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LOADING / UNLOADING AUTOMATION 2024

ATLS | TRAILER + CONTAINER LOADING/UNLOADING | PALLETS + CARTONS | JAN 2024

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EXEC SUMMARY: MARKET WITH ATTRACTIVE TAM OPPORTUNITY. FASTER GROWTH INHIBITED BY CUSTOMISATION DEMANDS, LACK OF STANDARD PRODUCTS

INDUSTRY DEFINITION

- This report focuses on Loading & Unloading Automation Equipment used primarily in warehouses to handle pallets + loose cartons
- There are two primary segments: ATLS (full load trailer Loading & Unloading automation) and PICK (loose carton Loading & Unloading automation)

DIFFERENT SEGMENT MATURITY LEVELS

- ATLS is relatively mature in product terms, whilst PICK is a fairly new addition, stemming from increased computer vision applications
- Market penetration mirrors maturity, although ATLS remains relatively under-penetrated reflecting some of the difficulties in retrofitting equipment
- Global FMCG remains the main segment for ATLS; PICK majors in parcel, cargo and ecommerce

MARKET SIZE/ DRIVERS/ INHIBITORS

- Both ATLS and PICK are viewed as solutions with large attractive TAM's
- Primary market drivers were access to labour, H&S issues and throughput improvements upstream exacerbating bottlenecks at logistics level
- Inhibitors included infrastructure/ civic works considerations and complexity impacting achievable ROI, and long lead times due to extensive customer evaluation processes

LOADING & UNLOADING COMPLEXITY

- Brownfield ATLS accounted for c.50% of projects and these were often complicated by higher civic works costs and process impacts, leading to longer and deeper evaluations
- AGVs could potentially offer a more flexible solution with less civic works but were often slower compared to one-shot ATLS solutions which could achieve 4 trailers/hr compared to 1-2 for AGVs
- PICK solutions were mainly for unloading, and some commentators believe the technology has yet to adequately encompass all the real world problems and customers' often unique processes in how to manage incoming/outbound goods

A CORNUCOPIA OF SOLUTIONS

- ATLS has evolved into a fully manual vs a fully automated market, with very few hybrid solutions. Modified is most mature (generally intra-company with customer owned fleets); Unmodified ATLS is increasing although primarily for loading
- The PICK segment was less binary, with fully manual to near fully automated solutions utilised with some element of human surveillance due to the unpredictable nature of the loads. Gripping technology in particular needs development.
- Interviews also suggested limited competition from Asia in the ATLS sector which indicated a lack of (current) standard solutions and approaches

GROWTH PROSPECTS

- Interviews suggested the pandemic had boosted revenue with some relaxation in demand in 2023
- Generally there was significant optimism for 2024, particularly within ATLS as companies tackle the logistics interface bottlenecks
- There may be further potential for yard management, trailer parking, etc. which could drive faster growth in the overall sector

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Automated Intralogistics

joloda hydraroll

Loading Robots
AUTOMATE YOUR TRUCK CARGO

THE LOADING + UNLOADING AUTOMATION SECTOR CAN BE DIVIDED INTO TWO PRIMARY APPLICATIONS: (OFTEN PALLETISED) TRAILERS AND CONTAINERISED LOOSE CARTONS

UNLOADING/ LOADING AUTOMATION EQUIPMENT USED WITH DIFFERENT TYPES OF DELIVERY VEHICLES

- *Trailers are primarily used for road transport, both domestic and international*
- *Payloads are frequently placed on pallets or palletised, but can also be loose cartons*
- *Trailer sizes can vary by country*

Pallet Loading/ Unloading

Carton Loading/ Unloading

Loading/ Unloading Equipment Sector

- *Primarily used in international sea import or export*
- *Payload is rarely placed on pallets to minimise delivery costs and maximise volume shipped*
- *Loose cartons are often squeezed into a container*
- *Two standard sizes 20” and 40”*

Source: STIQ Research & Analysis. Image source: container, trailer + truck, pallet + floor load

TRAILER + CONTAINER LOADING UNLOADING

- This reports focuses on automatic Loading and Unloading equipment primarily used with trailers and containers
- Trailers tend to be transported on roads between production and/or warehouse facilities typically domestically, but also internationally via land
- Containers tend to be used for international imports transported via sea, but are also used domestically via rail and other modalities

"Domestically you mostly see pallets on trailers coming in because the transport loop is shorter, but when you get to international shipping, say an FMCG is bringing in product from China or India because labour is cheaper there, then you're dealing with containers, and density is very important there because the cost and time spent on the logistics side is so much higher that you really need, to ensure you have very dense loading." [Anonymous]

AUTOMATION FOR PALLETS + CARTONS

- The primary payloads covered in this report include pallets and loose cartons
- Trailers and containers may both transport pallets and/or cartons, however, trailers were more likely to transport palletised goods whereas loose cartons were predominantly used in containers to maximise shipping volumes
- The choice to palletize or to palletize goods was often related to asset utilisation, i.e. faster loading/unloading of trailers vs. maximising value of imports for example
- This may also be related to internal processes as well

ATLS PRIMARILY FOCUSED ON PALLET LOADS AND PICK ON LOOSE CARTONS. YARD AUTOMATION & MANAGEMENT PERIPHERAL

LOADING / UNLOADING AUTOMATION SECTOR SEGMENTATION

	ATLS	PICK	*YARD (peripheral)*
Primary Payload	• Pallets	• Cartons	• *n/a*
Container/ Trailer	• Trailer (primarily)	• Container (primarily) but may also be used with trailers	• *Any*
Sub-segments	• ATLS Loading • ATLS Loading + Unloading • AGV & AMR	• Armed picking robot • Conveyor with custom picking head • Custom	• *n/a*
Location	• Loading bay	• Loading bay	• *Yard*
Description	• Typically single-shot systems that may unload or load a trailer with a full load of pallets in a single action • Focus (in this report) on palletized goods	• Picking robots, primarily focused on loose carton picking from containers and/or trailers • Common architecture is the use of a robotic arm in conjunction with a conveyance system to either feed or ingest loose cartons • Primarily used with shipping containers where payload tends not to be palletized to improve cube-density of valuable product	• *Autonomous vehicles transporting trailers + containers in a yard* • *Drop & Hook processes where trailers are pre-filled and parked for collection increasingly being adopted, especially in F&B* • *Drop & Hook may assist a factory's outbound flows by ensuring docks are not congested*

Source: STIQ Research & Analysis
Image sources: Trapo, Dexterity, ex9 (via Selfdrivenews)

LOADING & UNLOADING PROCESSES STRADDLE LOGISTICS + INTRALOGISTICS PROCESSES

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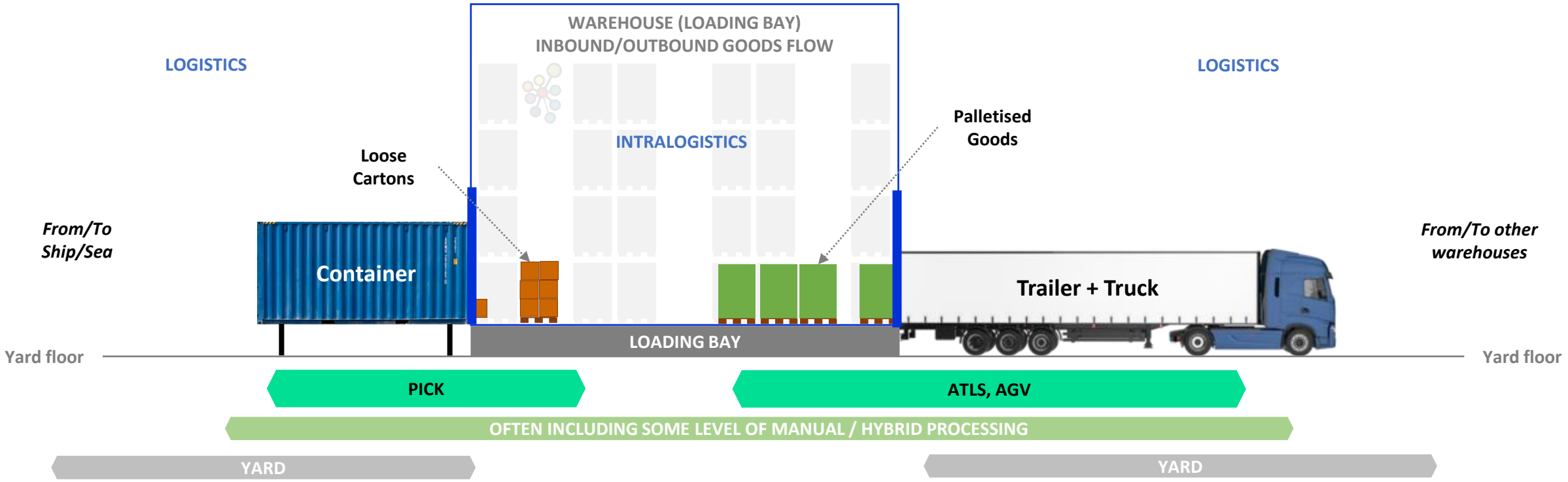
LOADING / UNLOADING OF CONTAINERS AND TRAILERS OCCURS AT WAREHOUSE LOADING BAYS (SIMPLIFIED)



Source: STIQ Research & Analysis. Simplified view of loading bays. Image source: container, trailer + truck

LOGISTICS AND INTRALOGISTICS

- The ATLS and PICK automation sectors straddle two (or more) separate disciplines: Logistics and Intralogistics
- **Logistics** processes involve anything outside of facilities and buildings, i.e. transportation by container, trailer, trucks, trains and any other modalities
- **Intralogistics** processes are any processes and movements of materials/goods within a building or a set of buildings
- Readers should note the definition of intralogistics (Wiktionary) can be somewhat fluid and may also extend to on-campus traffic between buildings

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THREE PRIMARY ATLS SOLUTION SEGMENTS: UNMODIFIED TRAILERS, MODIFIED TRAILERS AND AGVS

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MAIN TYPES OF ATLS SYSTEMS (SIMPLIFIED)

	UNMODIFIED TRAILER ATLS	MODIFIED TRAILER ATLS	AGV/AMR ATLS
Description	• Primary unmodified solutions use a skate or extended forks which are used to fill an entire trailer in one shot	• A few different trailer modification systems to load and unload pallets combined with a dock for full-trailer loading	• Robotics based solutions for loading and unloading pallets, typically based on forklifts or mobile plates
Modified Trailers	• No	• Yes	• No
ATLS at Source	• Yes	• Yes	• Yes
ATLS at Destination	• No	• No	• No
Primary application	• Distribution to end-users and customers	• Shuttle, usually between a factory and a warehouse	• Distribution to end-users and customers
Typical Transportation Distance (illustrative only)	• >200Km	• <100Km	• >200Km

Source: STIQ Ltd Research & Analysis

MODIFIED V UNMODIFIED (TRAILERS) ATLS

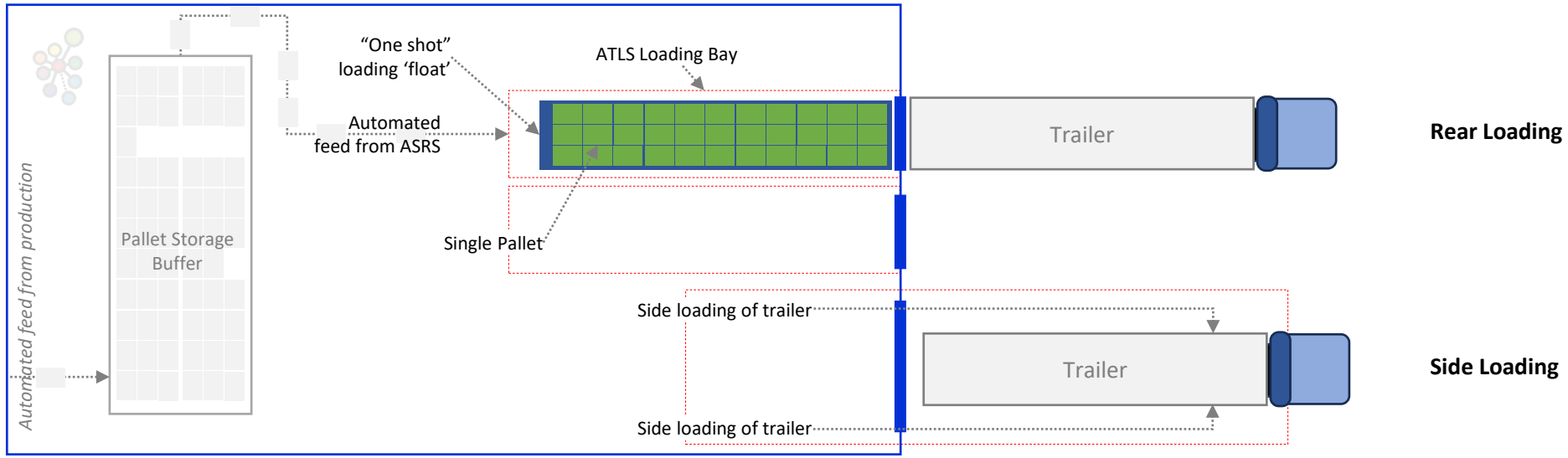
- The ATLS market is made up from a wide variety of solutions which can be divided into ATLS with Modified and ATLS with Unmodified trailers

"We classify the single-shot solutions into two broad technologies. You have Modified ATLS which is typically for intralogistics shuttling from A-B, the milk-runs. Then you have Unmodified ATLS which is typically for one-way loading, you just load the trailer and wave goodbye. This market is much bigger than modified because theoretically anywhere where there is a prepared load is a potential user of this technology." [Joloda]

- There was also an increasing number of autonomous forklifts and other types of AGV & AMRs in the space
- AGVs & AMRs was a relatively nascent addition to the market

THERE ARE A VARIETY OF ATLS LOADING STRATEGIES AND CONFIGURATIONS. REAR LOADING MORE COMMON

VARIOUS ATLS SOLUTION LOADING & UNLOADING STRATEGIES (SIMPLIFIED)



Source: STIQ Ltd Research & Analysis

VARIOUS LOADING STRATEGIES

- ATLS can be side-loading or traditional rear-loading
- Interviews suggested that the primary ATLS loading strategy was rear-loading of trailers, most likely due to trailer designs, ownership and space constraints, although some are solving the problem

"You don't need to own the fleet to be able to automate the process and there's no need to prepare the entire load in advance in front of the dock which uses 12-15 metres of space. With our system you feed in pallets from the side until the truck is fully loaded." [Loading Robots]

- Side loading was common in manual handling, but appeared to be a limited offering in the ATLS sector despite a vast majority of trailers being tarp-sided

"Tarp-sided trailers account for around 80% of all trailers in Europe but still their automation remains unsolved. There are a lot of solutions for rigid trailers that cannot work with the majority of European trailers… You can arrange three stations, one for opening the tarp, second is for loading and third is for closing the tarp. The good thing here is that it's not so important to park the trailer perfectly, so with this you can further reduce the cycle time. It's kind of like a fast-food drive-thru for side-loading." [Loading Robots]

AGV REAR LOADING ONLY (FOR NOW)

- STIQ research indicated all current AGV vendors which targeted automated trailer loading and unloading of pallets did so from a loading bay at the rear of a trailer

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FROM FULLY MANUAL TO NEAR FULLY AUTONOMOUS PICK SOLUTIONS, UNLOADING (AND LOADING) OF CARTONS FROM CONTAINERS AND TRAILERS

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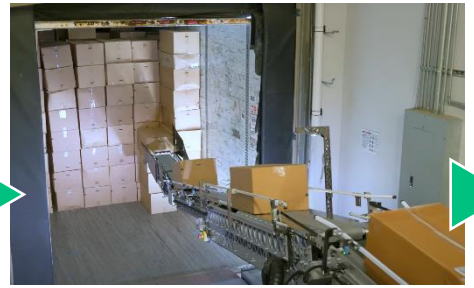
FROM MANUAL TO NEAR AUTONOMOUS CARTON PICKING

Fully manual handling

Manual + telescopic conveyor

Manual + platform + telescopic conveyor (hybrid)



Roaming conveyor solution

Dual pick arm robot with conveyor

Image Source: (from left) MCR, Dyno, Gorbel, Bastian Solutions (manual operated loading solution!), XYZ Robotics

FULLY MANUAL

- Fully manual is the default unloading solution, but may be difficult to manage at higher volumes
- There may be several issues, including staffing and retention, Health & Safety issues and potential holding penalties for containers and trailers just to mention a few

