

Organizations rely heavily on their warehouses to support their inventory management and order fulfillment processes. The modern warehouse demands automation that optimally integrates data, process, and technology.

On the Road to Maturity: A Guide to Automating the Warehouse

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Written by: Jordan K. Speer, Research Manager, Global Supply Chain

Introduction

Recent years have witnessed the swift evolution of consumer behavior, bringing changes that have injected significant complexity across the supply chain for retailers, manufacturers, wholesalers, distributors, and 3PLs. In many cases, the warehouse bears the brunt of the disruption and the urgency to quickly adapt.

These changes, driven by omni-channel commerce and fulfillment, personalization, and globalization, have created complexity in a multitude of ways, such as by adding greater numbers of SKUs to the supply chain, but in smaller production batches; by requiring the picking and shipping of individual orders for consumers versus bulk orders for retailers; and by simply increasing the daily throughput required. Warehouse operations become even more complex when the exponential growth of data that more detailed processes and products generate is added to the mix.

Each of these changes adds complexity to the warehouse. Consider that SKU counts have increased by the thousands, or tens of thousands. That SKU proliferation requires increased floor space for storage, more front-facing capability for picking, and a larger footprint for inspections, packaging, and shipping.

These changes also require more labor. Rising ecommerce orders plus increased SKUs require increased picking of individual items, increased time walking around the warehouse, and more time spent packaging and shipping; the result is an overall decrease in output per person. Greater complexity also produces more data that is crucial to effective operations, but only when it can be analyzed effectively for intelligence that leads to smart decisions.

This increased complexity also adds to the likelihood of human error, whether in activities such as analyzing data, inspecting goods, or picking, packing, and shipping. For example, consider how much more likely it is that the incorrect unit will be picked when there are 25 scents of the same brand's deodorant versus just five. Consider the difficulty of determining manually which orders take priority and how these decisions would shift against a backdrop of variable SLAs and unplanned disruptions such as delayed trucks or warehouse workers who fall ill.

AT A GLANCE

KEY TAKEAWAYS

With interconnected and automated technology and processes, data can be connected from system to system, enabling a unified view of orders and inventory, as well as people and assets, and the ability to optimize their flow through the warehouse.

Businesses with modern, integrated technology and a digital-first mentality are much better prepared to quickly assess and respond to challenges; they are more resilient.

KEY STATS

According to IDC research:

- » 39.6% of organizations identified the warehouse as a top focus for achieving supply chain visibility.
- » 53.8% of organizations identified flexible inventory as a top area of focus for agility.
- » 27.5% of organizations identified warehouse management as one of their top 3 areas of investment priority.

Those are just a few examples that demonstrate the drawbacks of manual or siloed operations and why there is a need for automating warehouse processes, technology, and data. *Crucially, however, automation is not a one-size-fits-all solution, nor does it come from flipping a switch.* While we can say that warehouses as a group are facing increased complexity, the particular needs of each when it comes to automation are vastly different, both in terms of the specific warehouse operations that would benefit from automation and in terms of the start point and pace of change; the latter two are also impacted by company culture, budget, and resources as well as the appetite among management for tackling these projects and the ability to develop a sound strategy around them.

Technology and automation can help organizations deal with the impact of increased complexity in the warehouse. However, understanding where and how to begin relative to your organization's particular needs, and how to move through appropriate stages to achieve higher levels of automation where it makes sense and is achievable, is crucial to success.

Why Now?

