ROBOTS IN THE WAREHOUSE

– WHAT DOES IT MEAN FOR YOUR WMS?

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INTRODUCTION

Smart robots are appearing everywhere, from autonomous vacuum cleaners to delivery drones and self-driving vehicles. The technology is also used extensively in warehouse operations, where robot-based solutions such as AutoStore have had huge successes lately, also in combination with more basic WMS or ERP systems. In this article we take it one step further to look at how to leverage intelligent automation by really integrating the processes with a more capable WMS. This will allow for a scalable way to manage the workload with clear and concise collaboration and areas of responsibility.

If you run a warehouse operation with more than 50 users, you are likely considering which type of warehouse automation that is the right choice for your business. We will dive into some of these options below. It is however not only a matter of which type of automation solution to select; the focus for this article is to point out how important your WMS is for enabling the best interaction across automated and user-operated processes. Let's have a look at how ➡
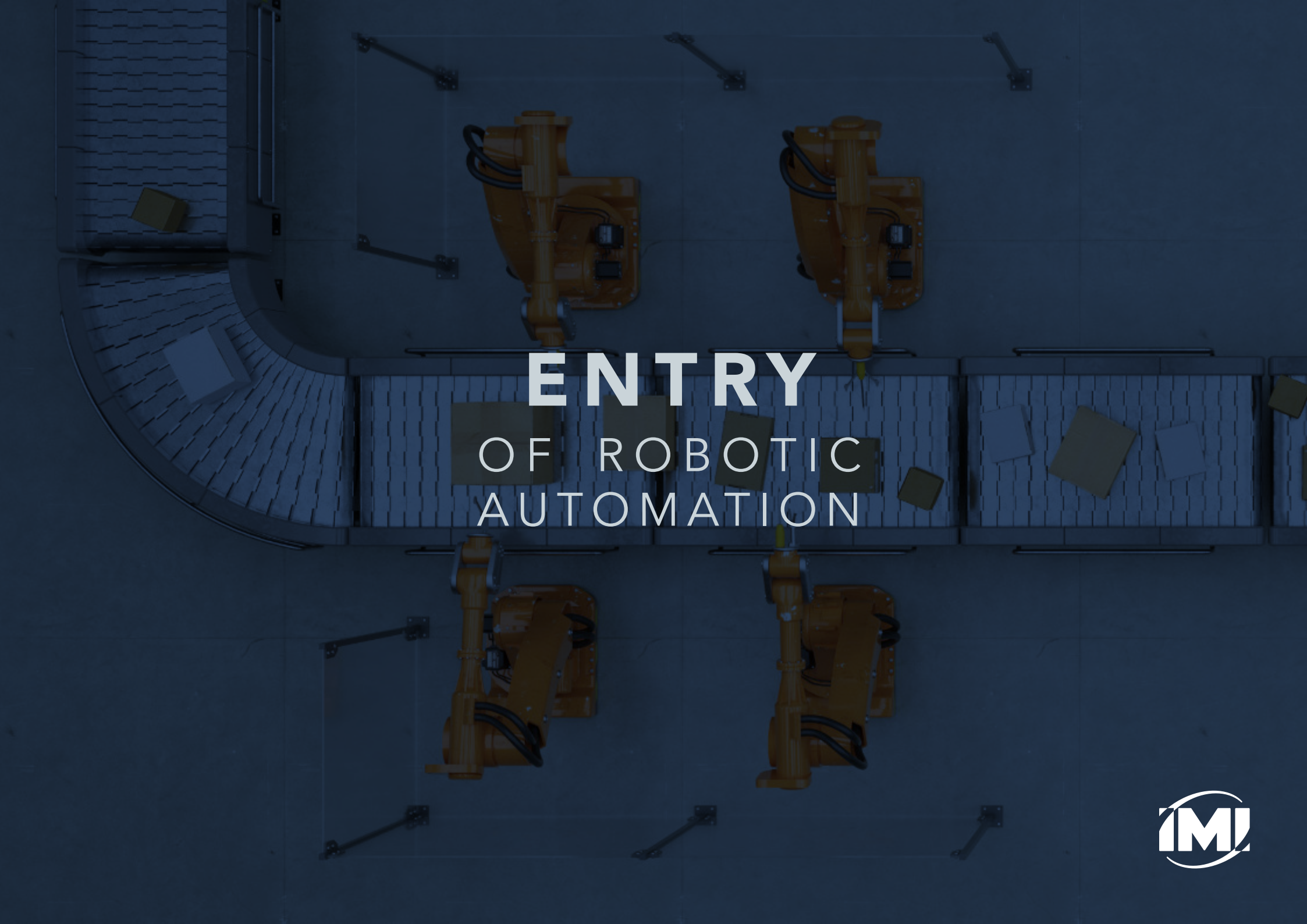
CONVENTIONAL AUTOMATION SYSTEMS

Traditional material handling automation (MHA) is an automated infrastructure based on electromechanics like storage systems, conveyors, sorters etc.

