GIDEON BROTHERS

The Buyer's Guide to Warehouse Automation

Material Handling Robots

GIDEONBROS.AI

About

This e-book brings you an overview of market trends and available material handling technologies, a self-assessment checklist and questions to ask autonomous mobile robot suppliers.

Understand:

- When to select autonomous mobile robots as your preferred material handling solution.
- What to ask your supplier and why it matters.

Chapter I

Why companies automate?

The challenges and trends that drive the surging demand for material handling automation.

Chapter II

Automation technology overview

A brief review of material handling automation technologies and their benefits and disadvantages.

Chapter III

Determine how much flexibility you need

A self-assessment checklist to help you determine how flexible your material handling automation technology must be to fit your operations. Or in other words, how to determine when autonomous mobile robots are the best solution.

Chapter IV

Questions to ask your autonomous mobile robot suppliers

A set of questions and context explaining why the information you get is important for you to make an informed decision.

1 Why companies automate?

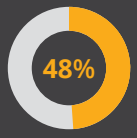
Demand for material handling automation is surging globally. Across most industries, companies face market trends and challenges that are driving the **need for change**. These challenges likely affect your operations in many critical facets, causing an increase in costs throughout your operation.

The challenges observed in the current market are broad, and some distillation is required to make clear the top-level issues that can impel undesirable outcomes. Surveyed leaders have rated the top supply chain challenges and found the following areas to be the most challenging.

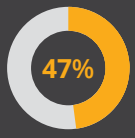
The top 6 challenges

The share of surveyed companies rating the issue as extremely or very challenging

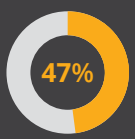
Hiring and retaining qualified workers



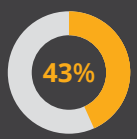
Forecasting



Customer demands for lower costs



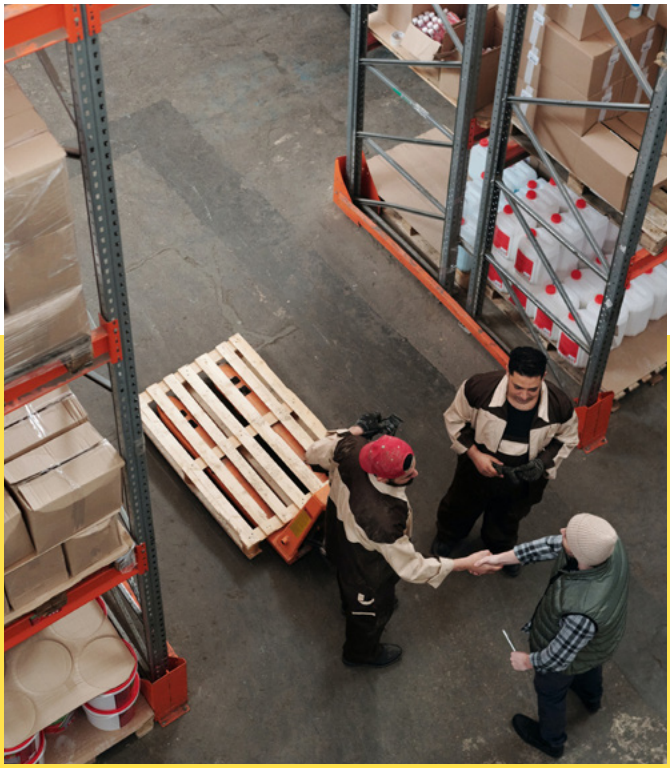
Customer demands on response times



Rising customer service expectations

Supply chain disruption

Seven signs you need to consider automation



1

LABOR SHORTAGE AND VARIABILITY

Hiring and retaining workers is one of the most common supply chain challenges companies face. With the high annual turnover rates and the shrinking labor force, the vacancies are becoming more difficult and costly to fill.

2

OPERATIONAL INEFFICIENCY

Several internal KPIs may signal inefficiencies, including low labor utilization rates and high travel time (the share of working hours spent on travel from A to B within the facility).

3

NEED FOR HIGHER THROUGHPUT

The trend of increasing customer expectations is resulting in the increased pressures for shorter delivery and turn-around time. Inadequate on-time order rates are a clear signal to increase capacities for higher throughput.

Next page

4

OPERATING AT PEAK CAPACITY

Operations confronting objective constraints, especially of space and the shrinking labor force, have no room for growth. With the re-shoring trend and the increased focus on building local capacities, automation.

5

INADEQUATE ACCURACY PERFORMANCE

Perfect order rate KPIs affect the bottom line as well as the less measurable customer experience. With surging e-commerce, improving perfect order rates in a competitive landscape is even more important.

6

INCREASED COSTS OF WORKPLACE RELATED INJURIES

In the US alone, the cost of injuries in the transportation & warehousing industry is estimated at $84.04 million per week. Handling objects is the most common cause, and forklifts are the most commonly involved type of equipment[1)].

7

NEED FOR OPERATIONS VISIBILITY

Metrics are a prerequisite for optimization – what gets measured gets improved. Capturing data for in-depth analytics enables ongoing optimization of operations and workflows resulting in higher efficiency and throughput.

Do you contend with **finding & keeping skilled labor?**

Most companies surveyed identified hiring and retention as the most challenging aspect of the current market, and analysts don't see it diminishing in the foreseeable future. The labor crunch is here to stay.

In a recent report, Interact Analysis forecasts[2] the number of warehouses globally to increase by 20% in five years, requiring a **50% increase in staffing** to keep up with exploding demand.

2.1MM

manufacturing jobs could remain unfilled by 2030*

$1TN

is the forecasted cost of unfilled vacancies in manufacturing in the US alone by 2030*

+4.5MM

full-time warehouse workers will be needed by 2025 due to exploding demand**

* Source: Creating pathways for tomorrow's workforce today, Deloitte and the Manufacturing Institute, 2021
** Source: Warehouse Building Stock Database, Interact Analysis, 2021

National statistics support the companies' and analysts' reports, showing that **unfilled vacancies** are on the increase in both the US and EU. In the US, unfilled vacancies hit **a new record** in spring 2021[3].

The labor crunch is further complicated by high worker turnover. Surveys suggest the average **annual employee turnover** reaches well **over 40%** in distribution centers[4], and the cost of filling a vacancy, depending on the market, can be equivalent to four months' wages.

However, the indirect cost of unfilled vacancies – including downtime due to training and the loss of profit – is much higher and more difficult to measure.