Automating the warehouse is not a new idea, and today there are many organizations whose highly sophisticated warehouse operations demonstrate the value that technology and automation offer in terms of scalability, efficiency, and speed. However, many organizations that have taken steps toward automation have not committed to the follow-through necessary to reap the full value of it, and others are still rooted in manual operations, old processes, and legacy software. While automation at times has failed to take root, it's unlikely that the recent rise in interest in warehouse automation will fizzle out as it previously has. Indeed, 27.5% of organizations in IDC's December 2020 *Supply Chain Survey* identified warehouse management as one of their top 3 areas of investment priority. The two fundamental drivers likely to provide momentum to these efforts are as follows:

1. Consumer demand and customer demand have fundamentally shifted; consumer desire for instant gratification puts pressure on supply chains to deliver faster and further than ever before.
2. The technology to manage complexity and allow for agility has advanced far beyond what was previously available. These advancements include:
 - **Artificial intelligence/machine learning (AI/ML).** Via data from sensors, RFID technology, and other sources, AI and ML enable improved decision making around areas such as route picking optimization, inventory positioning, and order flow.
 - **Robotics.** Automated guided vehicles (AGVs) and an even newer group of modern, intelligent robotics including autonomous mobile robots (AMRs) and robotic arms are transforming the warehouse with their ability to navigate flexibly, to "see" paths and objects around them, and to work collaboratively in tandem with humans in ways that incorporate the strengths of each and minimize ambulatory-heavy and repetitive tasks for people.
 - **Automation.** Intelligent sortation and conveyor systems and other materials handling equipment enable product to flow through the warehouse, to be aggregated, and to move to the "right" locations, minimizing human retrieval and sorting. Software, integrated with other software and with other technology and equipment, permits the orchestration of all parts and pieces in a balletic sequence that optimizes for the whole.

- **APIs.** Operations can be streamlined via APIs that provide real-time transfer of data with any API-enabled internal or external system, enabling warehouses to easily maintain SKU consistency, sync inventory, shop parcel rates, manage financials, track sales and purchase orders, and customize reporting.
- **Microservices.** Enabled by APIs, microservices allow the warehouse to deploy services independently around business capabilities, enabling agility, efficiency, and cost savings. For example, microservices are an efficient way to interface with a mix of humans using RF, voice, or vision picking systems alongside AMRs doing similar tasks.
- **Data as an asset.** With real-time data capture that is automated and integrated across the end-to-end supply chain and overlaid with an AI or ML engine, data shifts from being unwieldy and a potential source of error to being a strategic competitive advantage that enables warehouses to respond to conditions as well as help direct activity from the start of a product life cycle.

What Does the Data Say?

Today's warehouses ultimately require visibility and integration among the data, processes, and technology therein. In IDC's December 2020 *Supply Chain Survey*, 39.6% of respondents identified the warehouse as a top focus for achieving supply chain visibility, and 53.8% of respondents identified flexible inventory as a top area of focus for agility. In thinking about maturing a warehouse's operations, an organization should consider the role of technology in terms of more immediate short-term needs ("survival" mode) and longer-term needs ("thrive" mode).

For example, actions that companies can take in the near term include broader adoption of SaaS and cloud-enabled warehouse management software (WMS). In a recent IDC *COVID-19 Impact on IT Spending Survey*, 32.5% of respondents said that they have moved WMS to the cloud within the past 12 months, and 18.2% said they intend to do so within the next 24 months. Other actions might include the adoption of tools to streamline particular operations or enable better decision making in one area. This might look like the installation of a basic robotic arm to handle a commonly occurring repetitive operation or software that automatically selects a box that is the right size for an order based on factors such as weight, dimensionality, and the amount of protective packaging required.

Challenges on the Maturity Curve to Warehouse Automation

The evolution toward an autonomous warehouse requires a knitting together of data, processes, and technology. The term "warehouse automation" is broad. It belies the complexities of the connections between materials handling equipment, robotics, voice and vision technologies, software, hardware, the data flowing within, the multiple and changing workflows, and the human understanding and activities that go into evolving a warehouse to a more autonomous state that allows a business to move product and people optimally and profitably.

Warehouse automation is not a one-size-fits-all type of solution. To achieve the appropriate level of automation and digital transformation, an organization must consider a wide variety of inputs:

- » **The desired/appropriate blend of humans and automation.** The "right" blend enables a worker-centric focus that uses robotics, voice- and vision-based technologies, and so forth, to at times enhance human capabilities and at others completely manage tasks for them.