MANUAL + CONVEYOR

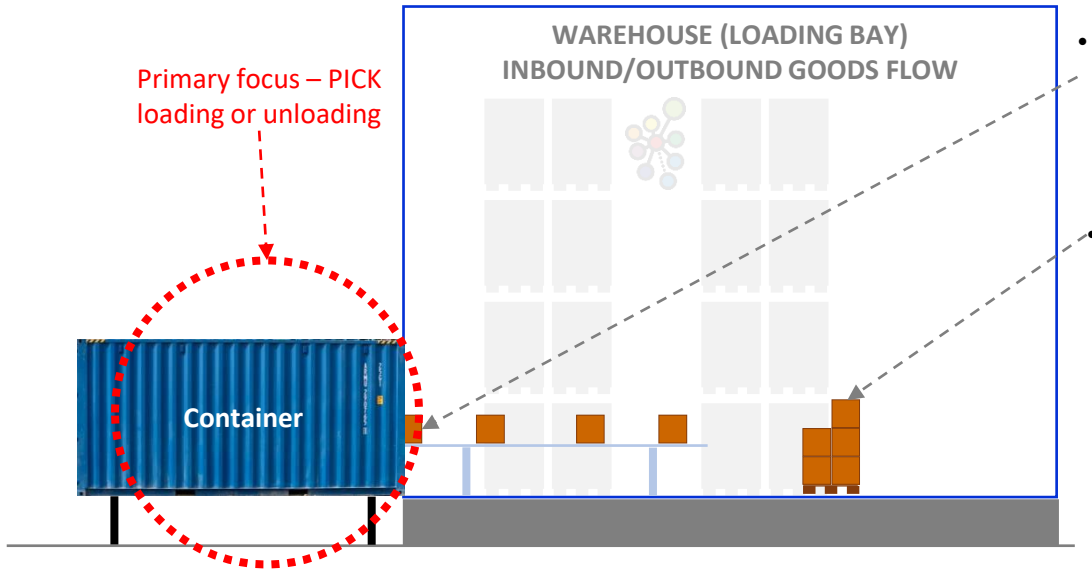
- Manual picking in conjunction with some form of conveyance that enters the trailer is the most common method for speeding up loose carton picking
- Greatly improves the speed and ergonomics of the manual pick process by eliminating the need for the picker to travel to and from the trailer
- Still has the same issues with staffing and Health & Safety as a fully manual process

FULLY AUTONOMOUS

- Newest form of automation in loose carton picking
- A combination of some form of manipulator and a method of conveying the carton out of, or into, the trailer
- Speed is typically on-par with manual processes
- Minimizes exposure to labour issues and Health & Safety risks, but still some exposure with the need for a supervisor
- Not yet able to address all use-cases

MOST PICK SOLUTIONS TARGETED THE UNLOADING PROCESS OF CONTAINERS, SOME LOADING ACTIVITY AS WELL

PICKING MAY INCLUDE A COMPLETE SOLUTION FROM CONTAINER TO RACK



- Loose cartons inside a container are unloaded and placed on conveyor for transport to palletization station
- Cartons are palletized

Source: STIQ Research & Analysis

"Container unloading can be a complex process because it's inbound, the state of the container is unknown to you. Once you take the product out, something must happen for it to be inducted into the warehouse. You need to sort and palletize them according to your strategy, then reorient the boxes so the barcodes are always facing outside. So, a solution can be as simple as just getting the stuff out, and as complex as creating the complete wrapped pallet for put-away or cross-docking." [Copal Handling Systems]

- This also hinted at a larger opportunity for PICK automation processes, potentially handling loose cartons from container unloading to palletized storage

PICK, A LARGELY MANUAL PROCESS

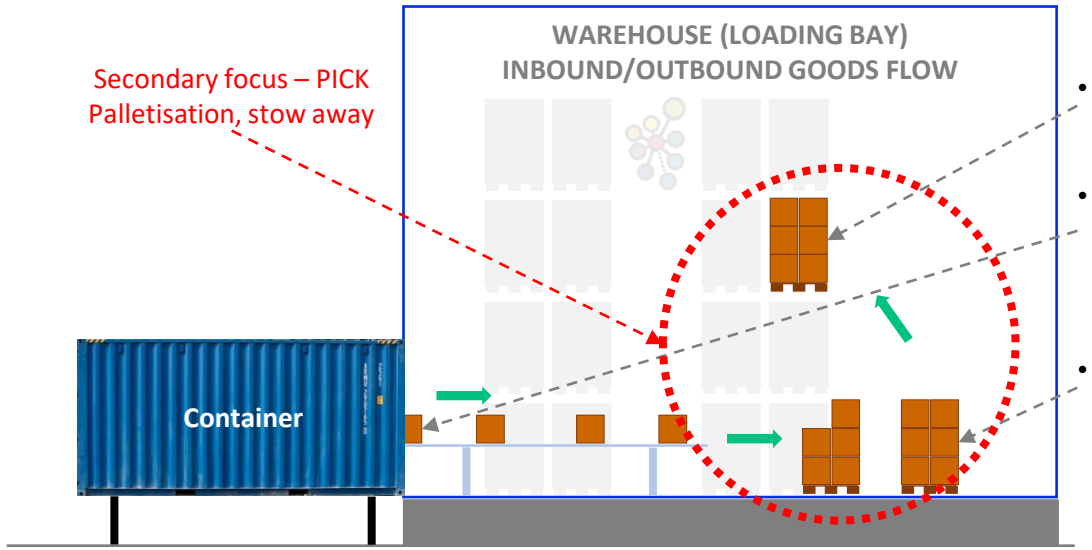
- Loose carton unloading processes were typically wholly manual with the assistance of a conveyor to bring picked cartons to a staging area where another manual process to palletize cartons was actioned
- This was later moved into storage or cross docked to customers or other locations

UNLOADING DEPENDENT ON ORIGIN

- Interviews hinted that the container unloading process can be complex, often depending on how cartons have been marked and loaded at origin + how they should be processed on arrival

LOOSE CARTON PICKING FROM CONTAINERS MAY ENCOMPASS A LARGER SOLUTION INCLUDING PALLETIZATION AND STORAGE

PICKING MAY INCLUDE A COMPLETE SOLUTION FROM CONTAINER TO RACK



- Palletized cartons are placed in storage, such as pallet racks
- Loose cartons inside a container are unloaded and placed on conveyor for transport to palletization station
- Loose cartons are palletized and packed for internal storage

Source: STIQ Research & Analysis

PICKING, ONLY ONE PART OF THE PROCESS

- Interviews with vendors suggested they may be targeting the container unloading process, but also viewed opportunities in downstream processing, such as the palletization of cartons

"Our philosophy is definitely that we want to focus on mobile case handling, starting with container unload, and then moving to other applications." [Anonymous]

"We're excited about the ecosystem of different vendors being composed together in simple and flexible ways to solve a more comprehensive process. There is often a desire from start-ups to want to own the entire value chain, but we're designing our product so that it's compatible with this interoperative vision of the future: Our unloading robots would connect to a palletizing robot, to a label scanner, a WMS, maybe some kind of ASRS system. " [Pickle Robot Company]

"Loading/Unloading is part of a broader value chain, yet we see many companies that don't even integrate into the WMS which you can understand from the perspective of, we just replace a manual process, but why would you limit yourself like that? There is a lot in automation, and you've paid a lot of money to get your system in control of a part of the process, so why would you let that opportunity slip away?" [Anonymous]

- Interviews also suggested such solution thinking could potentially add a higher degree of complexity

"The complexity is in coordinating both how the robot needs to move in and out of the trailer, with how material is flowing through chute, or sorter to the input buffer of the robot without interventions." [Dexterity]

CUSTOMER NUANCES CAN ADD COMPLEXITY

- In PICK automation, vendors were also required to meet customer processes, including how to manage parcels, barcodes, QR codes, how to display these, etc.
- Depending on such process requirements, this potentially meant a higher degree of engineering and customisation per client

"There's also the question of do we have enough people to deploy and service these solutions? We are making our solutions more standardised but there are a lot of things that are harder to control like QR/Barcode location on boxes, orientation, etc., therefore you need some engineering in a project. It's not a simple case of selling the solution and delivering it to the customer, it takes time to make the deployments right." [Copal Handling Systems]

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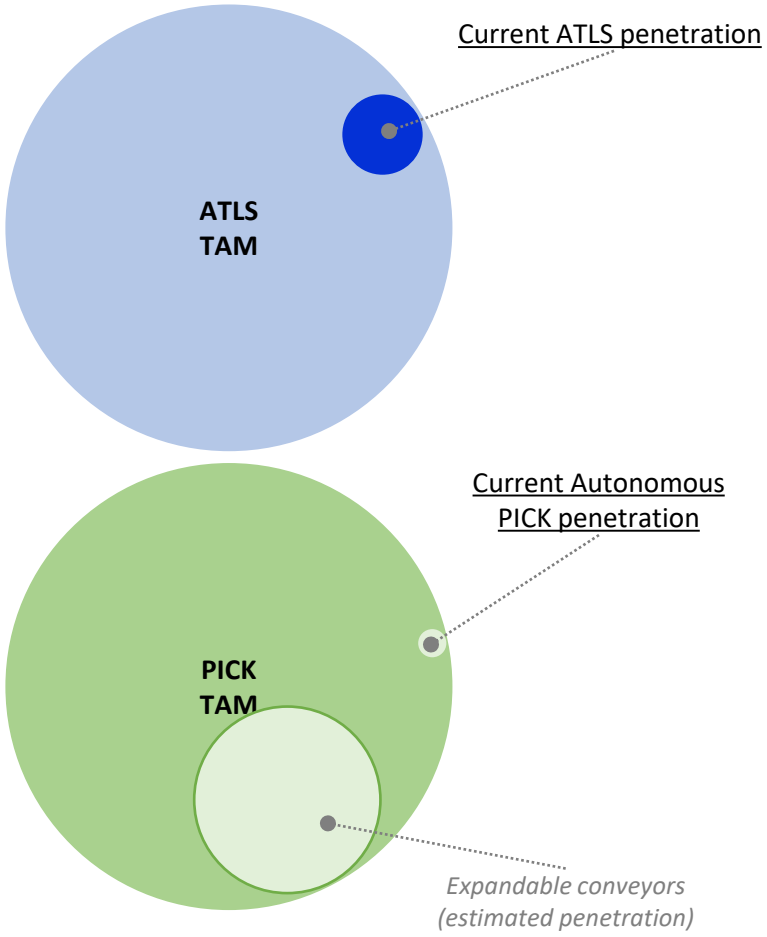
ATLS AND PICK BOTH UNDER-PENETRATED SECTORS. ATLS SOLUTIONS MORE MATURE VS AUTONOMOUS PICK SOLUTIONS. MANUAL HYBRID PICK SOLUTIONS WIDESPREAD

ATLS AND PICK MARKET PENETRATION (SIMPLIFIED)



Source: STIQ Research & Analysis.

UNDERPENETRATED MARKET SECTORS

- Interviews and research suggested a relatively low addressable market penetration for automated ATLS and PICK solutions
- Loading and unloading processes remained largely manual with some level of hybrid automation, such as a variety of expandable conveyors for PICK applications

<2% ATLS MARKET PENETRATION

- Interviews with ATLS vendors suggested the market was underpenetrated with huge potential upsides

"We see this whole ATLS market as being relatively new, we've heard it's as few as 2% of companies that are using some kind of ATLS, which means 98% haven't implemented a solution so it's definitely a large market opportunity." [SIMEC]

"Today I don't think even 1% of the operations in the world have some kind of ATLS, there is huge potential to grow the space." [CAPO Tecnologia]

LACK OF LARGER ATLS CUSTOMERS?

- Interviews suggested that the market remained at a stage where a small number of projects could make a huge impact
- However, this could also indicate that single projects were relatively large

"There are definitely bigger projects, but if a customer is having four docks converted, that's already a big project." [Anonymous]

"In the ATLS space, even an order of 4 units is quite a big order and when they go for 10 units that's huge. As of now, I don't really see that a company will find 100 customers a year demanding ATLS." [Forankra]

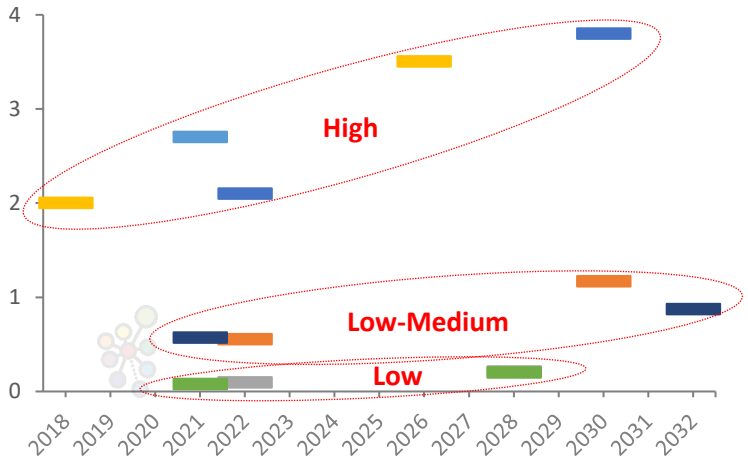
"You've got some people that only do loading, they don't really care what happens after with the unloading of the trailer. Then you have other people doing both loading and unloading which are typically much bigger in project scope." [SIMEC]

PICK LARGELY MANUAL PROCESS

- Interviews with end-customers and vendors suggested PICK remained a largely manual or hybrid manual process with some conveyor automation/ configuration
- Autonomous PICK robots were largely in trial phases with end-customers, but had not yet scaled through organisations

ATLS MARKET SIZE ESTIMATES HIGHLIGHTED THREE DISTINCT MARKET SIZE "CONSENSUS GROUPS" WITH SIMILAR FUTURE GROWTH INDICATIONS

PUBLICLY AVAILABLE GLOBAL ATLS MARKET SIZE ESTIMATES, 2018-2032 ($BN)



Source: Verified Market Research, Report Linker, Next Move Strategy Consulting, Precision Reports, Global Insights Services (GIS), Market Reports World, Prudour Pvt Lmt
Note: Results from Google search in Dec 2023.

SIGNIFICANT DELTA IN MARKET SIZING

- STIQ Ltd conducted a quick "meta-market research" search on google.com in Dec 2023
- As for most warehouse automation sectors, there was significant discrepancy between market research vendors for the global ATLS market
- The ATLS market size varied by up to 35X (2021) between vendors

COULD DEFINITIONS BE AN ISSUE?

- Occasionally, market sectors can be confusing with a lack of strong definitions
- However, the ATLS sector was a relatively well-defined product with a known set of serialised vendors and companies that produced bespoke one-off solutions
- It should be noted that many ATLS solutions can also be applied to other industries (outside of palletised goods), such as aggregates, car tyres, etc.

PICK AUTOMATION MARKET SIZE DATA

- As the market for PICK automation solutions was in its infancy there were no public indications available
- Many of the PICK automation companies were younger startups and displayed a high level of optimism regarding the potential market size

"We see that it's potentially a huge market, you're talking about hundreds of millions of containers coming to Europe every year, yet there are very few companies who are working on this problem." [Copal Handling Systems]

"China has a big potential market for loose carton picking. We think that currently 95% of the market would not see a good ROI with the current available solutions and pricing strategies, but even with just 5% adoption, the market is very big and has room to grow over the next 3-5 years." [XYZ Robotics]

"I've seen RFIs ranging from €45m-€75m so there is definitely a lot of interest out there." [Anonymous]

BUY STIQs ATLS MARKET SIZE DATA

- At STIQ we spend significant time talking to vendors, component suppliers and customers to get a view on market size and demand in the ATLS sector, market drivers and inhibitors, etc.
- STIQs data is clearly defined and segmented. To inquire – contact Tom tom@styleintelligence.com
- Note STIQs market size data is a **fee-based product**

ATLS GROWTH IN LINE WITH BROADER MHE INDUSTRY. PANDEMIC BOOSTED DEMAND IN 2022. LOWER GROWTH IN 2023 WITH POSITIVE SENTIMENT FOR 2024

ATLS BOOSTED DURING THE PANDEMIC

- Whilst not a major customer type for ATLS vendors, increased eCommerce sales during Covid appeared to have driven demand for ATLS solutions in line with the broader MHE space

"In the last four years, especially around Covid, the explosion in eCommerce led to huge growth in Europe and the US, but more interestingly also in places like South America… and the rest of the world." [Joloda]

"During the pandemic we almost doubled, especially with our ecommerce deployments. We doubled our team, our factory, our turnover, everything doubled." [Lodamaster]

- Interviews also suggested a sharp increase in evaluations of ATLS

"Covid had a major impact on the demand of these systems. Interest picked up during and after Covid where budgets were suddenly much more available to operators to really investigate and invest into these technologies." [Technica International]

"We have a lot of companies coming to us asking for an engineering study of a new plant with ATLS as a piece of the solution. Because right now if you consider the lack of operators, the throughputs that need to be tracked, and the efficiencies expected of these companies it's a must that you seriously evaluate your loading/unloading process." [CleverTech]

GROWTH SENTIMENT (ATLS)

Source: STIQ Research & Analysis

LARGER OPPORTUNITIES, SOME VOLATILITY

- This demand also seemed to reflect on the size of an individual project, both for PICK and ATLS

"The projects we're pitching for are at least 5x, and some 15x bigger than around 3 years ago. Of course, some of that comes from building a reputation and install base, but it has to be a reflection of the increase in awareness and demand for these kinds of solutions and that the companies are finding the budgets for it." [SIMEC]

- However, in some markets there was significant volatility in demand and requirements

"We have a very unstable domestic market which means there is a lot of uncertainty on what's going to happen so that means trailer loading/unloading is currently on hold. Export however is still going strong and so these budgets are being put towards container loading solutions." [CAPO Tecnologia]

INCREASED DEMAND IN 2024?

- Despite decreasing demand, there was significant positive views on ATLS growth in 2024

"After the pandemic we've seen the number and size of projects decrease, which is expected, however we are still in a very positive position, we'll still grow compared to last year." [Lodamaster]

"I focus on the French speaking markets, and demand is fairly stable." [Forankra]

"We saw a 30-40% growth in the last year, and we expect the coming year to be around the same." [Joloda]

"We're expecting more than 40% growth over the next year. We have some big projects we're in the early stages of, and some existing customer ordering more units too, but as mentioned, these take a while so it's hard to know if it's going to end up in 2024 or 2025. But regardless we feel there will be more projects tendering for 2026. There will also be more ATLS companies joining the fray, so it feels like everything is on an upward curve." [SIMEC]

"We're seeing a larger boom in the container loading systems." [CAPO Tecnologia]

ACCESS TO LABOUR AND H&S DRIVING THE LOADING/ UNLOADING SECTOR INCLUDING PICKING AUTOMATION. NEW FACTORY CONSTRUCTION A KEY MARKET DRIVER FOR ATLS.