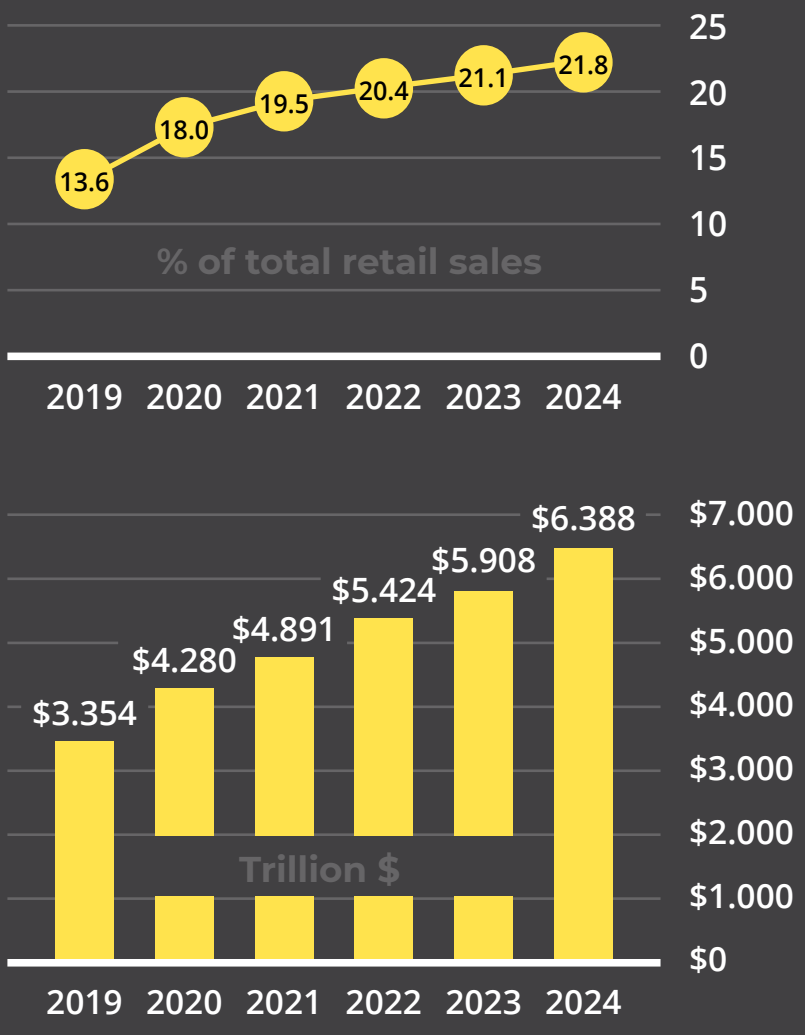
Flexible automation relieves labor shortage

- Free your employees from dangerous, dirty and dull jobs so that they can focus on more rewarding tasks that add value to your operation.
- Better working conditions lead to higher employee satisfaction and improved retention rates.

Is e-commerce changing your operations?

Even in the pre-COVID-19 era, e-commerce and the shift from brick-and-mortar to omnichannel brought dramatic changes in the supply chain for both B2C and B2B. With the pandemic, e-commerce growth rates surged further. E-commerce is irrevocably reshaping supply chains and **affecting all B2C and B2B sales**. Adjusting to this shift is vital.

Retail ecommerce sales worldwide



Source: eMarketer/InsiderIntelligence.com: Global Ecommerce Forecast, 2021

E-commerce trends that drive the need for automation

- **Increased SKU variability**
- **Increased customer expectations**
- **Increased volatility**
- **Increasing post-sales operations**
- **Increased forecasting uncertainty**

44%

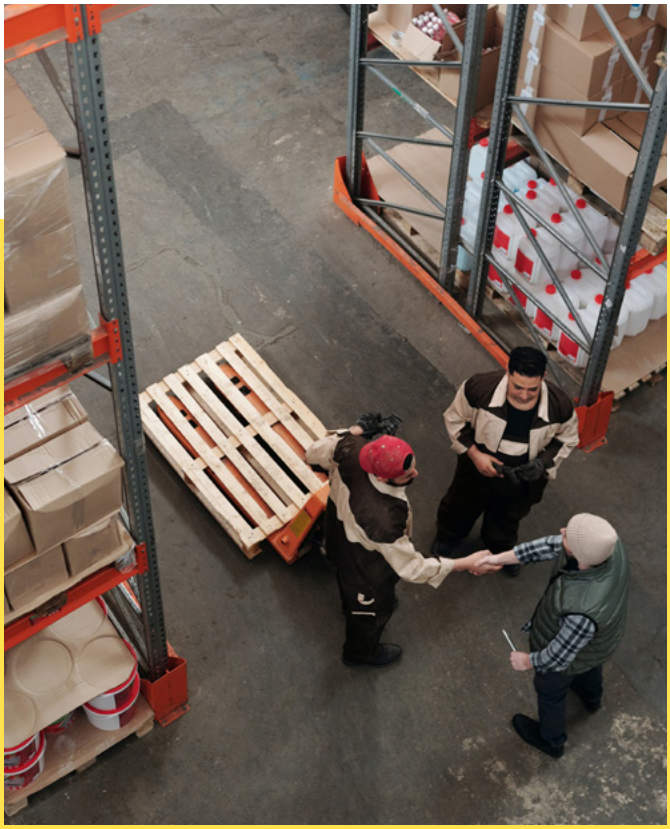
surged e-commerce sales in the US in 2020, estimates Digital Commerce 360[0]

The pandemic also spurred the shift to omnichannel. Both B2C and B2B businesses adapted to the pandemic by introducing or widening their services geared to omnichannel, such as **in-store or curbside deliveries**, and various virtual experiences to engage customers as in-store browsing became less accessible due to the public health measures.

In the B2B segment, the shift was especially marked: a McKinsey survey[5] of more than 3,600 decision-makers showed that over **90 percent of B2B companies shifted to a virtual sales model** just one month into the pandemic. Testifying to the changing habits, the poll showed that more than 70 percent of customers prefer doing business remotely, and an incredible 97 percent say they're willing to make digital, self-serve purchases exceeding the $50,000 value barrier.

And this shift, again, is here to stay: some 90 percent of respondents in the McKinsey survey say that **the digital model is "here to stay"** and 70 percent believe it's at least as effective as pre-COVID-19 ways of doing business.

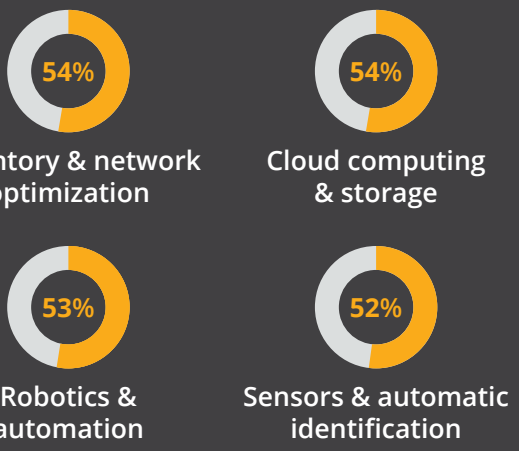
Build a more **agile and resilient** supply chain



The recent research shows that, in the post-COVID-19 world, investments into new technologies are a dominant approach to building **supply chain resilience**.
In a recent survey of 1300 supply chain professionals, Gartner found[6] that 89% plan to invest into making their supply chains more agile, and 87% plan to invest in resilience.

Investing in capacity-building technologies

Technology segments that most companies said they plan to increase investments into four capacity-building technology segments:



Source: Deloitte and Material Handling Institute: Innovation Driven Resilience, 2021

A deeper look into these investment plans tells a story of the increasing pace of digital transformation. This creates untapped growth capacities through smart workflow orchestration and full operations visibility.

Flexible automation of manual material handling is an essential part of such an integrated ecosystem.

With flexible automation, it's easy to scale up or down and redeploy the material handling capacity, making operations more resilient without sacrificing efficiency. Its data collection capabilities, when paired with powerful enterprise and forecasting solutions, open the route to both productivity gains and seizing more growth opportunities.

