



Vertical Market Outlook Series

Logistics



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Equipment Leasing & Finance Foundation

1625 Eye Street, NW • Suite 850

Washington, DC 20006

www.leasefoundation.org

202-238-3429

Kelli Jones Nienaber, Executive Director

Table of Contents

Logistics Market Outlook	4
• Scope of this Paper	4
• An Evolving Logistics Marketplace	4
Macroeconomic Environment.....	4
• New Frontier in Logistics.....	4
• Warehouses and Distribution Centers Remain Hesitant to Invest in Equipment Post-COVID	5
• Significant Uptick in e-Commerce Sales.....	6
• Big Data & Cloud Computing is Leading the Change	9
• Warehouse Automation Equipment Investments are Growing	12
• Labor Shortage a Challenge and Opportunity	13
Sector-Specific Trends & Key Developments	16
• Workflow Automation	16
• Equipment Modifications: Robotics, Artificial Intelligence, Telematics, and IoT	18
About the Researcher	20
Acknowledgements	20
Endnotes	21

Logistics Market Outlook

Scope of this Paper

Logistics is a complex market, encompassing the entire supply chain from manufacturing to delivery to the end-user. The recent spike in e-commerce, largely driven by the COVID-19 pandemic, has forced companies to re-evaluate fulfillment, given the rise in demand. This paper focuses on warehousing and distribution centers and the trends toward automation that will drive demand for equipment financing in this segment.

An Evolving Logistics Marketplace

In 2018 there were 18,182 private warehousing establishments, having grown from a figure of 15,203 a decade earlier in 2008, according to the U.S. Bureau of Labor Statistics. Fast-forward to 2020, and preliminary numbers estimated the number of private warehousing establishments to have grown to 19,267.¹ This steady rise over the last decade underscores the already growing market opportunity for warehousing equipment. This, combined with the increased volume of e-commerce activity and a sudden boom in the last year and a half thanks to the pandemic, has mounted strain on outdated systems and pointed to the need for warehouses and distribution centers (DCs) to augment their operations and fulfillment. This adds up to recent trends in the investment of warehouse management systems (WMS) platforms, automation, and robotics equipment to ensure warehouses and DCs can continue to operate and fulfill demand in this new reality that COVID-19 has brought about.

As *Forbes* poignantly put it: “Consumers buying items online was a major trend steadily rising before COVID-19, and then exploded during the outbreak; now, like working remotely, it’s considered a new normal, not likely to wane anytime soon. With most of the country on lockdown and e-commerce spiking, the stream of large, durable goods being shipped to residences became a flood. Distribution centers and order-fulfillment facilities – warehouses the size of multiple football fields – proved gigantically crucial linchpins. Emblematically essential, they kept America’s pulse beating during the pandemic-induced societal coma.”²

Macroeconomic Environment

New Frontier in Logistics

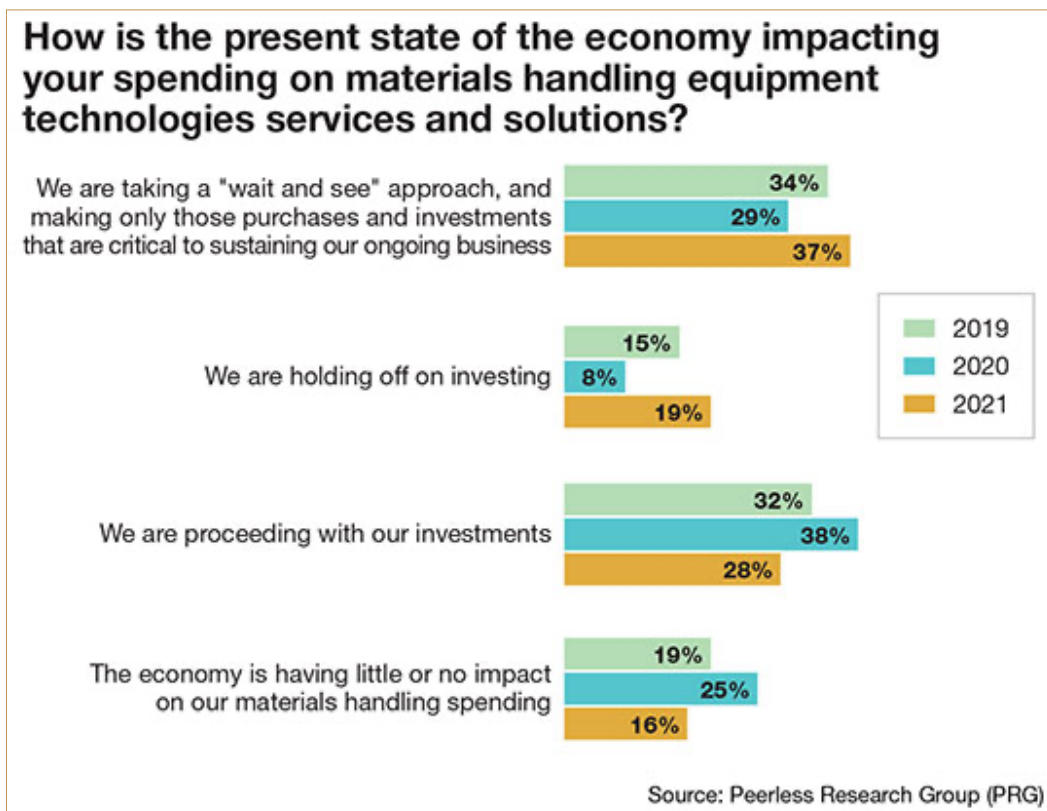
With the onset of the pandemic just over a year ago, the world came to a halt, and almost overnight, it converted into a digital-dependent society. So much so that much or all consumer purchasing went from one of multimodal to single-mode—e-commerce. This shift impacted the logistics and warehouse management not only for the last year, but more profoundly for the future to come, greatly accelerating trends that were forecast to come in the next decade or beyond.