- » **The type of product being warehoused and moved.** Products have many variables, including weight, size, "graspability," and number of SKUs. In addition, products can be parts or finished products, and differences among some products can't be distinguished with the naked eye. These all factor into an individual organization's needs in terms of warehouse layout, vertical versus horizontal space, robotic type and usage, software requirements, and so forth.
- » **The type of equipment best suited to handle and store products.** The appropriate use of specific equipment is determined by type of product, whether serving ecommerce or wholesale orders. Business suits require garment on hanger (GOH) materials handling equipment. This will not work for a toaster.
- » **The number and type of trailers in and out of the loading bays.** A drop-and-hook business model, for example, whereby truckers unhook or hook up trailers and leave, can put more strain on the warehouse to load and unload trailers, which will require either more lumpers and/or more automated equipment, ranging from robotics that can remove products from trucks to forklifts that can move products out of the receiving area to where they need to go.
- » **The number of dock doors.** If dock doors are limited, an organization might want to consider investing in robotics and automation at those locations to speed product off of trucks and through receiving so that those areas do not create bottlenecks.
- » **The height versus breadth of warehouse footprint.** Warehouses in Europe tend to be tall and narrow to accommodate the smaller available parcels of real estate, whereas warehouses in the United States, if they are outside of highly urban areas, tend to be short and sprawling due to plentiful land.
- » **Greenfield versus brownfield builds.** The processes employed in a warehouse as well as the distances that must be traversed will largely be determined by the type and size of warehouse footprint, as well as the type, size, and amount of variety of products moving through it; conversely, these factors may determine the type of facility built or leased, when that is an option.
- » **The availability and skill level of labor.** Moving inventory requires labor. As automation increases, the number of humans needed is reduced, but the level of skill needed is greater. Even with automation, labor can be difficult to find and harder to retain, with great variation depending on the particular geography and demographics at hand.
- » **Budget and appetite for change and management commitment to automation.** Whether warehouse automation or any other technology project, success is almost impossible without support from management not only in terms of providing resources and encouragement but also in terms of committing to the project 100% and requiring all employees to make necessary shifts.
- » **The ability and resources to develop a sound strategy for initiating and evolving automation in the warehouse.** Every warehouse setup is different and requires a road map that makes sense for the type of product and business model it serves.

Warehouse Automation Is Not One Size Fits All

The previously mentioned factors and others weigh heavily in the practical considerations of modernizing a warehouse. Beyond these specific considerations is the importance of developing a sound strategy to lay out appropriate steps for aligning processes and technology to optimize for desired business outcomes. Indeed, according to an IDC survey, the top 2 hurdles to deriving business value from an organization's digital transformation (DX) projects are that management and leadership orientation are mostly focused on processes and not on business outcomes and the metrics or KPIs an organization uses don't allow it to quantify business value adequately.

