last year. Aside from 2023, the last 5 years have been good. We're expecting 2024 to be an average year, leading into 2025 which we hope to be back on par with the last 5 years. Retail has definitely come back around." [Mantissa Corp]

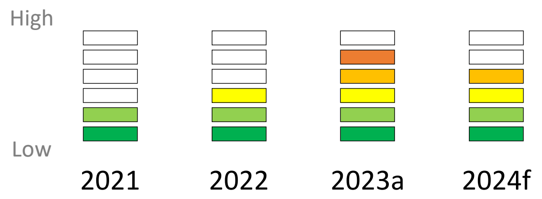
AMAZON RESTARTING SORTATION, POSITIVE

- STIQ conversations appeared to confirm Amazon have started up significant sortation projects in 2023-2024 which would be encouraging for the entire industry as demand is likely to trickle down

"Amazon has restarted building out their sortation activities at scale again. This is encouraging." [Anonymous]

SOME LEVEL OF INCREASED PRICE PRESSURES THROUGH END OF 2022 AND IN 2023. LIKELY TO COME DOWN IN 2024 AND 2025

PRICE PRESSURES ON SORTATION EQUIPMENT



Source: STIQ Ltd Research & Analysis

- However, part of this was also fuelled by other factors such as increased inflation and interest rates
- Conversations have hinted large customers are restarting major projects which may alleviate some of the price pressures experienced in 2023

COVID DISRUPTION ADDING PRICE PRESSURE

- Amazon's well publicised pull-out of projects in 2022 and most of 2023 (among other customers) had released a lot of sortation vendor capacity on the market which had led to some price pressures

"There are some pricing pressures that we haven't seen in the markets before. Part of that is capacity, there's a lot of capacity in the market, especially major customers pulling out a little. We've seen the prices for our components come back in line, aside from electrical components, where we still see increases, but the lead times are back in-line." [Anonymous]

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ECOMMERCE AND THE MOVE TOWARDS EACHES FULFILMENT IN B2B REMAIN THE TOP MARKET DRIVER IN THE SORTATION EQUIPMENT SECTOR

TOP SORTATION EQUIPMENT MARKET DRIVERS

Market Sector	Market Driver	Description	Impact
SORTATION EQUIPMENT	Continued Ecommerce Growth	• Continued growth in ecommerce is a direct driver of increased parcel volumes, especially during peak seasons • Ecommerce is a driver for both pre- and post-packing processes	▲▲
	Labour Shortages	• Sortation can be a resource intensive warehouse activity and frequently requires significant upstaffing during peak seasons	▲
	Last Mile Cost Efficiencies	• "Zone skipping" is increasingly driving savings in last mile delivery costs for larger online retailers • Sorting at origin may allow shippers to bypass major sortation hubs	▲
	Changing Delivery Network Structure	• Some sortation hubs have reached max capacity with some carriers beginning to use last mile hub sortation equipment with lower capacities	▲
	Picking Strategies	• Increased application of batch picking strategy has driven uptake of "Batch Sorters"	◄►
	Knowledge	• Growing awareness of products, especially pocket sorters, robot sortation, etc. may drive increased penetration	◄►
	Economic Climate/ Interest Rates	• Continued pressure on Capex investments from high interest rates and a turbulent post-Covid exit	▼
	Project Inertia	• Interviews have suggested a continued trend for projects to be postponed or hibernated since 2H22 which appears to have morphed into a level of inertia with historically high sales pipelines	▼

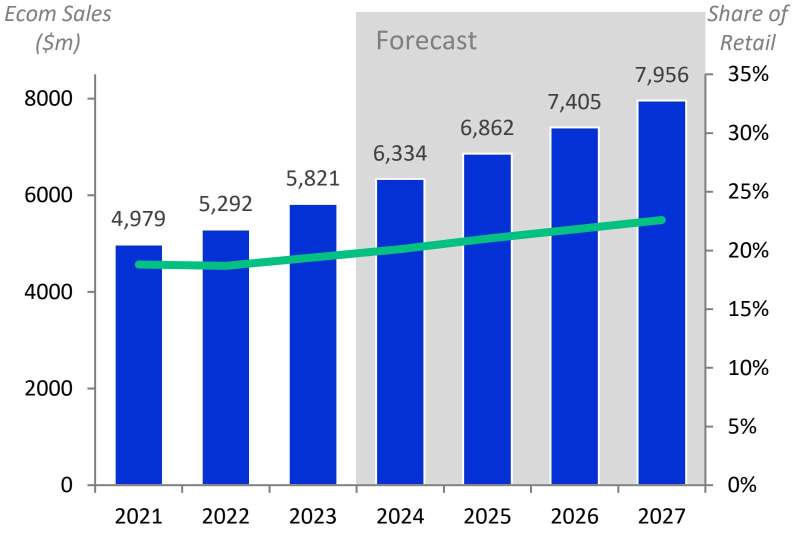
ECOM GROWTH, A MAJOR MARKET DRIVER

- Ecommerce and growth in "eaches" fulfilment is a major market driver in the sortation equipment sector, both for Pre-Packaging and Post-Packaging solutions
- This includes growth in omni- and multi-channel approaches
- Labour remains constrained with a very constrained market during peaks
- Larger ecommerce retailers can gain cost efficiencies by bypassing carriers' centralised sortation depots and inserting parcels further downstream
- Some carriers have announced large restructuring projects to manage future parcel growth
- The application of various picking strategies influences pre-pack solutions, such as batch picking which require sortation of eaches into order totes
- Increased knowledge of the usefulness of pocket sortation solutions may drive wider uptake, especially outside Europe
- High interest rates continue to supress investment activity in the wider MHE sector, although larger customers, such as Amazon, have begun larger scale works
- Some level of project inertia or fear appeared to have crept in since 2H22 with some customers continuing to be worried about future growth potential of their businesses

Source: STIQ Ltd Research & Analysis

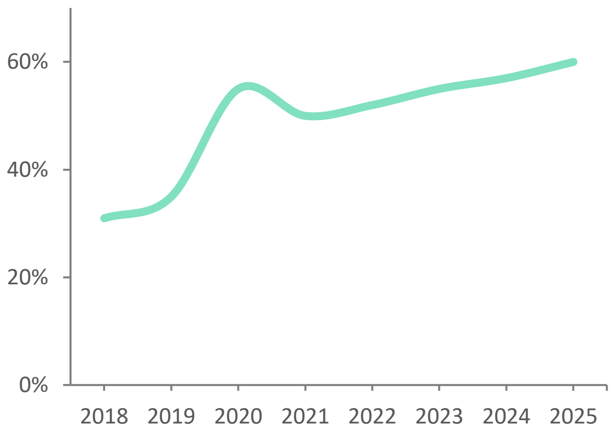
ECOMMERCE GROWTH AND PENETRATION SHARE OF RETAIL IS FORECAST TO CONTINUE

RETAIL ECOMMERCE SALES WORLDWIDE, 2021-2027



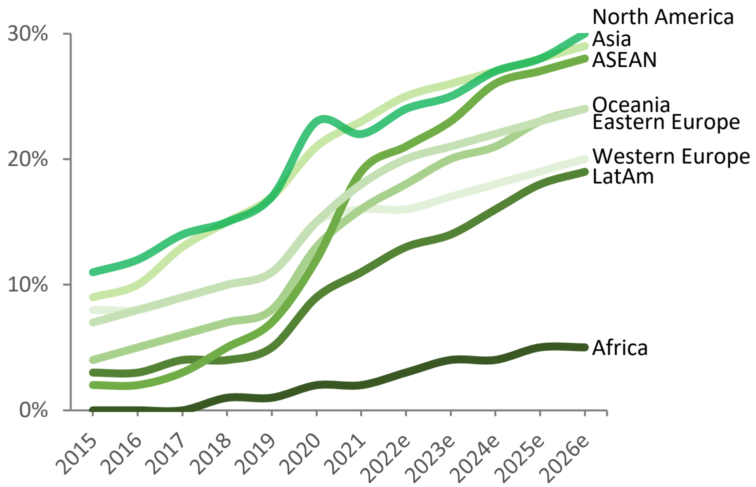
Source: eMarketer (link)

ECOMMERCE AS A SHARE OF APPAREL RETAIL IN THE UK MARKET, 2018-2025 (%)



Source: ONS via Mordor Intelligence (link)

ECOMMERCE AS A SHARE OF RETAIL, 2015-2026e (%)



Source: Morgan Stanley (link)

POSITIVE OUTLOOK FOR ECOMMERCE

- The outlook for continued ecommerce growth is generally very positive among various analysts
- Most forecasts indicated lower growth in more advanced ecommerce countries, however, this is most likely due to the size of the market
- Forecasts for ecommerce growth range from mid to high single % figures for growth from 2024 onwards

A COVID BUMP IN THE ROAD

- The Office for National Statistics (ONS) in the UK suggested apparel ecommerce had experienced a huge Covid boost and increased from 35% in 2019 to 55% in 2020 which returned to 50% by 2021
- However, despite this up-and-down experience, ecommerce penetration remained higher than in 2019 and was forecast to increase at a slower rate to 60% by 2025

THE GLOBAL ECOMMERCE OUTLOOK

- In 2022, a Morgan Stanley analysis hinted at continued growth in ecommerce penetration globally in most major markets
- In this analysis, ecommerce in LatAm, ASEAN, Oceania and Eastern Europe grew very strongly during Covid and managed to gain on other economies

ECOMMERCE REMAINED THE PRIMARY MARKET DRIVER IN THE SORTATION EQUIPMENT SECTOR, BOTH FOR PRE- AND POST PACKING SORTATION

ECOMMERCE, THE PRIMARY MARKET DRIVER

- Ecommerce has been the primary market driver in the last decade and is likely to remain so in the medium term for both pre- and post-packing sortation equipment

"For the last 10 years the sorter market always had solid, double-digit growth. Parcel business were a big one, but then you had the e-commerce players and they also saw double-digit YoY growth. Orders for sortation would come in summer, maybe September at the latest to make sure they were live before big holidays like Diwali, Singles day in China, Christmas. Then in 2023, there was news that parcel growth was flat or even declined in some regions." [Conductix]

- Growth in ecommerce has driven parcel volumes for carriers which remain a large customer base for vendors
- Specific sortation form factors and product requirements appeared to vary somewhat depending on local preferences, types of customers, etc.