Leading into the pandemic, the climate was already ripe for automation within the logistics and warehouse management space. Reasons for this are multifold but included the relatively low unemployment rate (3.5% in January 2020) contributing to a high number of warehousing/DC jobs remaining unfilled, healthy economy, changing consumer demands (rise in e-commerce), and faster delivery expectations. With this combination, it became clear to many warehouses and DCs that automation and robotics were the clear paths to keeping up with demand and staying afloat.³

Warehouses and Distribution Centers Remain Hesitant to Invest in Equipment Post-COVID

According to Peerless Research Group's *2020 Annual Warehouse and Distribution Center Equipment Survey* (released April 2020), there was a modest drop among respondents holding off on making equipment investments, with general spending remaining rather steady. "The survey's big picture has respondents staying close to the high bar for spending set in recent years, while layering in select investments to help solve for top challenges like tighter cycle times, additional customer requirements and the need to maximize available workforce," writes Roberto Michel, analyzing the results of the 2020 edition of the survey.⁴ While this was conducted pre-pandemic (January and February of 2020), it painted a picture of an industry with innovation already taking hold and demanding new investment—investment that has been mounting in recent years. This has only been amplified by the pandemic, accelerating the rate of investment and the need for automation and cloud functionality to meet the hyper-demand COVID-19 has brought with it.

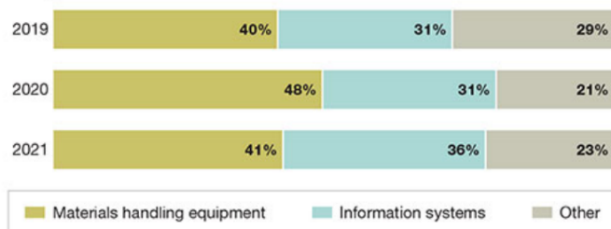
The post-COVID edition of the *Annual Warehouse and Distribution Center Equipment Survey* (released March 2021) shows a spike in companies holding off on investment in equipment. According to Peerless Research, warehouse and DCs "know they need to invest in more equipment and technology to fulfill more orders efficiently without adding hard-to-find labor, but many are coming off a highly disruptive year of dealing with COVID-19 challenges. For the short term, at least, there's more hesitancy on moving forward with investments than this time last year."⁵



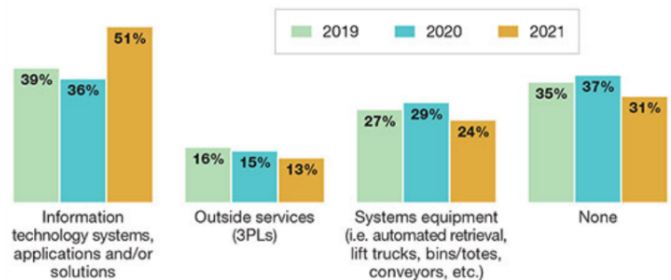
Despite companies stating that they are hesitant to make investments, spending on equipment has grown for three consecutive quarters, though growth in spending did slow in the most recent quarter. According to gross domestic product data reported by the Bureau of Economic Analysis, private investment in equipment grew 68.2% in 3Q 2020 compared to the previous quarter, 25.4% from the third quarter to the fourth quarter, and an additional 16.7% in the first quarter of 2021.⁶

The *2021 Annual Warehouse and Distribution Center Equipment Survey* shows that more companies intend on investing in information systems over equipment, which may restrain growth in the equipment leasing and financing market. In 2020, warehouses and DCs expected to spend 48% of their budgets on equipment, but this dropped to 41% of expected 2021 spending. Firms say that they will shift a greater share of their expenditures to information systems in 2021, with 36% of spending expected to go toward systems (compared to 31% in 2020). More than half (51%) of information system implementations will be in the deployment of new solutions this year, compared to 36% a year ago.

And, what percent of your overall spending during the next 12 months will be on...



Thinking about any new purchases, in which of the following areas were any the first deployment of a new solution, or a substantial change in processes or historical practices?



Source: Peerless Research Group (PRG)

According to a recent report from Grand View Research, the global WMS market size was valued at \$2.64 billion in 2020 and is expected to grow at a compound annual growth rate (CAGR) of 15.3% from 2021 to 2028. They found that a “growing transition toward cloud-based management systems in the warehouse industry is anticipated to boost the demand for warehouse management systems (WMS).” Advancements in cloud-based technologies have made these platforms more accessible. As a result, they are expected to fuel the adoption of WMS software irrespective of the organization’s size and complexity where these solutions are used.⁷

Before the pandemic, some key trends were already evident or emerging. Since COVID-19 gripped the world, these have only taken hold more strongly. Beyond the rise in cloud-based systems and the rise in e-commerce, some additional key trends include artificial intelligence, robotics and warehouse automation, and autonomous vehicles.

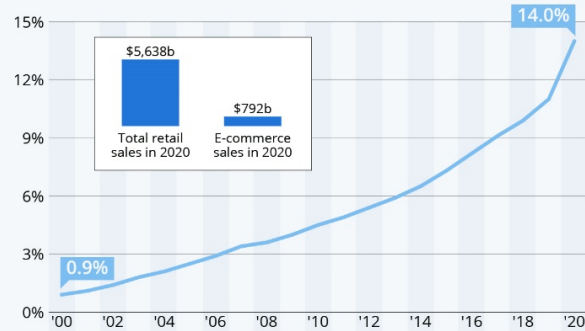
Significant Uptick in e-Commerce Sales

Retail habits have changed most dramatically during the pandemic. This has been no more pronounced than in the e-commerce segment, where the large boom has contributed to the huge uptick in volume and need for greater automation with DCs and warehousing operations.

According to the U.S. Census Bureau, e-commerce sales amounted to \$792 billion in 2020, equivalent to 14% of total retail sales. This is up from just 7.3% in 2015, illustrating the pace at which sales have moved online over the past few years, particularly in 2020.⁸ In 2020, e-commerce sales started on par with the previous year at 11.8% of retail sales; online sales spiked to 16.1% of retail sales in the second quarter as consumers shifted spending to online retailers during the early part of the pandemic. These numbers exclude foodservice sales.