Leverage the disruptive **potential of robotics**

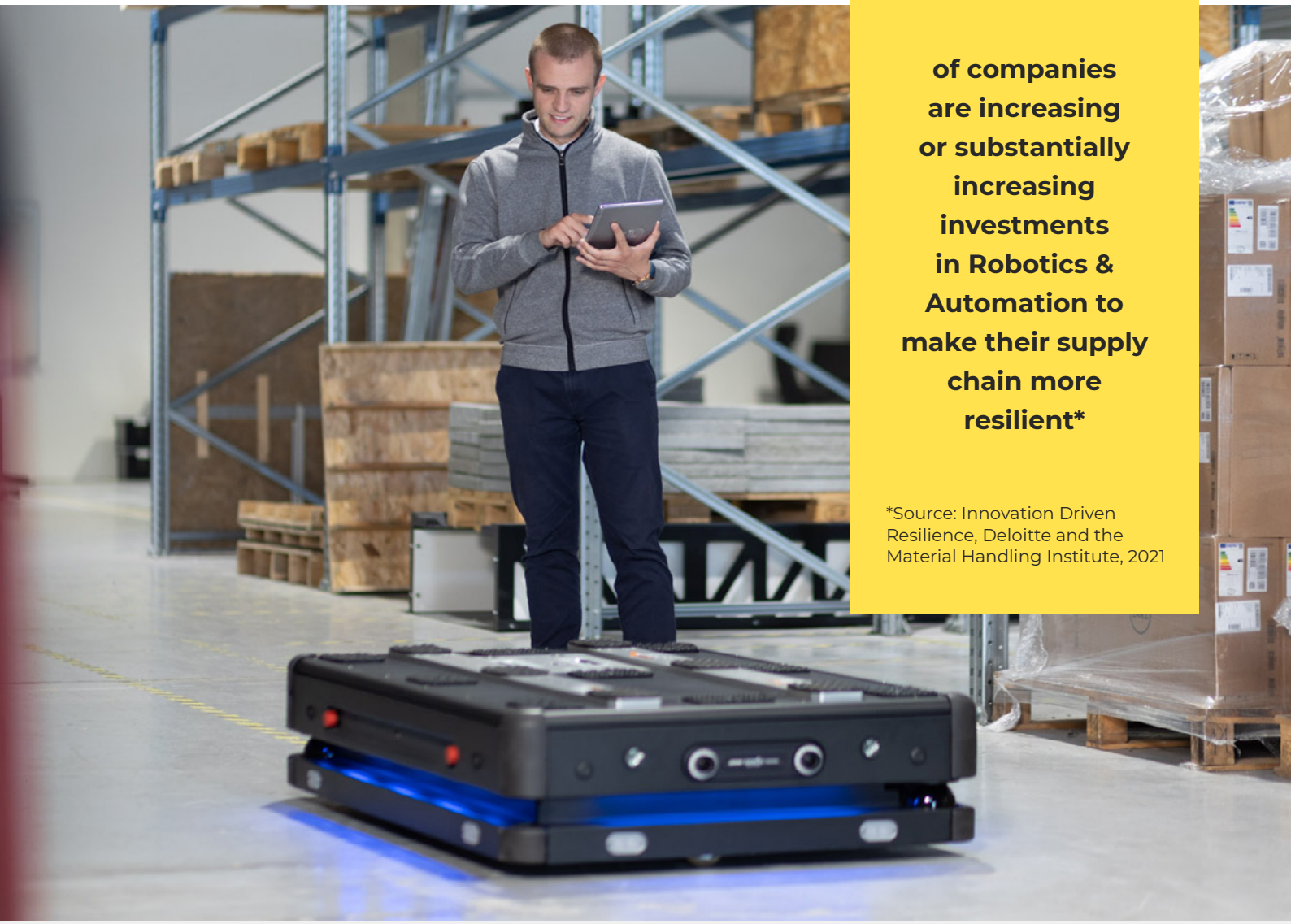
The shared challenges mean that most companies are looking at the same solutions. **Early adopters who automate will keep their competitive edge.**

Autonomous mobile robots (AMRs), the most recent of the material handling automation technologies, will make up a significant part of this surge of investments into new technologies. The independent tech advisory ABI Research[1)] estimates that revenues in this market segment will grow from US$800 million to US$49 billion in 2030. That's a CAGR of around 50%!

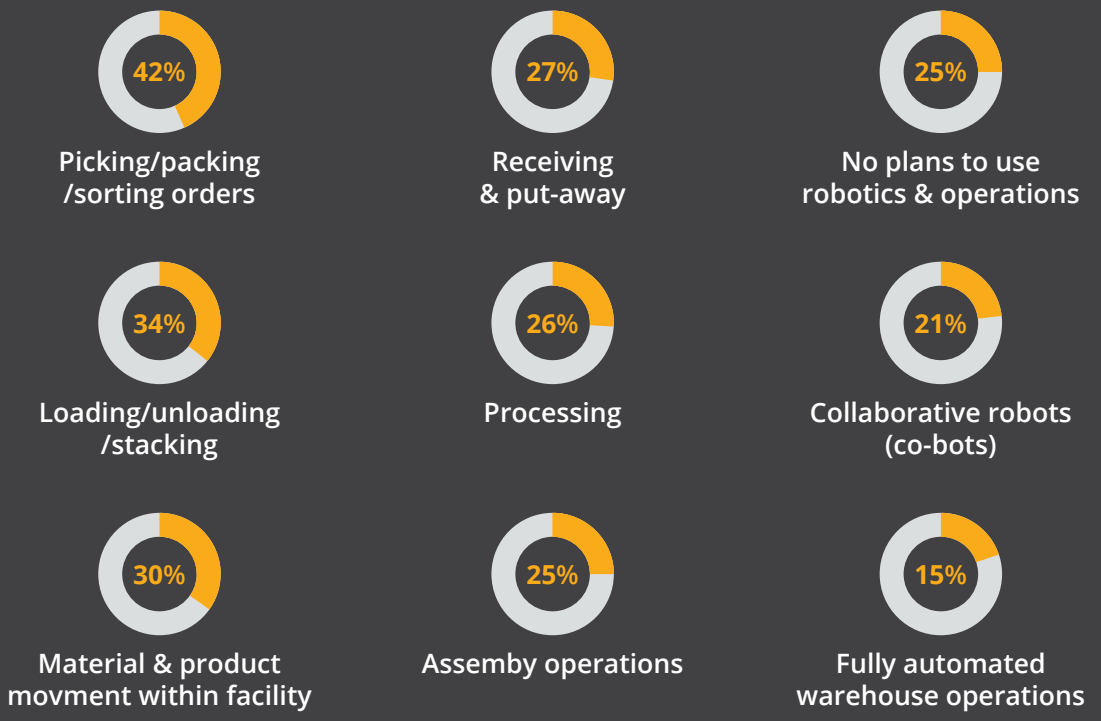
53%

of companies are increasing or substantially increasing investments in Robotics & Automation to make their supply chain more resilient*

*Source: Innovation Driven Resilience, Deloitte and the Material Handling Institute, 2021



The most common use cases for robotics and automation



Source: Deloitte and Material Handling Institute: Innovation Driven Resilience, 2021

Survey takeaways

Robotics and automation are used in most operations involving material handling.

Only 15% of companies are going for fully automated warehouse operations without human labor

Only a quarter of companies say they do not intend to use robotics

Autonomous mobile robotics will take a major part of these investments. The global tech market advisory firm ABI Research forecasts[7] that there will be 15 million autonomous mobile robots in use by 2030. Moreover, AMRs would surpass 80% of all commercial robot shipments, estimates ABI Research.

Flexible AMRs are set to transform material handling

Older material handling automation technologies – such as guided vehicles and automated storage and retrieval systems – don't fit well with most facilities because they need flexibility as well as efficiency and an acceptable total cost of ownership (TCO).

Autonomous mobile robots powered by the most advanced autonomy technologies, including **3D vision and AI**, are designed to work alongside people and to adapt to their working environment, not the other way around.