"We know that Cross Belts are favored all over the world in the parcel industry whereas the US prefers Tilt Trays. And it seems to be the packages that come to the US from overseas are less boxes and more bags or other, cheaper packaging, and that's where Tilt Trays sometimes have an advantage." [Mantissa Corp]

"Mail sortation is one of the use cases, but we work more with parcel sortation with 3PL, retailers and ecommerce companies. We're working with large ecommerce customers in Spain and India. We're also closing a deal with a large 3PL for a sportswear brand." [Unbox Robotics]

EXAMPLES OF PRE-PACK AND POST-PACK

Source: STIQ Ltd Research & Analysis

"We've seen our best fit, especially for ecommerce in the last and middle mile sortation. We do equipment in order fulfilment, sometimes retail brick & mortar fulfilment." [Intralox]

ECOMMERCE INCREASINGLY FUZZY CONCEPT

- It's worth noting that ecommerce or online channel sales is becoming an increasingly fuzzy concept which also extends into the B2B domain where suppliers are also fulfilling "eaches" instead of cases or packs

"We have tire handling, liquor and some other customer types that can be wrapped into ecommerce and retail. We do a bit with manufacturers occasionally. With retailers, we're in the back of a lot of stores here in the US, using the gravity equipment to unload incoming goods." [FMH Conveyors]

- For example, pharmaceutical companies fulfilling to hospitals or prescriptions to pharmacies , etc. are also included

"Retailers are a big part of our business as well as parcel companies and 8/10 of the top pharmaceutical companies. It's really the gamut of people looking to sort smaller items." [EuroSort]

"Customer types include pharmaceuticals… sorting pill bottles and OTC drugs… Eyewear, glasses and contact lenses, book distribution and general merchandising… pretty much all the verticals." [OPEX]

ECOMMERCE REMAINED THE PRIMARY MARKET DRIVER IN THE SORTATION EQUIPMENT SECTOR, BOTH FOR PRE- AND POST PACKING SORTATION [CONT'D]

- Retail store fulfilment remains an important customer as well, increasingly with elements of online channel fulfilment

"For the Split Tray, certainly pharma, jewellery, apparel and small parcels are the biggest use cases. For the Push Tray sorters, you can handle larger items and a larger array of items, from t-shirts to microwave ovens to 40lb bags of dog food or protein powder." [EuroSort]

"Overall, we're probably doing half-half Tilt Trays and Cross Belts. In the parcel segment it's majority Tilt Trays. In other industries like retail, apparel and footwear its more leaning towards Cross Belts." [Mantissa Corp]

"We do a lot of switching applications for retail fulfilment where there's multiple conveyor lines running in parallel coming into a machine." [Intralox]

PRODUCT SPECIFIC CUSTOMER TYPES

- Some sortation segments such as Pocket Sorters remain primarily deployed in a relatively limited range of customer sectors, possibly also due to lack of wider awareness

"Fashion and automotive are our most important markets." [Schoenenberger]

CROSS DOCKING APPLICATIONS

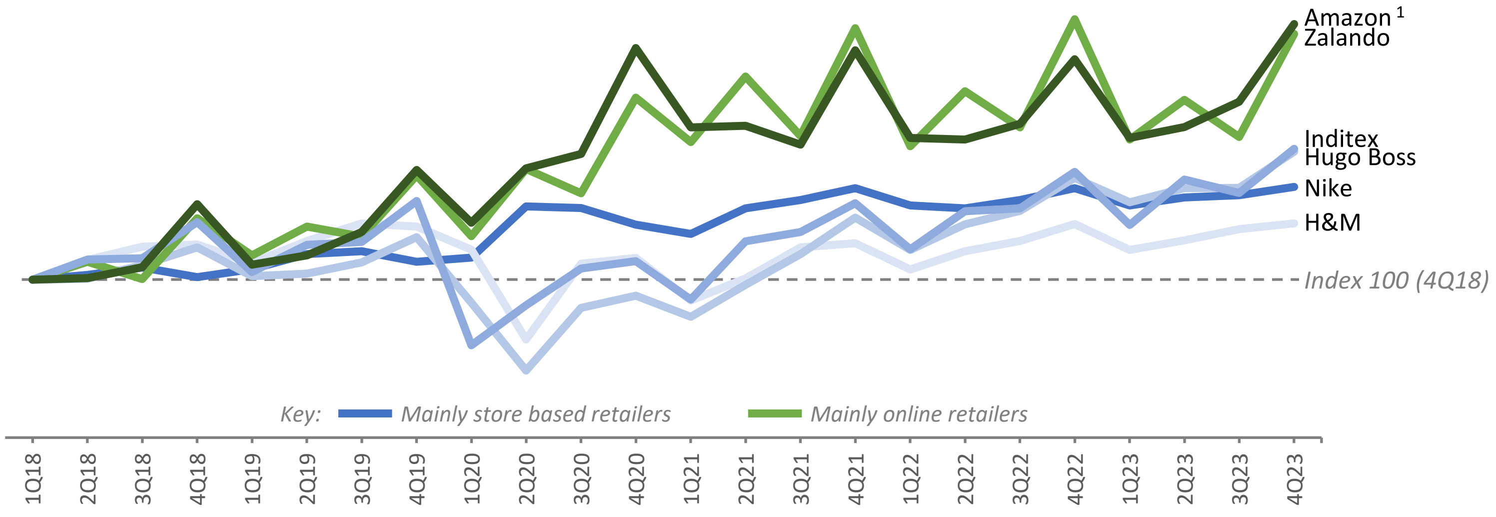
- As markets and requirements change, there are also sortation requirements in other warehouse applications
- One such example is cross docking in foods and groceries using Shoe Sorter

"In Europe we have applied our sorters with food retailers in fresh and chilled centers where they receive goods from suppliers. Cases from incoming pallets are unloaded directly onto the sorter and sorted to stores and immediately shipped. That's a very popular concept in Southern Europe, LatAm and Asia. This is also what we call cross docking. Shoe Sorters are popular for this." [Vanderlande]

"We received quotations from food industries, such as restaurant chains, the purpose is to supply chilled foods from their central kitchens out to each restaurant all over Japan. This means sorting the packed foods in cold and humid conditions. These customers prefer simpler systems like a Shoe or Pusher Sorter because it doesn't need electronics like a Cross Belt… on top of the fact that these are about 1.5x more expensive." [Bowe Japan]

ANALYSIS OF RETAILERS QUARTERLY RESULTS INDICATE SOMETHING OF A RETURN TO NORMAL GROWTH BEHAVIOURS IN THE LAST 6-12 MONTHS

INDEXED QUARTERLY REVENUE GROWTH FOR MAJOR RETAILERS, 1Q18-4Q23 (INDEX100=1Q18)



Source: STIQ Ltd Research & Analysis, Company accounts
Note: "Store based retailers" also have growing omni-channel operations often with $bn's in online revenue
[1] Amazon revenue index for "Online Store"

CAVEAT RE SELECTED RETAILERS

- Note STIQ selected retailers randomly across Europe and North America only – the experience of other retailers in other parts of the world may be completely different
- Most of the retailers selected operate globally and may be considered relative indicators
- Each of these retailers can be analysed individually in great detail but this report is mainly looking at how online v store-based retail has performed throughout and post-Covid

POST-COVID RETURN TO STORES?

- While online retailers experienced huge revenue growth in 2020, this appeared to have stagnated at a relatively steady level
- Store-based retailers experienced a huge drop in revenue in the first 3-6 months as stores were closed for months
- However, the experience of store-based retailers has been relatively steady growth since the first part of Covid

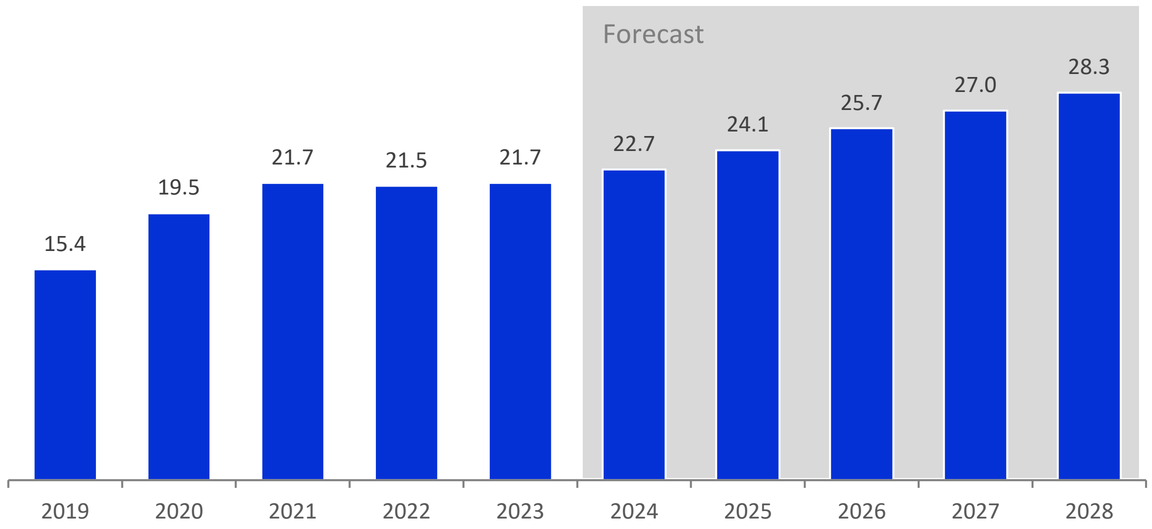
- Nike's experience could be related to a difference in business model, i.e. perhaps more wholesale than retail or a large quantity sold online, etc.

