MiR
A BETTER WAY

EBOOK

RG Group

Comparison Guide to Material Transport & Logistics Options

How to weigh capabilities and costs

FORKLIFT

AGV

AMR

MANUAL HANDLING

CONVEYOR

How to evaluate logistics options

When you're ready to automate material transport in your manufacturing facility, warehouse, or distribution center, you have multiple options. Those range from traditional forklifts and conveyors, to automated guided vehicles (AGVs), to today's advanced autonomous mobile robots (AMRs).

But with all of these options, there's also more pressure to get the decision right. You need to be able to justify that your choice presents a clear advantage over manual material handling in the near term, and that it will continue to meet your business's changing needs in the future.

While total cost of ownership (TCO) is a critical decision factor, effective evaluations also weigh three key parameters that impact business success: efficiency, agility, and safety. We'll walk you through that analysis.

What you'll find in this guide:

- Business challenges driving automation plans
- Understanding your material transport options (pros and cons)
- Total cost of ownership calculation
- Comparing your options with examples

Business challenges drive automation plans

Material transport and internal logistics are gaining visibility for competitive advantage for businesses around the world. Deciding on the best approach can be a complex choice, however, with multiple drivers:

- Global competition exerts cost pressures on every business decision, while rapid changes in consumer demands make flexibility critical.
- Labor shortages and labor costs are ongoing challenges that force companies to focus on the best use of valued human resources.
- Evolving safety requirements for employees – to protect them from repetitive injury due to material handling, physical injury from operating machinery, proximity injuries from working near moving equipment, and even safe distancing restrictions – all come into play.

Trends and challenges impacting internal logistics choices

Understand your options:
What are autonomous mobile robots (AMRs)?

First, it's important to understand your options. While manual material handling, forklifts, conveyors, and AGVs have long histories, AMRs may be less familiar. But mobile robots for logistics have been well-established for nearly a decade, with millions of AMRs successfully deployed around the world. And they continue to be a strong logistics contender, with growth projected to be as much as 40% per year, according to the International Federation of Robotics (IFR) .

Mobile collaborative robots are characterized by easy programming, flexible implementation, and extensive built-in safety mechanisms that allow them to navigate autonomously even through dynamic environments. Integrated cameras, scanners, and intelligent software guide the robot around obstacles and workers, as well as through doorways, tunnels, and elevators, automatically slowing or stopping the robot to avoid dangers to people or goods. Fleet software ensures the safest and most efficient logistics for one or dozens of robots. Robots come in a wide range of sizes and payload ratings and their modular design supports flexible top modules from racks or carts to pallet lifters or conveyors.

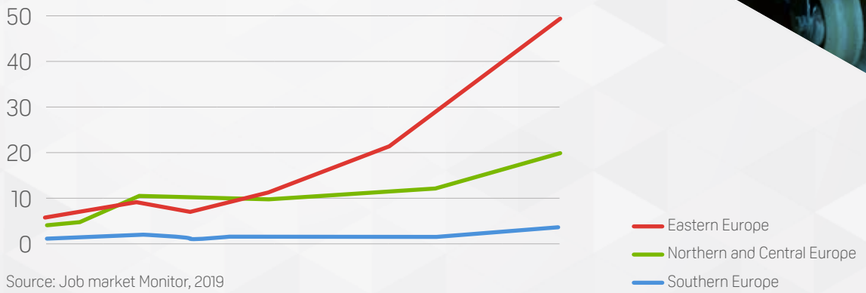
Logistics robot market to grow by

40%

per year

Labor shortage (2010-2019)

Companies indicating that labor shortages are limiting their production (%)



Source: Job market Monitor, 2019

Manual material handling

EFFICIENCY

- Cost-effective for short distances
- Requires full-time employee for low-value work, or high-value employees to leave their stations
- Depends on worker attendance, training, and attention to detail

AGILITY

- Operator is available to load and unload material
- Can operate in narrow aisles and dynamic areas
- Can adapt to changing requirements as long as workers are available
- In peak production periods, can put stress on existing resources, pulling workers from other positions to keep material moving