TOP MARKET DRIVERS IN THE LOADING & UNLOADING AUTOMATION SECTOR

Driver	Description	Impact
Access to labour (lack of labour)	• Employment levels remained elevated, and companies continued to struggle with a limited talent pool, especially in areas with a high density of factories and warehouses • Increasing automation penetration may de-risk operations and production output	↗
Health & Safety	• Carton unloading can be a physically demanding job where humans may be able to work only part of the day with potential for injuries • Automating carton unloading with PICK solutions could reduce physically very demanding work and associated injury risks	↗
New Factory and/or Warehouse Construction	• New factory + warehouse construction was a net positive market driver in the wider material handling industry • Building a business case for ATLS in greenfield appeared easier compared to brownfield. PICK nearly always deployed in brownfield/existing operations	↗
Shipping volumes	• Overall trading volumes mean more shipping containers and trailers • Growing trading volumes can drive up interest in loading and unloading automation	→
Product integrity	• Manual handling occasionally leads to damaged products • Automating loading + unloading could reduce damage associated with manual processing	→

Source: STIQ Research & Analysis.

ACCESS TO LABOUR, A KEY MARKET DRIVER

- STIQs research on the wider material handling equipment sector have indicated a gradual deterioration in access to labour for many warehouse operators
- This tended to be more pressing in areas with a high density of warehouses and factories
- Interviews suggested higher income countries were prime targets for PICK solutions

"In Europe and the US, something like 30-40% of the market can be targeted since the minimum wage is >€8-10/hour, which we think is the sweet spot for when ROI starts to make sense… that's most of Europe, US, Japan and Korea." [XYZ Robotics]

"It really depends on the market you're working in, you have to consider the labour costs and availability in the operation. If you're in a very low-wage country, then the ROI might be difficult to achieve, but if you're in Europe or North America, then you can see ROI that's somewhere between 1.5-4 years." [Technica International]

- Single shift ROI may be challenging for PICK applications but labour availability could mean there are no other options

"ROI for single shift operations is still challenging, it's somewhere around three to four years. The kind of client that is automating a one-shift operation is typically someone who is trying to innovate and stay ahead of the trends… potentially they're in an area with a tiny labor pool so they cannot pull in more people without raising wages to something crazy like $40 per hour." [Anonymous]

- Similarly, ATLS solutions primarily targeted full loads as ROI was likely challenged with partial loads

"All of our projects are full-loads because of the business case. Say for example you're able to load three trucks per hour, if you then decide you want to instead do multiple partial loads, you're now expecting to load the same number of pallets across more loading cycles, and while the loading cycle is occurring, you can't receive new pallets on top of the loading plate so you're also cutting down the capacity." [Actiw]

HEALTH & SAFETY AND DE-RISKING OUTPUT WERE PRIMARY DRIVERS FOR ATLS AND PICK SOLUTIONS

H&S + DE-RISKING OUTPUT DRIVERS

- Whilst higher labour cost countries are often prime targets for automation, there were also other aspects, such as de-risking operations and securing output
- ATLS solutions were often driven by the requirement to maintain output from production and to increase loading bay turnover

"A more general lever is the need to increase safety and speed while reducing dependency on the labor markets especially in the EU and the US. You could find a good driver, but they're expensive, or you get a cheaper driver, then your product gets damaged, and then you have a high turnover of workforce especially in areas that have many similar companies co-located, workers can easily switch jobs." [Actiw]

"We have a lot of deployments in traditionally low-income countries especially with global brands, and that surprised us but once you prepare the business case it makes sense. If, for example, you have a plant in Germany, you're probably pushing out 1-1.2k pallets per day, whilst in a country like Brazil you're easily hitting 2-3k pallets per day, and how do you hit those volumes? You can't add 20 forklift drivers, that's just dangerous and won't hit the target, so you need to automate." [Joloda]

- De-risking operations from potential manual mistakes can also be a strong driver

"We have a customer who is using our solution not because of the operational cost reductions, but because of the cost of a mistake in their operation. You can imagine if you have the same product going to multiple markets with specific requirements on packaging or quantities, it's a very costly mistake if you load the wrong variant, and that's something automation can really help to mitigate." [Loading Robots]

- In PICK processes there were more pertinent Health & Safety aspects, especially as people work in environments that may vary in temperature and with potentially heavy loads

"Another major lever is safety. You can have cartons that weigh 25-30kgs that need to be dropped from elevated heights, or lifted from lower heights, and 30kg is a lot of stress for an employee who's constantly doing this for 1-2 hours." [Technica International]

"In Europe it's hard to find people, so if you're a company doing 2-3 containers per day, you'd have to rent an unloading team where we see prices from €200-€400 per containers, all the way to €700-€800 per container in Australia. Using these figures, with a €1-million investment, the business case starts to make sense." [Copal Handling Systems]

"From a health and safety perspective - an employee cannot carry more than so many thousand kilos per day, so if an inspector comes in and sees a manual crew running the entire inbound, they can shut down the warehouse until the problem is solved, and finally you have a simple lack of available workforce." [Roboworks]

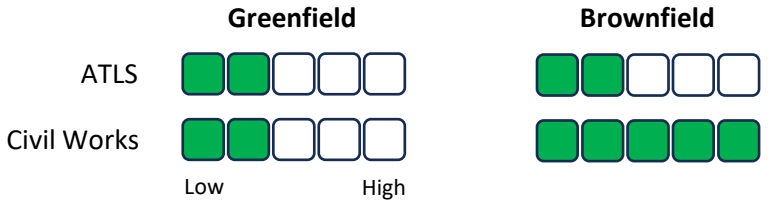
GREENFIELD AND BROWNFIELD OPPORTUNITIES IMPACTED ATLS AND PICK SOLUTIONS DIFFERENTLY. CIVIL WORKS OFTEN A KEY FACTOR IN ATLS BROWNFIELD

GREENFIELD V BROWNFIELD MARKET DRIVER/ INHIBITOR

SOLUTION	GREENFIELD	BROWNFIELD
ATLS	→↗	→
PICK	→	↗

Source: STIQ Research & Analysis.

ATLS: RELATIVE COSTS IN GREENFIELD V BROWNFIELD (SIMPLIFIED)



Source: STIQ Ltd Research & Analysis

NEW CONSTRUCTION, A KEY ATLS DRIVER

- Interviews suggested greenfield/ new factory construction was a key driver for the ATLS market

"We saw more greenfields recently especially during Covid. Many of the FMCG companies have started to recruit internal champions to investigate ATLS solutions. You get more savings from a greenfield project since in a brownfield, you typically spend 40% of the project on civil works trying to modify the existing building, so in some cases, a greenfield can almost save the cost of the system just on the civil works." [Actiw]

ATLS BROWNFIELDS, HIGH CIVIL WORK COSTS

- Brownfield opportunities typically require a larger budget proportion for civil works to be undertaken to fit ATLS solutions, which has inhibited faster market growth

"In a brownfield you can often see the price of final installation reach something like 5x the unit price because of the amount of civil works that might be needed to get the best installation. That's why it's important that you can deliver your solution in a modular way so that most customer use-cases and environments can be accommodated without having to force high Capex works like cutting metres of concrete etc." [Joloda]

- ATLS in factories tend to be installed towards the end of efficiency drives, which means mainly brownfield

"We mostly deal with brownfield projects because ATLS is typically at the end of the automation journey for our customers, so everything else is already in place. This can be very difficult because we aren't able to change too much, but if they were doing manual operations before, its likely they were using more space than a typical ATLS would need. Main challenge we find is the width of the gate might be limited." [Lodamaster]

"We see a lot more brownfield projects in our market. That's not a huge problem for us since a lot of these customers will already have the space at the docks because they were manually buffering pallets there. We also don't really need to make too many dock modifications especially with the doors. There are some cases where the dock has only 3 metres and forklifts need to make hard turns into the truck, and we can't really operate in that scenario." [Technica International]

- Similarly, AGV & AMR robots in Loading & Unloading of pallets may be included as an early construction consideration but would typically be commissioned as a brownfield solution once a factory was up and running

"It doesn't matter to us since we require no dock modifications, we don't care about the specifics of your dock, the rule of thumb is, if you are currently loading using a forklift, then we can work there." [Slip Robotics]

"Aside from one major project, the rest are brownfield projects which is in-line with our focus for the solution. Of course, we love to work in greenfields, but the benefits are mostly seen in brownfield projects where you have a lot of limitations on your docks, that's the kind of scenario we are targeting." [Loading Robots]

CIVIL WORKS, LEAD TIMES AND A LACK OF STANDARD SOLUTIONS CONTINUED TO INHIBIT GROWTH IN ATLS. PICK REMAINED A NASCENT TECHNOLOGY

TOP MARKET INHIBITORS IN THE LOADING & UNLOADING AUTOMATION SECTOR

Inhibitor	Description	Impact
Civil works (ATLS brownfields)	• High engineering costs and lengthy lead times to change existing buildings • Total ATLS solution costs could become prohibitive once civil works were included in some brownfield opportunities. This has also led to a higher degree of bespoke solutions in the market	↘
Trailer turnover (ATLS)	• Interviews with CPG/FMCG companies suggested a max limit of four trailers per loading bay per hour • This implies a very hard boundary for a reasonable ROI	↘
Nascent Technology (PICK)	• Many PICK solutions are unproven in production environments and may require frequent assistance from a supervisor, making ROI challenging	↘
Lead times	• Longer lead times as many different departments involved in often critical infrastructure	→↘
Lack of knowledge	• Interviews suggested few consulting firms were very knowledgeable about the advantages/ disadvantages of ATLS • Increased marketing and training may resolve some of these issues	→

Source: STIQ Research & Analysis.

ATLS, A LOT OF NON-STANDARD PRODUCTS

- Interviews and research suggested there was a large range of different ATLS products for specific applications

"It's a really bad bottleneck for companies exacerbated by the fact there isn't a single solution that covers all applications. You have Modified ATLS solving one case, Unmodified ATLS solving another case but nothing that covers everything. Each company has their own operation, product types, loading styles, which may not even have a viable solution out there for them." [Lodamaster]

LENGTHY LEAD TIMES AS STANDARD

- Leads times can vary, but were often estimated in years rather than weeks

"We have one deal that took 2-3 weeks, but that was an existing customer, and on the flip-side we have a customer we've been talking to for 10 years and still haven't closed it yet, so it's somewhere between those extremes." [Actiw]

- Greenfield opportunity lead times could be extensive as ATLS solutions could be a small part of an entire construction project

"For the bigger companies that have bigger budgets for this kind of automation, you can get the Capex approved fairly quickly, usually within 1 year, but some can take as long as six years to get the approval. Once they order though we can get it implemented in 2-6 months. Greenfields typically take longer because it's part of a larger project. " [Joloda]

- Interviews suggested conversations can be extensive with variance across customers, leading to periods of pure sales followed by periods of intense deployment

"Discussions can take a very long time, easily up to a year. What that means is you can have a period, even a whole year where you haven't deployed anything, then suddenly a year that's full of delivery of orders from the previous year. The goal is to try to keep that schedule balanced." [Forankra]

- Occasionally there was further investigation required by customers to gain a better overview of challenges and opportunities with ATLS solutions

"We would love to be able to sell a project today and another tomorrow, but these systems take time. You meet with the customer and discuss whether they've considered A or B… which they may not have. And then you've got a project that's pushed out by 5-6 months often with goalposts shifted. But now you both understand the implications and can determine the work from each side to get to the goal." [SIMEC]

RAAS PRIMARILY OFFERED BY YOUNGER PICK STARTUP VENDORS. HOWEVER, SOME ATLS VENDORS HAD ADOPTED THE BUSINESS MODEL FOR NEW PRODUCT RANGES

THE RAAS BUSINESS MODEL

- The Robotics as a Service (RaaS) business model largely emerged from VC backed startups in the last decade
- RaaS was often one of many types of business models on offer as its flexibility allowed it to serve many different types of potential customers

"We can work with pure Capex, a blend of Capex + Opex, or pure Opex, it really doesn't matter to us as long as our customers are in line with us on this long-term trajectory of consistent improvement of our solutions." [Dexterity]

"We have an upfront reservation fee, an installation fee, and then a monthly fee that includes a set number of containers with an additional overage fee. This RaaS model includes all the consumables and the maintenance. We also offer Capex for the super enterprise customers that might want 15-20 robots, but RaaS is our more popular model." [Pickle Robot Company]

- Some legacy vendors appeared to appreciate potential benefits of the RaaS model and had begun offering Opex models to potential customers

"More important than the product itself is the business model around the product. We have a simple structure, we have an initial fee followed by a monthly fee that includes the rental and maintenance of the system, and after one year we can take the machine back if you don't need it anymore. " [Loading Robots]

ROBOTICS CAPEX AND OPEX BUSINESS MODELS [1]

MODEL	SOLUTION OWNER	DESCRIPTION	SOLUTION PAYMENT	MAINTENANCE, SERVICE, ETC.
Capex	CUSTOMER	• The customer buys the solution from vendor	• Upfront payment for solution	SEPARATE
LEASE RAAS	CUSTOMER/ FINANCING COMPANY	• The customer agrees a leasing package with a finance provider with the possibility of buying the solution at the end of the agreement	• Monthly pre-agreed charges with a final payment to own the solution	SEPARATE
RENTAL RAAS	VENDOR	• The customer agrees a contract period with a vendor (typically 3-5years) with some charges for software integration if required	• Set monthly fee	INCLUDED
TRANSACTIONAL RAAS ("PAY-PER-PICK")	VENDOR	• The customer agrees a contract period with a vendor (typically 3-5years) with some charges for software integration if required	• Variable monthly fee, pay-per-pick or pay-per-presentation, etc.	INCLUDED

Source: STIQ Research & Analysis.. [1] STIQ recommends to double check with vendors as RaaS is currently evolving and T&Cs may differ. From STIQ Ltd 2023 G2P Solutions report (download here)

- Interviews suggested there may be some customer types that could be more interested in RaaS based on their own business models, such as 3PLs for example

"3PLs in particular love this model because it is as flexible as their operations are unpredictable. They can move the robot to a different site, if they lose an account they can stop for a year and we can take the unit back, then if they get new business they can start again, so it really works for them. " [Pickle Robot Company]

"Some customers might prefer Capex, but for 3PL we think the Opex model will make a lot of sense, since they have very dynamic businesses and so the flexibility in the Opex model might work very well with them." [Loading Robots]

- Others suggested that some customers may be looking not only for robots, but an entire solution

"In our space, the concept of renting just a robot doesn't work. People aren't just looking for the hardware, they want a solution that's fully integrated, so we are proposing to not offer a RaaS service, but instead Unmanned Transport as a Service, where the monthly fee takes into consideration the full solution needed." [ex9]

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GOLD SPONSORS

INDUSTRY-WIDE CONSENSUS ON APPLICATIONS OF UNMODIFIED AND MODIFIED ATLS

UNMODIFIED VS MODIFIED ATLS

- Interviews suggested Modified ATLS was the most mature segment in the sector

"Most of the mature solutions in the market are Modified ATLS that serve the shuttle use-case between production and distribution." [Loading Robots]

- Modified ATLS often required ownership of trailers which could narrow applications somewhat

"Modified ATLS requires significant changes to the trailers, so the company has to own the trailer. This means it's a very logical solution for a company that has a factory with a separate warehouse, within the same operation." [Lodamaster]

- Unmodified and AGV solutions could be an option for situations where origin lacked control over the destination

"For FMCGs for example a beverage producer, it's very common to have a shuttle between your manufacturing and distribution centers, and that works very well because you own the fleet and can do whatever you want with them. The problem is how to automate when you don't have a dedicated fleet and need to be able to work with any truck." [Loading Robots]

"For Unmodified ATLS, you don't have to modify the trailer which is good for distribution companies because they can still work with the logistics partners, without owning the trailers." [Lodamaster]

- Interviews further suggested that Unmodified ATLS demand had seen an increase

"We see more and more the demand for Unmodified ATLS, now it's around 50:50 between Modified and Unmodified projects. We're especially seeing with new warehouses an interest in Unmodified ATLS." [Forankra]

- Unmodified ATLS was typically limited to loading-only, which excludes it from any inbound processes
- Some vendors described a trend for customers to install both Modified and Unmodified ATLS on separate docks to cover these various use-cases
- A typical setting for this would be a factory that both distributes to end-customers and to internal warehousing

"You wouldn't convert all your docks to Modified ATLS because it can't support all the use cases in a warehouse, but you may convert a single dock to cover the shuttle between warehouse and factory, and their other docks may cover distribution to customers." [Lodamaster]

- Some vendor interviews suggested new developments in Unmodified ATLS that could work in both loading/unloading contexts

WHICH TRAILER MODIFICATION TO CHOOSE?