An incredible synergy can be achieved between AMRs and people, who will remain the primary value-creators. Their robotic helpers will take over the simple tasks to make operations more efficient and resilient.

It is this collaboration between people and machines that is uniquely capable of transforming material handling.

95%

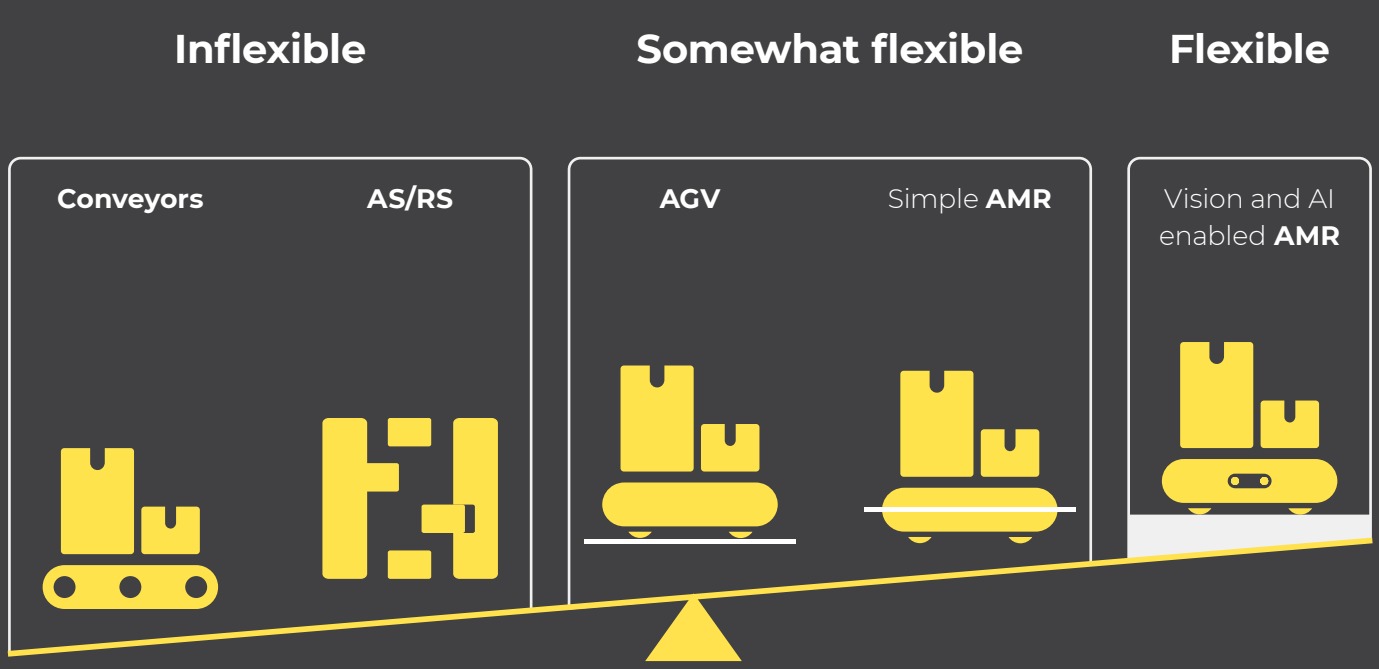
Almost 95% of industrial facilities still depend on (ever-scarcer) manual labor.

2 Warehouse automation technology overview

Automation of material handling has been around for quite some time, with the first **conveyors** appearing in the late 1800s in the mining industry. **Automated guided vehicles** (AGVs) first appeared in the 1950s, soon to be followed by **automated storage and retrieval systems** (AS/RS).

Autonomous mobile robots (AMRs) are the latest material handling automation technology, commercially available only in recent years.

The flexibility scale of material handling technologies



Conveyor systems

Conveyor systems are a standard and straightforward type of industrial equipment for moving goods quickly over a distance. The most common types of conveyors use belts, rollers, wheels, or chains for moving goods.

Pros
Conveyor systems

- **High efficiency for high-volume goods**
- **Advances in sensors (including vision) offer some new use cases**

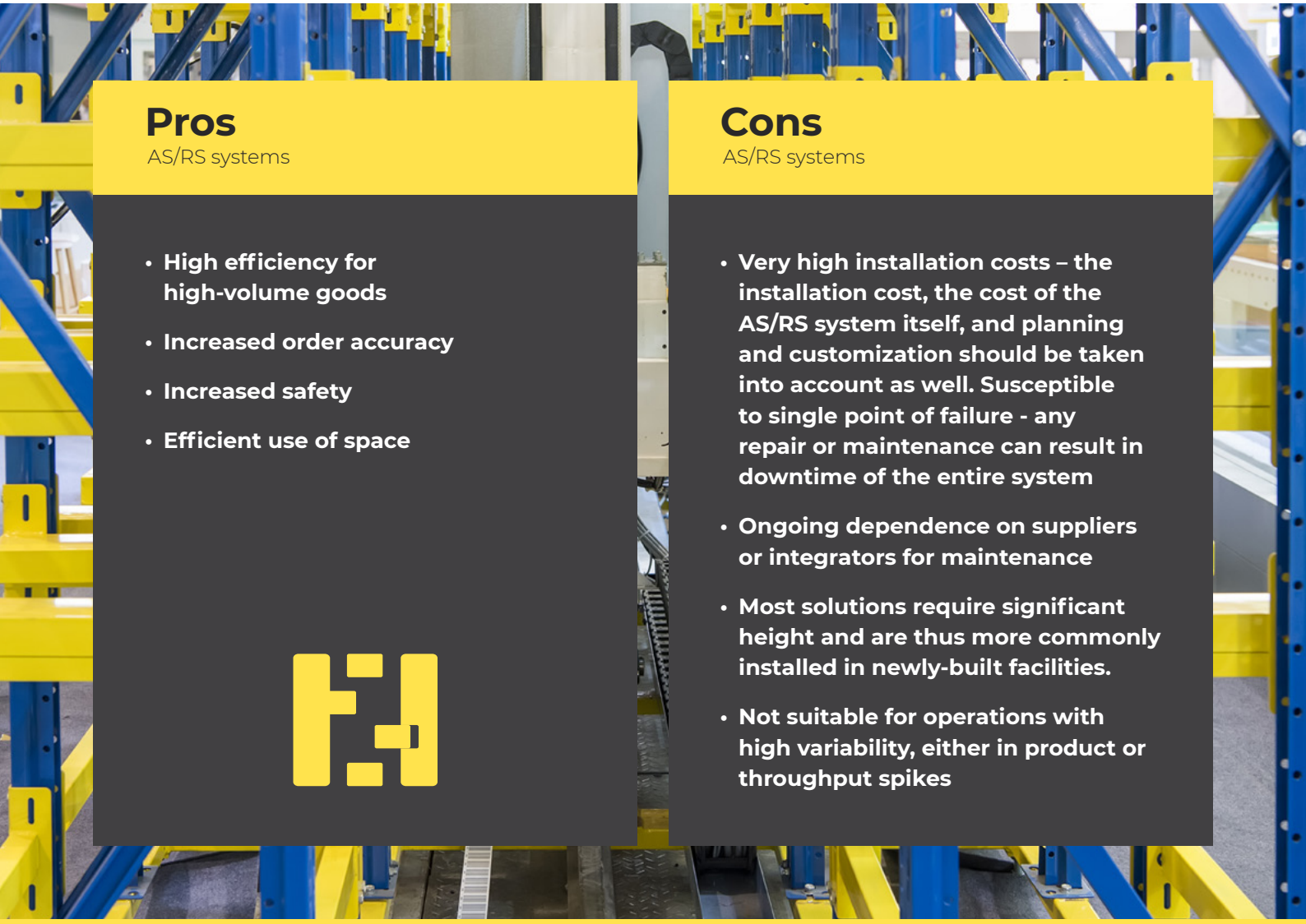
Cons
Conveyor systems

- **High installation costs**
- **Extensive space requirements - limiting the capacity to grow**
- **Injuries – due to high speeds, employees are exposed to significant injury risk**
- **Fixed infrastructure – any changes to SKU positions, picking methodologies, or workflow reorganization bring significant cost**

Conveyors are inflexible but efficient for handling high-volume goods with little seasonal fluctuations and for operations that don't expect significant changes to SKU positions or workflows.