WHAT DOES THIS MEAN FOR SORTATION?

- STIQ interviews and conversation in the MHE space has indicated some thawing of frozen projects from 2H22 with a relative increase in the willingness to pull the trigger on projects in 2H24
- Conversations also suggested Amazon may have restarted postponed projects or started up new sortation equipment projects at significant scale
- This could be a result of a return to high single digit quarterly growth for the online retailer in the last 4 quarters
- Most of the store-based retailers appeared to have returned to pre-Covid results with some stabilisation of revenue flows
- It is likely there is a certain level of over-capacity in the market that needs to be ironed out before new MHE orders will be placed with potential for depressed order bookings throughout 2024

HYPER GROWTH IN US PARCEL VOLUMES DURING Covid AT 18.7% CAGR 2019-2021 REPLACED BY MODEST GROWTH FORECAST AT 5.7% CAGR 2024-2028

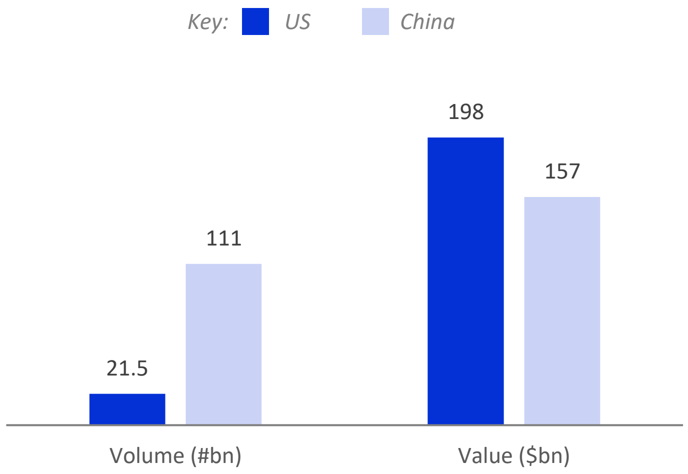
US PARCEL VOLUMES, 2019a-2028f, (#BN)



CAGR 2019-2021	CAGR 2024-2028
18.7%	5.7%

Source: Pitney Bowes Shipping Index (link)

US v CHINA PARCEL VOLUMES & VALUE, 2022 (#BN, $BN)



Source: Pitney Bowes Shipping Index (link)

Covid GROWTH IN PARCEL VOLUMES

- US parcel volumes increased at an astonishing 18.7% CAGR 2019-2021 through the early part of Covid
- However, the growth momentum from Covid lockdowns dissipated in 2022 and even led to a slight decline in volume which continued through 2023

MODERATE GROWTH FORECAST

- Pitney Bowes forecast US parcel volumes will increase from 22.7bn to 28.3bn at a more moderate rate of 5.7% CAGR 2024-2028

CHINA LARGEST VOLUME MARKET

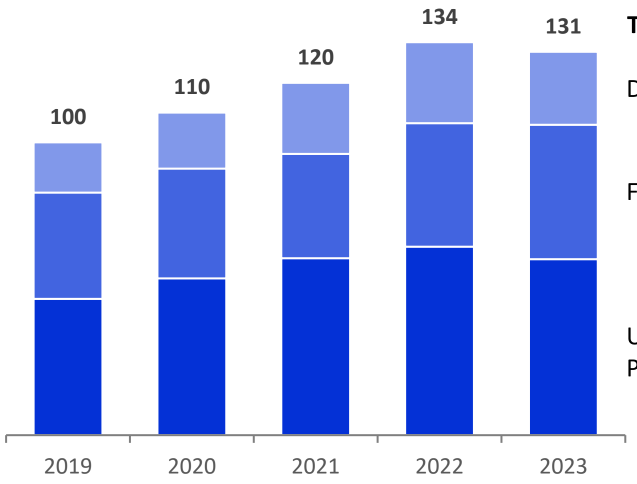
- China is the leading market globally for parcel volumes and recorded 111bn parcels shipped in 2022, more than 5X than the second largest market – the US

"From our perspective, our hardware is very good, it can even be faster than some other products because of how much volume goes through Chinese distribution centers. We have to be able to support those volumes." [Confirmware]

- However, lower labour rates combined with intensive competition, etc. in China also meant carrier revenue was $157bn compared to $198bn in the US market

PARCEL CARRIERS EXPERIENCED SHARP GROWTH THROUGH Covid, 2020-2022. SOMEWHAT REDUCED VOLUMES IN 2023

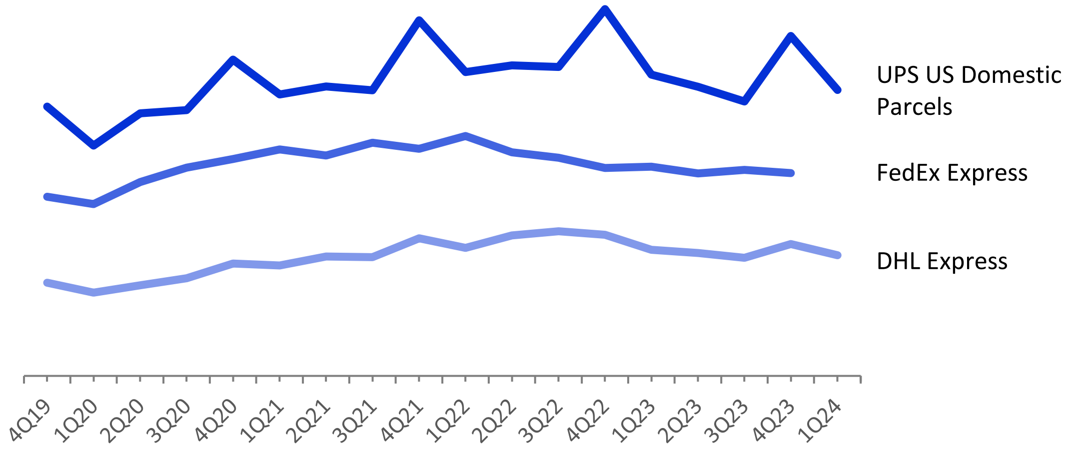
SELECTED LEADING CARRIERS ANNUAL REVENUE, 2019-2023, ($BN)



	CAGR 2019-2022	Change 2022-2023
Total	**10.3%**	**-2.4%**
DHL Express	17.3%	-10.0%
FedEx Express	5.2%	8.9%
UPS US Domestic Parcels	11.4%	-6.6%

Source: STIQ Ltd Research & Analysis, Company accounts.
Note: FedEx FY 18-22 (FY May 31), others calendar

SELECTED LEADING CARRIERS QUARTERLY REVENUE, 4Q19-1Q24, ($BN)



Source: STIQ Ltd Research & Analysis, Company accounts.
Note: FedEx 3Q20 normalised to calendar 4Q19, no data for FedEx in calendar 1Q24

KEY PARCEL CARRIERS

- The parcel (B2B + B2C) carrier market is fragmented and served by a wide variety of companies including leading businesses like DHL, FedEx and UPS alongside national & private postal operators and smaller couriers
- Note that these companies have different FY dates and may report revenue differently
- STIQ has selected specific segment revenue for the three companies: DHL Express, FedEx Express and UPS US Domestic Parcels to illustrate revenue performance

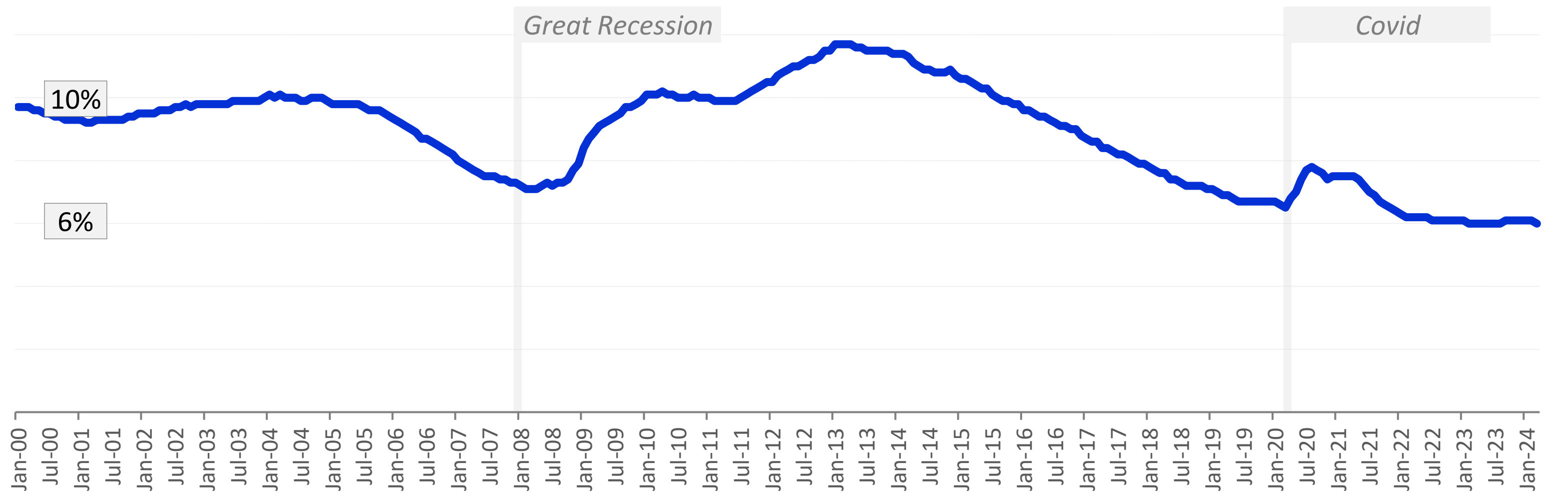
THE PARCEL MARKET 2019-2023

- DHL, FedEx and UPS increased revenue at 10.3% CAGR 2019-2022
- However, revenue for the three companies declined by -2.4% in 2023
- Quarterly results appeared to indicate a decline in 2022 continuing into 2023 with a potential levelling out in 1Q24