- Within Modified ATLS, there are multiple systems for conveying the prepared pallets into the trailer
- The most common are moving-floors, slip-chains and skates
- It was reiterated that the type of conveyancing system should be carefully considered based on your operating parameters

"If you're going for a pallet-based solution, there is a lot to consider for example, heavy and large cargo needs to be supported by the pallets that you use, or the weight distribution is uneven therefore making it hard to shift on regular forklift, or some customers using multiple pallet types including non-standard pallets. In that case, you might use a moving floor system that doesn't use beams to handle the pallet. If you are using standard pallets, then you could use a beam-solution and the unloading is less complex than the previous case." [SIMEC]

ATLS AUTOMATION PART OF AN INCREASINGLY COMPLEX WAREHOUSING FLOW, ESPECIALLY WITH GLOBAL END-CUSTOMERS

Loading & Unloading, Jan 2024
Published by WWW.STIQ.LTD

ATLS, PART OF A COMPLEX PROCESS

- Whilst ATLS may appear a relatively simple solution to fill a trailer in as short time as possible, end-customers and vendors appeared to appreciate the impact on increasingly complex up- and downstream processes of such equipment
- This had also been reflected in vendor's changing sales strategies

"Eight years ago, a lot of pre-sales was talking about the nuts and bolts, the mechanical properties of the system, but we all learned that this isn't what the customer cares about. That's when we started to focus on the business case, let us understand the entire process, what are your volumes, how many drivers you have, the salaries, and importantly all the wait times. Then we have a video to help visualise the solutions and how they could be applied to the problem statement presented by the customer." [Joloda]

- STIQ interviews in the MHE industry have highlighted an increasing use of visual simulation tools, 3D animations, etc. to showcase solutions and as sales tools

"With digital twins and 3D mapping we can make sure that we plan a solution whilst respecting the existing infrastructure like buffers, etc. This is really the way you can differentiate in the market, how you tailor a solution in accordance with the customer requirements and logic." [CleverTech]

ATLS AND FREQUENT CUSTOMISATION

- Vendors appeared to suggest there was a relatively high level of customisation in the ATLS sector
- STIQs research of the ATLS sector also highlighted a level of participation in ATLS from general mechanical contractors/shops with single deployments
- Customisation was often an issue of the space available at loading bays

"Modified Trailers can also work as a semi-auto system, especially if there is no space for a single-shot system. You place the pallets on the front of the trailer and the belt or chain can take the pallet to the back of the trailer." [CAPO Tecnologia]

- Serial vendors had modularised their approach to minimise customisation as far as possible

"We've modularised our solutions by standardising the application of them, so we have a lot of modules that we can use to fit the customers' needs" [CleverTech]

"The core machine is the same but depending on the customer needs we modify it to ensure their operations are smoother. Maybe they use a different size container, or it comes on a truck chassis so needs some height or side adjustment, so we can modify the system to suit the situation." [Actiw]

- However, a level of customisation was to be expected especially for vendors with an international exposure where trailers may be different sizes with different loading bay and construction standards

"We often get requests from places where the definition of a trailer can be stretched. We know that every project will have some customization. But that customization should be like in Japan where they have different trailer sizes, and that's something we are happy to work towards." [Joloda]

- Furthermore, increasing automation (by mainly global end-customers) also meant a growing demand on IT integrations, especially with unloading processes

"We always need to consider how we integrate with the warehouse systems. For loading, it's a bit easier, you take from the warehouse and load it onto the lorry, but for unloading, where are we meant to send it? Does it go into quarantine, are they empty pallets? We make sure we connect to the WMS/ERP systems so that we can buffer both inbound and outbound pallets to load the system effectively." [SIMEC]

THE ATLS MARKET IS SEEING BOTTLENECKS FROM TRAILER MOVEMENTS

Loading & Unloading, Jan 2024
Published by WWW.STIQ.LTD
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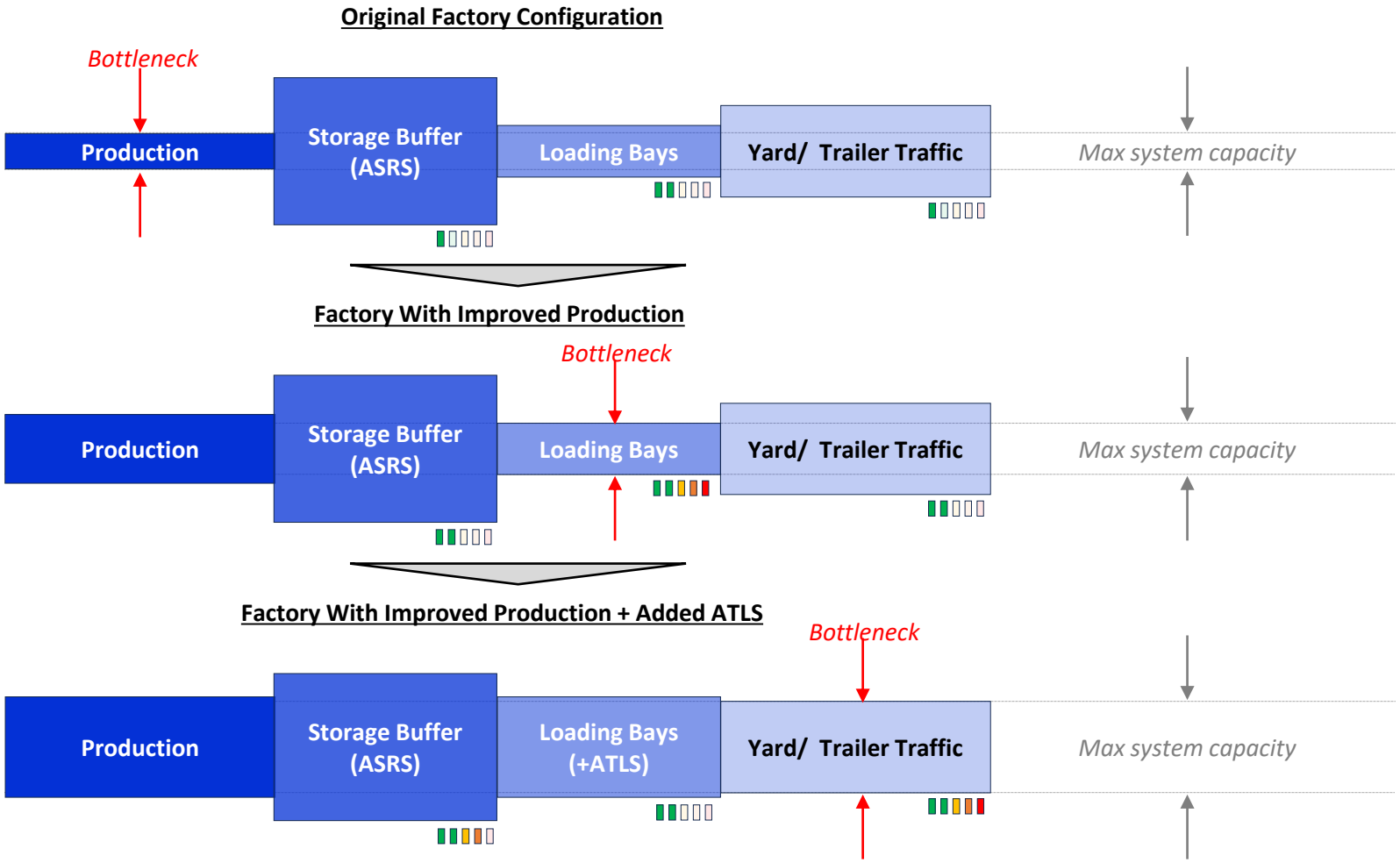
PRODUCTION & WAREHOUSE OPTIMISATION FLOW (SIMPLIFIED)



Key: *Low operating pressure* *High operating pressure* *Height of boxes = capacity*

Source: STIQ Research & Analysis

ATLS AND THE PRODUCTION LINE

- This analysis primarily applies to Modified-Trailer ATLS most frequently deployed in warehouses connected to a production line
- As production capacity comes near to or exceeds trailer loading capacity, there can be a case for adding ATLS to relieve the bottleneck

"The investment usually goes into the production side, so after a couple of years, you end up with double your production capacity, but your docks are still the same old process, so you have this bottleneck in your supply chain. Then you add the fact that containers or trailers are a confined space so you can only throw so many people at it, so then how do you handle the flow?" [Actiw]

"Manufacturing facilities in Europe are mostly fully automated with minimal touch on pallets all the way up to the docks, but that last step of loading the trucks, it's mostly fully manual. This is a weak link in the supply chain since it's highly dependent on humans conducting non-ergonomic tasks which generates inefficiencies, delays and safety risks." [Loading Robots]

- Interviews suggested ATLS solutions may have higher capacity that what is currently achievable in the yard
- I.e. the limitation may be truck+trailer drivers' ability to quickly park up and process an ATLS load
- However, this could reach a level where improvements get close to where you would consider building a new factory
- I.e. ATLS could be near the point where a customer might consider a new factory

THE TIMING OF AN ATLS PROJECT COULD OVERLAP WITH THE NEED TO BUILD A NEW FACILITY

Loading & Unloading, Jan 2024
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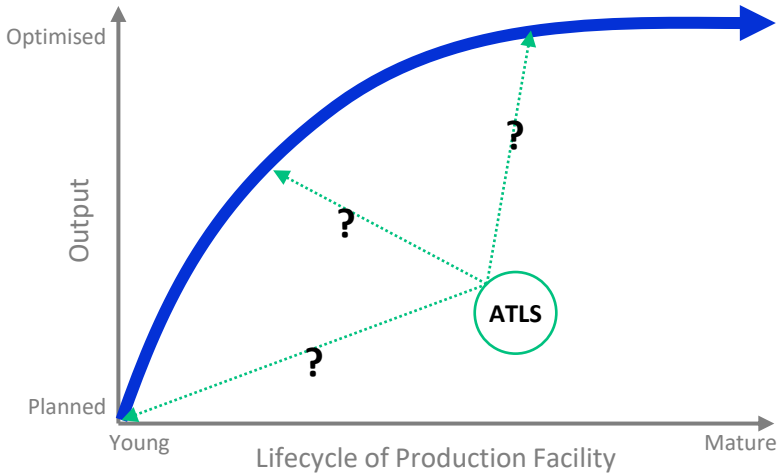
WHEN IN A FACTORY LIFESPAN IS AN ATLS SOLUTION IMPLEMENTED?



Source: STIQ Research & Analysis

ATLS THE LAST MAJOR PROJECT IN A FACILITY

- Interviews suggested larger international companies with standard palletised output were already experimenting with all kinds of automation solutions and were potentially looking at ATLS as a final step in their automation transformation
- Vendors suggested that ATLS projects are very rarely the first automation a company will implement, instead it could be deployed at the end of a broader automation journey

"The bigger players are ready, they've been working with AGVs, ASRS whatever the specific technology is, they're automating their warehouse. Then they get to the loading bay, their beautifully prepared pallets are sitting there, and suddenly you're directing a manual forklift to load the pallets onto a trailer or container. They haven't done this final step, and they're more aware of it now." [SIMEC]

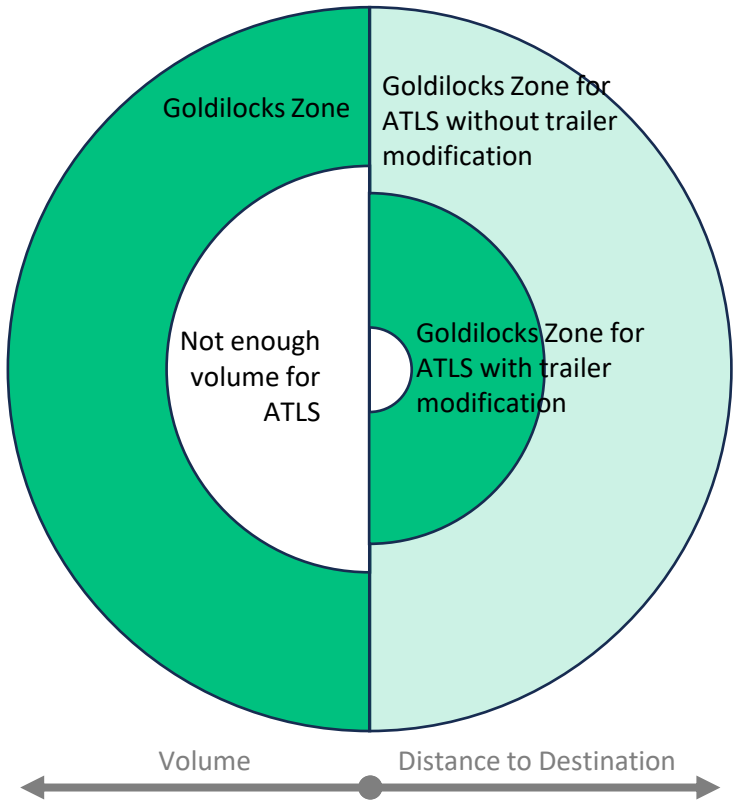
"Right now, only the big companies invest in these types of solutions. Mostly FMCGs both internationals and some local Turkish brands, but they are all fairly large companies. They typically get to these solutions once they've completed automating everything else in their warehouse, RFID, pallet conveyors and elevators, and then they finally decide to solve loading/unloading at the bays." [Lodamaster]

TO GREENFIELD OR BROWNFIELD?

- This analysis applies to pre-existing warehouses that are installing ATLS as a brownfield project
- ATLS appeared to be one of the last automations implemented in a facility to hit target throughputs
- This could indicate a facility reaching close to its maximum throughput capability, i.e. throughput cannot scale indefinitely with demand in a defined space
- This might also imply an overlap between implementing ATLS as a brownfield project, and building a new greenfield facility incorporating ATLS

CURRENT TECHNOLOGY AND GOLDILOCKS ZONES FOR ATLS SOLUTIONS

THE ATLS GOLDILOCKS ZONE



Key: *"Goldilocks Zone" (perceived product suitability)*

Source: STIQ Research & Analysis

GOLDILOCKS ZONE BY SOLUTION

- With the current customer volumes and vendor technologies, there appeared to be Goldilocks Zones where the solutions were applicable at a justifiable ROI
- Volume of trailers through the docks is an important factor for ROI

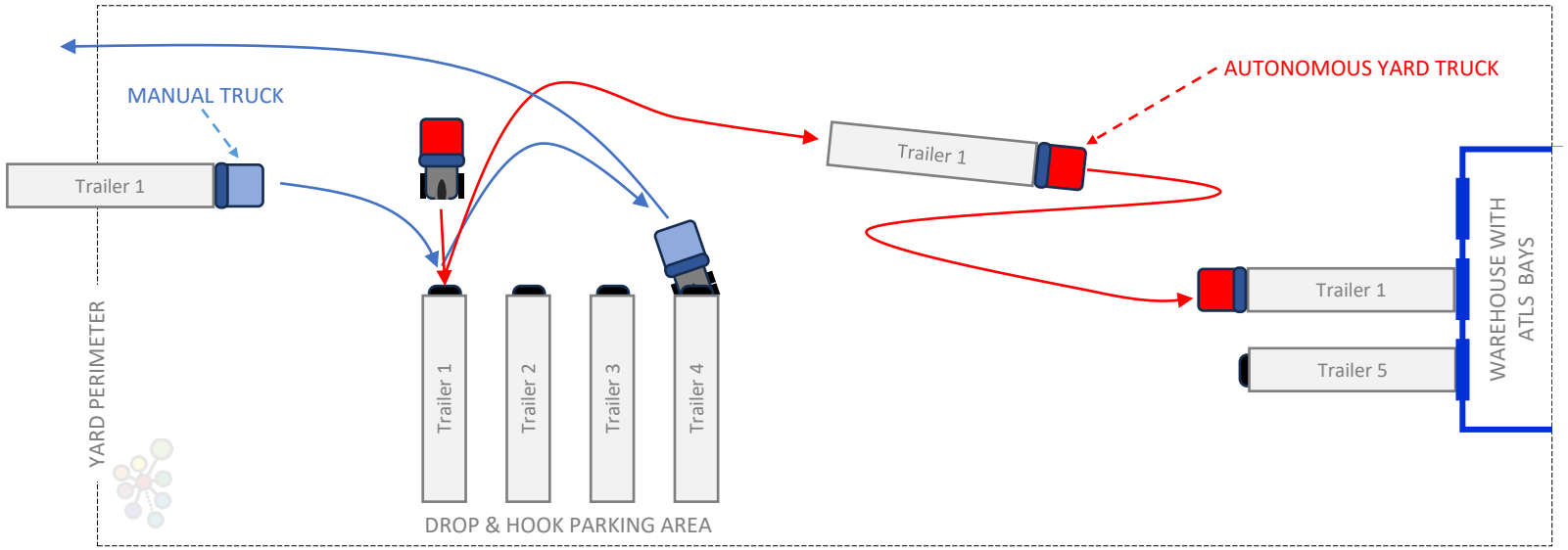
"As a back-of-the-envelope calculation we judge a system that is pushing around 30 trucks in 8 hours to be ideal for automation, but that doesn't mean if someone is coming with only 12 trucks, we don't consider it. If someone is coming with only 12 trucks asking for automation, they're suffering from something, so we should at least determine if ATLS will solve their concern." [CleverTech]

- Regarding drive-time, there are two different goldilocks zones – for trailer modification ATLS and non-trailer modification ATLS
- ATLS with modified trailers may be most suitable when distance to destination is less than 100km away, typically an internal shuttle, whilst Unmodified ATLS is more suited to distribution with distances greater than 100km

"Distance in a Modified ATLS shuttle is a very big factor. If you have a very large distance between the two facilities it means you'll need to increase the number of trucks along the route to ensure the throughput is satisfied, then if you automate the route with a Modified ATLS you'll have to upgrade all the trucks along that route, that's why you see Modified ATLS in short-haul shuttles and never in long-distance use-cases." [Loading Robots]

COULD AUTONOMOUS TRAILER VEHICLES COMBINED WITH DROP & HOOK PROCESSES UNLOCK A LARGER ATLS OPPORTUNITY?