Automated Storage and Retrieval Systems (AS/RS)

AS/RS are fully automated storage systems, off-limits to humans, where goods are placed into and retrieved from storage in a centrally-run, computer-operated system.



Pros
AS/RS systems

- **High efficiency for high-volume goods**
- **Increased order accuracy**
- **Increased safety**
- **Efficient use of space**

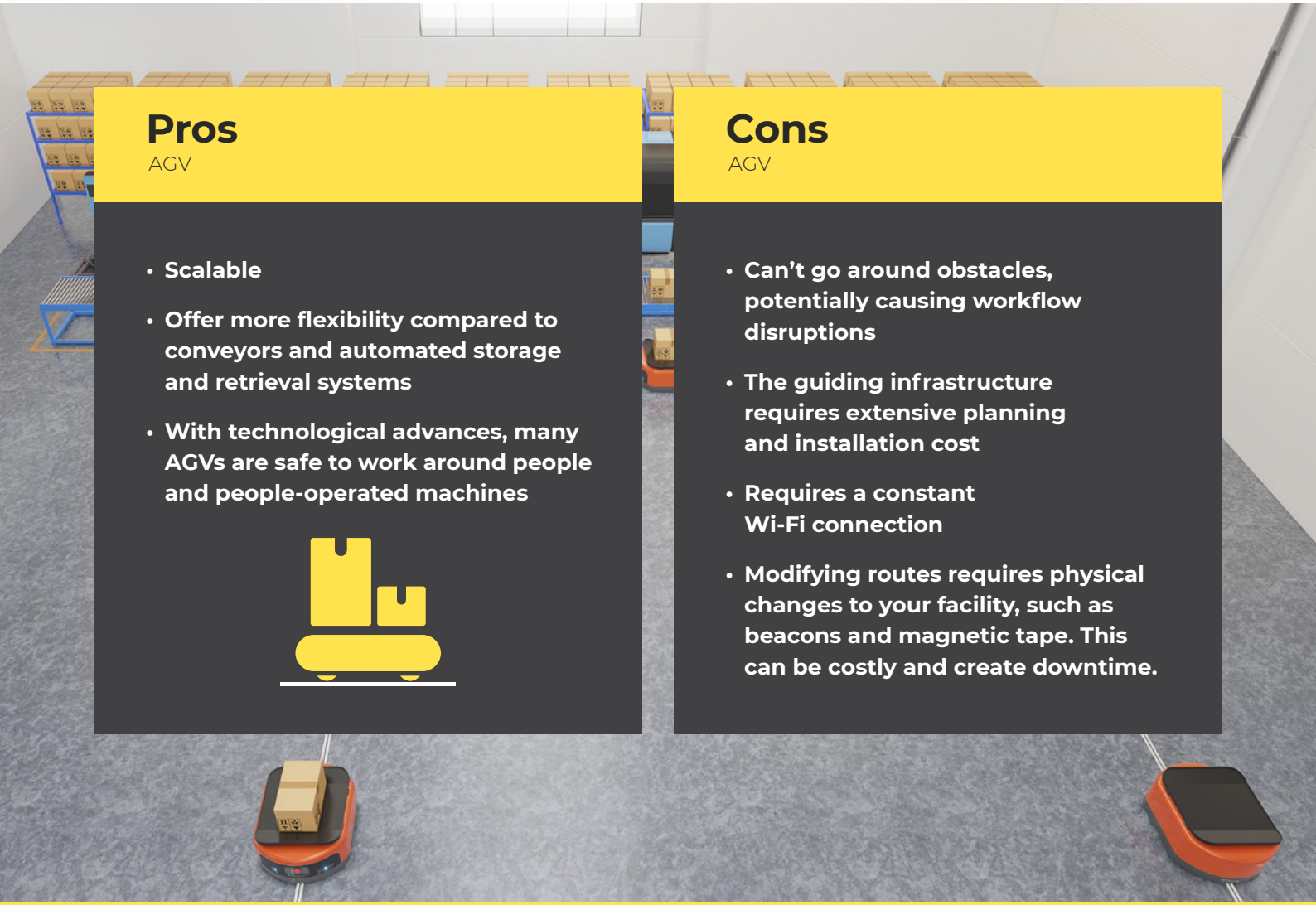
Cons
AS/RS systems

- **Very high installation costs – the installation cost, the cost of the AS/RS system itself, and planning and customization should be taken into account as well. Susceptible to single point of failure - any repair or maintenance can result in downtime of the entire system**
- **Ongoing dependence on suppliers or integrators for maintenance**
- **Most solutions require significant height and are thus more commonly installed in newly-built facilities.**
- **Not suitable for operations with high variability, either in product or throughput spikes**

AS/RS are inflexible and have very high installation costs but are very efficient for handling high-volume goods with little seasonal fluctuations, especially for greenfield projects.

Automated guided vehicles (AGV)

AGVs are vehicles relying on guidance systems and infrastructure such as beacons or magnetic tapes on the floor. AGVs have been commercially available since the 1950s.



Pros
AGV

- **Scalable**
- **Offer more flexibility compared to conveyors and automated storage and retrieval systems**
- **With technological advances, many AGVs are safe to work around people and people-operated machines**

Cons
AGV

- **Can't go around obstacles, potentially causing workflow disruptions**
- **The guiding infrastructure requires extensive planning and installation cost**
- **Requires a constant Wi-Fi connection**
- **Modifying routes requires physical changes to your facility, such as beacons and magnetic tape. This can be costly and create downtime.**

AGVs offer some flexibility and are easily scalable, but the guiding infrastructure brings increased installation cost and they are best adapted for operations with predictable workflows where pre-defined routes can be easily set up.

Autonomous mobile robots (AMR)

AMRs are self-driving robotic vehicles that can plan their routes to a given destination and navigate around obstacles. Their defining feature is that they build their own map of the facility and localize themselves within it. This feature enables their self-driving capabilities, requiring no guiding infrastructure. In practice, they plan an optimal path to a given destination and they can avoid obstacles they encounter en route.