At IMI, we have integrated our WMS to these types of warehouse automation solutions for many years, successfully helping our customers automate entire warehouse areas or sub-processes. The WMS interacts with the MHA via its warehouse control system (WCS) at defined handover points. MHA projects have often been of type 'engineer to order' and tailored to suit the specific assortment and warehouse layout. The downside of this approach is that it requires a lot of upfront investment in physical infrastructure and control systems. Therefore, these types of systems have mostly been embraced only by the largest warehouses. Unfortunately, it is often difficult to make process changes afterwards and they are (often) regarded as not only expensive but also inflexible.
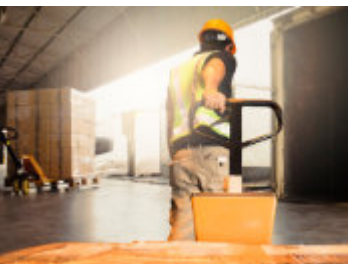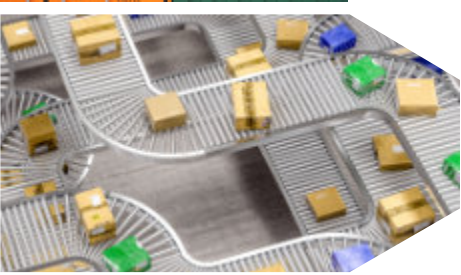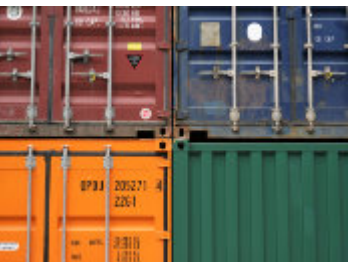
ENTRY
OF ROBOTIC AUTOMATION

ROBOTS IN THE WAREHOUSE

The traditional MHA systems are now being combined with, or even replaced by, smart robots that can be more flexible and dynamic in their behavior. How? As they use cameras and sensors combined with artificial intelligence (AI) they can be made aware of the infrastructure and surrounding events to act and respond in a human-like fashion. This enables them to work autonomously or in collaboration with other robots or human staff. Gartner talks about this as Intralogistics Smart Robotics and predicts that 75% of product-centric larger enterprises will adopt robotic automation in 3 to 5 years[1], and in the hype-cycle analysis of innovative supply chain execution technologies[2], one third of the emerging technologies are directly related to intra-logistics robotics and/or coordination of work across people-directed and automated activities.

It is also promising from a cost/investment perspective, with lower entry price and a more modular approach. You can start small and grow the usage incrementally by adding more robots to increase capacity.

[1] Dwight Klappich, Gartner Group: "Market Guide for Intralogistics Smart Robotics", 18 April 2022 (the article includes a great walkthrough and recommendations regarding different types of smart robot applications).

[2] Dwight Klappich, Gartner Group: "Hype Cycle for Supply Chain Execution Technologies, 2022", 27 June 2022.

A SHIFT IN FOCUS

An interesting observation is that many companies state a shift in focus regarding the automation decisions, from pure labor cost reduction towards using automation for

1 increasing capacity and

2 to mitigate shortage in available labor.

At the same time, manual workforce is often used/required for managing parts of the assortment that are unsuitable for automation and for managing peak demand. It implies new needs to balance and coordinate the workload across automation and manual workforce.

AUTOMATION OPTIONS
FOR NEW OPPORTUNITIES

AUTOMATION OPTIONS

So, what do these new opportunities mean to your warehouse operation, and what is required for successfully integrating (a mix of) smart robotics and conventional MHA with your WMS?

Some examples of conventional automation solutions and their corresponding newer robotic solutions are:

| TYPE OF AUTOMATION	CONVENTIONAL	ROBOTICS
Internal transportation	Automated Guided Vehicle (AGV) systems with fixed routes (pallets). Conveyers and sorters with fixed installation (smaller goods).	Autonomous mobile robots (AMR) with more flexibility, moving like normal lift trucks (pallets) or carts (smaller goods) within a warehouse area.
Picking automation	Picking machines that drop products in totes on a passing conveyor.	Intelligent robot with arm/grip/vision capabilities, fixed or movable.
Automated storage and picking solutions (goods-to-man or goods-to-robot)	Automated storage and retrieval systems (AS/RS) like high bay storage or vertical lifts that deliver load carriers to pick stations.	Engineered robotics systems with robots working within a 'grid' bringing storage shelves, bins, or totes to pick stations.