TIME TO DOCKING PARKING, A POTENTIAL BOTTLENECK IN LOADING & UNLOADING



Source: STIQ Research & Analysis

AUTONOMOUS YARD VEHICLES, A SOLUTION?

- Interviews indicated a bottleneck at loading bays was a potential barrier to further growth in the sector
- This was primarily related to a limitation in the number of trailers that could be parked and dispatched, often including manual operations
- Yard management processes, such as Drop & Hook processes could potentially mitigate such bottlenecks and other congestion
- Interviews suggested this is already a widespread practice in the F&B sector

"This concept is called Drop & Hook or Drop-Trailer and is all about pre-loading. You reduce the amount of dock congestion by prefilling trailers for drivers to collect from the yard without coming to the docks and it's something we see a lot in food and beverage companies." [ex9]

AUTONOMOUS YARD VEHICLES

- Autonomous yard vehicles could be one potential solution to drive further growth in ATLS once these reach manual parity and beyond

"Compared to a person that does this 100 times a day, then a robot is likely to be slower now. But the advantage of a robotic system is that if you improve the algorithm, the entire fleet gets better instantly, so over time we think that we will reach parity with manual operators." [ex9]

- As with nearly all other warehouse related jobs there appeared to be fewer drivers available post-pandemic

"I don't know if it's because of the pandemic, or just a general trend in the market, but there are just fewer people working in these roles. It's especially visible in logistics because, compared to say an engineer not coming to work, the rest of the team can pick up the slack, but if the driver doesn't show up, then everything stops, and it creates a chain reaction of delays. So, then you depend on subcontracting which is extremely expensive and don't have the intimate knowledge of your operation." [ex9]

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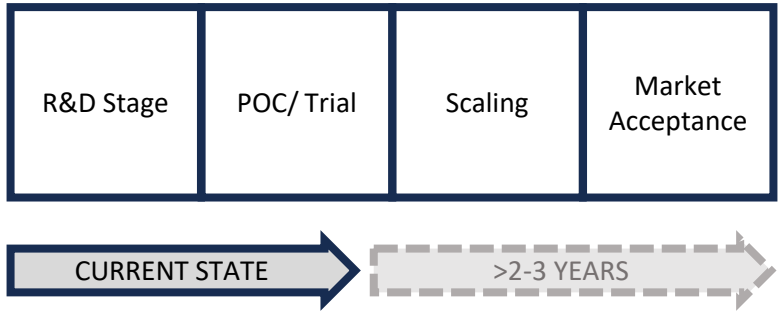
PICK SOLUTIONS REMAINED RELATIVELY NASCENT. INCREASED INTEREST AND PARTICIPATION COULD HELP PUSH TO MATURITY IN THE NEAR FUTURE

CURRENT AND EXPECTED PICK MATURITY



Source: STIQ Research & Analysis

BUILDING ON PREVIOUS DEVELOPMENTS

- Conversations suggested that PICK came as a natural extension of developments seen in adjacent solutions like palletization and carton-picking solutions

"This year we evolved the carton-box picking robot to a mobile solution, allowing it to be placed into a container for unloading. We see this as a natural extension of the carton box picking solution." [XYZ Robotics]

"We had done induction, order picking, palletizing and depalletizing but hadn't started with any truck solutions. With the lessons we learned in palletizing and depalletizing we could get to an early prototype of our truck loading system" [Dexterity]

ANTICIPATION FOR PICK IN THE MARKET

- Interviews with both buyers and vendors stated that while there are big advancements, there is yet to be a mature enough solution for wide-spread deployment

"I don't think it's a solved problem. A lot of the current solutions are really solving the situation where the boxes are well known and similar in size, but that's not most cases, most are dynamic with unknown sizes, weights and orientations and that's where we feel the real opportunity is. A lot of public disclosure is in highly controlled environments which is fine, you need to build excitement, but I'm not convinced the solutions are mature yet." [Anonymous]

"All the videos I've seen are in a clean-room testing environment or at trade shows, I haven't really seen any of these new systems in the harsh environment of a warehouse. I would like to see more demonstrations in an operational environment." [Roboworks]

- However, the market displayed a keen anticipation for the maturation of these technologies to enhance their already existing solutions

"We see them as playing a big part in the next 2-3 years, especially when combined with a telescopic conveyor. Rather than having an operator unloading all the boxes, you would have the robotic arm, or arms, inside of the container, loading and unloading the products. For us, we are actively talking to some of these companies to see if we can create a more autonomous solution." [Lodamaster]

- There are some concerns with the need to scale, potentially forcing companies to commercialize too early and locking them into a product development cycle driven by a single customer

"What I see in the industry is companies deploying too early at some sort of scale with a customer, so then they very quickly get married to the customer's process and expectations. Then you try and apply it to a different scenario, and it doesn't seem to work right because it wasn't designed for that case. We don't want to deploy too early; we want to make sure we can solve as broadly as possible before we commit to customers." [Anonymous]

PICK RATE PARITY WITH MANUAL PROCESSES - THE FIRST MILESTONE FOR VENDORS

OPTIMAL CASE SIZE FOR PICK ROBOTS

- Interviews hinted at an upper-limit on the case size for PICK solutions at around 30x30x30 inches (76x76x76 cm)

"We can handle up to 60 lbs, and dimensions of 24x24x30 inches." [Pickle Robot Company]

"You get a wide mix of boxes, with boxes with a minimum of around 6x6 inches and can get as big as 30x30 inches." [Dexterity]

TARGETING HUMAN PARITY

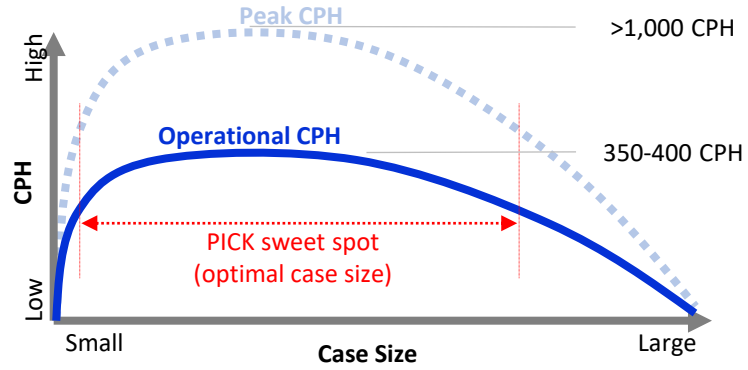
- Most vendors targeted manual picking parity as a first commercial milestone
- A CPH of 350-400 appeared to be the current aim among vendors

"The target is to get our algorithms and designs to push the robot to human parity, which is about 350 cases per hour." [Dexterity]

"We think we'll settle at an operational throughput of 400 cases per hour, beyond that is very challenging. It's important to note the operation throughput. A lot of metrics we see with companies claiming 1500 CPH eventually come back down to 600 CPH and then finally to this 350-400 CPH sweet spot that we are stating. Operational throughput represents a stable, consistent throughput, rather than taking the peak CPH which may have been a single minute of an entire shift.“ [Anonymous]

“Speed is a major driver for this kind of technology. It depends on the size of the cartons, but for a 35x35cm box, you can empty a container in c.1hr which is on-par with manual operations." [Technica International]

CASES PER HOUR (CPH) PICKED, (#)



Source: STIQ Research & Analysis

- Some vendors highlighted that manual parity is variable across environments but is typically limited by downstream processes in the warehouse

"Our goal for market entry was human parity. You don't want to ask the customer to redesign their processes to adopt these automation technologies, since they likely have a bottleneck and so couldn't even ingress more that 600 CPH. Of course, it will get faster, but the customers will also need to be ready for that for it to mean anything." [Pickle Robot Company]

"Human parity is a hugely variable metric. If the container is full of tiny 5x5 cases, you can just scoop those onto your telescopic conveyor, if you have RFID then you're bottlenecked by the reader to no faster than 300-350 CPH otherwise you get scanning errors, so it really depends on the application. For the use cases we're targeting, parity is somewhere around 400 CPH." [Anonymous]

- The payload handled could also have an influence on the required throughput, however human parity was still the benchmark

"It really depends on the customer’s situation. We have a customer who is doing 4-5 containers a week, but they can't find the people in their area to unload the containers. For other companies that are unloading bags, the requirement is to be able to unload one container every hour, whilst for containers with something like 5,000 boxes, around 2 hours per container is the target. This is more or less in-line with manual unloading." [Copal Handling Systems]

NEAR TERM PICK SOLUTIONS DESIGNED WITH HUMAN INTERVENTION BAKED IN TO IMPROVE APPLICABILITY AND SPEED TO MARKET

Loading & Unloading, Jan 2024
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HUMANS IN THE LOOP

- Vendors consistently described the complexity of container unloading, in particular the “first-box” issue in a stuffed container

"The hardest parts of unloading are the first-pick, top-pick and side-picks. Once you get past these, the rest is not too challenging, most systems can handle that." [Anonymous]

"Stuffed containers are obviously a huge problem, it's difficult for a robot to remove the first carton from a fully pressed and loaded container. Poor orientation of cartons will also be a problem to robotic systems, but in the end, we see these as technical issues that can be solved over time. Once companies start to work with manufacturers like us, we can mature these solutions." [Technica International]

- The suggested near-term solution is to have human intervention baked into the PICK process

"You need to have interventions, for example in a tightly packed container, the first parcel may need to be manually removed before you can run the robot, but I don't see that as an issue. If you have an automatic machine stop a few times per container, an alarm goes off, the machine stops and someone can intervene and then it can continue, I think that's acceptable." [Roboworks]

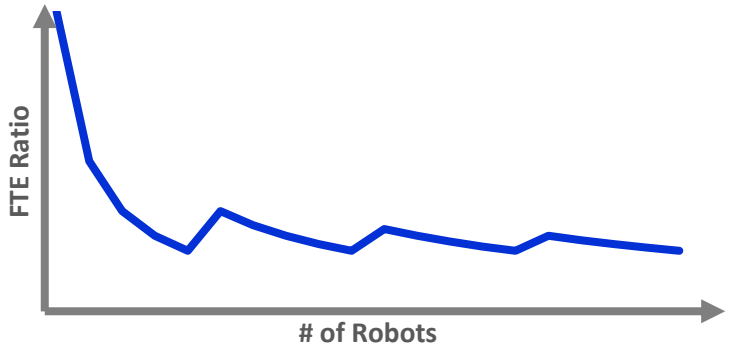
"It won't be easy to remove operators completely from the loading/unloading operations, especially with containers coming from Asia that are typically stuffed with products, it's hard to have a robot remove the first box from a stuffed container, but with an operator supporting the robot, you can automate most of the process. For the foreseeable future, we see a human operator always being present for this activity." [Lodamaster]

"Once you position the robot at the trailer door it should all be autonomous. It has sensors to keep it centred with the trailer as well communicating with the upstream feed to say that it's done with the current layer. A person can be there to help troubleshoot or intervene if there is a hinky situation, but the expectation is that it will more-or-less run itself" [Dexterity]

- Whilst it was said that human intervention is not the end-goal, including humans in the process improved the applicability and speed-to-market for PICK solutions

"We decided a long time ago that a fully unsupervised solution would take another 10 years to reach the market, that's why we decided on a supervised system. You can have one supervisor managing a fleet of seven of these robots, and if it gets into a problem, a light will flash, the supervisor activates the safety, they intervene, then they resume the system. Just that alone means now if you have a tire in the container that you didn't expect, it doesn't disqualify the otherwise eligible container." [Pickle Robot Company]

RATIO OF FTE v NO. OF ROBOTS DEPLOYED



Source: STIQ Ltd Research & Analysis

ONE HUMAN TO MANY DOCKS

- To mitigate the impact of interventions on ROI, vendors are designing their processes to enable a single supervisor to manage multiple installations

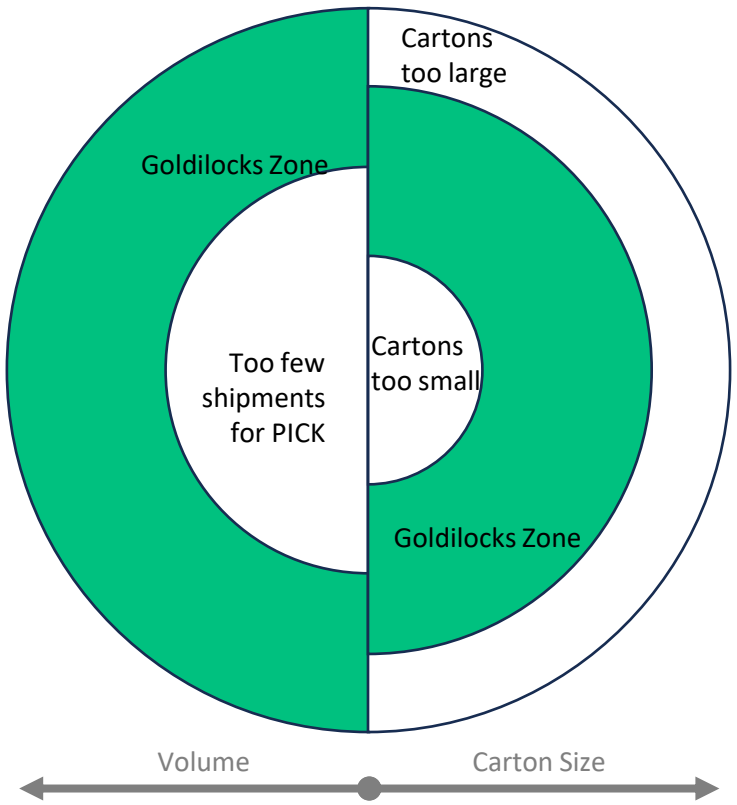
"We definitely predict a many-to-one ratio of supervisors to these systems" [Dexterity]

"Even if you're running with the best software, there are going to be situations where what you're picking up is out of spec. So, there will inevitably be some interaction from a human-operator to resolve these cases. Still you're looking at something like 99% of the time, the system is running fine, and a single operator running 4-10 of these systems depending on how tightly controlled the input is of the system." [Anonymous]

"Over the last couple of months, we've seen several of our installations running with only a single forklift operator to vacate pallets once they're complete." [Copal Handling Systems]

CURRENT TECHNOLOGY AND GOLDILOCKS ZONES FOR PICK SOLUTIONS

THE PICK GOLDILOCKS ZONE



Key: *"Goldilocks Zone" (perceived product suitability)*

Source: STIQ Research & Analysis

GOLDILOCKS ZONE FOR PICK SOLUTIONS

- With the current customer volumes and vendor technologies, there appeared to be Goldilocks Zones where the solutions were applicable at a justifiable ROI
- Carton volume is a key factor in determining the feasibility of a PICK solution
- Many PICK solutions use suction to grasp cartons which is then limited to higher quality packaging and reasonable sized, not overweight, cartons

"I don't think the robots on the market now can viably solve for most of the container unload market because of the dependence on suction cups. You typically have heavy boxes on containers from China on container ships at sea for 5 weeks, building up humidity, then you try and lift them from one side using suction, you'll rip the boxes, and the contents will spill out." [Roboworks]

GET A GRIP

- The gripper was described as the main area of improvement for the applicability of PICK solutions

"If you hold a box on its short edge, with the long edge facing away from the gripper, the centre of gravity is further away from the gripping point. In this orientation, it's very difficult to get a stable grip, especially if the payload is heavy. With standard dimensions, say 600mm, you're going to see this problem from around 18kg or 40lbs, especially with suction alone." [XYZ Robotics]

- The quality and condition of the carton could further exacerbate the limitations of any particular gripper

"You have to ensure you have a stable grip on the payload while you're moving it. For normal boxes, a suction might be OK, but you must consider what happens if the box is short and long, or the box is damaged or damp? It's incredibly difficult to manipulate that with just a suction gripper." [XYZ Robotics]

BATTERY v MAINS POWER DELIVERY

- Interviews suggested some variance on the best method of energy delivery with the debate centred around the question of flexibility vs continuity

"I don't understand the desire to use batteries at the docks. You're in the part of the building where it's the lowest price to get power and data, the edge of the building, so why would you want to generate that locally?" [Anonymous]

PICK INNOVATIONS PREDOMINANTLY DRIVEN BY SOFTWARE. FURTHER MATURITY COULD SHIFT THE INDUSTRY AWAY FROM PALLETS

A HARDWARE ITERATION AWAY

- Vendors believed that the PICK space is one or two hardware cycles away from being scalable with some form of end-effector innovation required

"I expect another hardware twist on the end-effector. You could design an effector right now that would be a very good solution, but it would be very expensive. Therefore, I expect an effector that would have a very specific form for this application that is balanced in its costs and benefits to solve this problem." [Anonymous]

- A shift away from high-precision, heavy industrial arms, to more cost-controlled, lightweight platforms could also help achieve scale through better economics

"The typical industrial robotic arm is a lot of heavy steel with extremely high accuracy motors and gearboxes so you can achieve that millimetre precision. Most of our use-cases don't need that, we need about a cm of precision, which implies a lighter, cheaper arm that is also easier to control due to lower inertia." [Dexterity]

"Right now, the business case is the tricky part. There is a lot of cost control that needs to happen in the space. Certain companies benefit from being seen as almost a luxury product and therefore can sign up brands regardless of the cost because of the prestige, but for the rest of the market, the pricing is just way off. Solutions need to be designed with very tightly controlled costs. Don't build hardware where a commoditized off-the-shelf solution exists unless you are innovating on the form-factor." [Anonymous]

COMMODITY HW, DIFFERENTIATED SW

- As was seen in other robotics domains, the hardware platforms are expected to commoditize and converge into a few optimal form-factors
- PICK could also become a space driven by software algorithms and UX innovations as the main differentiator between vendors

"If you look at the AMR space 5-10 years ago you had many different form-factors, but now they've converged to a similar 350mm profile and form-factor. Everything will get commoditized on the hardware side sooner rather than later. I think there will be someone who releases a solution with a slight advantage for a year or two, but eventually it will get incorporated into other designs. The real differentiation I feel will come in the software aspect of these solutions." [Anonymous]

"Our operating hypothesis is that robot arms are commoditized; mobile bases will be commoditized as there are enough vendors out there for them. However, building the intelligence that enables the robots to complete these complex tasks is where we can be unique and differentiated" [Dexterity]

- Some vendors indicated the market may eventually converge to a cost per pick business model comparison, however, such comparatives were not yet possible due to the nascent nature of the sector

"If the competition is fair, the market will eventually converge to a cost-per-pick calculation. A robot that processes 800 CPH costing 100k, is clearly better than a robot processing 500 CPH costing 80k. The market isn't there yet, but eventually that's where we'll arrive." [XYZ Robotics]

THE TRAILER IS THE PALLET?