Pros
AMR

- **Require no guiding infrastructure**
- **Operate in busy, unstructured environments thanks to their localization and mapping capabilities**
- **Can navigate around obstacles as they are not following a predetermined route but rather autonomously navigating to a destination point**
- **Scalable and fully flexible for any workflow**
- **Safe to work around people – the risk of injuries is significantly reduced.**
- **Technological advances mean some operations can now be automated for the first time**

Cons
AMR

- **May require additional infrastructure such as pallet stands or something similar**
- **May require uniform Wi-Fi coverage throughout the facility (However, 5G networks bring ample capacities and new potential for a proliferation of new Industry 4.0 solutions.)**

The latest advances (AMR)

Due to the fast pace of technological advances – including sensors, AI and machine learning applications - there are significant differences in features and capabilities within the AMR category. For example, mobile robots equipped with advanced autonomy technologies can automate some operations for the first time, such as trailer unloading or operating both outdoors and indoors. **AMRs with advanced autonomy are also more reliable and adapt better to the unpredictability of busy, unstructured environments where people, other vehicles and goods constantly shift about.**

Autonomous mobile robots are a flexible tool that can adapt to dynamic and ever-changing facilities, where people and goods constantly move about. This superior adaptability minimizes infrastructure requirements, installation cost, and downtime when changes are needed. The most advanced solutions automate some historically manual operations for the first time, such as **trailer unloading** or **operating both indoors and outdoors**.

3 Determine how much flexibility you actually need

Picking the ideal material handling automation solution will depend largely on how much flexibility you need.

Ask yourself:

How often would your operations be able to sustain the downtime and the cost to change the layout of magnetic tapes or other guiding infrastructure for AGVs?

Is there a large fluctuation in your volume or the numbers of SKUs over the course of a year?

How readily would you be able to redirect people (or people-operated) traffic in your facility?

These are some of the considerations that determine your flexibility needs. **Conveyors** and **AS/RS** systems are not flexible but offer great efficiency for high-volume SKUs, especially if there is relatively little seasonal variation in demand. They're a solution that's hard to beat if you don't expect your workflows to change much over the years. For all other operations, **AGVs** or **AMRs** might be a better solution. However, each facility has its own complexities, some of which are easier for machines to tackle, and some require more advanced features.

The self-assessment checklist

The self-assessment checklist below helps you determine how much flexibility you need and how "dynamic" – how unpredictable and unstructured - your facility is?

The checklist will help you determine **what kind of AGV or AMR would best fit your operations**.

Is your facility what robotics suppliers call a "dynamic environment"?

	Dynamic facility High flexibility req.	**Static facility** Low flexibility req.	**Why is this relevant?**
Do you have seasonal demand spikes or variability for different SKUs?	☐ **Yes**	☐ **No**	AMR and AGV solutions can both be good options in this situation. What to look for here is the solution that offers the simplest scaling and system modification options (how positions, routes, tasks, etc., are set up), as well as the level of integration with your other systems.
How often do you change SKU positions?	☐ **Seasonally or even monthly**	☐ **Rarely**	If you need flexibility in this regard, AMRs might be the better solution since there's no cost associated with changing the fixed guiding infrastructure that AGVs require.

Determine how much flexibility you actually need

Would you be able to set up fenced-off areas and make some corridors off-limits to people and people-operated forklifts/carts?	☐ **No**	☐ **Yes**	If you need the entire facility to remain accessible, you need a solution that can work safely around people and people-operated vehicles without causing disruption. Some AGVs and most AMRs would fit the bill, with a varying degree of efficiency.
Are you looking to automate material handing in loading bays or other large indoor spaces without shelving and other fixed infrastructure?	☐ **Yes**	☐ **No**	Only AMRs equipped with advanced robot vision (usually relying on AI) can navigate autonomously in open spaces without fixed infrastructure such as shelving. Using AGVs would require never placing cargo on the floor that interferes with guidance infrastructure (e.g., tapes or beacons).
How often do you temporarily place packaged or palleted goods on the floor awaiting put-away or dispatching?	☐ **Weekly or daily**	☐ **Rarely**	Only the most advanced AMRs, able to recognize specific objects around them, are reliable here. For simpler AMRs, an occasional box shouldn't be a problem. However, their localization may fail if they constantly encounter cargo on the floor, as it makes it more difficult to match a specific location to their map.
Do you need to automate operations both inside and outside the facility?	☐ **Yes**	☐ **No, inside only**	Only the most advanced AMRs, equipped with robot vision that works in all lighting conditions, can handle this. The alternative is an AGV with a guidance system that can work both inside and outside.

4 Questions to ask autonomous mobile robot suppliers

Autonomous mobile robots are the most recent of the material-handling automation technology. However, with the rapid technological advances, there is an immense range of capabilities and features within the category.

Robot vision and AI applications (including machine learning) are among the new developments that have brought about significant technological leaps.

Vision and AI have made it possible for robots to understand better what surrounds them, and with an improved comprehension of the world around them, they become safer and perform more reliably in busy, unpredictable, people-populated environments.

Moreover, vision and AI bring exciting new automation potential, making it possible to automate some material-handling operations for the first time. For example, some of the most advanced autonomous technologies are now enabling robotic forklifts to **unload pallets from a trailer entirely autonomously**.

Navigation in large loading bays (where there is no fixed infrastructure that older AMRs require to navigate reliably) is another capability only recently made possible. The perception of robot vision has been improved by combining more advanced cameras with AI. An exciting new use case is the capability for the same AMR to operate both indoors and outdoors – two environments that have until now been very difficult to bring together.

The new automation potential brought by this augmented robotic vision is now increasingly being highlighted as "the future for mobile robotic navigation". Analysts estimate that the AMR market is likely to be dominated by solutions relying on vision or sensor fusion, including vision.*

*Source: Industrial Robotics for Material Handling Competitive Ranking, Industrial Autonomous Material Handling Market Tracker and Vision the Future for Mobile Robotic Navigation?, all by ABI Research, Q4 2020 and 2021

1 Will the robot perceive overhead obstacles or forks of an empty forklift in their lower-most position?

This question will reveal a lot about the robot's sensors.

The typical, early-model AMR would be equipped with 2D LiDAR (the acronym is meant to evoke "radar," but it's a laser sensor, in fact). 3D LiDARs would, of course, offer phenomenal detail, but computing and energy requirements, as well as cost, make it unviable for AMRs. The 2D LiDAR is placed so that it sees only **a thin horizontal cross-section** of its surroundings, usually some 20 cm (8 in) above the floor. A pair of 2D LiDARs cover the full 360 degrees around the robot, but they don't see anything below or above their laser-beam thin line of view. This is why many mobile robots have depth cameras - to be able to sense more of their environment including overhead or low-lying obstacles.

The robots still must have 2D LiDARs, as these are (so far) the only safety-certified sensors available.

2 Will the robot be able to navigate in open loading bays?

This is something only the most advanced AMRs can do.

As AMRs try to localize themselves, they rely on finding fixed spots they've included in the map they've built. That's easy in a nicely organized grid of shelving racks. However, in a loading bay, there are **no fixed points** and goods constantly shift about. No way to make a usable map of that.

However, with advanced AI and robot vision, a robot can navigate by using the background – the ceiling or the far wall.

3 Can the robot work round the clock without stopping?

The answer to this question will tell you how much time the robot spends charging. If the robots are programmed to charge in-between tasks, this means that uptime may reach 80% or more. Some robots, however, have the option of **battery exchange**, making them able to run almost non-stop.

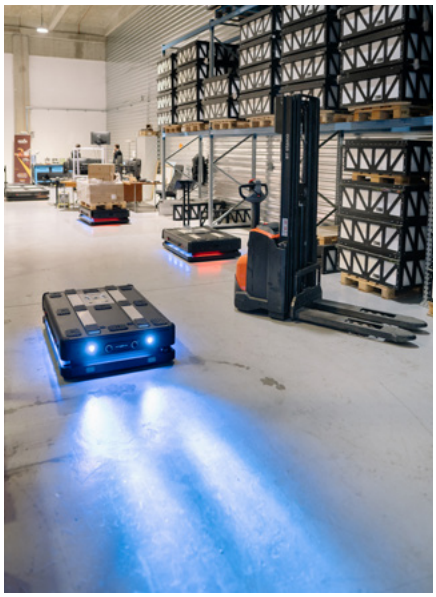
24/7
356 days

4 Can we temporarily leave pallets or boxes in corridors as they await put-away or dispatch?

This may seem to be a simple question, but the confidence with which the supplier replies will tell you a lot about how reliable the **mapping and localization algorithm** is.