FENCES AND OPENINGS

When the automation solution is serving a 'fenced' warehouse area or defined movement routes, it is normally integrated with your WMS via the automation vendor's WCS, which is normally best at optimizing the automation system's movements and performance. An important difference with smart robots is that it opens for mixing robots and human workers in the same areas. Then the WMS will need to coordinate the timing and interplay between robot 'users' and human users and interact with the robots directly via the Robots' Control System: See below for a simplified view on how the different systems usually interact[3].

(Note: the TMS box is there to represent the external logistics aspects of timing and capacity, which is coordinated with the intra-logistics activities via the WMS – e g shipping container consolidation and load planning/sequencing.)
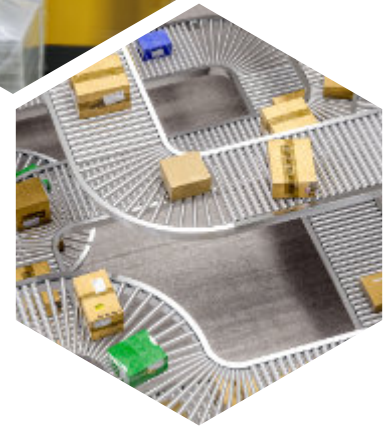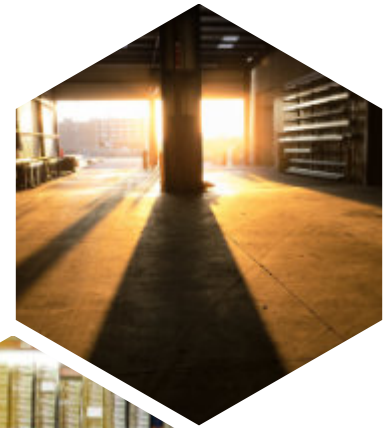
[3] For a more complete picture of different integration options, see Simon Tunstall & Dwight Klappich, Gartner Group: "Select From the 8 Software Deployment Options to Support Warehouse Automation and Robotics", 17 May 2019.

SYSTEMS INTERACTION

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┌──────────────────────────────────────────────────────────────┐
│                         ERP/OMS                              │
└──────────────────────────────────────────────────────────────┘

┌──────────────────────────┐    ┌──────────────────────────┐
│           WMS            │◄──►│           TMS            │
└──────────────────────────┘    └──────────────────────────┘