"2023 was not a good year for parcels. It's really a cyclical market so if the market goes down, the parcel companies are the first to stop investing or they delay their plans. Then when the economy grows again, they start again." [Vanderlande]

A HISTORICALLY LOW UNEMPLOYMENT RATE IS DRIVING DEMAND FOR MATERIAL HANDLING EQUIPMENT, INCLUDING SORTATION SOLUTIONS

MONTHLY UNEMPLOYMENT RATE, EUROPEAN UNION, JAN 2000- MAR 2024 (%)



Source: Eurostat

HISTORICALLY LOW UNEMPLOYMENT

- Current unemployment rates are the lowest since January 2000 at around 6% since early 2022
- The number in the chart is an average across the European Union however, often unemployment or access to a willing and able labour pool, especially around warehouses, tends to be far more constrained
- Warehouse operators are increasingly taking availability of labour into account when considering new warehouse locations

UNEMPLOYMENT, A CAUSE FOR CONCERN?

- A possible cloud on the horizon could be the potential for a new recession, especially if low unemployment figures are an indicator
- Just prior to the Great Recession (2008-2009), European Union unemployment reached its lowest point of c.7% since January 2000
- In March 2024, the unemployment rate in the European Union was 6%

LABOUR PRESSURES DRIVING AUTOMATION

- Official statistics have highlighted an increasingly favourable environment for automation providers with record unemployment levels
- Covid disruption potentially also helped companies realise some vulnerabilities without automation

"Given the current worldwide situation, with wage inflation and lack of labor… so automation is everywhere now. During Covid some ecommerce retailers doubled their sales since people couldn't go to the stores and this really highlighted the issue with the lack of automation." [Itoh Denki]

"The availability of labor is getting worse, and automation is playing a larger role. In sortation it's playing a bigger role." [Falcon Autotech]

- Local dynamics are also playing into automation growth

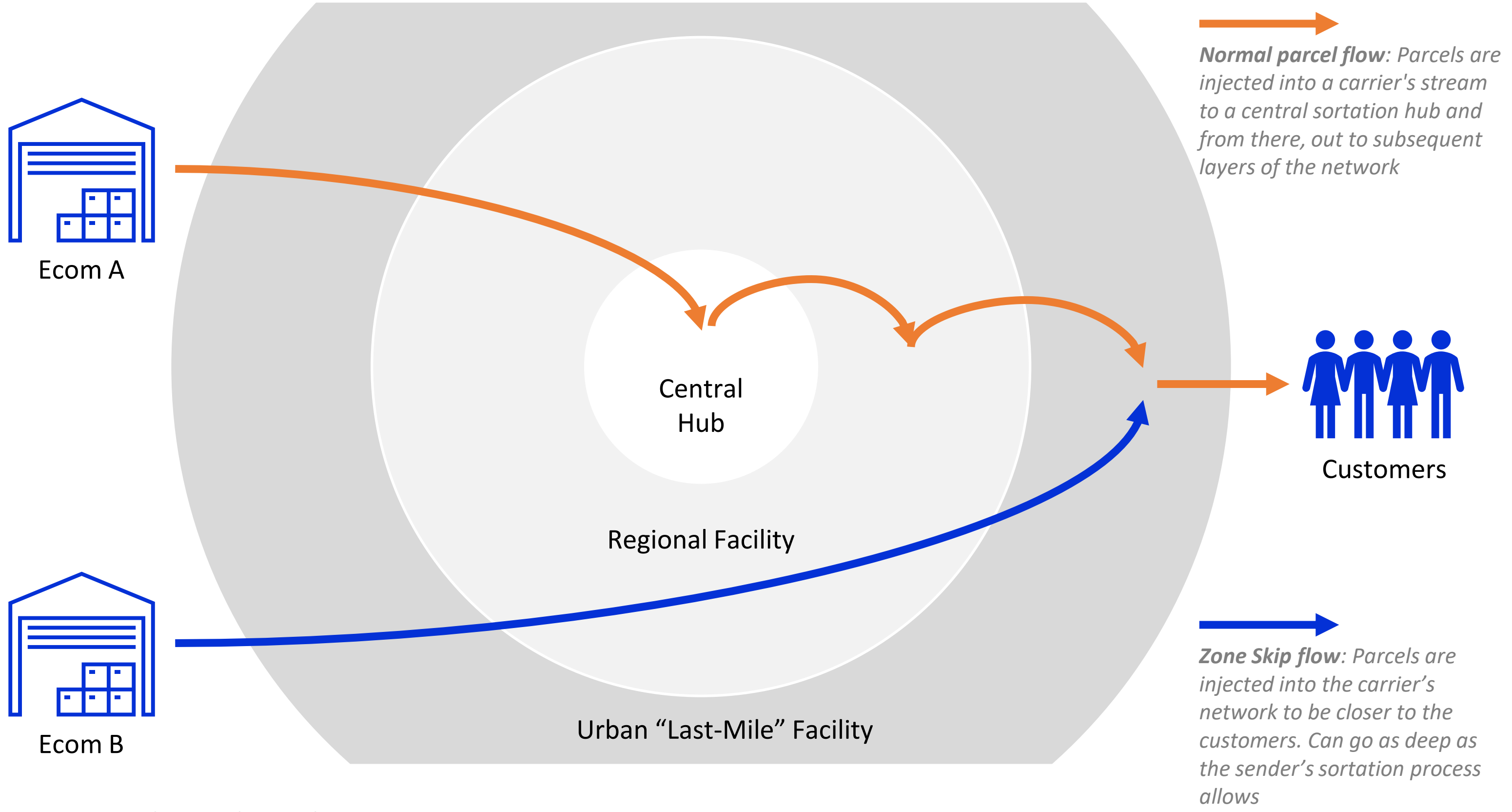
"Previously, automation in logistics is in limited range due to building conditions and availability to hire young workers. But recently that has changed, relationship between logistic and IT is mandatory, and aging of population is getting faster, so the industry is really feeling this crisis." [Bowe Japan]

- Unemployment levels may even force smaller companies to adopt automation

"Historically, smaller companies wouldn't be looking at automation with volumes as low as 1.5k per day, but with labor becoming such a demanded commodity, they may not have a choice and a system that costs $100k-$150k may actually pay for itself in a reasonable time frame." [IDParcelandMail]

ZONE SKIPPING INCREASINGLY USED BY LARGER SHIPPERS. SORTING AT SOURCE AND BYPASSING CENTRAL HUBS PROVIDED COST BENEFITS

SIMPLIFIED ZONE SKIPPING CONCEPT (ILLUSTRATED)



Source: STIQ Ltd Research & Analysis

ZONE SKIPPING

- Parcel shippers with very large volumes are known to "Zone Skip" which bypasses major sortation centres and sometimes injects parcels directly at last mile hubs
- Volumes required means this is relatively isolated to top shippers in specific countries

"Zone Skipping is when the customer line hauls to a distant facility to inject a large group of shipments into our network closer to the destination zone. It has odd effects and causes issues for Alt Return Address. Customers typically use our ground facilities as the shipper address with their own address as a return address on the label." [Anonymous]

"Zone skipping is where you pre-sort your parcels into groups to deliver an entire gaylord to say the 080 zip-code which is New Jersey and bypass all the other centers in the USPS centers network, where USPS would give you a discount. If you can avoid having to leverage USPS, or UPS or DHLs automations at their hubs, and skip them and send my pallets directly to the spokes, that benefits both organizations. Essentially, you're interacting with them at a deeper stage in their network." [OPEX]

ZONE SKIPPING IMPACT ON SORTATION

- STIQ's hypothesis is Zone Skipping will be positive for carriers as the sortation load becomes more decentralized
- This could drive less demand for super sort centers with increasing demand at smaller depots
- Potentially, this could also have driven "hot-mapping", moving automation and staff around the network to meet changes in demand and requirements

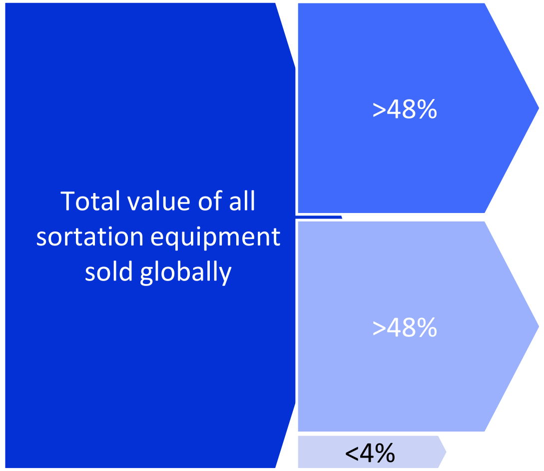
"Parcels have been flat or down over the last three years, but now it's making a comeback. What you see with the largest parcel companies, it has to do with what's called "hot-mapping", where the automation moves to where the volumes are. When you hear in the news that they're closing an area or removing a shift, usually it means they're investing in another area of the country." [Mantissa Corp]

CONTENTS

GOLD SPONSORS

THERE ARE VARIOUS ROUTES TO MARKET FOR SORTATION EQUIPMENT VENDORS. THE DIRECT TO CUSTOMER ROUTE FAVOURED IN LESS COMPLEX SORTATION PROJECTS