Pandemic Accelerates Shift to Online Retail

E-Commerce sales as a percentage of total retail sales in the United States*



* not seasonally adjusted; excluding food services sales
Source: U.S. Census Bureau



statista

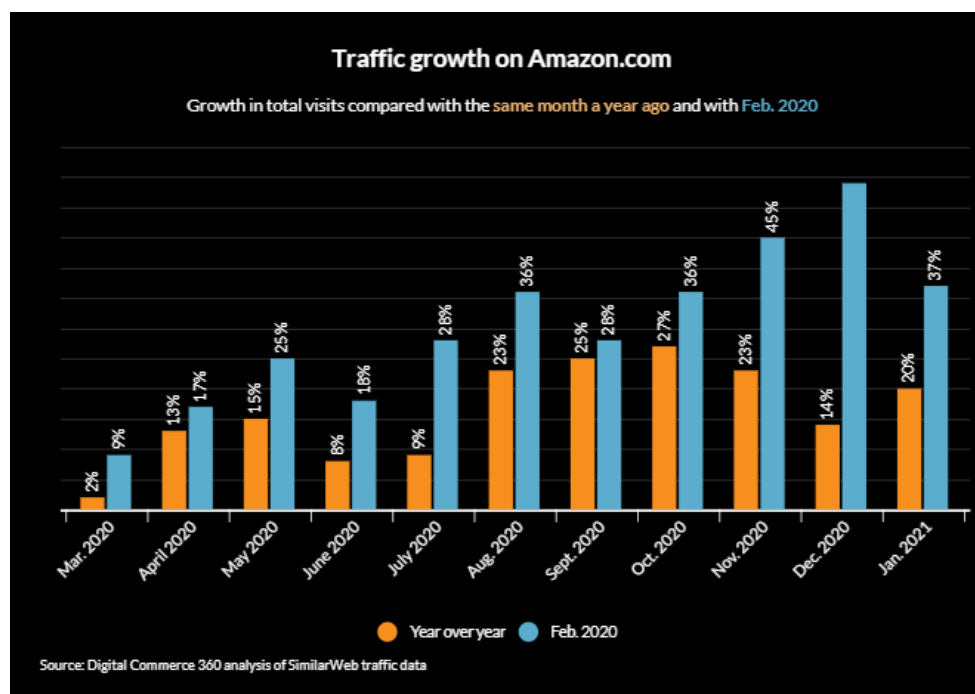
In looking at additional analysis from Digital Commerce 360 and the U.S. Census Bureau, there are yet higher estimates of e-commerce performance throughout 2020:

- Consumers spent \$861.12 billion online with U.S. retailers in 2020, up 44% from \$598.02 billion in 2019, according to the latest Digital Commerce 360 analysis. Online spending represented 21.3% of total retail sales last year, compared with 15.8% the year prior.

Changing consumer spending habits due to the coronavirus pandemic contributed to the spike in e-commerce sales last year, as statewide lockdowns and fear of contracting the virus kept consumers out of physical stores. COVID-19-related boosts in online shopping resulted in an additional \$174.87 billion in e-commerce revenue in 2020, Digital Commerce 360 estimates. If it weren't for the bump in online sales from the pandemic, the \$861.12 billion in e-commerce sales wouldn't have been reached until 2022.⁹



For Amazon, one of the most popular, highly trafficked e-commerce retailers, usage increases were even larger, speaking to the heavy boom in e-commerce. This has spurred the large need for logistical support on the warehouse and DC side of the equation.¹⁰



The most recent data from the Census Bureau and the National Retail Federation (NRF) reported a healthy start to 2021. January retail sales climbed to \$568.2 billion, a 5.3% increase over December 2020 and a 7.4% increase annually.¹¹ Additionally, total retail sales from November 2020 through January 2021 were up 4.6% compared to the same timeframe a year ago. Brick and mortar retailers suffered due to the pandemic and the growth in e-commerce, with 12,200 retail stores closing in 2020. Commercial real estate firm CoStar Group reported that one-third of store closings were by department stores, clothing chains, or other mall-based retailers.¹² While there was a shift in consumer behavior to direct-to-consumer e-commerce spending before the pandemic, fewer consumers visiting physical stores during the crisis pushed many retailers to bankruptcy.

As outlined by NRF officials and NRF Chief Economist Jack Kleinhenz, January spending marks a strong start to 2021:

- “NRF officials noted that the increase in January retail sales built off of the strong momentum over the course of the November-December period, which it defines as the holiday shopping season, and saw an 8% increase, to a record tally of \$787.1 billion.”
- “We expected retail spending to ramp up in January thanks to the latest round of stimulus checks and better COVID trends, and it clearly did. There was none of the falloff in spending that we often find post-holiday, and the increase was even better than expected. There is plenty of purchasing power available for most consumers, and the pickup in shopping has even been reflected in the number of hours worked by retail employees. Confidence is building thanks to the availability of COVID-19 vaccines, and states and local governments are beginning to remove restrictions on economic activity. Going forward, I expect consumer spending to build on this momentum.”

With these data points coalescing into a superb success for e-commerce in 2020—and even into 2021—it underscores the overwhelming impact and burden on the logistics and fulfillment sectors. This all points to the growing need and demand for automation and additional AI support to help fulfill the increasing demand for e-commerce orders into 2021.