- Vendors suggested benefits of loose-loading in container shipping necessarily applied to domestic trailer shipping
- Should the technology mature and become more economic, there could potentially be a transition away from a majority pallet-based distribution, to an end-to-end loose carton supply chain

"Between the input and output of supply chain is a lot of pallets, which isn't somewhere we can work right now. We believe though that if you can change the economics of loose loading, you might see that customers switch from pallets to loose-load because they could improve their cube density greatly if they could automate that process. Currently it's very costly and time consuming to loose-load a truck, but eventually if you could push the cost down and the process is effectively palletization but directly onto the trailer, that could change things." [Pickle Robot Company]

"We see that customers that deal with heavyweight products would prefer a pallet-based truck loading process, while lighter weight products would prefer loose carton loading. Although we do see a lot of lightweight products being loaded onto pallets because the technology for loading pallets is much more developed than loose cartons. We believe that if the technology for loose carton loading matures, you'll see many more light-mid weight product companies utilising them." [Technica International]

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AUTOMATE YOUR TRUCK CARGO

ATLS END-CUSTOMER SEGMENTS LARGELY INCLUDE INTERNATIONAL COMPANIES IN CPG/ FMCG AND F&B. VERY HIGH OUT AND/OR INPUT VOLUMES A KEY KPI

GLOBAL FMCG MAIN SEGMENT FOR ATLS

- ATLS was a potential option where larger volumes were expected either at output and/or input to the facility

"The ATLS market is really about either volume coming in, or volume going out. So automotive is typically volume in, beverages can be both volume in from the reverse logistics of empty packaging and bottles, and volume out with the distribution of finished goods." [Joloda]

"We see roughly 60% are production warehouses, dealing with trailers and 40% are typically 3PLs dealing with container loading." [Actiw]

- ATLS Vendors described their main customers as global blue-chip companies, typically with production lines

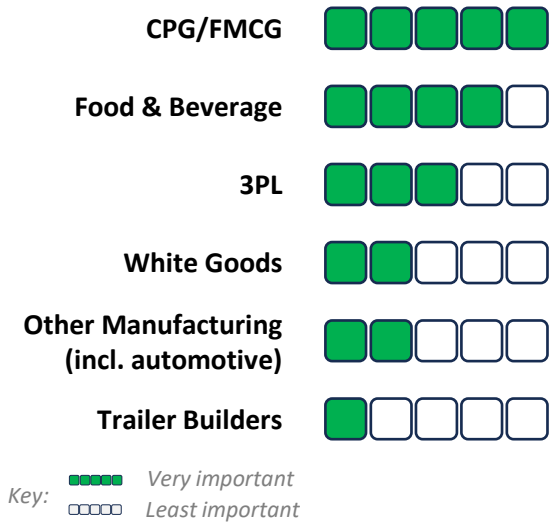
"The types of customers we deal with are white goods, food and beverage, chemicals, textiles… in general FMCG companies." [Anonymous]

"If you look at our customers, it's mostly international companies with operations in Brazil… CPGs." [CAPO Tecnologia]

"Customers are a combination of the blue-chips that produce very high volumes of goods, the 3PLs that typically work with the FMCGs to handle the logistics. In addition, we also have very strong relationships with SIs especially in greenfield and major brownfield projects." [Joloda]

- AGV solution vendors had also experienced traction with CPG/FMCG customers

ATLS KEY CUSTOMER SEGMENTS



Source: STIQ Research & Analysis. Sentiment from interviews

"CPG is the main area we are seeing traction, things like groceries and food in both production, distribution and retail because of the way that food and groceries operate, they have large volumes of almost entirely palletized product, and FDA requirements means they can't get away with some of the floor-loading practices you see in more durable goods processes." [Fox Robotics]

- Some interviewees indicated traction with indirect customers as well

"An interesting channel are the trailer builders who we also have a very close relationship with. They are also a kind of lead-gen for us since they often come to us and present a customer with a problem, they have a heavy load, something with a strange shape, and we can suggest a solution that could solve that issue." [Joloda]

- However, the eCommerce and high street retail sectors remained a challenge for ATLS systems as they often used non-standardised processes

"Ecommerce and retail can be a challenge as its typically very non-standard. Some of them use pallets in-store, but most of them use trolly-dollies. There isn't a great solution for them just yet. Retail has a lot of volume, you can imagine a large regional DC in the US having 200 doors, servicing 2-3 states, it's a wonderful prospect but there is still work to be done there." [Joloda]

INTERNATIONAL CUSTOMERS

- However, scaling sales to many of these international customers could also add further complications with local maintenance and servicing

"To be able to scale internationally, at a minimum you need to establish a local service organization, especially at the early development stages with complex sensors and algorithms. Once the system is stabilized, it could be less necessary, but still a local service presence is desirable for customers." [Copal Handling Systems]

"You have to have people on the ground when selling abroad. You need a presence or to be able to call on someone to provide support for your customers. It's not like selling a commodity, you're selling a solution." [SIMEC]

PICK AUTOMATION CUSTOMER TYPES STILL TO TRICKLE DOWN, BUT TARGETS INCLUDED ECOM, SHIPPERS, 3PLs. TELESCOPIC CONVEYOR CUSTOMERS POSTAL, CARGO + ECOM

PICK AUTOMATION, NASCENT STAGE

- Interviews suggested Loading & Unloading of loose cartons was largely a manual process, frequently enhanced with a variety of telescopic conveyors

"We've mostly encountered manual unloading processes, so someone standing in the container, throwing boxes onto a belt." [Roboworks]

- Telescopic conveyors were primarily sold into postal, cargo and ecommerce sectors where customers deal with loose carton shipments

"The most active sectors for telescopic conveyors is postal, cargo and ecommerce because they typically deal with loose cartons and they need to handle thousands of parcels in each container which means they spend a lot of time loading and unloading." [Lodamaster]

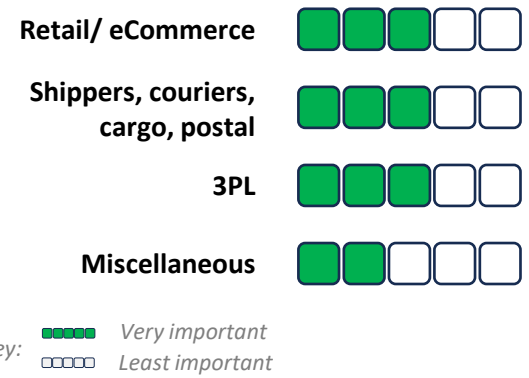
- These customers appeared to have the most pressing requirements for potentially increasing automation

ECOM + 3PL POTENTIAL PICK CUSTOMERS

- PICK vendors stated their primary markets were eCommerce and parcel couriers due to their dependence on loose carton freight

"I think there are two markets for unloading: you have the Courier-type parcels market where you unload loose loaded parcels from trailers, then you have the container unloading market of containers from Asia that need to be unloaded and palletized." [Roboworks]

PICK KEY CUSTOMER SEGMENTS (ILLUSTRATIVE IMPORTANCE)



Source: STIQ Research & Analysis. Sentiment from interviews

"So far we see 3PLs as the biggest adopters of this kind of technology, particularly on the import freight side. You have around 28m containers coming into the US every year and we estimate about half of them are eligible containers meaning they're loaded in the right way, with the right freight." [Pickle Robot Company]

"Truck loading is much more concentrated in your typical logistics settings such as 3PLs, parcel carriers etc. Unloading however really does range the gamut from apparel, FMCG, durable goods, retail, really a wide mix of industries" [Dexterity]

- 3PLs also figured as key potential target customers for PICK solutions

"We see that bag unloading is almost always 3PL, whilst box or carton unloading is always the end user" [Copal Handling Systems]

"This is especially important for the 3PL market which we are targeting, they need that flexibility to have a solution that can target multiple applications in a single warehouse. Aside from that, they want to be able to ship the robot to another location should a contract end, so they really want to be flexible." [Anonymous]

PICK AUTOMATION + SUPPLY SIDE CONTROL

- Some vendors believed PICK processes could benefit greatly from controlling the load-side of the trailers/containers

"Ideally you would have some kind of supply side control, the power to make some changes on the production-side, which is normally the case with the larger FMCG and retail companies we work with. There are companies, especially trading companies where the goods are already put into the containers, so they have little control of that process, that's where it's more challenging, but it's still possible." [Copal Handling Systems]

- However, others while seeing the benefits, thought this was a very unlikely capability of a customer, and instead focused on evolving the technology

"You can't expect the customer to go to their supplier and change the way a container is filled. This would help things, but we just assume that it's not even an option and that technology will solve the problem of messy containers over time." [Pickle Robot Company]

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BUYER INTERVIEW #1: FMCG/CPG PRODUCTION LINES AND ANY POST-PRODUCTION LINE FLOWS ARE CRITICAL. ATLS FALLS WITHIN THIS SCOPE

PRODUCTION LINES ARE CRITICAL

- Keeping production lines running is critical to FMCG/CPG companies
- This includes product flows beyond the production lines into various buffer systems and out of the loading bays, where ATLS is a potential solution to increase outbound capacity and flow

"At the end of a production line, it's critical that you keep it flowing. If your outbound is slower than your production rate, you'll get a backlog that will eventually cascade up and stop production. There is a huge drive to keep the whole flow moving to the degree that we'd rather load the pallets into the trailers and park them outside rather than consume factory space." [Anonymous Buyer 1]

VIEWS ON MODIFIED/ UNMODIFIED ATLS

- Cold chain applications were considered very suitable for modified ATLS, potentially being fitted at twin locations on the same campus

"Cold chain is a very good candidate for intralogistics Modified ATLS. If you take something like ice cream, you produce it in a cold-facility, and then need to store it, so naturally the distance would be short to ensure the finished product is always in a controlled environment. Therefore, you'll typically see the storage facility within the same campus." [Anonymous Buyer 1]

- Modified was most likely useful in a closed-circuit situation where both origin and destination was under ownership of the same company

"If your operation is a closed-circuit, you know the destination, you own the trucks and the distances are relatively short, you're more likely to invest in a Modified ATLS system. If you have no idea where the trucks come from, what the operation is at the destination, how long they need to travel, then you're going to go for Unmodified ATLS." [Anonymous Buyer 1]

- The interviewee indicated modified trailer ATLS appeared to be more prevalent in Europe

"We've seen in Europe a greater prevalence of Modified ATLS, whilst the US and ROW tended towards Unmodified Trucks." [Anonymous Buyer 1]

IMPORTANT WITH THE RIGHT PARTNER

- ATLS investments can be large and may also impact a variety of intralogistics and logistics processes, and identifying the right supplier can be critical

"At this level of investment, it's important to work with a partner that can consider a longer-term strategy that considers your operation at the network level. 3D simulations and space validations, and even the site-level throughput calculations are very important questions to answer, but once that project is complete, the next-order consideration is what happens at the fleet, or network level." [Anonymous Buyer 1]

- Whilst many suppliers can quite quickly sketch up a project, there are other considerations beyond the loading bay that can affect efficiencies gained

"Many companies can quickly produce a 3D visual of the docks after a few design reviews, but once that space validation is solved, there are so many other considerations to ensure the units/hour is being met, especially when considering all the potential scenarios: if a truck is broken down, if we need to reschedule, where to put rejected pallets, etc. It's important for a company, especially if they want to act as an integrator to at least anticipate these questions and then to be able to provide some calculation towards it." [Anonymous Buyer 1]

- Furthermore, integrating an ATLS solution may not require a lot of IT & software implementation and integration, but needs to be mapped out from a process impact perspective to understand constraints

"There are a lot of considerations to be made when integrating with any of these solutions. Occasionally when we speak to some newer companies that may have less integration experience, they'll tell us that we don't need any system integration. While this may be true for IT systems, we would need planning integration to really find out what the constraints of the system with respects to our operation are." [Anonymous Buyer 1]

BUYER INTERVIEW #1 [cont'd]: THE COMPLEXITY AND CRITICAL NATURE OF FACTORY OUTBOUND PROCESSES MAY IMPACT BUSINESS CASES. AGVs INCREASINGLY FEATURING

EVALUATIONS NOT ALWAYS A GO

- Due to the critical nature and complexity of surrounding systems for an ATLS solution, it can often be tricky to make a positive business case even in suitable scenarios

"I was involved in four reviews, and eventually saw one installed. That one was because it was a greenfield project, so it was part of the Capex from the start and was just a technology selection process with a lot of flexibility in the decision making. Brownfield was much more complex since you started to have these next-order questions come up, so we need to get averages of current operations, so who has that data? Who's going to create the model, and why should they invest time into it? Do we need this? What happens to our current forklift drivers, should we keep them in case we need them? It's exponentially more complex to justify a brownfield than a greenfield." [Anonymous Buyer 1]

AGVs & AMRs NASCENT, BUT EVALUATED

- Despite having good knowledge of AGVs and AMRs, these solutions remained relatively nascent and unproven for the trailer Loading & Unloading application

"There are a lot of questions around AGVs & AMRs. AGVs are a bit easier to understand since their paths are more or less repeatable, whereas AMRs are by design to be unrepeatable since they are reacting to their environment when navigating. We see the main advantage being the ability to alter layouts or implementations as needed, whereas with the traditional ATLS solutions, you're dedicating the space they're installed in for that purpose." [Anonymous Buyer 1]

- Rail guided AGVs have also featured

"We've seen some solutions like Rail Guided AGVs and Telescopic Conveyors which can be shared between docks. We were looking at these solutions especially in areas at the back of the factory that are very limited in space." [Anonymous Buyer 1]

- More recent developments include AMR platforms, but these also require evaluation of reverse logistics processes

"We had to think about the reverse logistics needed for some of the more novel solutions that have you placing a platform with the products into the truck. At some point you're going to need to bring the empty platform back to the source facility, and that requires you to really plan the process and make sure you have enough resources to keep the flow during busy periods. The worst case is you have product that needs to go out, but all your plates are at the destination. It's a non-trivial problem that needs to be considered." [Anonymous Buyer 1]

- However, there appeared to be emerging opportunities for such solutions

"We have facilities with a closed-loop shuttle that have a need for reverse logistics for example to return reusable containers back to the production facility to then refill with product. With planning it's possible to exploit the reverse logistics to be able to increase asset utilization." [Anonymous Buyer 1]

PICK ROBOTS VERY EARLY STAGE

- The interviewee hinted that PICK robots were increasingly being deployed to pack trailers directly

"Increasingly in China and India, we're seeing that rather than pallets, loose cartons are being loaded directly into the trailer, like a parcel delivery service. Over the last 3 years, we've seen solutions which have a robotic arm at the end of a telescopic conveyor picking and placing the cartons onto the trailer directly, basically palletizing the entire trailer." [Anonymous Buyer 1]

BUYER INTERVIEW #2: GOOD DEMAND FOR ATLS SOLUTIONS. EVALUATING SOLUTIONS IS MORE COMPLEX THAN JUST MEASURING THE BAY DOORS

ATLS IN DEMAND, MAINLY IN THE US MARKET

- The interviewee suggested there was a relatively high demand for ATLS solutions within their global organisation
- Most of the demand appeared to originate from the US market

"We have demand of many 10's of units a year over the next three years across the US and Europe, but predominantly in the US due to the way the infrastructure is set up there." [Anonymous Buyer 2]

- There were important differences in how goods are transported throughout Europe versus the US market which could explain some of the greater demand

"Infrastructure in the US is just different to Europe. The warehouses are further apart, they're moving from dead stacking to palletized loads, where if the distance is less than 100km, they'll palletize, more than and they'll dead-stack the load. They just have a different go-to-market strategy and infrastructure, and that's why we think they are implementing so many of these solutions, especially the Unmodified ATLS." [Anonymous Buyer 2]

- In general, the North American market has been driving much of the growth in the wider MHE market throughout 2023 – see also STIQs other reports here

EVALUATING ATLS SOLUTIONS

- Creating a business case for an ATLS solution involved more than just the equipment itself, such as civil works
- Greenfield business cases were slightly easier to make a case for as bays can be designed from start as opposed to a brownfield situation where major modifications may be required