SAFETY

- Depends on training and oversight

Forklifts

EFFICIENCY

- ✚ Can handle larger payloads
- ✚ Can travel quickly over long distances
- ⛔ May require full-time employee
- ⛔ Depends on worker attendance, training, and attention to detail
- ⛔ Expensive equipment, power/fuel, and maintenance costs

AGILITY

- ✚ Can operate outside
- ✚ Can lift pallets directly off the floor
- ✚ Can operate in reasonably narrow aisles
- ⛔ Not appropriate in dynamic areas where operator may not notice obstacles or people

SAFETY

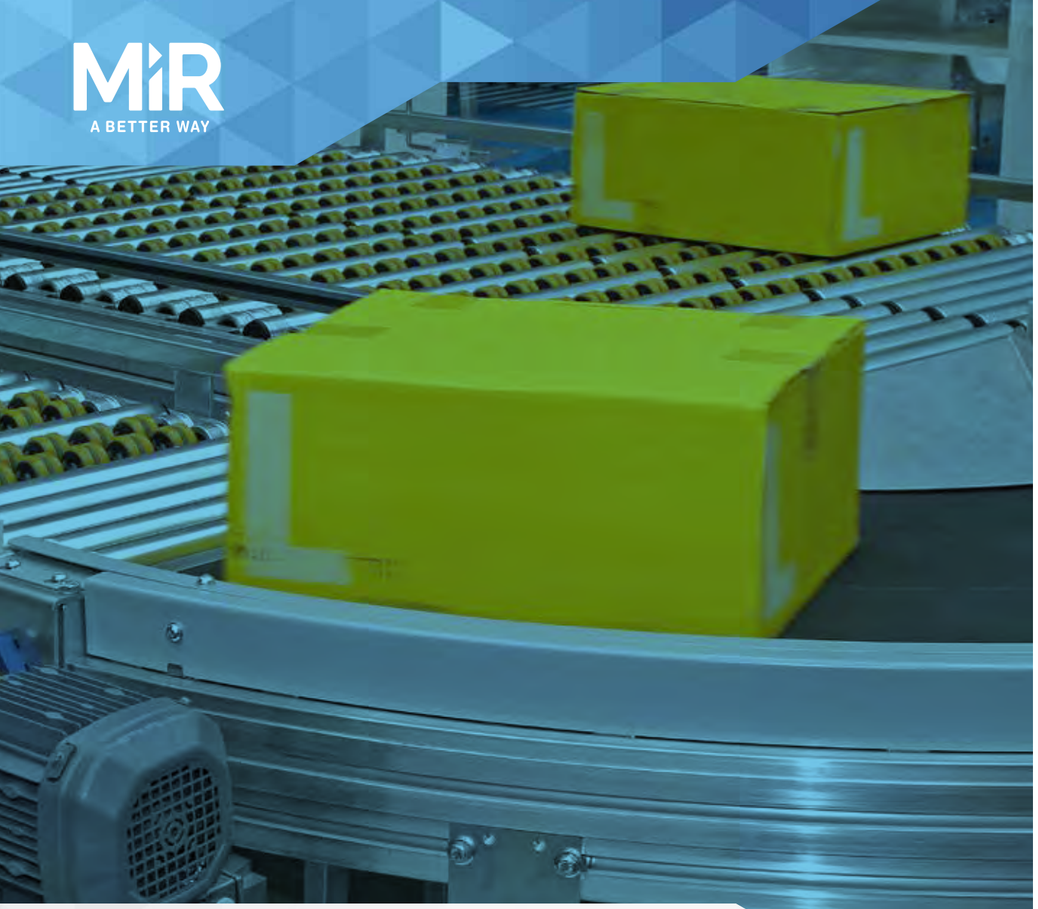
- ⛔ Depends on training and oversight of driver
- ⛔ Introduces hazards to other workers in busy areas

40% **of forklifts will be involved in accidents**

Example from the US:

61,800 non-serious accidents per year
34,900 accidents resulting in serious injury
85 fatal accidents per year

Source: OSHA



Conveyors

EFFICIENCY

- Cost-effective for short distances
- Can quickly handle high volume and high payloads
- Can block traffic flow of workers and other material transportation routes
- Maintenance and power costs add up