While existing warehouses and DCs are in the process of automating, there is also significant potential demand for companies to equip new spaces. Real estate investment trust Prologis estimates that e-commerce companies require 1.2 million square feet of distribution space for every \$1 billion in sales. JLL forecasts that the growth in e-commerce expected in the coming years could lead to demand for an additional one billion square feet of industrial real estate space by 2025.¹³

One potential source that may help fill the void is retail space. The 12,200 retail stores that closed in 2020 opened up 159 million square feet of retail space. Commercial real estate firm CBRE reports that “retail-to-industrial conversion projects will likely accelerate in 2021.” Since 2017, there have been 59 retail-to-industrial conversions, turning 13.8 million square feet of “aging retail space”¹⁴ into 15.5 million square feet of new warehouse/industrial space.¹⁵

The opportunity for equipment finance comes across a broad spectrum of companies. From 2019 to 2020, there was a 2.5% increase in the number of warehousing establishments.¹⁶ Growth is coming from large companies like Walmart and Amazon, as well as smaller third-party logistics companies. IBISWorld reports that the third-party logistics market is very fragmented, with only 7.5% of U.S. revenues coming from large industry players. In comparison, the remaining 92.5% of the market comprises smaller players. The research firm estimates that there will be a 25% increase in the number of third-party logistics firms from 2021 to 2027.¹⁷ This represents a significant opportunity for equipment financing firms to target smaller players in the market that may need new equipment in the coming years.

Big Data & Cloud Computing is Leading the Change

As the trend in big data and cloud computing continues, it behooves warehouses and DCs to move to capitalize on this as well. The public cloud service spending is expected to grow 18.4% in 2021 to \$304.9 billion (up from \$257.5 billion last year), and the cloud is projected to make up 14.2% of the total global enterprise IT spending market in 2024 (up from 9.1% in 2020). With such an increase, WMS seemingly would align well with the cost-benefit, and the trend points to this shift.¹⁸

As described in *Logistics Management* by Bridget McCrea, “many companies stuck to the on-premise software delivery approach when selecting WMS. Fast-forward to 2021, and WMS is now getting more firmly entrenched in the cloud.” This has led to an inflection point for convergence of technologies and data that are most aptly handled via the cloud; thus, investment in such infrastructure is key right now. As described by Dwight Klappich, research vice president at Gartner, “We’re very close to becoming cloud-first with WMS, and it has been a long journey when you compare WMS to other supply chain software applications.”

With the next generation of cloud infrastructure, only recently is there now support for multi-tenant cloud deployment. This allows for varied and multilayered capabilities to become cloud-manageable, which is most needed for warehouses and distribution centers to begin adopting WMS.¹⁹

Clint Reiser, research analyst from ARC Advisory, a leading technology research and advisory firm for industry, logistics, and infrastructure, made the following series of comments around WMS:

- “Companies have been sticking with their existing, on-premises warehouse management systems (leading up to COVID), despite the fact that many of those solutions are 10 to 20 years old and lack modern ‘bells and whistles.’ Before there can be a full-scale march into the cloud on the WMS front, companies will want to know more about payment and financing models, the ability to communicate across sites, and the system’s architecture. These issues are still being worked out.” Certainly, as COVID has pushed on, these inquiries have become more pronounced and perhaps expedited.
- “[The industry] appears to be at the point where the concerns about having WMS in the cloud have mitigated substantially. There are even some instances where companies would prefer the cloud. The latter group includes purchasing departments that use centralized processes, but also need to be able to communicate across multiple sites.”
- “As with most cloud implementations, the main draws include the fast implementation times and lower upfront costs associated with this software delivery method. Other key pluses include less pressure on internal IT departments—because the vendor handles the patches, updates, and other tech work—and the fact that the software supports both remote and mobile work.”²⁰

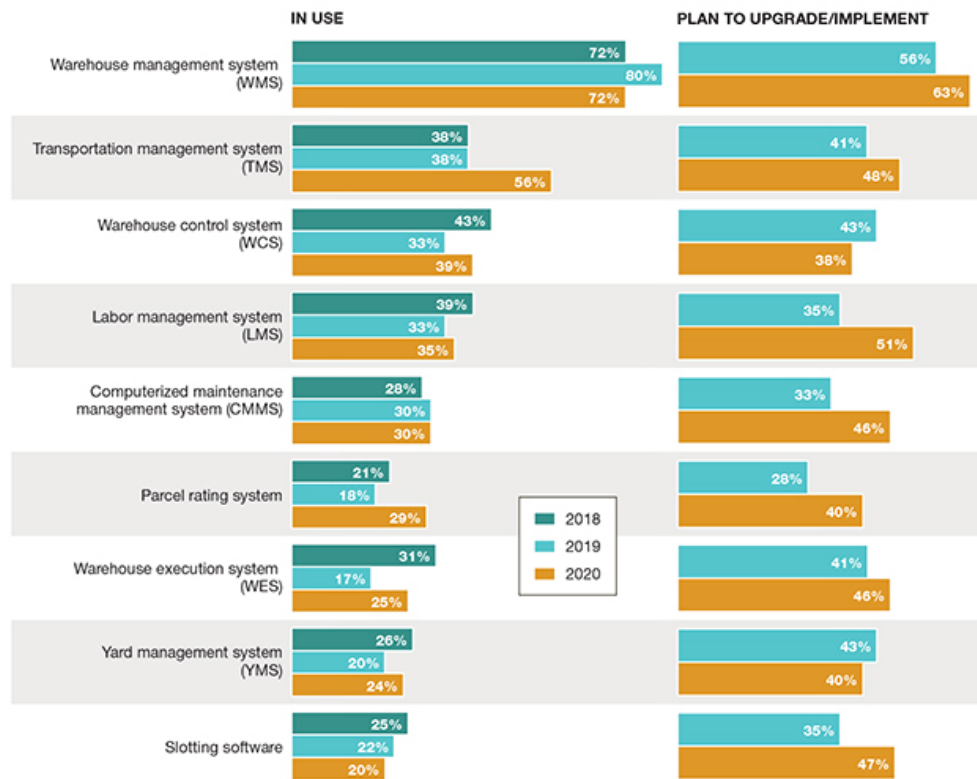
To further the case for WMS cloud systems and highlight the stress of the pandemic, Dwight Klappich, research vice president at Gartner, further explained the current industry situation:

- “Current wave of cloud WMS customers tends to be those with tech-obsolete systems in place or whose business requirements have shifted significantly over the last year or so. A company with a warehouse designed to move pallets, for example, and is now doing more e-commerce fulfillment due to the pandemic, probably needs a new WMS right about now. Rather than investing in a new, on-premises software deployment, that company may gravitate toward a cloud-based option.”
- “Technical obsolescence continues to be a big driver for this market. That said, the total cost of ownership is one issue that could be holding back cloud-based WMS adoption. That is probably going to normalize itself as the pandemic intensifies, but for now, some vendors are still asking for more money than customers are willing to pay for a cloud WMS platform.”²¹ This is best illustrated by data that points to WMS as being the most likely to be implemented or improved by many warehousing organizations amid the pandemic and beyond:

To further this point, Grand View Research analysis goes on to report the following:

- SMBs and large businesses alike are making the switch to cloud-based systems:
 - “Surging demand for cloud-based systems can primarily be attributed to medium- and small-sized businesses that do not require the implementation of advanced warehouse technologies and high-speed automation.”
 - “Large-scale companies are also switching to cloud-based WMS as it allows organizations to offload exhausting tasks, such as maintenance, infrastructure administration, timely upgrades, and other tasks that are carried out on the on-premise software.”

What supply chain execution software solutions are presently in use in your organization and which will you be upgrading or implementing during the next 24 months?



Source: Peerless Research Group (PRG)

- “Cloud enables businesses running on conventional on-premise technologies to transit to a platform that will support and cater to their clients’ needs more efficiently. Low upfront cost and shorter implementation time are key factors that are encouraging companies to adopt cloud-based systems.”
- “In the healthcare ecosystem, a WMS ensures that medical equipment and medicines are supplied on time—something that has become of utmost importance amid the global pandemic. Also, it continuously updates the database of the inventory moving in and out of a warehouse, which prevents the shortage of inventory. Furthermore, in the healthcare domain, continuous sharing of information and transparency of all processes are the critical factors for efficient warehouse management. WMS enables complete transparency of logistic activities and enables proper tracking of medical devices and medicines. Similarly, in the food & beverage industry, it ensures optimized picking, directed put away, and rotation of stock based on its expiry date.”
- The WMS market is anticipated to witness substantial growth during the forecast period due to the changing supply chain models of product manufacturers and rapidly growing consumer demand, especially in the transport and logistics, and retail sectors.
- The software segment is expected to register the highest CAGR over the forecast period owing to the increasing adoption of WMS software by small- and mid-sized enterprises (SMEs) worldwide.
- The cloud segment is expected to register the fastest CAGR from 2021 to 2028 owing to numerous functionalities offered by cloud-based WMS over the traditional on-premise WMS.

- Transportation and logistics are expected to be the fastest-growing application segment over the forecast period due to the rising need for technologically advanced WMS to help logistics companies keep their operations aligned with the ever-demanding market and rise in e-commerce usage.²²

Another factor that could drive companies to the cloud and away from their outdated WMS is the threat of cyber-attacks and ransomware. Cyber-defense firm TrapX Security found that 53% of manufacturers agreed that their organization's operational technology infrastructure is vulnerable to some type of cyber-attack.²³ For example, a major U.K. WMS provider was the victim of a ransomware attack in April 2020, and customers reported that the inability to fulfill orders was a "total nightmare."²⁴ According to *InfoWorld*, "Because on-premises systems are aging, their intrinsic security can be easily defeated by hackers."²⁵ Cloud-based systems, on the other hand, are more secure than on-premise systems because they have built-in security safeguards that are constantly updated by the cloud operator.

Warehouse Automation Equipment Investments are Growing

Even before the emergence of COVID-19, warehouses and DCs were in the "midst of a massive shift in fulfillment operations, primarily driven by the rapid increase of e-commerce with direct-to-consumer fulfillment and the impact on labor costs and staffing challenges," notes Clint Reiser, director of supply chain research at management consulting firm ARC Advisory Group.

To further understand how the warehousing and logistics industry was meeting e-commerce demands and what technologies they have been implementing and planning to invest in, DC VELOCITY and ARC Advisory Group conducted a broad industry study in 2020. The key takeaway: *The future of warehousing depends on investment in software and automation technologies.*²⁶



Source: DC Velocity

Survey respondents (from the ARC Advisory Group *2020 Warehouse of Tomorrow* study) “chose WMS as the one warehouse technology investment that is the highest priority/importance to their organizations over the next three years. But the most impressive statistic from the research is that a full 96% of survey respondents indicated that they expect the warehouse automation value proposition (in comparison to the manual alternative) to increase over the next three years.”²⁷

“Warehouse automation is expected to become an increasingly desirable option to the manual alternative over the next few years,” a recent *Forbes* analysis points out. According to recent research, the likelihood of warehouse automation investment over the next three years remains high, with 60% of respondents indicating it was “very likely.” With broad-based investment activity expected, the next logical question is, “Why is warehouse automation being viewed in such a positive light?” As discussed previously, studies further indicate that changes in the operating environment—such as labor costs, labor shortages, and increased throughput requirements—are the primary influential factors. Additionally, advancements in automation, such as lower costs and scalability improvements, are supporting factors that will help fuel this surge accelerated by the pandemic.²⁸

Labor Shortage A Challenge and Opportunity

The U.S. economy is within 1% of its pre-pandemic levels, thanks to a 6.4% increase in GDP in the first quarter of 2021.²⁹ Nick Bunker, economic research director at Indeed Hiring Lab, said, “The labor market needs to gain 8.2 million jobs to put us back where we were pre-pandemic, not accounting for the jobs that would have been created if the pandemic never happened.”³⁰