SIMPLIFIED ROUTE TO MARKET OVERVIEW FOR SORTATION EQUIPMENT VENDORS



Sold, deployed by system integrators

- May include SIs own sortation system or systems sourced from OEMs
- Typically part of larger projects with additional margin
- May also include more complex software integration work (WMS, WCS)

Sold, installed by vendors directly

- Projects that do not require an SI to be involved, typically in parcel sector where sortation is the primary function, such as sort centre
- Software integration may be done by client directly

Managed by customers directly

- Few customers have the engineering capabilities required to work directly

Source: STIQ Ltd Research & Analysis, Estimates from interviews and conversations

SORTATION EQUIPMENT MARKET ROUTES

- There were three major channels to market for sortation equipment manufacturers
- The direct to customer channel was very important for vendors simply due to many parcel projects only focusing on parcel sortation, such as at carriers
- Only a small number of customers had engineering capabilities internally and vendors frequently deployed at customers directly
- System Integrators also offered a route to customers, typically as part of larger projects including other warehouse automation equipment and/or often with more complex software integration requirements
- Symptomatic of the entire MHE sector, system integrators will buy in parts and/or equipment they do not offer themselves, sometimes even from companies which could be considered competitors

EXCLUSIVELY SORTATION PROJECTS: DIRECT

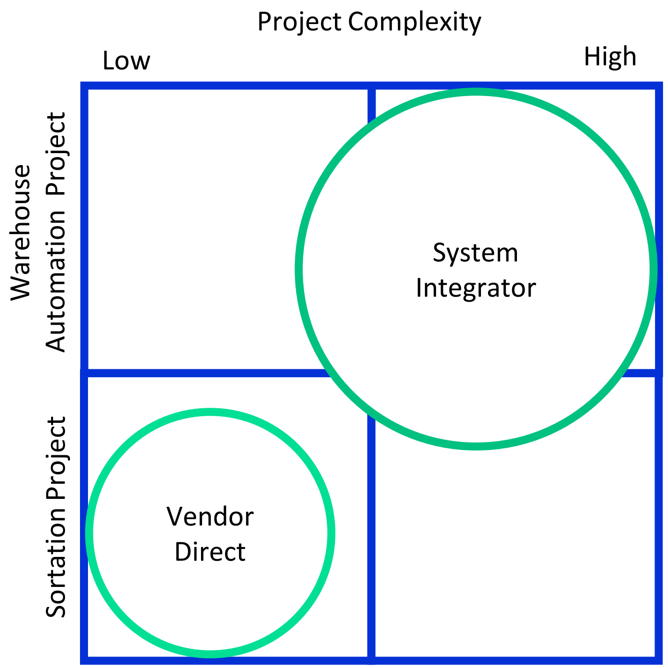
- The direct route tended to be domestic, or where there is a key customer, or where the size of a project is such that it would not warrant the involvement of an SI
- For example, where projects exclusively focus on sortation, vendors tended to offer a turnkey “SI” service, simply because of the limited scope
- Furthermore, interviews hinted that some customers with projects focusing exclusively on sortation frequently also had internal resources to manage such projects

“Our turnkey service, often used by parcel companies, includes the hardware and all the software integrations. In that sense, we operate more like a System Integrator. But to be specific it is only parcels with sorting equipment. We don't deal with box closers or robotics, etc., so very parcel sorting focused companies.” [EAE Solutions]

“Projects would come via an SI when the customer doesn't have the willingness or capability to execute projects themselves. When we go direct to the customer, there’s normally a willingness from the customer to design the process and control the project. They'll have a large logistics department doing these projects several times a year.” [Schoenenberger]

THE DIRECT-TO-CUSTOMER ROUTE OFTEN LINKED TO HISTORICAL DEVELOPMENT OF VENDORS. GREY SCALE WHERE SYSTEM INTEGRATORS MAY GET INVOLVED

LOW VS HIGH COMPLEXITY SORTATION PROJECTS



Source: STIQ Ltd Research & Analysis

DIRECT ROUTE WITH DOMESTIC PROJECTS

- The direct-to-customer route was sometimes favored in a domestic setting, but was more often than not part of the historical development of a business

"We sell directly to customers in North America. On the international front, our primary sales channel is partners or integrators. From a maintenance & service standpoint, UK, Germany, France and Australia we do the service, everywhere else our partners do the service." [OPEX]

"We are an odd-duck because of our history as an OEM in the mail sorting, which were all our own systems. Now as we transition to parcels, because of speed to market we're now selecting more solutions and integrating them, so we bring an OEM mentality to the project but being a little more like a System Integrator." [IDParcelandMail]

"For sorting, it depends on whether there's a system integrator with good contacts or if the customer prefers a direct service. We can accommodate both routes. It's not restricted to one way. In India we mostly work directly with customers." [Falcon Autotech]

GREY SCALE WHERE AN SI MAY GET INVOLVED

- When projects include other machinery & functionality, it was rare for sortation vendors to do turnkey and often work with SIs

"It's usually the system integrators that do the installation. We can do it, but it makes more sense for the SI to integrate things like scanners, loading operations, communication with software. Projects that are directly integrated by us would be in the US and where most of the equipment is ours. Then it also makes sense for us to do the full project since there isn't much scope for an SI to take on the work and the risk."[Intralox]

"Where we are part of a larger system, say with an ASRS, some conveyors, and other robotic systems, we're a smaller part of that installation and that would be an integrator doing those, and that's about 50% of our revenue. Our direct sales, they're typically our larger customers and the main part of the project is our system, then we'll do that directly." [Tompkins Robotics]

"If you need systems that we don't provide, Cross Belts, ASRS then of course we'd be part of those projects through a system integrator. If a company wants to only install our systems, say 200m of conveyors, then we can do it all, we make the hardware, we install it, we do the software and interfaces, the support, everything." [Sortcon]

THE OEM ROUTE

- Some sortation vendors also acted as component suppliers to OEMS, for example ARB or Wheel Sorter vendors

"While we do often work with integrators and end-customers that have their own integration teams, our main target is the OEM companies. Ideally we would have the OEMs integrating our product into their sortation systems because you need to have a conveyor to feed the divert plate. Technically we can use our wheels as a conveyor, which we're actually working with some integrators and OEMs on at the moment." [Omnia Wheels]

SORTATION EQUIPMENT VENDOR OR SYSTEM INTEGRATOR IS A GREY AREA. STARTUPS OFTEN WORK DIRECTLY WITH END-CUSTOMERS

VENDOR/SYSTEM INTEGRATOR GREY AREA

- There is a grey area where some vendors may be considered a system integrator versus a vendor which also goes to the growth strategy of businesses

"We define ourselves as technology independent, so even if we have our own Tilt Tray sorters or conveyors, we never insist on using our own products. We try to figure out what the customer needs and gather the solutions from the market. We position ourselves as the single point of contact for the whole project." [Lodamaster]

"We sell directly to customers and through SIs, but most is direct with end-users. We have our own integration arm as part of Duravant that does system layouts and project management, as well as a service arm. All the things that come with a typical integrator, we're doing those things ourselves." [FMH Conveyors]

THE SI EQUIPMENT MANUFACTURER

- On the other end of the spectrum, some companies preferred the direct route, but would also work with SIs as a supplier

"Most of our work is direct. We do work with integrators where we're part of a broader system, but the majority is direct with end-users. All our pouch projects are direct. Overall, less than 10% of our work is with integrators." [Element Logic]

- SIs offer equipment sales to other SIs, however, some newer products may be tested and further developed before offered to a wider audience

"We sell a lot of our equipment like conveyors and shuttles through other integrators, but our pouch sorter we want to first sell directly as part of a broader TGW system. At the beginning, we want to be able to prove and stabilize the product within our own environment so it's just much easier that way." [TGW]

STARTUPS OFTEN GO DIRECT TO CUSTOMERS

- Startups suggested a heavy focus on direct engagement likely due to limited market exposure, reference sites and technology maturity

"Most of our business is direct at the moment. Even the customers we're catering to in the European and US markets are directly working with us. Maybe there are agents involved but all the post-sales, the deployment is coming through us. We are gradually increasing our conversations with SI partners who could then package our system with other solutions and give it as a whole ecosystem to the customer." [Unbox Robotics]

- As startups mature and start gaining overseas traction, they will rely more and more on partners

"We consider ourselves as a solution provider, not an integrator. Internationally we work with our integrator partners, and we focus on building and delivering products. In China, there aren't so many distributors or integrators that we feel can play that role to install our solutions so domestically we integrate projects ourselves." [Libiao]

EXCLUSIVELY SELLING TO SIs

- A few vendors work exclusively via partner networks and generate demand by marketing their product and brands to end-customers

"Relationships with end users are very powerful. We executed a program of multiple sorters to a single end-user via seven different integrators. That can only be done when end users recognize the value of products and solutions." [Interroll]

"With integrators we say to them here's a tool that you can keep in your toolbox. But at the same time, we're also going to end users and educating them on the benefits of our sorters, so regardless of the integrator they end up going with, they may spec us into the RFPs, and that's happening more often now." [EuroSort]

MARKET DYNAMICS MEAN SORTATION EQUIPMENT AS A SHARE OF A PROJECT VARIES GREATLY DEPENDING ON THE CHANNEL TO MARKET (AND END CUSTOMER)

SORTATION EQUIPMENT AS A SHARE OF A PROJECT BY END USER (ILLUSTRATIVE)

Source: STIQ Ltd Research & Analysis

VARYING SORTATION % OF PROJECTS

- Interviews suggested projects vary between customer industries, and the sortation equipment share of project size also varied with complexity of additional functionality
- This was partly also due to the size of more complex solutions and the fact a system integrator would typically be involved in such projects

"In the parcel industry, discharges are fairly simple and the sorting technology is a larger part of an overall project. But in retail or packing systems, the discharges can be quite complex as you're trying to create efficiencies on the picking side. These things can be a huge part of project costs and there the sorting technology becomes a small part." [Mantissa Corp]