AGILITY

- Fixed travel paths aren't easily adaptable for changing requirements

SAFETY

- High speeds present safety hazards to workers

>40 workplace conveyor fatalities/year in US
>9,000 conveyor belt injuries

~25%

of all workers' compensation claims in US

Automated guided vehicles (AGVs)

EFFICIENCY

- ➕ Long, documented history
- ➕ Capable of fast throughput
- ➖ Can block traffic flow of workers and other material transportation routes
- ➖ Expensive infrastructure installation

AGILITY

- ➖ Dedicated routes require infrastructure changes to adapt to changing requirements
- ➖ Obstacles in dynamic environments can stop traffic flow until an operator solves the issue

SAFETY

- ➖ High speeds present safety hazards to workers

AGV Automated guided vehicles can't navigate around obstacles

Autonomous mobile robots (AMRs)

EFFICIENCY

- Long operational time with in-mission charging
- No operator required – keeps workers at stations
- Real-time fleet tracking, management, and programming
- Low operating and maintenance costs
- May require fixtures for pallets or conveyor interfaces
- Requires reliable WiFi connectivity

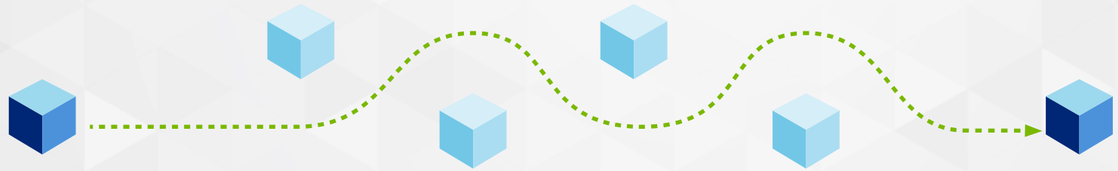
AGILITY

- Tight turning radius
- Navigates through dynamic environments
- Easily reprogrammed for changing needs and new processes
- Minimal infrastructure and floor space requirements

SAFETY

- Safely navigates around human workers, equipment, and goods
- Easily controlled access to robot movements, speed, and mission

AMR Autonomous mobil robots navigate through dynamic environments



Total cost of ownership (TCO) calculation

As you analyze your material transport options, you'll quickly discover that there is no one-size-fits-all answer. As with any equipment cost calculation, both initial and ongoing running costs must be included in your determination so you understand not just upfront but also long-term costs that will impact return on investment.

For each of these categories, there is a broad range of size, payload, speed, and other capabilities that impact costs, so calculations for different applications can vary dramatically. And each organization must decide the value of safety, agility and efficiency within their operations.

Here are some cost considerations to include in your own calculations:

	Manual Handling	Manned Forklifts	Static Conveyor	AGV	AMR
Initial Cost	• Hardware	• Hardware	• Hardware • Software • Solution Design & Engineering • Implementation • Testing • Training	• Hardware • Software • Solution Design & Engineering • Implementation • Testing • Training	• Hardware • Software • Solution Design • Implementation • Testing • Training
Running Cost	• Operational • Maintenance & Service • Training Refresher • Insurance	• Operational • Energy (Electricity or Fuel) • Maintenance & Service • Training Refresher • Insurance	• Operational • Energy (Electricity) • Maintenance & Service • Training Refresher • Insurance	• Operational • Energy (Electricity) • Maintenance & Service • Training Refresher • Insurance	• Operational • Energy (Electricity) • Maintenance & Service • Training Refresher • Insurance

Other considerations when calculating TCO

• Savings due to increased safety • Efficiency improvements with an agile solution • Increased uptime • Demand response

Compare Your Options

For many common material transport applications, AMRs will often be the safest, most flexible, and most cost-effective option. With autonomous navigation and intelligent fleet-management software, AMRs keep production flowing without taking skilled employees from their workstations to move material from one process to the next. And AMRs reduce dependency on low-skilled workers who do nothing but move parts, assemblies, and even trash all day long. This is a huge advantage during tight labor markets or in situations where it may be difficult to be fully staffed. It also drives efficiency as the robots stay focused on the job around the clock.