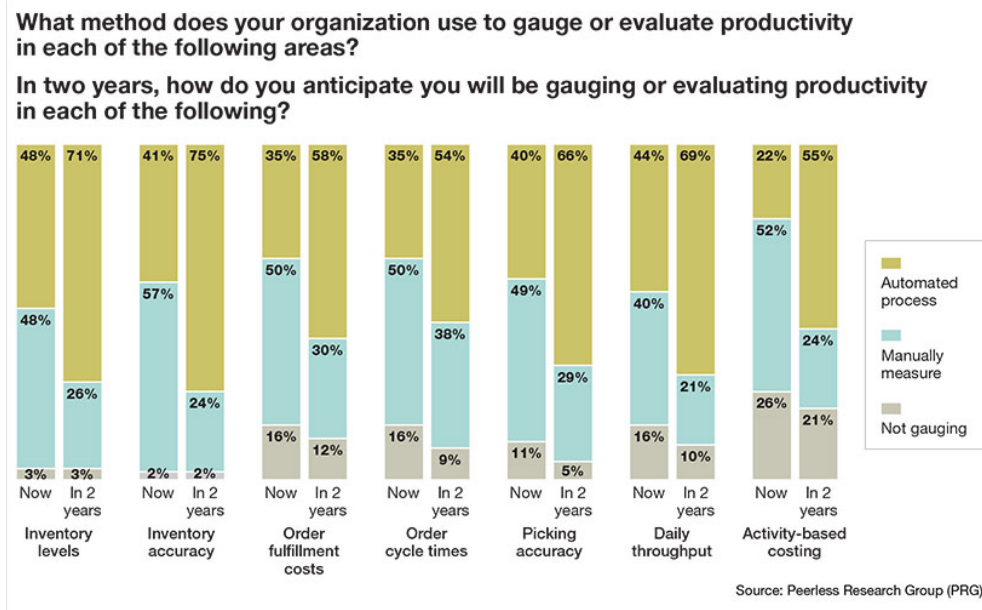
The pandemic has proven companies’ resiliency, as the country is essentially producing the same amount of goods and services as before the pandemic, but with millions of fewer workers. A key part of this ability to meet increased demand has been automation, which may be partly responsible for the slower growth in the job market. Employers added just 266,000 jobs in April 2021, while economists forecasted job growth of more than 1 million workers during the month. Investment in automation and equipment has been on the rise for three consecutive quarters, which has resulted in an increase in productivity. According to the *Washington Post*, “Adjusted for inflation, U.S. productivity has risen by almost 4 percent since the fourth quarter of 2019, nearly twice the increase in output-per-worker over the past five quarters, according to the Bureau of Labor Statistics.”³¹ Economists believe that employment will not return to pre-pandemic levels, but companies are relying on increased automation to make up for reduced employee counts.

McKinsey & Company examined the impact of the pandemic on productivity, finding that firms are using automation to fill the gap in the labor shortage with technology:

The use of technologies such as digitization and automation appears to have accelerated some companies during the pandemic. With the right conditions in place, this can raise productivity by substituting employees or contributing to raising output per worker. In the December 2020 McKinsey Global Economic Conditions survey of executives, 51 percent of respondents in North America and Europe said that they had increased investment in new technologies (excluding remote work technologies) during 2020.

Significant productivity acceleration could be possible once the economic shock of the pandemic dissipates, if corporate action spreads, and if demand strengthens. In the eight sectors reviewed, we estimate there is potential for an increase of 1.5 percentage points of productivity growth per year in the period to 2024.³²

According to Honeywell, despite the growth in automation, “80% of distribution centers are operating manually yet drawing from a very limited labor pool. But automation will drive distribution centers and warehouses to change how they measure productivity. The 2021 Warehouse/DC Equipment Survey from Peerless Research points to a dramatic shift in how companies will gauge productivity. According to the survey, “respondents are placing a strong emphasis on doing more over the next two years to automate the gathering of data needed for metrics such as throughput, inventory accuracy, and order fulfillment costs.”³³



Sector-Specific Trends & Key Developments

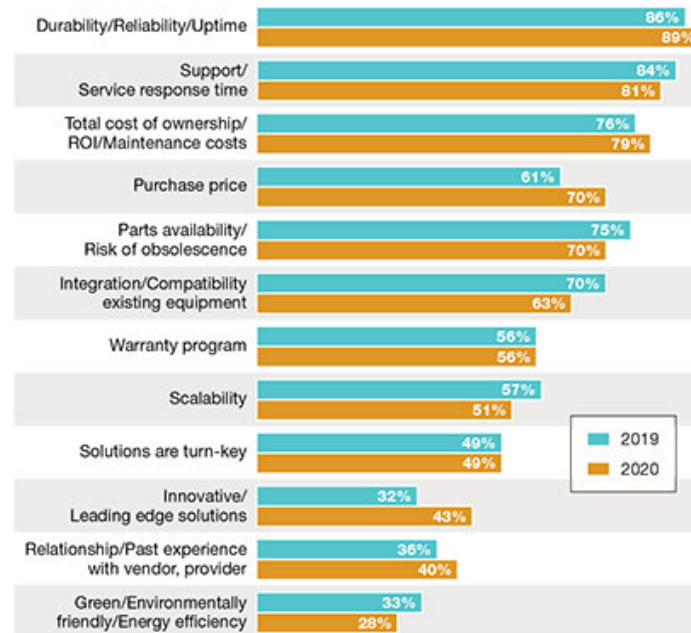
Workflow Automation

The warehousing industry is in a state of uncertainty due to COVID-19. However, while disrupting many players in the market, the pandemic did spur much change and fuel process and plant improvements at a faster rate than otherwise expected. This was realized through warehouse and DCs increasingly turning to automation due to labor shortages and health and safety concerns. Additionally, due to a rise in demand due to e-commerce, automation was sought out to keep up with volume.

This can be evidenced by various research findings conducted through quantitative research in the field. Research from Peerless Group Research (PRG) and Logistics Management found the following:

- “When evaluating automation systems and solutions for possible purchase, many stated they want to carefully assess total cost of ownership, return on investment (ROI), and maintenance costs (ranking second most important in 2020 at 79%), with additional considerations including purchase price, parts availability, risk of obsolescence and integration/compatibility with existing equipment.”