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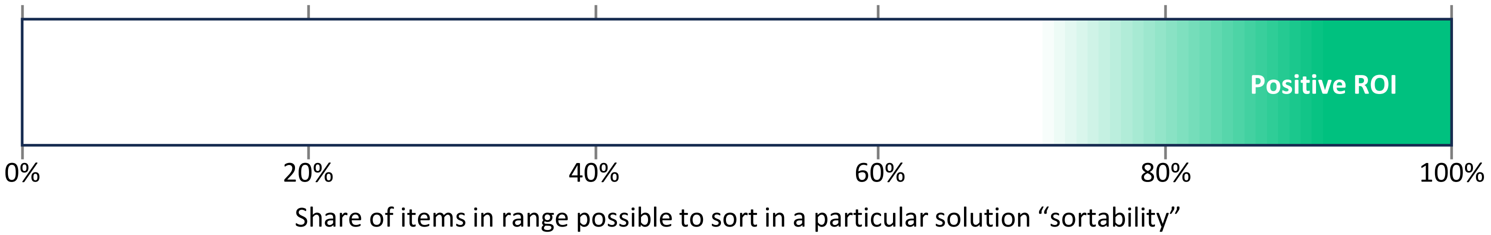
A HIGHER RATIO OF PARCELS OR UNITS THAT CAN BE SORTED (THE "SORTABILITY RATE") OFTEN KEY TO POSITIVE ROI

SHARE OF SORTABLE ITEMS MAY DETERMINE ROI



Source: STIQ Ltd Research & Analysis

COST REMAIN PRIMARY KPC

- Cost is often a primary KPC for vendor selection but other criteria such as technology, level of support, MTTF, etc. also pay into decisions

"What drives a decision depends on customers. Some might value price more, but others value technology, reliability, the level of post-sales support. If all suppliers are equal, the price is the only thing. With all put together, it's probably 70:30 in terms of technical vs cost." [Falcon Autotech]

ACCEPTABLE ROI TIGHTENING?

- Interviews suggested the acceptable range of ROI is tightening to less than 3 years

"An acceptable ROI used to be 3yrs because the economic climate allowed this. Now the climate says you need to pay back in 1-2yrs. Prices have improved to support that. But it's also the throughput increases, the breadth of SKUs that can go through the system, and the positive upstream and downstream impact." [Berkshire Grey]

ROI DRIVEN BY RATIO OF SORTABLES

- While raw parcels per hour is important it was suggested that an equally important metric is the ratio of packages that can be sorted by the system
- A threshold of 80% was suggested as the minimum for a positive ROI on a sortation line

"We really try to design the system that you can deal with at least 95% of the parcel spectrum so keeping uglies to 5% or less. A rule of thumb is that when 20% of your parcel flow is unsortable by your line, then ROI is very challenging." [EAE Solutions]

SECONDARY SORTATION FLOWS

- Items that cannot sorted in a primary sorter or sortation flow can potentially be sorted in a secondary flow

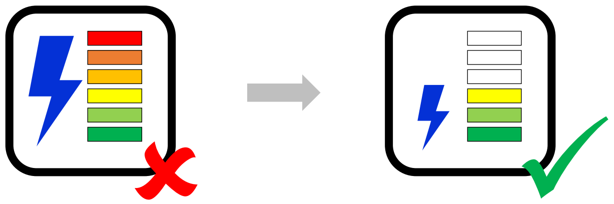
"If you're sorting 80% of items, that means very little must go on secondary flows and there's no post-sortation merges. If you're only hitting 60% of SKUs, that's 40% of goods on a separate flow. That's why it's not just important that you can do many sorts but what you're covering in that." [Berkshire Grey]

- Depending on customer "sortables", it may sometimes be favourable to install two separate sort lines

"It's important whether the automation can handle all or at least most of a package mix. If a customer is trying to handle furniture and polybags, we typically wouldn't advise them to handle those in the same sort line. You'd want to have separate processes for the bulky products." [Intralox]

ENERGY CONSUMPTION AND NOISE LEVELS OF SORTATION EQUIPMENT INCREASINGLY IMPORTANT KPCs, ESPECIALLY IN EUROPE

ENERGY CONSUMPTION, AN IMPORTANT KPC



Source: STIQ Ltd Research & Analysis

ALTERNATIVE KPCs INCREASINGLY IMPORTANT

- Interviews suggested energy consumption and noise levels were increasingly included in RFP's and RFQ's, especially in Europe

"There are also concerns around sustainability and carbon emissions, so we are also seeing energy consumption constraints being reflected into RFQs." [Falcon Autotech]

"Traditional belt conveyors use massive AC motors and spend maybe 50% of their energy just to overcome the tension of the belt. Whereas with smaller DC motors at each roller, you're only driving the area that has a package." [Itoh Denki]

"There's a lot of talk in Europe now around noise levels, and you only realize if you visit a site. You don't notice while you're inside, you only realize when you leave the building, that it was noisy." [TGW]

- Avoiding pneumatics has been one part in reducing noise levels

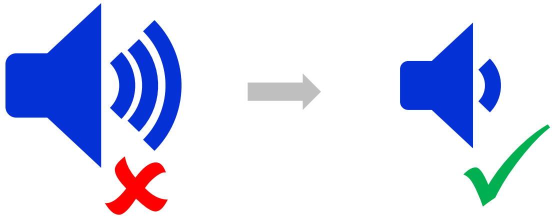
"At the end of the day, energy savings mean low cost. There are other reasons, noise is an issue, especially with regulations around working environments. If you're using pneumatic pushers, that's extremely noisy, even the way you handle your plastic totes can have a huge influence on the noise." [Itoh Denki]

"It took a lot of work to design, but ultimately it's a simple to use product, it's simple to install, it avoids pneumatics, swivels, pop-ups. It all runs on 24 volt DC and can be programmed to do whatever you need." [Omnia Wheels]

- Mobile robot sortation appeared to be less noisy, but currently also has a lower max throughput

"Recently we've had more inquiries about power consumption. Since we also offer robotic sortation, it really showed the noise issue. We didn't notice it and neither did the robotic vendor, but we took a customer to a reference site with the AGV sortation and the guy said – wow, this is so silent. Then we suddenly realized how noisy traditional sortation equipment is." [Lodamaster]

WORKPLACE ENVIRONMENT IMPACT, AN INCREASINGLY IMPORTANT KPC



Source: STIQ Ltd Research & Analysis

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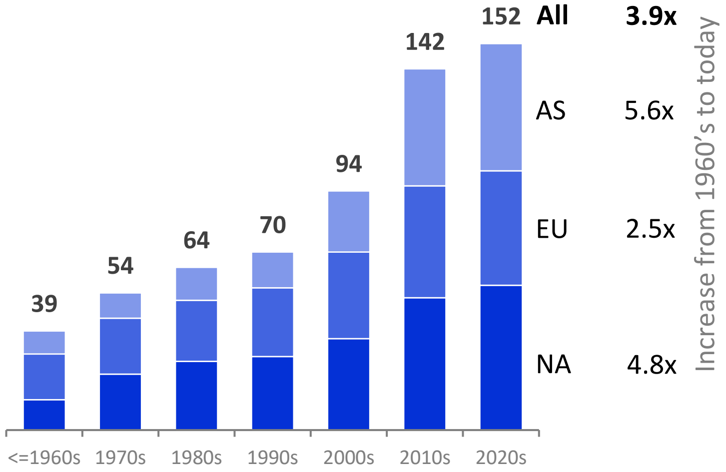
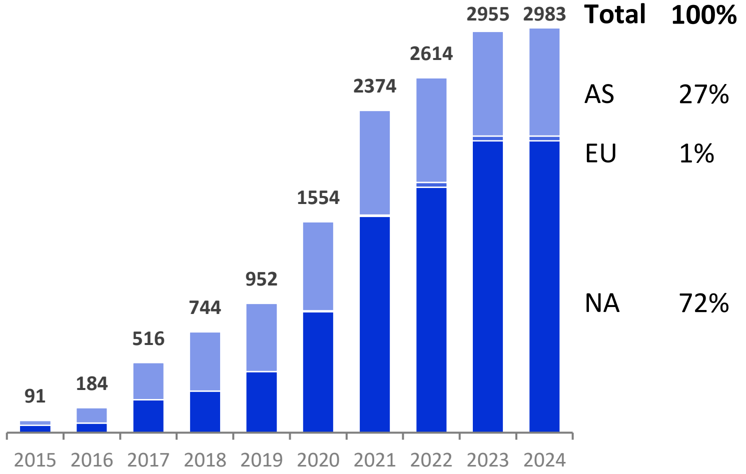
ECOMMERCE BOOSTED THE NUMBER OF VENDORS IN THE 2000's. ROBOTICS VENDORS IN NORTH AMERICA THE MAIN BENEFICIARIES OF FUNDING INFLOWS

SECTOR STARTUP ACTIVITY BY CONTINENT, PRE-1960s-2020s (#, AGGREGATED)



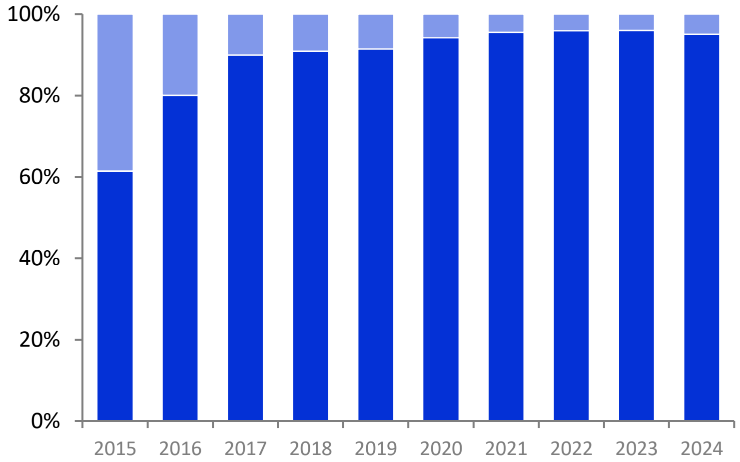
Source: STIQ Research & Analysis. Company foundation year
Note: A vendor may have added Sortation solutions post company foundation year