              ┌──────────────────────────────────────┐
              │                 WCS                  │
              └──────────────────────────────────────┘
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Human operators	Robot Control System	Material Flow Control/PLC	Combination of Lower-Level Controls
Human operators	Autonomous robots/cobots	Automated sub-processes	Automated areas (storage + picking)
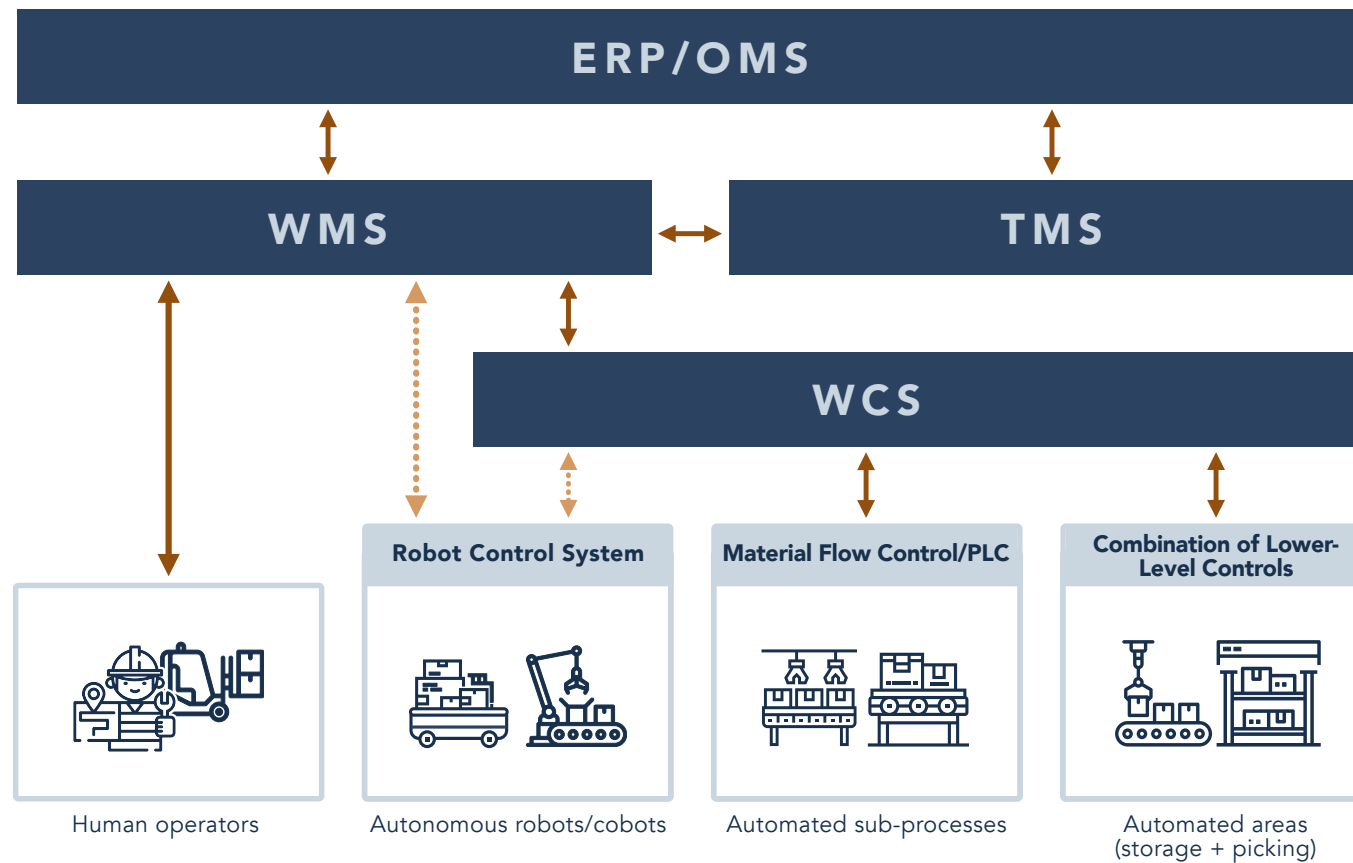
WHAT TO CONSIDER
IN DIFFERENT PROCESSES?

# CONSIDERATIONS FOR INTEGRATION

Let's look at some important aspects for integrating the automation technologies that currently have the broadest usage; internal transportation for specific task types, and automated storage/picking for entire warehouse areas.

(Picking automation is more specifically tied to certain types of products but more general robotized solutions are under fast development.)
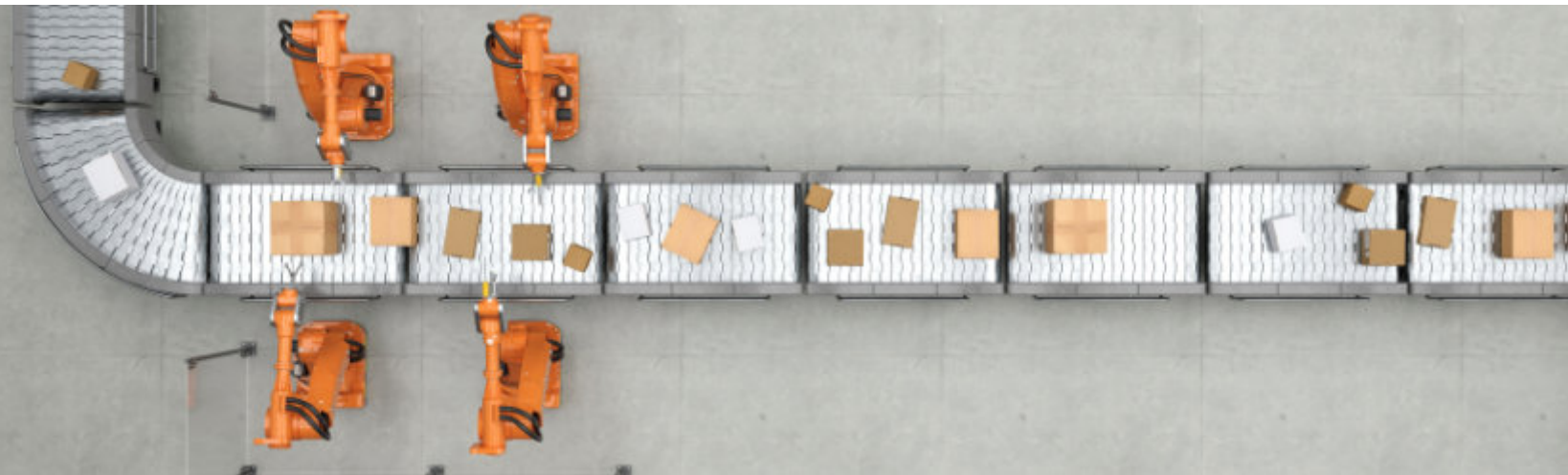
INTERNAL TRANSPORTATION