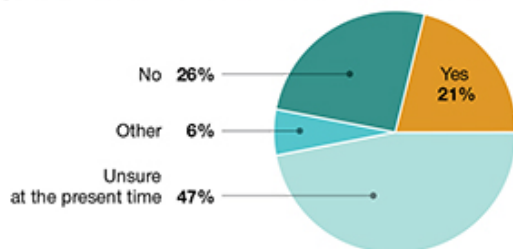
How important are each of the following when evaluating automation systems and solutions for possible purchase?



Source: Peerless Research Group (PRG)

- The onset of COVID has spurred some warehousing and DC facilities to aggressively explore automation options, as seen here:

In light of the coronavirus outbreak, is your company changing its purchase plans for warehouse and DC solutions?



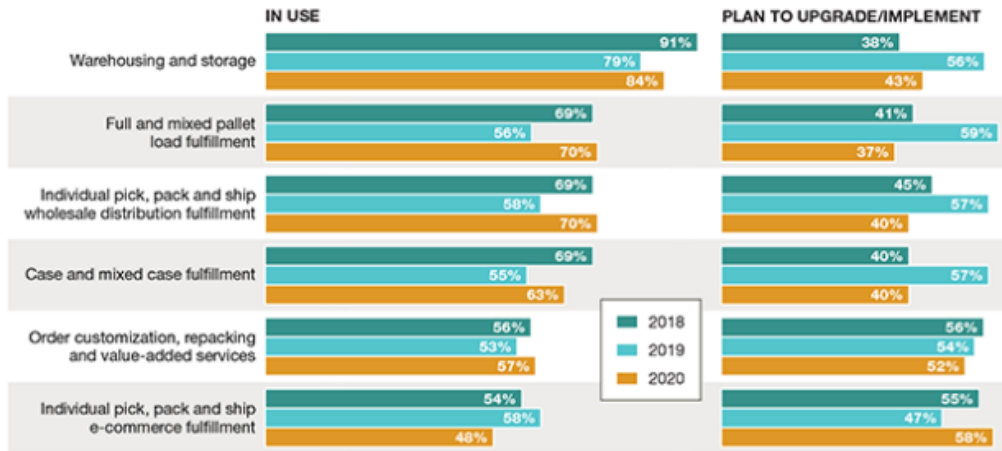
When do you see changes to your purchase plans being made?



Source: Peerless Research Group (PRG)

- “Automation has made a bigger mark in operational areas like labeling, packaging, picking, replenishment, storage, and retrieval, all of which reported greater usage numbers compared to last year’s survey. Of the manual processes that are due to be automated soon, reporting is the top pick, with 46% of respondents saying they’ll be automating this function in the near future. Other manual processes that are on the automation agenda right now include conveyance (32%), labeling (39%), packaging (30%), and picking (28%).”

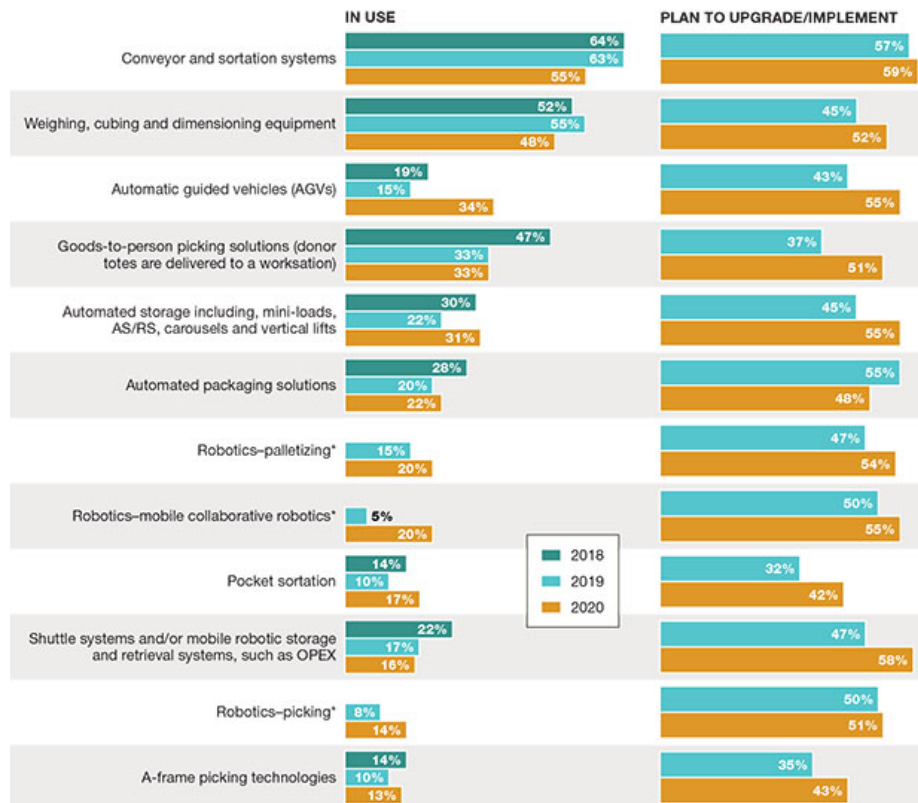
**Which order fulfillment activities are you currently employing?
And, which are you looking to implement or improve over the next 24 months?**



Source: Peerless Research Group (PRG)

- “Over the next 24 months, 58% of companies want to implement or improve current individual pick, pack, and ship e-commerce fulfillment activities, while 52% are most interested in enhancing their order customization, repacking, and value-added services. Forty-three percent see room for improvement in their warehousing and storage operations, while 40% want to do a better job with case and mixed-case fulfillment.”³⁴

