A SMART APPROACH TO WAREHOUSE AUTOMATION
Are you looking to automate your warehouse operation? In this white paper, we will identify some key success factors to best leverage your combination of Warehouse Management System (WMS) and Material Handling Equipment (MHE). Due to the large risk and investment involved in a full-blown automation project, it is often better to automate selectively using a phased approach, and focus on the parts that are underperforming.
AUTOMATION VS FLEXIBILITY

Let’s start with the contradicting terms of automation and flexibility. As a warehouse management professional you would often equal automation with a complex MHE system including conveyors, sorters, high-bay storage cranes etc. Most of us looking for such solutions think of it as a black box, a closed system supplied by an automation vendor to meet strictly defined input/output requirements.

A ONE SYSTEM approach for automation works fine when you operate in a stable environment. That means not too much change in product assortment, order patterns or distribution channels. Or when you can afford the luxury of significantly over-dimensioning your system and facility. Under such conditions you can go ahead and create a business case based on the key factors of volumes (peak and average), utilisation (the system must at least be in use x hours on average), and labour cost level. So if you think your operation will stay as is, change marginally, or you enjoy the luxury of infinite capacity, you can stop reading here.

But what if you need to deal with change? Well, yes, who doesn’t? The last couple of years have clearly put our ability to change and adapt into focus. It is therefore wise to adopt this broader definition: Automation is any measure you implement to make your operation perform smarter and produce more with less people. It means getting access to and making use of the right information to eliminate unnecessary and/or manual process steps. Adding MHE systems is one option, but there are certainly others. The key consideration is how FLEXIBLE you want to be in coping with changing conditions.

It requires a design where automation can be included to improve specific tasks or sub-processes, allowing you to expand and automate entire parts of the operation.
LOOK AT THE ENTIRE PROCESS

Forward looking warehouse operations design their production solutions to support changing patterns in demand and market focus. A couple of our clients have recently shifted to a model where movements and picking are supported by different automation technologies, but where the overall supply chain strategy and coordination emphasise the ability to quickly shift which product goes via which warehouse channel.

One key principle is that you should NOT build your operational processes around your automated MHE systems, but instead take a PROCESS APPROACH and look at the automated processes as a way to address certain parts of the operation. It is dangerous to have a portion of the solution mandating/limiting the overall solution. In a warehouse context we need the support of a warehouse management system that can tie in larger and smaller MHE components when needed, and to coordinate that with mobile scanners and voice users and even manual processing. And – maybe most importantly – make them interchangeable!

The characteristics of the WMS has a key impact for the process approach. A proper WMS, designed for high productivity, automates the operation by creating tasks which are automatically pushed to workers and automation sub-systems whenever there is something to do. It minimises idle time and gives the worker a clear picture of what to do, which calls for fewer manual operations and reduced worker expertise. A best-of-breed WMS drives the operation and gives supervisors and managers a real time overview of labour and capacity across manual and automated processes.

This means we achieve higher flexibility at a given automation level:
DIFFERENT PROBLEMS REQUIRE DIFFERENT SOLUTIONS

Products will naturally fall into a couple of typical categories, with regards to how they benefit from automation:

- Products picked in smaller quantities and with relatively low pick frequency that go into high-bay storage via pallet cranes or mini-load systems. Picking from goods-to-man pick stations instead of traveling long distances makes a great investment case.
- Nicely shaped products picked in small quantities but with high frequency will naturally go into picking machines. The sheer speed of the equipment can increase throughput and reduce labour needs many times over.
- Bulkier products and products picked in larger quantities typically use semi-automated solutions like voice interaction, scanners etc, but in combination with internal transport (conveyors, auto-guided vehicles). Some manual control and handling allows for greater flexibility.

If we need to do merge-in-transit down the chain, any of these are candidates for being cross-docked and sorted by destination without put-away and picking.

If we apply this on grocery distribution it might look like this:

Regional DC: Medium SKU range, large orders

Automating inbound logistics for fast movers

Central Warehouse: Tobacco - very low SKU range

Automating the picking process

Central Warehouse: Dry goods - high SKU range, small orders

Automating internal transport

We need to categorise the automation solution based on which scenario we want to automate. This means we apply a best-of-breed approach also when selecting the WCS (Warehouse Control System) and MHE solution.
ENABLING CHANGE
Successful automation projects take a very holistic approach to allow for categorisation as discussed above, as well as to provide the flexibility needed for an ever-changing supply chain operation. A site might start as an entirely manual operation, upgrade to include mobile solutions and scanners, extend with voice interactions, and then gradually adopt MHE systems based on product category and/or turnover profiles. This can only happen if you combine these into a solution that allows implementation and change in a phased approach – by site, area or zone – with no (or little) change to the software.

It requires WMS support for flexible definition of warehouse profiles like layout, picking strategies, and the equipment used. It also requires standard interfaces to one or more Warehouse Control Systems (WCS) so that MHE like mini-loads, conveyors, sorters and robots can be staged to perform optimally and be seamlessly incorporated into the operation.
THE WAREHOUSE CONDUCTOR

If you want to get the most out of your pool of forklift truck drivers, pickers AND material handling equipment, a proper WMS is essential to help you prioritise and balance resources.

Look at the WMS as the conductor of the orchestra. The conductor keeps everything in sync and can adapt the pace and intensity to the dynamics of performing teams, individuals and instruments. But the more automation (sequencers, pre-programmed loops etc) you add, the more the conductor gets tied to a pre-defined – and flat – performance.