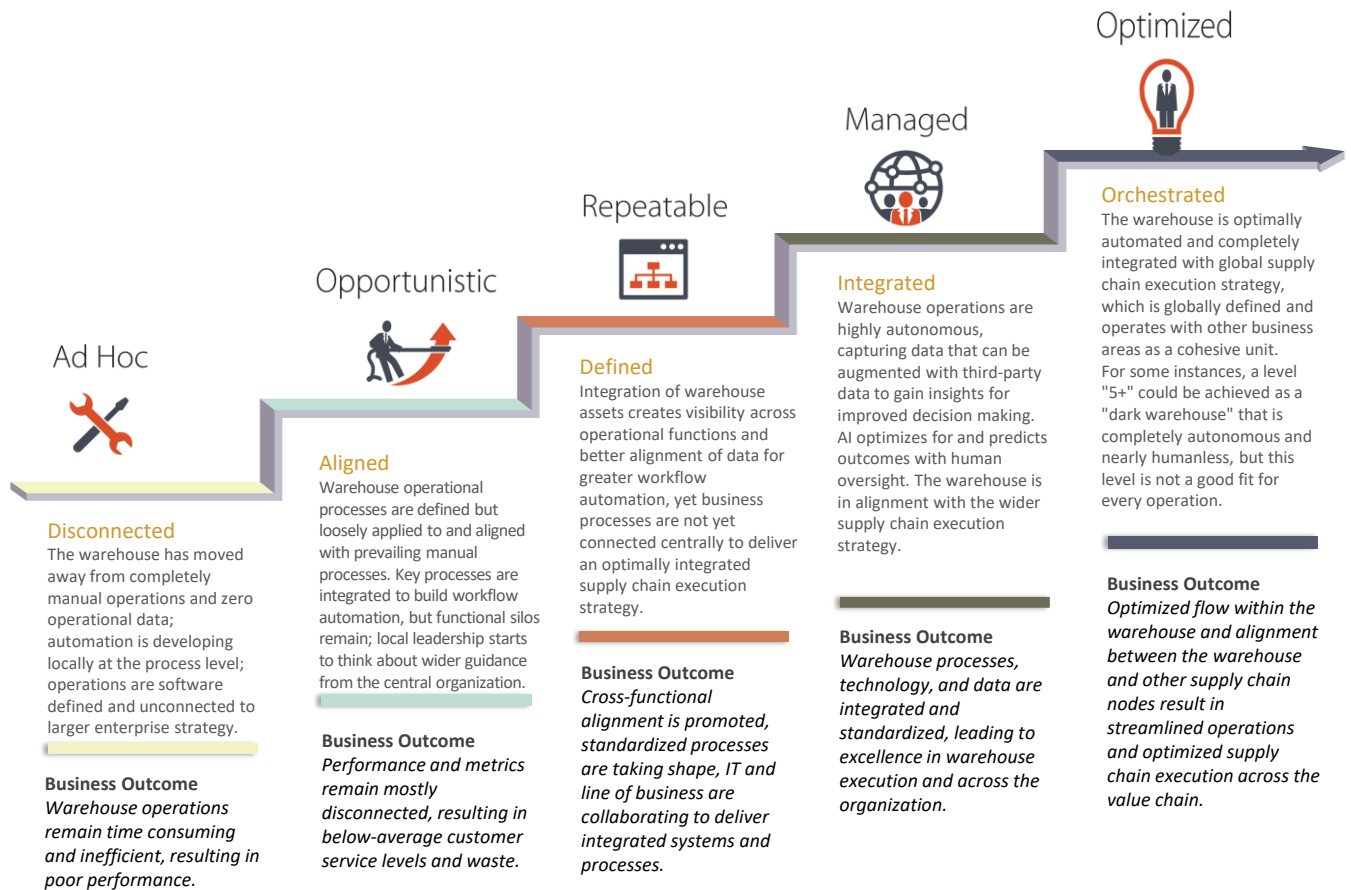
While each company has requirements unique to its product and business model, there are nevertheless common paths along which a company should proceed on the road to maturity across various stages, as applied to the warehouse or any other line of business. In terms of warehouse automation maturity, companies must assess where they are along a progressive path that starts with manual-heavy, disconnected processes and moves through subsequent stages of increasingly aligned, defined, connected, and orchestrated automation, with the "dark warehouse" at the top of that path, although dark warehouse is a good fit for only a subset of organizations.

We can think of this path as travelling from digitally distraught to digitally determined, following stages that IDC identifies as ad hoc, opportunistic, repeatable, managed, and optimized. The closer organizations come to achieving digital determination, the more resilient and agile they become, able to adapt to and adjust for sudden disruption without stopping the flow of goods to customers and end consumers.

A glance at this evolution to warehouse automation across data, process, and technology reveals a succession of progressing automation and interconnectivity of technology and processes that enable data to move smoothly and optimally through them. As data is unsiloed and increasingly standardized, it can be plumbed more readily by AI and ML to reveal underlying patterns and provide descriptive and then predictive and eventually prescriptive insights for decision making. Over time, as automation increases and as AI learns, human involvement lessens, with people "touching" the warehouse at the edges, making decisions only as an exception and simply enabling the automation. This evolution happens only when the leadership of an organization takes gradual steps to support automation of processes first at the local level and then under unified, central control.