This algorithm builds a map (2D or 3D, depending on how advanced the autonomy tech is) made up either of points or entire surfaces (again, depending on what's under the hood) that the robot senses around it. The robot then localizes itself by comparing what it senses to its saved map. If it encounters a box on the floor in an aisle, that's OK – there's plenty of other features that match up - and the robot can still be fairly confident where it is. However, if goods are placed on the floor regularly, this may become a problem. The robot will more often be uncertain of its location, calling for help and causing disruption.

This is where advanced robot vision and AI (including machine learning) become very useful. Robots that are trained to detect and **recognize different objects** are smart enough to disregard transient goods on the floor when they build maps and localize themselves. Such machine intelligence also makes it easier to navigate the tricky, bustling spaces – including loading bays and outdoors – and safer around people. In addition, it brings in some neat features (make sure to check out the last question).



5 Will it work in facilities with low lighting?

This is another question that may reveal a hidden issue early on.

Warehouses and manufacturing facilities usually have less-than-ideal lighting, with plenty of dark patches. Moreover, where there's light, there may be too much of it – the industrial-grade floors often result in glare due to reflection. As a robot moves, it will vibrate, which causes jitter in its camera. For AMRs with ordinary cameras, these issues may make them see things when there's nothing there.

With more **sophisticated cameras** able to adapt to adverse lighting conditions, image stabilization, plus a good AI backbone helping it sort out visual inputs, the more advanced robots will work more reliably.

6 Can we (re)configure the system ourselves, or do we have to rely on system integrators?

Getting the answer to this question will tell you how easy to use the supplier's software is – and how much you would have to depend on them in the future for modifications, scaling and redeployment. This is not to imply you have to do these things in-house – having great support from your supplier is definitely something you should think of when considering AMRs, especially since it's such a new technology.

Nonetheless, one of the great advantages to AMRs is that thanks to their mapping capabilities, most can start **performing actual tasks within an hour or two** of turning them on for the first time in a new facility. As AMRs require no fixed infrastructure, the installation process becomes a matter of initial mapping (guiding one robot around a facility so that it can build the map), bringing online all the fleet robots, plugging in the coordination hub and giving the robots their tasks.

7 Do we have to keep the floor free from small debris?

Getting an answer to this question will prevent disappointment later. Not all cameras (nor what the robot can do with the input) are equal. The simpler AMRs and AGVs will decide that torn paper packaging is an insurmountable obstacle. With enough bits of trash around to 'block' all routes to the destination, it will just give up and call for help.

The advanced AMRs, on the other hand, are better able to understand what is in front of them – not an obstacle, but a bit of paper or other debris that can safely be traversed. The type of the **camera sensor** also plays a role here – off-the-shelf camera sensors are usually not best adapted for conditions in industrial facilities – poor lighting, reflections from the floors, and vibrations created by the moving robots. An AMR equipped with a stereo camera sensor designed especially for conditions in industrial environments would thus have better performance.

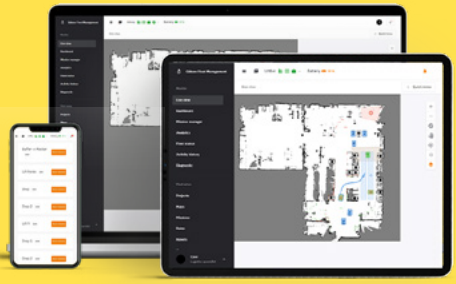
8 If we decide to scale the project and let the robots run in new areas of the facility, can we modify the facility map ourselves?

This question goes into the nitty-gritty details of how flexible the robots' **mapping capabilities** are. It will also help you calculate downtime for updates.

The issue is that some AMRs are not able to update the map on the fly, as they go about their regular work. So, if you add another rack of shelving, you may need to start the mapping process all over. You may also have to restart the process if you decide to 'promote' the robots to work in a new area of the facility. The more advanced solutions have the option to expand the existing maps as well as make dynamic updates to the map on the go.

9 Do we have to integrate it with WMS or similar systems?

The answer will show you the depths of the controlling software. Integration with WMS, of course, means you get the very most out of your robots. However, custom integrations take a great upfront investment. Having a supplier that offers user-friendly fleet management and orchestration software that does not require immediate, upfront integration with a WMS, will mean you're able to automate immediately and **scale as your requirements grow**.



10 What happens if pick-up points or drop-off points move?

Sometimes, the pick-up or drop-off point – such as a pallet stand – may be moved by accident. Or the person who moved it forgot to update the map with this detail. A disruption-avoiding feature is for the robot to be able to "look" around to check if the point is somewhere in the vicinity. In other words, this is another measure of how "smart" the AMR is. A **tolerance of +/- 1.5 feet** (or some 50 cm) allows an AMR to avoid most accidental disruptions.

11 Can the robot work without Wi-Fi?

AGVs need Wi-Fi to work, as they depend entirely on inputs from the central system. Thus, your facility should have good Wi-Fi strength coverage in the entire facility for the AGVs to perform well. This is not a trivial thing to achieve.

In contrast, AMRs, as a rule, do their own navigating. They also receive their tasks from a central hub (such as a Warehouse Management System),but they get just the destination, not the entire route. Still, they do need to remain connected in order to receive their tasks. Also, a fleet is more efficient if it's coordinated from a central hub. So, having a stable Wi-Fi connection is recommended for AMRs. That said, some AMRs may finish their tasks even with patchy **signal coverage**.

However, with 5G networks, the signal strength is not an issue and the increased capacities are enabling the development of new advanced automation solutions.

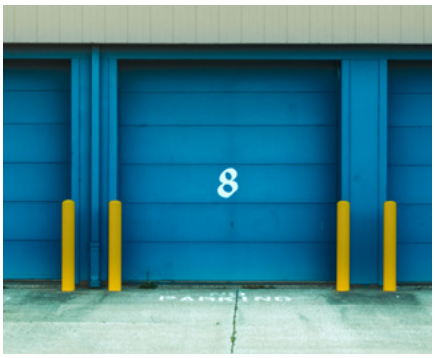
12 What other infrastructure do we need to install?

If the robot requires beacons, magnetic tapes, or other systems of virtual 'tracks' to follow, it is, in fact, an AGV (automated guided vehicle), not an autonomous robot at all. This means less flexibility in many other features.

Genuine AMRs may need some sort of auxiliary equipment, depending on the form or function of the robot. For example, if it's a squat platform transporting pallets, it may need pallet stands for drop-off or pick-up. However, even if they require additional equipment or add-ons, AMRs still provide unparalleled flexibility as they **don't require fixed infrastructure** or significant modifications in your facility.

(We believe AMRs should adapt to the facility and the installed infrastructure, not the other way around. New technologies offered by top innovators certainly enable such flexibility.)

13 Can the robot work both indoors and outdoors?



This is another question that will reveal the difference between standard and breakthrough AMR technology. Outdoor spaces – yard storage, parking, or even pedestrian areas – are entirely different environments compared to interiors. Lighting, shapes, speeds, weather, surfaces – everything is different. Having a **2-in-1 is a rare feat**.