With a range of integrated safety mechanisms, AMRs are safer than forklifts or AGVs, especially in areas where workers are active such as on manufacturing floors or dynamic logistics centers. At the same time, AMRs are more flexible than conveyors or AGVs, allowing companies to adapt more quickly to changing demands and production processes.

Read on for specific examples >>>

Example:

Global Pharmaceuticals Manufacturer Saves 35 Worker Hours Per Week with Forklift-to-AMR Transition

The Chinese plant for Novo Nordisk, a leading global pharmaceuticals company, previously depended on manned forklifts to transport pallets of packaging materials to a series of high bay racks. Now, five MiR500 AMRs with integrated pallet lifters have improved warehouse logistics and competitiveness.

Zhao Xin, warehouse supervisor at Novo Nordisk's China plant, says, "Internal transportation is arguably the most tedious work in our Tianjin plant. The transportation route between the depot area and warehouse has a distance of 100 meters with three to four twists and turns. Also, the path has to go through some crowded areas inside the plant. Therefore, we have decided to use new technology in order to make a change."

In a typical working day, it took more than five hours for the forklifts to deliver materials, and more than eight hours in busy production times. Gao Yue, warehouse handler, says, "The MiR500 robots have saved us at least 35 man-hours a week for transporting materials. Workers can now focus on more important and high-value tasks in the warehouse."

Calculating TCO

Running costs of manned forklifts are relatively high, which typically leads to a lower TCO for AMRs, even in areas with low labor costs. Novo Nordisk uses the MiR500 robots to work daytime shifts. In this case, considering just running costs, it will take around three years for the TCO of the MiR500 robots to match that of one manned forklift. If the MiR robots ran around the clock at their full potential, however, the TCO would be much lower due to increased uptime. Because the robots also offer just-in-time deliveries compared to up to eight hours for manned forklift deliveries, the value of reduced storage space and increased efficiency should also be considered in overall TCO.

Calculating TCO

At Honeywell, four MiR100 robots replace the labor costs of six full-time employees, saving more than $300,000 USD per year in running costs. This pays off the initial investment of the MiR100 robots very quickly. Additional TCO considerations include the MiR100 robots' use between conveyors. The robots do work equivalent to a large conveyor, but with more flexibility than fixed conveyors that can't easily be rerouted as demands change. And while loading and unloading of the conveyors may be sporadic, so their full capacity isn't used, AMRs can handle different tasks throughout the facility when not needed at the conveyors. This adds benefits to be included in a TCO analysis.

Example:

Honeywell Automates Manual Material Handling Across Multi-Floor, 91,000 m² Facility for Efficiency and Agility

Honeywell Safety & Productivity Solutions in Poole, U.K. faced a challenge in automating transport of raw materials and assemblies of gas-detection products from its warehouse to manufacturing. The system needed to navigate from the warehouse on one floor to production across two floors, through narrow corridors, double fire doors and elevators, and needed to adapt to changing manufacturing lines to optimize productivity.

Design engineer Timothy Ward says, "The main challenge we want to overcome with the MiR robot is the staff, who are allocated to pushing carts. We wanted them to get back onto the production line and drive efficiency. By bringing the MiR robots on-site, we are freeing up six full-time staff members to produce more and make the line more efficient."

The MiR robots are integrated with a flexible conveyor top module, which enables changes in the facility without impacting internal logistics. Ward explains, "By putting the conveyor on the MiR, we gain the flexibility of being able to move anything where we want around the factory, which means with our LEAN principles we can tailor lines, we can move things. We don't have to have a conveyor running throughout the whole factory, which is very fixed and expensive to move. We just tell the MiR the new location. It just goes and automatically updates its mission to go to that position."

Honeywell typically looks for a return of investment in two years, which has been achieved by the MiR robots and integrated conveyor system. Honeywell has since implemented MiR robots at four other sites in the U.K.

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Let us help you weigh your options

As an industry leader in internal logistics, we can help you analyze your needs and calculate your specific total cost of ownership with our proprietary tool.

Get your ROI calculation

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ROI Calculator **www.rg-group.com** | 1-800-340-0854