Figure 1 details the steps to warehouse automation maturity.

FIGURE 1: *The Path to Maturity: Steps in the Evolution of Warehouse Automation*



Source: IDC, 2021

1. Ad hoc. Warehouse automation is developing locally at the process level; operations are software defined and unconnected to the larger enterprise strategy.

This is the first step away from completely manual operations that have no connected assets and thus no operational data sources. At the ad hoc stage, data has moved off paper or spreadsheets and into some software applications but is inconsistent and unreliable. Data management is still manual and is aligned with software applications used at the process level, with data processed manually rather than flowing from system to system. Other sources of digital data begin to emerge but are also not integrated, and some basic analytics emerge. Operational processes are defined at the local level and performed by humans but enabled by software applications. Workflow continues to be documented manually, and processes become more efficient for direct handoffs but are still not automated. KPIs are focused on local operations, measured with software. There is awareness of digital security requirements, but security practices have not been integrated given the small amount of data exposed. Knowledge and interest in automation are growing among local stakeholders with an eye toward greater integration; there is distant support but not involvement from executive leadership.

2. Opportunistic. Warehouse automation is tactical, workflow automation is developing, analytics enter the picture tied to use cases, strategy is local.

The increase in connected assets introduces reliable operational data for specific process areas that is used for human-led descriptive analytics, providing greater understanding of "what is" but not yet ready to predict or guide. Data sources and operational data grow, but data management is still manual; data integration is advancing, but many gaps remain. For example, the WMS may integrate orders and generate pick tickets, but those tickets may be passed off manually, with picking and packing performed manually, without systems visibility into those operations. At the opportunistic stage, operational processes are defined but loosely applied and aligned with manual effort, which prevails. Point-based automation is on the rise, giving way to some simple material flow automation, with some events triggered automatically as key operational processes are integrated to build workflow automation. Now, performance metrics begin to be tied to innovation in automation. While automation technology remains tactical, with integration occurring selectively at local sites, local leadership has its sights set on a larger strategy, with executive support. Research into a digital security framework grows.

3. Repeatable. Technology and processes are integrated and aligned with a developing corporatewide strategy.

With operational assets now connected, reliable operational data is produced for specific business process areas, with this asset — data — requiring attention to ensure it is aligned across processes. Data management is primarily digital but still reliant on human intervention. While intelligent analytics are enabled by the rise of quality data to be prescriptive, they too require human review and refinement. At the repeatable stage, data integration is companywide and data is centralized. Processes are standardized and increasingly automated, with alignment between them enabled by connected data and other assets. This integration automates workflows, including those outside the direct process flow. Think incoming inventory, for example, which might automatically trigger material flows. The improvements wrought by automation generate excitement to build upon these initiatives. Now, there are multiple automation technology types supporting processes, but they are not yet interconnected centrally. The pursuit of an aligned digital strategy is companywide. While automation projects are still realized locally, they are aligned with an evolving corporatewide digital strategy.

4. Managed. Warehouse operates with high levels of autonomy with human involvement limited primarily to oversight and automation initiatives tied to a unified corporatewide strategy.

In the managed stage, warehouse operations are highly autonomous, capturing data that can be augmented with external third-party data to gain deeper insights for improved decision making. Indeed, managing this data is critical to operational execution (consider the importance of customer-related data and real-time service-level data to sequencing orders based on delivery expectations), with warehouses reliant on real-time data, which is integrated across systems. At this stage, humans are involved primarily in QC and audits. Using AI, models autonomously learn how to optimize for and predict outcomes, with humans mostly providing oversight. Operational processes are redesigned to support an optimally automated environment, end to end, with multiple automation technology types interconnected centrally. Software-based changes for processes are integrated as recommendations, still requiring human execution. Digital security is in the limelight across the organization for all automation initiatives. Automation falls under a unified, cross-organizational strategy that is supported at the top levels of the organization and that integrates key partners. Performance is measured and incentivized organizationwide versus locally.