SECTOR FUNDING ACTIVITY BY CONTINENT, 2015-2023 ($M, AGGREGATED)



Source: STIQ Research & Analysis, Crunchbase

PICKING + MOBILE SORTATION ROBOTS AS A SHARE OF ALL FUNDING, 2015-2024 (%)



Source: STIQ Research & Analysis, Crunchbase

MORE VENDORS IDENTIFIED

- STIQ identified c.30% more sortation vendors in 2024 compared to 2023
- This was partially due to improved visibility of mainly Asian vendors
- Sortation equipment vendors have predominantly evolved from various engineering businesses driven in large part by markets for parcel and luggage sortation
- From the 2010's ecommerce also drove uptake of eaches or unit sortation equipment
- Asian vendors experienced the fastest growth in new vendors from the 1960's with 5.6X more related businesses in the 2020's

FUNDING AND M&A ACTIVITY

- Funding increased sharply from 2017 to 2021 and slowed down in 2022 and 2023 with a near freezing of activity in 2024 (publicly announced funding rounds!)
- North American companies accounted for 38% of all vendors but attracted 72% of all funding
- Of the companies identified, c.33% had been involved in an M&A transaction whether as a target or an acquirer
- About half of all the sortation vendors acquired were located in the US

ROBOTICS COMPANIES ATTRACTED MOST $'S

- The vast majority of funding (>95% by 2024) in the sortation equipment sector went to robotics companies
- These businesses are primarily involved in Picking Robotics and Mobile Sortation Robots

CONTINUED CONSOLIDATION IN THE SECTOR WITH INCREASING LACK OF TARGETS FOLLOWING RECENT EUROPEAN ACQUISITION SPREE IN NORTH AMERICA

SELECTED SORTATION EQUIPMENT SOLUTIONS SECTOR TRANSACTIONS, 2010-2024

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

- Knapp acquire Duerkopp
- SNBC IPO IPO

- Amazon acquire Kiva Systems

- KION Group IPO IPO

- KUKA acquire Swisslog
- Daifuku acquire Wynright

- Körber acquire Consoveyo
- Siemens spin up Logistics division
- Dematic acquire SDI Group

- KION acquire Dematic
- Honeywell acquire Intelligrated
- Bowe acquire Optimus Sorters
- CIMC acquire Pteris Global

- TICO acquire Vanderlande & Bastian Solutions
- Ross & Baruzzini acquire CAGE

- MHS acquire Van Riet
- Platinum Equity acquire Bluecrest
- Lummus Corp acquire Carter Intralogistics

- Orchard Holdings acquire TREW
- THL Partners acquire Fortna (MHS)

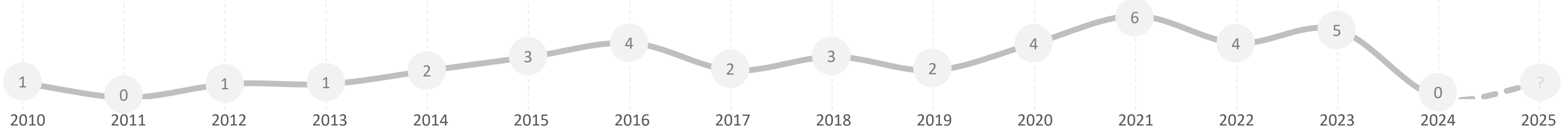
- Damon Group IPO IPO
- KKR acquire CMC
- Ocado acquire Kindred
- MHS acquired OCM

- Regal Beloit and Rexnord merger
- Bluecrest acquire Fluence Automation
- FATH acquired Flowsort
- Berkshire Grey IPO IPO
- Leadec acquire Diversified Automation
- Dunes Point acquire Hy-Tek

- Reliance Retail acquire Addverb
- Kengic Intelligent IPO IPO
- Koerber acquire Siemens Logistics
- Element Logic acquire SDI Industries

- Jungheinrich acquire Storage Solutions
- Alstef acquire Solution Net Systems
- Berkshire Grey taken private
- Duravant acquire NPI
- Delhivery minority stake in Falcon Autotech

Number of transactions per year



Source: STIQ Ltd research & analysis

SECTOR M&A ACTIVITY

- STIQ tracks M&A activity up to a month prior to publication and in 2024 (to May), there had been no M&A activity announced in the sortation sector
- This could also signal muted supply of targets as sortation companies are increasingly consolidated within larger groups

EUROPEANS ACQUIRE IN NORTH AMERICA

- In 2022 and 2023 there were three acquisition of North American sortation vendors by European companies; Element Logic + SDI Industries, Jungheinrich + Storage Solutions, Alstef + Solution Net Systems

- While this could simply be coincidence, it could also point to the continued health of the North American market and European vendor's expansion plans
- There could also be a level of diversification as none of the acquirers had sortation equipment in their portfolio prior to the acquisitions

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SORTATION EQUIPMENT DIRECTORY: A-C

Addverb
IN | 2016
- System integrator

Aegis Sortation
US | 2017
- Sorter vendor

Alstef Group
FR | 1961
- Sorter vendor
- Acquired Solution Net Systems in 2023

Ambi Robotics
US | 2018
- Sorter vendor

ASI Inc
US | 1972
- Sorter vendor

Baoxiang Technology
CN | 2010
- Sorter vendor

Berkshire Grey
US | 2013

Revolutionize Sortation with Berkshire Grey
Unlock unmatched efficiency in your warehouse with Berkshire Grey's Robotic Sortation systems, powered by AI and machine learning. Tailored for diverse verticals including retail, e-commerce, grocery, parcels, and 3PL, our solutions offer precision sorting at top speed. Offering a cutting-edge alternative to traditional sorters, our compact, modular systems 4X your productivity, with 50% less space and labor. With the option for manual or fully robotic induction and near 100% SKU coverage, streamline operations for store replenishment, eCommerce, wholesale, and omnichannel fulfillment.
- Seamlessly integrate into your existing setup and scale effortlessly.
- Reduce costs and future-proof your logistics with technology that evolves with your business needs.

Transform your fulfillment with Berkshire Grey—where cutting-edge meets efficiency.

Berrmak
TR | 1998
- Sorter vendor

BEUMER Group
DE | 1935

BEUMER Group is a global manufacturer of material handling solutions. As a third-generation family-owned business, the company offers high-quality system solutions and comprehensive customer support worldwide and is a "Partner of Choice" for the retail, e-commerce, fashion, and automotive industries. Key BEUMER technologies includes the Pouch System, loop sorting systems and line sorter systems together with a comprehensive Software Suite and data analytics setup. With 5,600 employees worldwide, BEUMER Group generates an annual order intake of around 1.25 billion euros. In line with the company motto "Made Different", BEUMER commits to the highest standards of quality, innovation and sustainability.

Biaoma Automation Equipment
CN | 2017
- Sorter vendor

Bluecrest Inc
US | 2018
- Sorter vendor

BlueSword
CN | 1993
- System integrator

Bowe
DE | 1945
- Sorter vendor

Bullseye
CN | 2018
- Conveyor vendor

Cellumation
DE | 2017
- Sorter vendor

Cheng Hua
MY | 1956
- Sorter vendor

Conductix Wampfler
DE | 1902
- Component supplier

Confirmware
CN | 2005
- Sorter vendor

SORTATION EQUIPMENT DIRECTORY: C-H

Covariant
US | 2017

- Sorter vendor

Daifuku
JP | 1937

- System integrator

Damon Group
CN | 1997

- Sortation vendor
- IPO 2020

DCS
US | 1982

- Sorter vendor

Dematic
US | 1900

- System integrator
- Acquired by KION in 2016

Dexterity
US | 2017

- Sorter vendor

EAE Solutions
NL | 2014

- Crossbelt Sorter Vendor & System Integrator (CEP)

PREMIUM SORTING JUST BECAME AFFORDABLE

Check out the E-Cross, References, & latest innovations!

Element Logic
HQ | 2013

- System integrator
- Acquired SDI in 2022

Eton Systems
SE | 1967

- Sorter vendor

EuroSort
NL | 2001

- Sorter vendor

Falcon Autotech
IN | 2004

- Sorter vendor

Ferag
CH | 1957

- Sorter vendor

Fidus Global
US | 2020

- Software vendor

FMH Conveyors
US | 1910

Fives Intralogistics
FR | 1812

- Sorter vendor

Fortna
US | 1946

- Sortation vendor
- Merged with MHS in 2022

Geek+
CN | 2015

- Sortation vendor

Gebhardt Intralogistics
DE | 1952

- System integrator

SORTATION EQUIPMENT DIRECTORY: H-O

HIKRobot
CN | 2001
- Sortation vendor
- HIK Vision, parent company, on US entities list

Honeywell
US | 2001
- System integrator
- Honeywell acquired Intelligrated in 2016

Hy-Tek
US | 1963
- System integrator

Hytrol
US | 1947
- Sorter vendor

Itoh Denki
JP | 1946
- Pioneer and leader in DC motor driven rollers for conveyors, Itoh Denki developed a range of 24VDC compact sorters that can be easily integrated in a wide range of sortation processes, allowing flexible and cost-efficient lines designs.
- Our line of compact sorters combines precise transfers, safety, high reliability and energy efficiency.