When you have automated the entire set, you won’t need the conductor, right? Well, it could be true provided you don’t need to deal with dynamics or change.

The reality is maybe more that you spend your nights twisting and turning worrying about how your operation is doing to keep up with variances and new patterns, and wind up sleepless thinking of it as an endless game where you struggle to be organised enough to defeat the “opposing” and irrational side (here: the erratic customers with their volatile demand).

One of the most challenging parts of increasing automation is the planning and coordination of the various timeframes on the outbound side. It is easy to end up in a situation where the outbound areas become over-crowded if the conductor (WMS) is unable to synchronise and coordinate the speed of the automated and manual processes.

Does this mean that we should give up the dream about the perfect supply chain where processes are automated and integrate seamlessly to link demand with matching supply? Certainly not, if you don’t dream about achieving “the unattended supply chain” you should probably change position.

Now, let’s consider some fundamentals in getting closer to achieving more automated processes without compromising the ability to change.
DATA QUALITY

With a vision of highly automated warehouse processes, we want to receive products by identifying what is coming, match that with business rules, and make an (automatic) decision about how to handle it, where to put it, and if it needs to go through QA (Quality Assurance).

Basically you want as much information as possible to be known upfront – dimensions, packaging, origin, identifiers, descriptions, classifications etc. Provided that you can handle the data and make it available, it can trigger your defined business rules and direct available resources, pending orders and task priorities. You need the WMS to interpret the data to trigger rules-based decisions regarding channel and process flow. As you have seen, warehouse automation with a Warehouse Control System (WCS) alone will not do the trick. But the more qualified data you collect, the better you will do in creating the ‘unattended’ flow, and the more automated MHE you can use.

If you want to sleep better, then work with your customers and suppliers to get the basic information right. The less handling and checks you want to perform in the warehouse, the better and richer data you will need. For example, to automate a cross-dock channel, you need specific item-level information like:

- Have we verified that we have all required product information so that we can cross-dock?
- Do we know the next destination for the package – if not, how do we get it?
- Are the specific contents in a package allocated to a specific customer order?
- Are there multiple products in a box/on a pallet that can be cross-docked together?
- Do we have a ‘bill of materials’ for each package that uniquely identifies the contents?

There is no shortcut. You need the systems to capture, carry and pass on ‘live’ information about your products, orders and shipments. Without the right data (and ability to make use of it) you’re back in that eternal game, wondering which side will win today!
MODULAR AUTOMATION PROCESSES AND INTEGRATIONS

A key requirement is to enable a seamless interaction between your WMS and the WCS controlling the automated equipment. Clear separation of responsibilities is essential, and some principles to a sound approach are expressed in this table:

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<th>WAREHOUSE MANAGEMENT SYSTEM</th>
<th>WAREHOUSE CONTROL SYSTEM</th>
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<td>• Manages the overarching order fulfillment activities and breaks orders down into tasks to be performed.</td>
<td>• Controls and optimises its subsystem (conveyor, sorter, picking machine, or a more complete storage and retrieval system like a mini load or pallet racking with cranes).</td>
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<td>• Passes tasks to the WCS and receives progress updates and confirmations.</td>
<td>• Executes tasks per instruction from WMS.</td>
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<td>• Predicts and calculates the movement patterns of any manual task, and also estimates time-to-completion for automated processes.</td>
<td>• Performs slotting activities to reorganise and optimise product placement when equipment is idling.</td>
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<tr>
<td>• Tracks task confirmations and progress.</td>
<td>• Owns the definitions of equipment and locations used in the subsystem it controls, making it a ‘black box’ from the WMS perspective.</td>
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This means each process needs to be defined with requests and expected responses (confirmed moves, pallet now available in pick-up location, etc), and you need to ensure that your WMS can be configured to dispatch the right task messages and receive matching confirmation messages.

Similar to when dispatching individual movement tasks to users, the WMS should dispatch requests to the WCS such as: put away this pallet, retrieve x pieces of this product for picking. The requests can be for single step processing (move pallet with ID XYZ from A to B) or for more complex operations (sending off a batch of cartons for cross-docking and invoking WCS to identify, measure and weigh cartons, sort and label them by destination and confirm the final location and sequence as completed). How the task is performed should be left to the WCS, e.g. ‘which location to put away to’ or ‘which product location to retrieve items from’.

The integration also needs to be fault-tolerant so that deviations can be received and processed if/when required.

Using this principle with a strong separation of concern facilitates testing as the ‘other side’ (WMS and WCS respectively) can be replicated using simulated responses and scenarios. This minimises risk and helps point out potential bottlenecks before committing to the detailed design of the automated process.

It is key that the solution can accommodate flexible physical touch points between ‘manual’ and ‘automated’ process steps, e.g. using alternative drop locations when handing over pallets or totes from a forklift to a conveyor or crane system. This needs to be configurable in the WMS to reflect the way the automation equipment works.
BOTTOM LINE

With the flexibility of today’s automation equipment within integrated warehouse control systems (WCS) we can adjust and fine-tune automation to meet variations in volume and also to some extent in demand. But you need the WMS to provide flexibility in combining full and partial automation with semi-automated and even manual process steps.

Even more important: The WMS helps you manage the dynamics of change, in sites and distribution channels, in product assortments and in interaction with transportation. So make sure you have the right ‘hooks’ in your WMS to plug in one or multiple WCS.

ABOUT IMI

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