14 Any other interesting features that others (usually) don't have?

Thanks to the booming demand, autonomous mobile robots are quickly becoming a standard choice for material handling automation. In the current AMR landscape, the difference in automation potential between the industry standard and the most advanced solutions is considerable. This is why understanding what top AMR innovators offer beyond the industry standard may unlock competitive advantages for your operations.

We at Gideon Brothers would highlight, for example, how our **proprietary 3D vision and AI technology** enables robotic forklifts to unload pallets from trailers entirely autonomously. Our AMRs understand the world around them in full 3D, and they recognize separate objects. This makes them safer and more reliable in the unstructured, unpredictable, busy environments they share with people.

This capability to recognize different classes of objects is what robotics developers call semantics, and it requires using machine learning to train robots to recognize what an object is – a pallet, a forklift, or a wall.

They can navigate in loading bays and have the capability to work both indoors and outdoors. Our robots build **full 3D maps** of the environment using images captured by our proprietary stereo cameras, and you can see the 3D maps, real-time, in our Fleet Management software.

About

Gideon Brothers is a robotics and AI solutions company that specializes in **flexible automation of material handling** processes for logistics, warehousing, manufacturing, and retail businesses.

Our advanced mobile robots and complete software solutions help businesses solve their most complex supply chain challenges:
rising customer expectations, increased product variability, logistics volumes, a growing variety of distribution channels, and ultimately, the labor shortage.

The innovative, flexible material handling ecosystem we have developed helps **customers to increase throughput, maximize productivity, and create an effective and safe working environment.**

Gideon's self-driving robots are **built to adapt to unstructured, dynamic indoor and outdoor environments.** They are powered by our **proprietary spatial AI and 3D vision technology**, enabling businesses to automate and orchestrate workflows of humans, robots, other equipment, and data sources; in real-time.

Thanks to next-generation AI and 3D vision technology, our AMRs automate some of the most complex material handling operations, such as **trailer unloading, navigating in large loading bays or operating both indoors and outdoors.**

Our mobile robots work side-by-side with people in the world's busiest warehouses and manufacturing plants and have been designed to quickly adjust to customers' processes and applications fields.

"Gideon's vision to enhance current industrial warehouse and manufacturing operations through close collaboration between humans and their robotic assistants, while automating complex manual processes to make work safer and more efficient, presents a shift in an industry ready for disruption."

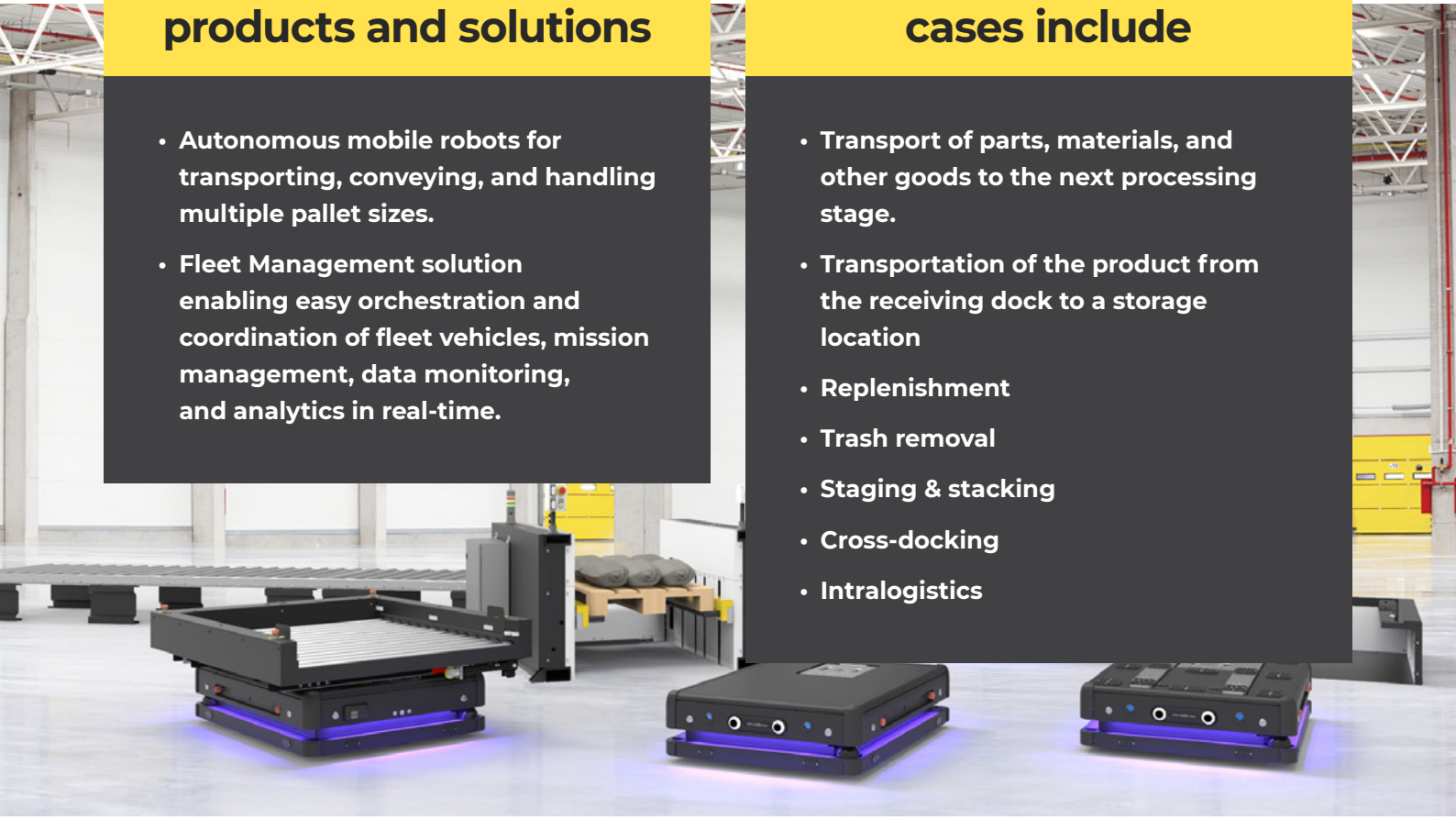
Annant Patel
Director at Koch Disruptive Technologies

Gideon Brothers' products and solutions

- **Autonomous mobile robots for transporting, conveying, and handling multiple pallet sizes.**
- **Fleet Management solution enabling easy orchestration and coordination of fleet vehicles, mission management, data monitoring, and analytics in real-time.**

Typical use cases include

- **Transport of parts, materials, and other goods to the next processing stage.**
- **Transportation of the product from the receiving dock to a storage location**
- **Replenishment**
- **Trash removal**
- **Staging & stacking**
- **Cross-docking**
- **Intralogistics**



Innovating for growth and resilience

We are building solutions for some of the world's leading customers, including Koch Industries/ Georgia Pacific and DB Schenker. In the recent "Industrial Robotics for Material Handling Competitive Ranking", the independent tech advisory ABI Research has recognized Gideon Brothers as a Top Innovator thanks to our innovative use of AI & 3D vision.

Would you like to learn more about how we solve your most complex indoor and outdoor workflows? Subscribe to our Newsletter to receive a monthly roundup of updates.

Sign up

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01

Liberty Mutual Insurance:
„2020 Workplace Safety Index“

02

Interact Analysis:
“Warehouse Building Stock Database 2021”

03

US Bureau of Labor Statistics:
“Job Openings and Labor Turnover Survey”

04

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06

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