ID Parcel & Mail Solutions
US | 2024

AFFORDABLE AUTOMATED PARCEL SORTING SYSTEMS
ID Parcel & Mail Solutions designs, builds and services automated parcel and mail sorting systems at a lower price point for small operations, or large operations with lower volume applications. Our systems achieve critical goals without the added cost of ancillary equipment that may be nice to have but not required. Leading parcel & mail processing companies from around the world have relied on our expertise when determining the appropriate system components for their specific requirements.

Inquiries: sales@idparcelandmail.com

Interroll
CH | 1959
- Sorter vendor
- IPO in 1997

Intralox
US | 1971
- Sorter vendor

Knapp
AT | 1952
- System integrator
- Acquired Duerkopp in 2010

Leonardo
IT | 1948
- Sorter vendor

Libiao Robot
CN | 2016
- Sorter vendor

Lodamaster
TR | 2011
- System integrator

M&M Beheer & Advies
NL | 2018
- Consulting firm

Mantissa Corp
US | 1973
- Sorter vendor

Muratec
JP | 1982
- Sorter vendor

Mushiny
CN | 2016
- Sorter vendor

Okura Yusoki
JP | 1927
- Sorter vendor

Omnia Wheel
AU | 2002
- Sorter vendor

SORTATION EQUIPMENT DIRECTORY: O-T

Omnimod
NO | 2020
- Sorter vendor

OPEX
US | 1970
- Shuttle ASRS

Plus One Robotics
US | 2016
- Sorter vendor

Regal Rexnord
US | 1955
- Sorter vendor

Prolistic
CH | 2001
- Sorter vendor

RN Logistik
BR | 2009
- System integrator

Sanki Engineering
JP | 1925
- Sorter vendor
- IPO in 1961

SCHÖNENBERGER Systeme
DE | 1964
- Sorter vendor

SJF Material Handling Inc.
US | 1979

Sortcon
TR | 2021
- Sorter vendor

Solystic
FR | 1955
- Sorter vendor
- Acquired by Northrop Grumman in 2001

Solution Net System Inc
US | 1971
- Sorter vendor
- Acquired by Alstef in 2023

Stevia Automation
PL | 2010
- Sorter vendor

Storage Solutions
US | 1978
- Sorter vendor

StreamTech Engineering
US | 2007
- System integrator

Sumitomo
JP | 2009
- Component supplier

Tenivus
US | 2002
- Engineering firm

TGW
AT | 1969
- System integrator

Tompkins Robotics
US | 2017
- Sorter vendor

TREW
US | 2019
- System integrator

Tsubakimoto Chain
JP | 1917
- Sorter vendor

SORTATION EQUIPMENT DIRECTORY: U-Z

Unbox Robotics
IN| 2019

Key Features of the UnboxSort
- Scalable **Robotic Put-wall** with 1000s of Sorting Exits in 50% lesser space without the need to pre-sort.
- Highest productivity per robot
- Installation in Weeks
- 3X jump in Productivity leading to more than 60% savings in operational costs
- Focus on E-com, 3PL and Retail Order Consolidation & Parcel Sorting

Vanderlande
NL | 1949
- System integrator
- Acquired by TICO in 2017

Versatile
UK | 2024
- Sorter vendor

Vitronic
DE | 1984
- Component supplier

Wayzim
CN | 2016
- Sorter vendor

Wellwit
CN | 2015
- Sorter vendor

XYZ Robotics
CN | 2018
- Sorter vendor

Zion Solutions Group
US | 2022
- System integrator

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INTERVIEWS, TRADE SHOWS AND GLOSSARY

STIQ INTERVIEWED THESE STAKEHOLDERS

ADDVERB (IN)	CEO EMEA
Alstef (FR)	Sales Director
Ambi Robotics (US)	CEO
AWL (NL)	Director Strategy & Development
Berkshire Grey (US)	**VP & GM, Mobile Robotics**
Beumer (US)	**Director of Sales**
Bowe (JP)	Sales Manager
ChengHua (MY)	Sr System Engineer
Conductix-Wampfler (DE)	Global Market Director Industrial Automation
Confirmware (CN)	Overseas Sales Director
EAE Solutions (NL)	Head of Solutions Design
Element Logic (US)	**VP**
EuroSort (US)	Regional Sales, US
Falcon Autotech (IN)	Chief Business Officer
ID Parcel & Mail Solutions (US)	President & CEO
Interroll (CH)	Sorter Solutions Sales Director
Intralox (US)	Product Manager
Itoh Denki (JP)	**GM Europe**
Libiao (CN)	Head of Overseas Support
Lodamaster (TR)	Manager
M&M Beheer & Advies (NL)	Founder
Mantissa Corporation (US)	Director of Engineering Operations
Muratec (US)	National Sales Manager
Omnia Wheel (AU)	Sales Manager
OPEX (US)	Manager, Product Management
Prolistic (CH)	CEO
RN Logistik (BR)	Founder, MD
Schoenenberger (DE)	Head of Material Flow Consulting & Sales Pouch Sorter
SJF (US)	VP
Sortcon (TR)	Technical Co-founder
TGW (AT)	VP Pocket Sorter
Tompkins Robotics (US)	President
TREW (US)	VP Marketing
Unbox Robotics (IN)	**CEO & Co-founder**
Vanderlande (NL)	Senior Manager
Vitronic (US)	VP Sales, BU Automation

ANONYMOUS CONTRIBUTORS:

- A few stakeholders requested to remain anonymous and STIQ is very grateful for their valuable contributions
- If you wish to participate in a STIQ report but prefer to remain anonymous, please simply let us know; We receive many incoming inquiries from a wide range of stakeholders with comments on our range of reports

TRADE SHOWS & EVENTS VISITED

IWLEX	(Coventry, UK)	WEB
LogiMAT	(Stuttgart, DE)	WEB
Logis Tech Tokyo	(Tokyo, JP)	WEB
Modex	(Atlanta, US)	WEB
MTC Robotics and Automation	(Coventry, UK)	WEB
NRF Big Show	(New York, US)	WEB
Promat	(Chicago, US)	WEB
The Delivery Conference	(London, UK)	WEB

GLOSSARY

AMR	Autonomous Mobile Robot
AGV	Automatic Guided Vehicle
ARB	Activated Roller Belt
AS	Asia
ASRS	Automatic Storage & Retrieval System
B&M	Brick & Mortar (physical retail store)
CAGR	Compound Annual Growth Rate
CEP	Courier, Express and Parcel
CPG/FMCG	Consumer Packaged Goods (US/UK)
DC (1)	Distribution Centre
DC (2)	Direct Current
EU	Europe
FC	Fulfilment Centre
G2P, GTP	Goods to Person
GOH	Garment On Hangers
M&A	Mergers & Acquisitions
MHE	Material Handling Equipment
NA	North America
OTC	Over The Counter
RAAS	Robotics As A Service
ROI	Return On Investment
RPC	Robotic Pick Cell
SI	System Integrator
SMB/SME	Small & Medium Businesses (US / UK)
US	United States of America
WCS	Warehouse Control System
WDS	Weigh, Dimension, Scan
WES	Warehouse Execution System
WMS	Warehouse Management System
WxS	Warehouse [Control/Execution/Management] System

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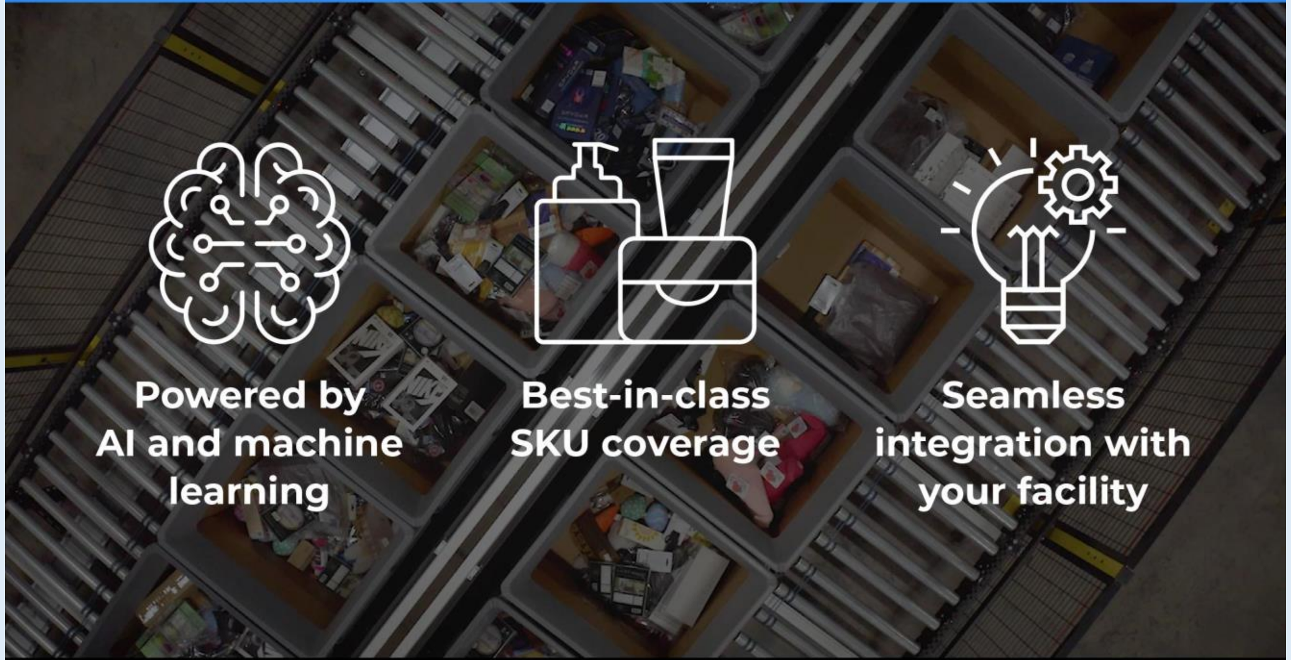

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