"A key thing to watch out for is the additional civil works needed. In a greenfield you don't need to worry about that since the cost is integrated into the initial Capex of the building, but in brownfield it's likely you will have to make modifications to properly integrate a single-shot ATLS: you'll need some automated infeed to keep the required rate of 100 pallets per hour, you'll need to install a combi-lock outside the dock to make sure the trailer is locked in, you'll need some safety components like fences. You can easily go from an initial cost of say 500k to 1m just because of the civil works, and that needs to be considered in the business case." [Anonymous Buyer 2]

- Furthermore, brownfield opportunities nearly always included space constraints

"A typical issue is space constraint, and something we've seen is an L-shaped unit with an indexing conveyor that has off-shoot chain conveyors to the docks. The modified truck with its own chains will pull into the bay, and the indexing system will take the pallet, run it along the main branch, index it off to a branch and onto the trailers chain to then load the pallet. This does require a lot more Capex and planning to achieve but it's an interesting solution." [Anonymous Buyer 2]

MODIFIED V UNMODIFIED

- Modified and Unmodified ATLS trailers appeared to be more suitable for different delivery missions
- Modified trailers were typically deployed in a pair of facilities and could also include some level of ownership of the modified trailers

"Modified ATLS is typically in a pair of facilities, where A is the factory and B is the warehouse. The factory produces pallets of finished goods that you need to unload to say an overflow warehouse. You're building a shuttle between A and B, usually within 50km of each other. You'll typically have a fleet of 4-5 trailers where you may reduce it by 2-3 trailers because of the ATLS improving efficiency at A and B." [Anonymous Buyer 2]

- Unmodified ATLS trailers were primarily suitable for delivery directly to a customer and where there was less influence on trailers

"Unmodified ATLS works where you have a DC or a factory that ships direct to customers. You likely don't have a standard trailer, you have multiple configurations of loading patterns because that's what your customers ask for. You can't modify the trailer, and you don't have control of the unloading side, so you need an Unmodified ATLS which are typically more expensive than the Modified ATLS systems."[Anonymous Buyer 2]

BUYER INTERVIEW #2 [CONT'D]: PLAY BETWEEN INTRALOGISTICS AND LOGISTICS. ATLS ENABLED BAYS SHIP MAX 4 TRAILERS PER HOUR IN AN IDEAL SCENARIO

BUSINESS CASE TO INCLUDE LOGISTICS

- Whilst an ATLS system is at the end of the intralogistics solution, it also impacts logistics processes

"You need to understand the classifications of the systems to then be able to select the best solution for your needs. Is this a shuttle or direct to customer process? That leads you down a path. Is it fully automated or semi-auto? That's another path. How many trailers do I need to modify and how much will that cost? Then you may get to a point of: OK based on that let's evaluate the slip-chain solutions." [Anonymous Buyer 2]

- Process improvements at the bay may have wider asset utilisation impacts which could be beneficial with other suppliers and/or stakeholders

"A lot of people neglect the calculation of asset utilization. You'll need to discuss with your transport carriers, but the argument is that since you're more efficient at the dock, the driver will spend less time waiting, so then you can make more trips with the same pool of drivers. If you consider the parameters of drive time, loading and unloading times, you can't change the drive time, so you then see what the loading/unloading time reduction is as a percentage of the total cycle. For example, a 40% loading time reduction might mean an overall cycle time reduction of 15%, then you could take that to your carrier partners to provide a better price since you're utilizing their asset more, and that can be the case made to procurement as one of your capital approval requirements." [Anonymous Buyer 2]

RETURN ON INVESTMENT

- The interviewee suggested an IRR >=25% would be sufficient to progress a project

"A standard payback for us is something like 25% IRR, anything above that and we're happy to progress the project. What we do is consider all the cases and assumptions, we then summarize it for the business unit: here are your options, here are the implications, here's how the implementation would look etc. " [Anonymous Buyer 2]

ATLS, MAX 3-4 TRAILERS PER HOUR

- Interviewee suggested the top performing ATLS solutions can load a max of 3-4 trailers per hour, but this appeared to be a theoretical/ ideal process stream

"The best solutions can ideally load 3-4 trailers an hour, but in reality, you need to arrange your upstream and downstream, your load-forming and buffering, your yard management and trailer swapping all need to be perfect to hit that theoretical limit. Realistically, once you incorporate all these aspects, a system that promises four trailers an hour might actually serve two trailers an hour, and occasionally if you really stress it, get to three trailers per hour." [Anonymous Buyer 2]

AGVS ENTERING THE MARKET, QUESTIONS

- AGVs were still too slow in comparison to ATLS solutions and did not meet business cases

"If you're assessing with current models, the AGV solution seems too slow for a business case, the sweet spot for an ATLS is 3-4 trailers an hour, whereas AGV solutions do 1-2 trailers an hour. Larger FMCG companies should have some kind of internal sandbox program to be able to test these solutions without the constraints of going into production so that we can try an understand the benefits of these much more flexible, but slower solutions." [Anonymous Buyer 2]

- This buyer was tracking new solutions in the market, but pricing and performance in a real live environment remained a question

"We see a lot of new solutions that we are ideologically interested in, but they're not yet commercialized, or even ready to be commercialized. You see the videos of them in very controlled environments and they seem to tick all the boxes, but we don't know if they can cope in production, and we're also very worried about the price of these systems once they hit the market." [Anonymous Buyer 2]

CONTENTS

TRADITIONAL ATLS VENDORS DIDN'T PERCEIVE AGV AS A COMPETITOR. AGV IN A SUPPORT ROLE TO ATLS COULD OPEN UP THE MARKET

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ATLS OUTPERFORMS AGV/AMRs by c.2-3X

- Multiple autonomous forklift (AGV/AMR) vendors have attempted to solve the loading/ unloading application (see also STIQs AGV & AMR Robotics report here)
- Note that ATLS vendors suggested AGV & AMRs had not yet featured as competition

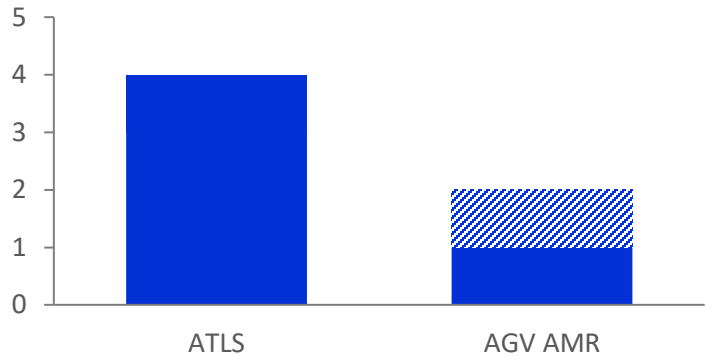
"We haven't seen any realistic competition just yet to match the speeds we are requested to achieve per loading dock. There's always the challenge of computer vision in confined spaces, especially with the curtain-side trailers, the accuracy of laser or video is not perfect." [Actiw]

"As far as we know, in Brazil, no-one has used an AGV that goes into the trailer, but we think it's a huge market, they're just too expensive right now." [CAPO Tecnologia]

- ATLS vendors and stakeholders retained a high level of interest in AGV & AMRs as a potential threat

"We think AGVs will definitely have a place in ATLS, we just don't fully understand how it will react to unknown scenarios, or what the ROI calculations look like for an AGV solution. I know the costs will come down, but they just feel a little complex, especially if you consider things like batteries and charging." [SIMEC]

CURRENT MAX NUMBER OF TRAILERS LOADED PER HOUR (#)



Source: STIQ Ltd Research & Analysis. Interviews

- ATLS vendors suggested AGV & AMR solutions may be too slow and keep trailers bound to loading bays for longer than necessary

"With our experience with trailers and the challenges around them, especially third-party trailers that you can't control, I feel this is where the limit of the AGV and AMR is, you'll still need some kind of a loading dock. If you notice how long it takes for an AGV to enter a trailer and load and then exit, you're keeping that trailer in the dock, you keep the truck connected and a driver waiting, and the AGV costs the same order of magnitude as a single-shot solution. I do however see that value in AGVs and AMRs in preparing the dock for a full ATLS to then load into the trailer once it arrives." [Joloda]

AGV & AMR SUITABLE FOR LOAD FORMING?

- The current primary use for AGV & AMRs appeared to be for ATLS load forming, not as a replacement for ATLS

"We looked into it and found that AGVs aren't fast enough for unloading. However, we do see a place for AGVs bringing pallets to and from the bay in an optimal way so that you reduce the number of forklift operations and consequently the number of forklift drivers that may be waiting around for hours waiting for a completed pallet." [Copal Handling Systems]

"It used to be that you get the load to and from the dock using something like conveyors or shuttle carts, but now we're starting to see more and more AGVs and AMRs that are helping to form the load. They can prepare the load before the trailer arrives, and so we see more and more integrations with AGVs, especially with our static docks." [Joloda]

"One possible use-case that we are considering for one of our projects is to replace the pallet conveyor on the input of the loading system with an AGV that is bringing the individual pallets." [CleverTech]

WHILE AGVS CAN'T (YET) COMPETE WITH TRADITIONAL ATLS THROUGHPUTS, VENDORS ARE WORKING TO IDENTIFY THEIR NICHE IN THE MARKET

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FINDING THEIR SPACE IN THE MARKET

- AGV vendors appeared to be aware of the limitations compared to single-shot, focusing their strategy towards unmodified ATLS use cases where the trailer is an unknown variable in the operation

"For a single-shot ATLS, especially the modified-trailer systems, the main barrier to adoption we've seen is they require a great deal of control over the trailer and the process. So, if you have a manufacturing facility that you're pushing products out of to a DC, we won't be as fast as a single-shot so you might as well invest in a traditional solution. However most inbound traffic is going to come from a vendor who isn't complying with your technology, they're just shipping a van to you and that breaks the viability of ATLS. This is the scenario where an autonomous forklift would naturally fit in." [Fox Robotics]

- Novel solutions to exploit limited spaces have also been developed, potentially improving the business-case for a AGV solutions

"With our solution, a single robot can cover three docks. You can have a trailer leaving the dock, while another one has a trailer assigned to it about to arrive, while one is being serviced currently by the system." [Loading Robots]

COMPUTER VISION A MAJOR FOCUS

- Various challenges were described for AGV/AMR based solutions
- The unpredictable nature of an inbound trailer was one of the main issues, requiring complex computer vision algorithms to robustly interrogate

"One of the hardest solutions to solve for is autonomous unloading because of the potential chaos once you open the trailer door. Things move in transit, you can't predict the pattern of the loaded pallets, you weren't in control of the loading so you're just getting someone else's work that you have to unload… You have things like tail palettes, the first two rows of palettes are extremely hard to unload because of how forklift drivers nudge up the loading ramp especially with the last row, they end up at awkward angles since they're stuck without much room to maneuver so they leave it like that. " [Fox Robotics]

DIFFERENT AGV & AMR FORM FACTORS

- There were two primary form factor approaches in the AGV & AMR ATLS segment with forklifts and floats
- However, interviews also suggested that mobile robots would need to adapt to the trailer condition

"There are issues to overcome regarding the trailer floor condition, but spillage is another issue, you have product on the floor, loose plastic, cardboard, wood from damaged pallets." [Fox Robotics]

- Other vendors had approached the problem from a different angle, for example reducing speed, but increasing the capacity of a movement

"We automatically load/unload in under 5 mins using a big, low and slow AMR that carries 6-10 pallets at a time in and out of the trailers, so 3-4 of our robots will fill out a 53 ft trailer." [Slip Robotics]

FULL AUTONOMY NOT THE CURRENT GOAL

- Given the complexity, vendors considered intervention to be a part of the process, with around 95% autonomy

"For sure you will find problems especially during unloading because you have no idea what you're going to find, the orientations, the payloads, etc., so you might get some issues where someone has to come and intervene but overall, it should be able to handle most cases." [Loading Robots]

"Given these issues we think the technology is at around 95% autonomy, meaning there is a 5% intervention rate." [Fox Robotics]

ATLS SECTOR EXPERIENCING MAINLY NEAR-SHORE COMPETITION. LACK OF ASIAN COMPETITORS. DIFFERENT DYNAMICS FOR PICK AUTOMATION IN ASIA

COMPETITION HIGHLY REGIONAL IN ATLS

- Interviews suggested Asian competition was rare or non-existent in the ATLS segment
- Primary competition was typically more local

"We don't see much competition coming from Asia, we're mostly in competition with European companies because it doesn't really make sense since there would be a lot of logistics costs bringing these heavy, mostly steel based solutions from Asia into the EMEA region." [Lodamaster]

"In our region we see the competition coming from USA rather than Asia. The USA is highly industrialised with a high cost of labour which justifies automation… Asia is a strong industrial region, but they haven't seen the pressures from labour costs as seen in Europe and the US to develop these solutions. To be frank, it's still quite a niche space and not yet commodified enough for there to be fierce competition." [Technica International]

- In some instances, trucking companies were also considered competitors

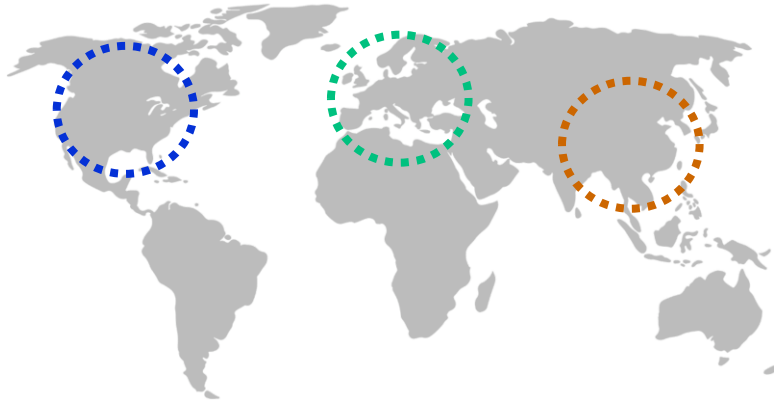
"Transportation companies want to rent their trucks to the big end-customers. The more they rent the better for them. Installing ATLS could mean they cannot rent out as many trucks. That's why I see the truck companies as a competitor." [CAPO Tecnologia]

REGIONAL EVOLUTION OF LOAD + UNLOAD

- Interviews indicated there would potentially be key differences between countries and how they approach loading + unloading, often related to the industrial set-up and pre-existing automation equipment

"We see an interesting divergence between Chinese vendors doing a ton of carton-box picking on pallet compared to Europe and North America who do way more piece picking. There are also a lot more ASRSs in Europe, Japan and North America compared to China… It all boils down to three major factors; the cost of labour, the cost of land, and the structure in eCommerce to B2B business. Each market will have their companies develop their own domestic strategies, because you need to survive locally and grow the domestic market first before considering a global strategy." [XYZ Robotics]

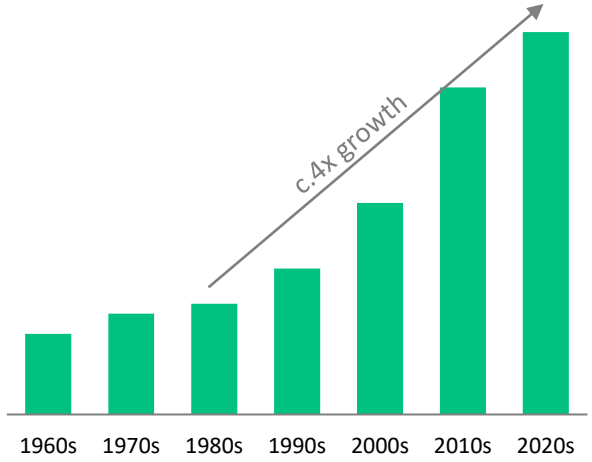
PRIMARILY LOCAL ATLS COMPETITION



Source: STIQ Research & Analysis

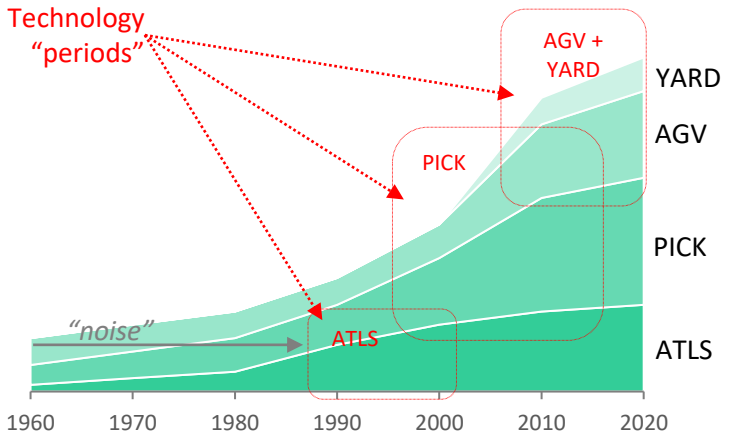
PLENTY OF NEW ENTRANTS IN THE SECTOR SINCE THE 1980s. THE DIFFERENT TECHNOLOGIES EMERGED IN DISTINCT PERIODS

LOADING/ UNLOADING COMPANIES BY DECADE FOUNDED, 1960s-2020s [1]



Source: STIQ Research & Analysis. Indicates year company was founded, may be different to when solution was added to ranges

LOADING/ UNLOADING COMPANIES BY PRODUCT & DECADE FOUNDED, 1960s-2020s [1]



- These type of companies are referred to as *"noise"* in the above chart, i.e. they may be founded decades earlier compared to when they added the product
- ATLS was the earliest technology and experienced accelerated rapid increase in the number of vendors in the 1990s
- PICK includes two different types of picking technologies – one more mechanical in the 2000s and one deployed with computer vision algorithms in the 2010s
- AGV technologies accelerated sharply in the 2010s most likely assisted by open-source initiatives, such as ROS
- In the end of the 2010s, yard vendors emerged on the back of or in parallel with the growth in autonomous car technology vendors