AGVs or AMRs can effectively be used for moving goods between different areas, e g from receiving to storage or from picking area to shipping. This is a great area to remove simple tasks that are consuming a lot of time, especially in larger warehouses with long distances between areas. The new benefit with AMRs is their movement flexibility plus they can work alongside manually driven vehicles. It makes it possible to ramp up gradually or to complement with manual capacity at peak.

Some of our customers have also started to use AMR reach trucks, with ability to perform pickup and delivery also in higher pallet racking.

For smaller goods (not stacked on pallets), new AMR carts can be used for bringing load carriers to and from pickers, adding new flexibility compared to conventional conveyors that require fixed installations and are more difficult to manage from a sequencing standpoint. The carts will receive instructions to bring empty totes (or similar) to a first pick zone, carry on to following zones using a pick-and-pass approach, and eventually deliver the completed tote to a pack station or shipping location.

REQUIREMENTS FOR YOUR WMS

Here are some things to look for in your WMS to support:

- Ability to configure movement routes between areas (and specific locations).
- Ability to define segments within movement routes to combine manual handling with automated transports, using different equipment and defined handover locations for pickup and delivery/drop.

> *A movement route might for instance consist of three segments:*
> **1** *Pick up in receiving and put on a handover location,*
> **2** *Automated transportation via AGV or AMR to a storage area*
> **3** *Manual putaway in a narrow aisle.*

- Generate and control movement orders that can be broken down into tasks per segment for coordinated dispatch to different types of users (human or robots). It requires knowledge about equipment characteristics like speed, capacity and accessibility.
- APIs for sending tasks and receiving updates from WCS (or robotic systems)

AUTOMATED STORAGE AND PICKING

Conventional automation has long existed for high-bay pallet storage and retrieval systems.

For these it is important to have good a model in the WMS for handover locations, so that goods can be buffered in front of and after the AS/RS, for ease of access and flexibility for cranes or VNA trucks.

Similar solutions for 'mini-loads' often have integrated pick stations with pick-to-light signaling where the responsibility for pick load carrier build algorithms and pick sequencing can belong in the automation system or in the WMS.

SOLUTIONS FOR E-COMMERCE

For solutions in (e g) e-commerce or parts operations where products are picked in eaches (consumer units) rather than boxes, systems like AutoStore (with products stored in bins in a grid) or CarryPick or Geek+ (with products stored in movable shelves) have gained a lot of success.

We have several implementations of these with our customers, and they usually prefer to get batches of pick orders and a longer time window for fulfilling them.

Why? It is because the internal lead time for organizing the bins/shelves in the right pick sequence for the pick stations is quite long.

BENEFITS OF FLEXIBILITY

If all products are put into the automation system, there are limited requirements on the WMS.
It is important to have solid integration points regarding replenishment of products into the system, and for passing the right selection of pick orders.

However, if you need some flexibility to manage peaks and to pick parts of the assortment manually, you can benefit a lot from:

- Ability to quickly set up multiple pick locations for the same products in different areas, and during peaks pick some orders in automation and some outside automation.

- Differentiate in which unit of measure different orders are picked.

- Define pick-and-pass sequences where the same order can be started in the automation system and then passed on to manual pickers for completion.

CONCLUSION

– WHY A CAPABLE WMS
MAKES THE DIFFERENCE

WHY A CAPABLE WMS MAKES THE DIFFERENCE

Some of our customers have implemented 'fully automated warehouses', which means that most (but usually not all) of the assortment can be handled using automated storage and picking systems.

You will however need a capable WMS even in those cases to deliver the mechanisms to integrate your selected automation solution(s) into the operation, and to provide the right level of flexibility.

With a configurable WMS you will be able to gradually expand your usage of automation and robotics in your operations by:

- Soft configuration of where automation equipment is used – movement routes, areas, pick zones etc.

- API-based integrations with the ability to interact with different types of automation systems on the appropriate level.

- Coordination of dependencies, timing constraints and pick sequences across both automated and manual processes.

- Managing of the workload across assortments, warehouse areas and zones with regards to capacity and throughput.

In a rapidly changing world, make sure you have a WMS capable of the kind of flexibility needed to give your company the best conditions to adapt to new conditions, so that you can focus on what makes you great. We are dedicated to making businesses run smoothly.