5. Optimized. The warehouse is fully automated, completely integrated with the supply chain, and incorporated into corporatewide strategy to transform markets and create new business models.

In the optimized warehouse, data is captured in real time across the entire warehouse, external data sources are integrated, and AI provides predictive analytical capabilities with the warehouse autonomously adapting operational strategy to the signals AI provides. Data integration across business processes enables automated and scalable decision making. Rigid operational standards and data-driven, self-disruptive processes support physical work execution of machines without human intervention. Multiple automation technology types are interconnected throughout the facility, with technology solutions the "rule" and human intervention the exception. In this environment, the entire supply chain is critical to the success of the automated environment, with performance management thus including suppliers and trade partners. Autonomous operations are viewed as a strategic directive at the enterprise level, and digital security requirements are continually evaluated and adjusted. At the "optimized+" level, we can consider the dark warehouse, but it's important to note that the dark warehouse requires too great of a financial investment for it to be sensible for many organizations. It can be a perfect fit for moving huge amounts of inventory swiftly or for moving product in an environment that is uninhabitable or unsafe for humans, such as a cocoa processing facility, where low oxygen levels are maintained to guard against fires. Yet most organizations will find that they achieve a truly optimized state for their operations without the need to establish a dark warehouse.

Benefits

A modern, automated warehouse sits at the heart of an organization's supply chain, seamlessly speeding inventory on its way to meet and exceed customer service-level agreements. By automating manual processes, organizations can reduce errors, speed cycles, increase efficiency, and free up labor. Automated processes make it possible for data to connect from system to system.

Interconnected and automated technology and processes enable data to flow among internal systems and external partners. The resulting unified view of orders and inventory leads to the ability to optimize product flow through the warehouse. That data can be fed back into the organization to improve other functional areas and better serve the customer and consumer. For example, the Internet of Things (IoT), such as the sensors embedded in AMRs that help them navigate the warehouse floor also absorb data about the environment, which, in turn, can be used to further refine operations, such as the routes on which the AMRs are directed. These automated and connected systems improve service and speed to customers and foster more collaboration within the supply chain.

Trends

Some of the major trends that are driving the need for automating and integrating warehouse data, technology, and processes are:

- » **Order flexibility.** Consumers and business users are demanding more flexible and transparent ordering and fulfillment options as customer journeys become less linear.
- » **Artificial intelligence.** AI is driving a new age of warehouse automation by providing predictive and prescriptive insights that, when combined with automated technology, can make recommendations or autonomously make decisions that further the strategic objectives of the business.

- » **Cloud.** Cloud has become the default deployment option in WMS. Optimized DX initiatives can take a long time, especially for large enterprises moving from legacy to modern applications; organizations can take advantage of faster cloud-based alternatives to digitize business and better manage complexity.
- » **Changing business models.** Business models such as omni-channel ordering and fulfillment are becoming more popular, demanding more agility from warehouses.
- » **Data as an asset.** With real-time data capture that is automated and integrated across the end-to-end supply chain and overlaid with an AI or ML engine, data shifts from being unwieldy and a potential source of error to being an instrument for strategic competitive advantage. Warehouses can use data responsively or can use data to direct activity at the onset of a product life cycle.

Modernizing the Warehouse with Körber

Körber brings modern warehouse capabilities to retailers, manufacturers, and other organizations. With the combined experience of the 12 companies recently brought together and integrated under the Körber umbrella, the company has a history of supporting retailers and manufacturers in the warehouse management space. Körber enables a wide range of companies, from large to small, to make large order commitments and deliver on those promises with fast and efficient warehouse processes that incorporate automation, voice/vision/mobility, robotics, materials handling equipment, systems integration, WMS, and consulting.