INCREASED NUMBER OF ENTRANTS

- The Loading & Unloading sector has continually experienced a growing number of new entrants
- This appeared to accelerate in the 1990's through to the 2010's and into the 2020's
- There were nearly four times more companies in the sector in 2024 when compared to 1980's

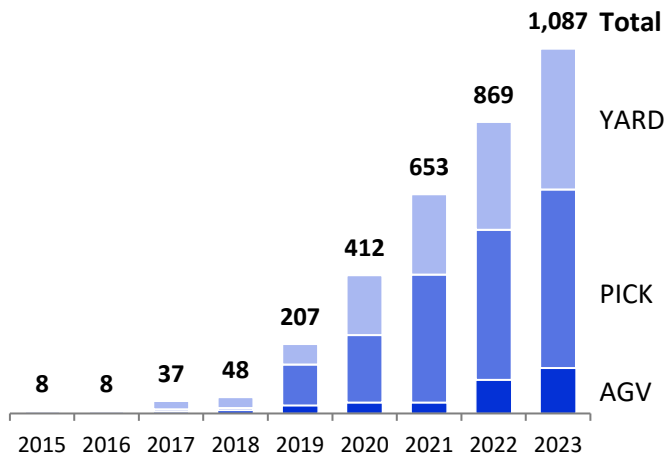
TRENDS IN NEW ENTRANTS

- There were discernible "technology periods" for each of the technologies in the Loading & Unloading sector where new companies/ technologies emerged in the market
- Note that this analysis is based on when a company started, not when they added a particular technology!
- For example, Boston Dynamics was founded in 1992, but only released its picking solution in 2022 (source)

[1] *Vendors tracked by STIQ Ltd*

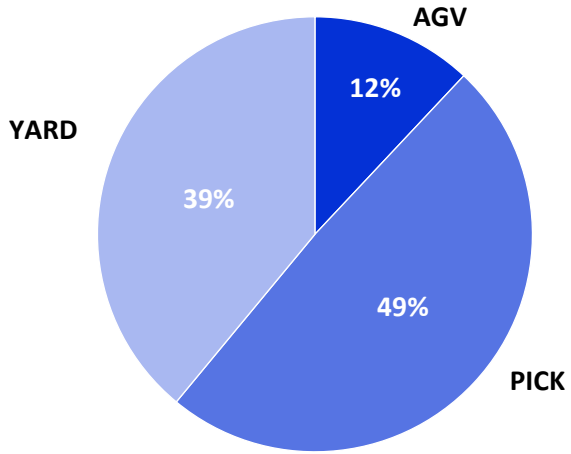
THE LOADING / UNLOADING SECTOR ATTRACTED c.$1BN IN FUNDING 2015-2023. THE BULK OF ALL KNOWN FUNDING (c.61%) THROUGH COVID 2020-2022

LOADING/ UNLOADING SECTOR FUNDRAISING 2015-2023, ($M) [1]



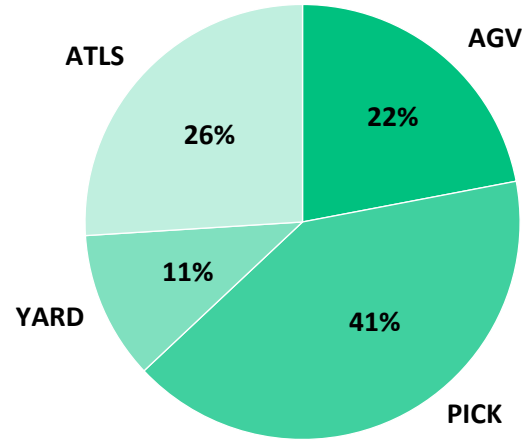
Source: STIQ Research & Analysis. ATLS segment = $0

SHARE OF ALL FUNDING 2015-2023, (%) [1]



Source: STIQ Research & Analysis. ATLS segment = 0%

SHARE OF VENDORS (%) [1]



Source: STIQ Research & Analysis

LINEAR FUNDING

- Whilst the sector has been largely active since around the 1980s, funding did not appear to have accelerated until 2017-2019
- Sector fundraising accelerated during Covid and increased by c.30 times from 2017 to 2023

PICK ROBOTS ATTRACTED MOST FUNDING

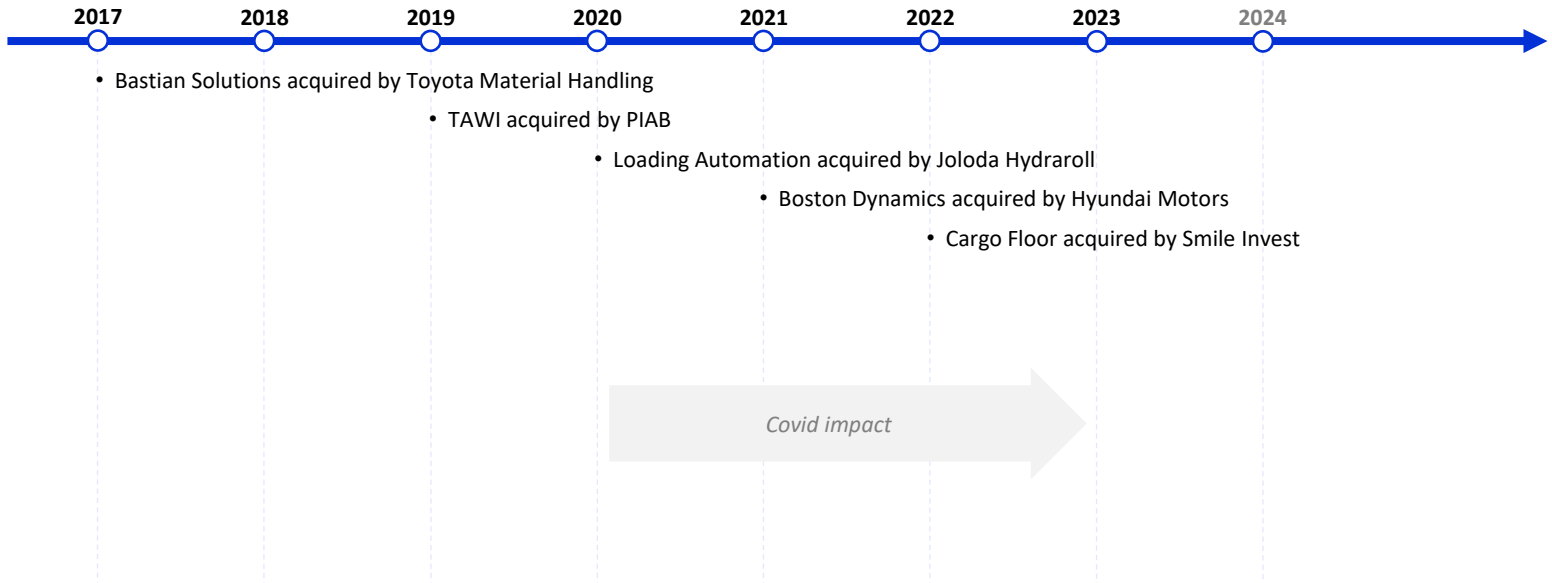
- The PICK segment attracted c.50% of all funding inflows into the loading/ unloading automation sector
- Many of the PICK companies have pivoted from other sector/ niche focus into loading/ unloading automation with few starting out focusing on loading/ unloading
- However, Yard solutions represented 11% of companies covered in this report and attracted 39% of funding

- AGV vendors attracted 12% of all funding but represented 22% of vendors
- ATLS vendors represented 26% of all vendors, but raised no public funding for their solutions

[1] *Vendors tracked by STIQ Ltd*

SPORADIC M&A ACTIVITY IN THE LOADING / UNLOADING SECTOR TO DATE. UNLIKELY TO CHANGE IN THE SHORT TERM

SELECTED SECTOR TRANSACTIONS, 2017-2023



Source: STIQ Ltd Research & Analysis. Not exhaustive

ACTIVITY LIKELY TO REMAIN SUBDUED

- STIQs view was M&A activity in the Loading & Unloading sector would remain subdued, especially when compared to other material handling industry sectors, such as System Integration and WMS Software
- However, there has been an influx of venture capital in the sector primarily in the picking robotics segment which could potentially accelerate M&A activity in the shorter term

LIMITED M&A ACTIVITY

- There has been relatively limited M&A activity in the Loading/ Unloading sector with five transactions between 2017-2023
- Three of the five transactions occurred during the pandemic

- The slow M&A pace in the Loading & Unloading sector could be due to a limited number of companies in the sector
- Many of the ATLS vendors were founded in 1990's or early 2000's and would now be considered mature
- Note that many of the ATLS businesses have also established alternative revenue streams which may cross over into other industries/ sectors where M&A activity could be more prevalent

CONTENTS

GOLD SPONSORS

VENDOR PROFILES: A-C

Loading & Unloading, Jan 2024
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Company Profiles: How to read?

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

W in cb ▶ = *links to:*

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

Actiw

FI | 2007 | -

- ATLS

Agilox

AT | 2017 | -

- Autonomous Forklift

Ancra Systems

NL | 2001 | -

- ATLS

Ant Machines

DE | 2021 | -

- Trailer bot

Anyware Robotics

US | 2023 | -

- Stealth mode

Ari Global Solutions

IN | 2001 | -

- ATLS

A-Service

NL | 2000 | -

- ATLS integrator

ASI

US | 2000 | -

- Trailer bot

Bastian Solutions

US | 1952 | -

- Carton unloading system
- Acquired by Toyota Material Handling in 2017

Beumer

DE | 1935 | Global

- Loading/unloading (aggregates)

Boston Dynamics

US | 1992 | -

- Carton unloading system
- Acquired by Huyndai Motors in 2021 for $1.1bn

Caljan

DK | 1963 | -

- Telescopic conveyor

CAPO Tecnologia

BR | 2016 | -

- ATLS

Cargo Floor

NL | 1993 | -

- ATLS

VENDOR PROFILES: C-F

Carton Mover Logisch

NL | 2010 | -
- Telescopic conveyor

Clemvision

SG | 2001 | -
- Carton unloading system

Clevertech

IT | 1987 | -
- System Integrator

ConveyX

US | 2018 | -
- Telescopic conveyor

Copal Handling Systems

NL | 2006 | -
- Carton unloading system

Dedem Mekatronik

TR | 1995 | -
- Carton unloading system

Dexterity

US | 2017 | -
- Carton unloading system

Dextrous Robotics

US | 2019 | -
- Carton unloading system

Dorabot

CN | 2015 | -
- Carton unloading system

Duro Felguera

ES | 1858 | -
- ATLS
- Part of industrial conglomerate

Easy Systems

NL | 2007 | -
- Telescopic conveyor

Ergate Technology

CN | 2021 | -
- Telescopic conveyor

Europa System

PL | 1994 | -
- ATLS

ex9

FR | 2021 | -
- Autonomous yard transport solutions

Filics

DE | 2019 | -
- AMR

VENDOR PROFILES: F-J

Forankra

XX | 2013 | -

- System integrator

Fox Robotics

US | 2018 | -

- AMR

GIDEON

CRO | 2017 | US

Gideon is helping customers streamline dock operations by automating palletized, **full trailer loading AND unloading** using **Trey – a forklift-style AMR built on multiple OEM chassis.**

Using a **proprietary AI vision system**, Trey can recognize and handle a wide variety of loads, **from standard pallets to automotive racks.**

Gideon's **Fleet Management System** allows coordination between robots and enables connection with the WMS and other high-level systems - unlocking complex applications including **conveyors, label scanning and decision-making** for a complete automation solution and dock optimization.



Joloda Hydraroll

UK | 1962 | NL,FR,US,BR,JP

Introducing Joloda Hydraroll... We are thé global leader in loading solutions and we're here to help lighten your load. We're more than 'off-the-shelf', we're the pioneers, the creators, the experts. Here to innovate, automate and streamline your logistics to create the ideal solution for your loading problems.

We design, manufacture, install and maintain specialist loading systems; solving businesses' unique loading and unloading challenges by creating solutions that integrate seamlessly to provide unparalleled, long-term benefits.

Gorbel

US | 1977 | -

- Manual assisted load/unload

Hanwha

KR | 1952 | -

- Carton unloading system

Haver & Boecker

DE | 1887 | -

- Other loading/ unloading

Honeywell

US | 1906 | -

- Carton unloading system

JBT Corp

US | 1894 | -

- AMR

VENDOR PROFILES: L-O

KSM Viet Son Mechanical

VN | 2016 | -
- ATLS

Lab0

US | 2021 | -
- Stealth mode

Loading Automation

US | 2004 | -
- ATLS reseller
- Acquired by Joloda Hydraroll in 2020

Loading Robots

ES| 1858 | NA
- Valid for any truck (container, canvas or rigid box)
- **Unmodified truck**
- Load not prepared in advance
- Side or Back Loading

Efficiency
Faster truck loading
Operating cost savings
Safety
Safer truck loading and unloading
Reduced risk of damage to trailer/goods
Environment
Zero carbon emissions
Electric powered
People
Avoidance of labour shortage
Mistake-free operation

Lodamaster

TR | 2011 | -
- Telescopic Conveyor Producer

Mews Partners

FR | 1992 | -
- Consulting firm

MSK Covertech

DE | 1975 | -
- ATLS

Mujin Robotics

JP | 2011 | -
- Carton unloading system

Nandan GSV

IN | 1991 | -
- ATLS

Nido Automation

IN | 2010 | -
- Telescopic conveyor

Okura Yusoki

JP | 1937 | -
- ATLS

Outrider

US | 2017 | -
- Autonomous yard vehicle

VENDOR PROFILES: P-T

Pickle Robot Company

US | 2018 | -
- Carton unloading system

Roboworks

NL | 2021 | -
- Carton unloading system

Simec Systems

FI | 1841 | -
- ATLS

TRAPO

DE | 1957 | Global

Skilled Group

IT | 1973 | -
- AMR

Slip Robotics

US | 2020 | -
- AMR

Sortcon

TR | 2021 | -
- Telescopic conveyor

Suzhou Wisedock Automation

CN | 2022 | -
- Telescopic conveyor

TAWI Group

SE | 1923 | -
- Manual assisted loading/ unloading
- Acquired by PIAB in 2020

Technica International

LB | 1982 | -
- ATLS

Terberg Special Vehicle

NL | 1869 | -
- Autonomous yard vehicle
- Division of Royal Terberg Group B.V.

TEUN

NL | 2018 | -
- Carton unloading system

VENDOR PROFILES: W-X

WDX

PL | 1995 | -

- ATLS

WSR Solutions

NL | 2014 | -

- Carton unloading system

Wynright

US | 1972 | -

- Carton unloading system
- Acquired by Daifuku in 2013

XYZ Robotics

CN | 2018 | -

- Carton unloading system

CONTENTS

CREDITS & INTERVIEWEES, TRADE SHOWS, GLOSSARY

INTERVIEWS:

• Actiw	Sales Director
• Anyware Robotics	VP of Product
• CAPO Tecnologia	Director
• CleverTech	BD Manager
• Copal Handling Solutions B.V.	Sales
• Dexterity	Co-founder
• Duro Felguera	General Manager
• ex9	CEO & Co-founder
• Forankra	Project Manager
• Fox Robotics	Co-founder
• Joloda Hydraroll	Sales Director
• Lab0	Founder
• Loading Robots	General Manager
• Lodamaster	Solution Design Manager
• Mews Partners	Partner
• Nandan GSV	CEO & Co-founder
• Pickle Robot Company	CEO & Founder
• Robo Works	CEO & Founder
• Simec Systems	Sales Director
• Slip Robotics	VP Sales
• Technica International	Founder
• Trapo	Product Manager
• XYZ Robotics	CEO & Co-founder

INTERVIEWS - USERS & BUYERS:

- STIQ also interviewed multiple end-users/ buyers of Loading & Unloading automation equipment for this report – big thanks to these anonymous contributors from FMCG/CPG + F&B

EVENTS (STIQ RECOMMENDS):

- Automatica (DE) [Web]
- Logimat (DE) * [Web]
- Logis-Tech Tokyo (JP) * [Web]
- Modex (US) * [Web]
- Promat (US) * [Web]

Visited by STIQ or planning to visit

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FURTHER RESOURCES (CONTACT US):

- Market size data + To discuss this report or the wider material handling sector, trends, equipment, solutions, etc. Email STIQ Ltd > tom@styleintelligence.com

GLOSSARY

3PL	Third Party Logistics
AGV/AMR	Mobile Robots
ASRS	Automatic Storage & Retrieval System
ATLS	Automated Trailer Loading Systems
B2B	Business-to-Business
CPG	Consumer Packaged Goods
CPH	Cartons per Hour
DC	Distribution Centre
EMEA	Europe, the Middle East and Africa
ERP	Enterprise Resource Planning
F&B	Food and Beverage
FDA	Food and Drug Administration (US)
FMCG	Fast-Moving Consumer Goods
H&S	Health and Safety
IRR	Internal Rate of Return
M&A	Mergers & Acquisitions
MHE	Material Handling Equipment
PICK	Loose Carton Picking Automation *(this report)*
POC	Proof Of Concept (trial)
RaaS	Robotics as a Service
RFI	Request for Information
RFID	Radio Frequency Identification
ROI	Return on Investment
ROS	Robotics Operating System (ROS +ROS2)
TAM	Total Addressable Market
UX	User Experience
VC	Venture Capital
WMS	Warehouse Management System