Supply chains are growing more complex by the day. Körber provides a broad range of end-to-end supply chain solutions that fit different business sizes, strategies, and appetites for growth. The company can provide software, automation, voice, robotics, and materials handling and has a team of more than 10,000 associates with expertise to enable organizations to tie their data, processes, and technology together. With a global footprint and a local presence, the company serves organizations that have diverse needs and requirements. Its partnerships with robotics companies, systems integrators, and other organizations combined with its own expertise give Körber the experience to meet the requirements of today's supply chains and to grow and evolve along with changes coming down the pike.

Challenges

Körber faces the following challenges in the warehouse automation market:

- » The need for resiliency and visibility is top of mind for executives, and the realization that the supply chain is an area of competitive advantage and not just a cost of doing is business has hit. With the supply chain in the spotlight, there will be increased pressure to enable this resiliency through a combination of global diversification, deep data analysis, operational transparency, automation, and smart robotics — and the ability to integrate it all together. Körber is well positioned to do this but will be joined and pressured by current and emerging competition.
- » As Körber works to help organizations automate and streamline their warehouses, it will have to educate the market about the worker-centric benefits of automation and robotics (i.e., that they are collaborative tools, assisting and enabling humans with tasks by handling some of the least satisfying and most tedious labor, rather than human replacements).

- » Körber must continue to educate the market about its new name and its product portfolio. Körber has been strategic in its approach to its acquisitions and rebranding. Typically, companies go through a merger and announce a rebranding — and then spend the next several years integrating the combined businesses. However, Körber AG, which acquired HighJump in 2017, did the reverse. It orchestrated the integrations among HighJump and 11 other companies from around the globe and then announced the rebranding at the end of that 2.5-year period. Nonetheless, Körber will need to continue to make efforts in branding to get the new name to take hold.

Conclusion

A modern, automated warehouse is required to achieve the resiliency, agility, and visibility that organizations need to compete and thrive in today's complex marketplaces. The creation of a modern warehouse demands that organizations take steps to deploy a state of warehouse automation wherein technology, processes, and data are automated and integrated sufficiently to allow efficient and quick product flow that is optimized to business needs. In an automated warehouse, there is minimal or no human decision making at points where the optimum scenario requires crunching of massive amounts of data; no human labor where the work is very heavy, repetitive, or time consuming; and a seamless integration of robotics, other assets, and people with the data that directs them.

A modern warehouse allows an organization to be more resilient to market fluctuations, crises, and economic downturns so that the organization does not miss a beat delivering on obligations to customers.

A modern, automated warehouse is required to achieve the resiliency, agility, and visibility that organizations need to compete and thrive in today's complex marketplaces.

About the Analyst



Jordan Speer, Research Manager, Global Supply Chain

Jordan Speer is Research Manager for IDC Retail Insights, responsible for covering the global supply chain. Ms. Speer's core research examines how digital technology opens opportunities to better connect and optimize the execution of the end-to-end supply chain from order creation through order fulfillment. Her research covers sourcing, transportation, warehouse and labor management, returns, and global trade management with particular emphasis on how leading-edge technologies such as AI and analytics are key to evolving and improving these processes. Ms. Speer works with retailers and technology providers to help all parties understand where industry is headed and which best practices will align with their strategies to take them there.

MESSAGE FROM THE SPONSOR

Conquer Supply Chain Complexity with Körber

With growing complexity in product lines and order structures, along with increasing logistics service level demands, there is no room for error. From selecting the perfect automation or material handling solution that's the right fit for all your operational requirements, through to system design, testing and implementation, Körber's team will support you at every stage of your automation journey.

Our Automation Solutions are designed to help you:

- » Reduce cost, complexity and downtime across your organization.
- » Manage rapid change and scalability in your supply chain.
- » Gain access to vital knowledge and resources to generate a competitive advantage

Whether you're seeking traditional automation like layer pickers, palletizers and conveyers, or innovative technologies like autonomous mobile robots (AMRs), Körber has the right solutions to help you conquer supply chain complexity.

Find out more on www.koerber-supplychain.com.



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IDC Research, Inc.
140 Kendrick Street
Building B
Needham, MA 0249, USA
T 508.872.8200
F 508.935.4015
Twitter @IDC
idc-insights-community.com
www.idc.com

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