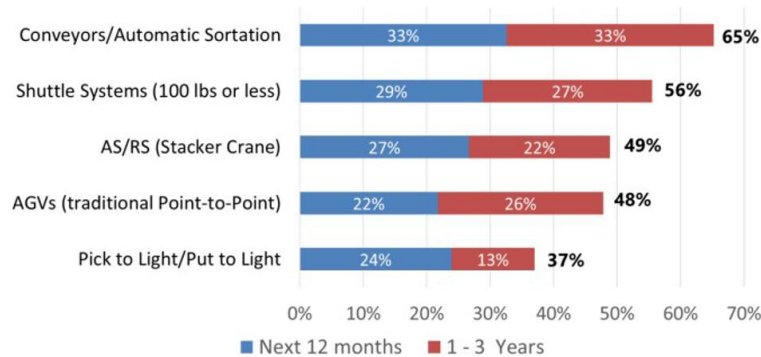
**What automated equipment is presently in use in your organization
and which will you be upgrading or implementing during the next 24 months?**



* Not asked in prior waves

Source: Peerless Research Group (PRG)

As the warehousing industry looks to automate, there are many systems in place that are ripe for replacement and/or improvement. For example, as cited in the *Forbes* analysis, “conveyors and sortation systems are a staple of warehouse automation and are often deployed along with other subsystems. So, it’s understandable that over 60% of respondents expect to invest in conveyors and sortation over the next three years.”

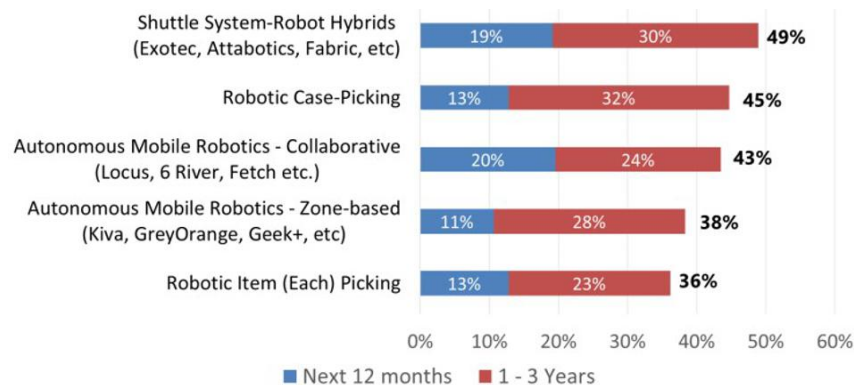


Established Warehouse Automation: Adoption Expectations

Source: *Forbes*

Further *Forbes* analysis of ARC Advisory Group’s study shows the following:

- “Shuttle systems is the technology with the second-highest level of adoption expectations. ARC’s warehouse automation and AS/RS research also show that the shuttle systems market is growing rapidly. These findings are further supported by estimates of recent growth rates by industry trade groups such as the European Material Handling Federation. Generally speaking, shuttle systems address the needs of many warehouses by providing high throughput, scalability, and storage density. Surprisingly, there were also relatively high levels of adoption expectations for AS/RS (stacker cranes), traditional AGVs, and beyond—showing that these well-established technologies continue to address the needs of modern warehouse requirements as well.”³⁵



Emerging Warehouse Automation: Adoption Expectations

Source: *Forbes*

As automation fully takes hold, warehouse managers and DC operators can better fulfill and complete their jobs. As explained by Dwight Klappich, research vice president at Gartner, “There are still vendors out there that have circa early-2000s types of user experiences. Companies haven’t invested much in the user inter-

face, especially in the supervisory workforce. However, this is an area where we're now starting to see more investment." Some of that investment he speaks to is going toward digital and mobile options that allow supervisors to untether from their desks and run their operations while traversing the warehouse or DC floor.

"There is no reason for supervisors to be stuck in their offices anymore, as they need to be able to get out on the floor and have access to the data that helps them do their jobs better," says Klappich. He sees the opportunity for automation as an opportunity for increased focus on user experience as part of an overall shift toward creating a more efficient, engaging warehouse. "It's about giving employees tools that make their jobs better, easier and more efficient, and more enjoyable."³⁶

Equipment Modifications: Robotics, Artificial Intelligence, Telematics, and IoT

Even before the pandemic became an issue, there was difficulty finding human labor. Warehouses and DCs had already begun exploring automation and robotics to support growth fulfillment needs. Now, amid the pandemic, many facilities have faced mounting challenges and surging fulfillment volume forcing them to find alternate ways to do more with even fewer workers.³⁷

As *Forbes* outlines, the human labor factor plays heavily into the trend toward robotics: "One of the main forces driving this trend – a shortage of labor – might seem outdated. Yet even with U.S. unemployment hurtling toward a Great Depression-like 25%, the demand for warehouse material handlers remains insatiable. Major ground transportation players, besieged by a spike in home deliveries, still struggle to staff thousands of vacant handler positions while simultaneously pushing more into automation. These handling (toting, sorting, picking, packing) jobs are mentally and physically taxing and don't pay so great." "The turnover rate for these jobs is incredibly high, yet even with the spike in unemployment, I'm still not sure this is going to change," said John Santagate, VP-Robotics, Körber Supply Chain, a supply chain technology provider.³⁸

As COVID has mounted, many warehouse clients have been relying more heavily on robotics-based solutions, such as autonomous mobile robots (AMRs) to supplement human workers, especially as workers fell ill or had to stay home to take care of children no longer in school; or just worried about their safety.³⁹ Robotics and automation have been able to rise above these challenges. Warehouse automation appears poised to surge based on estimates for projected AMR sales expected to double to \$27 billion by 2025, and likely stand to grow beyond that as the pandemic has pushed the industry to automate even sooner and more rapidly.⁴⁰

Robotics in the warehouse were far less prevalent even five years ago, but with the pandemic, they have been thrust into the limelight and are on pace to become widely adopted. The percentage of warehouses and DCs likely to invest in robotic warehouse automation technologies (let alone more emerging, fringe technologies like autonomous mobile robots) within the next three years has become substantial.⁴¹

According to *Forbes's* analysis of ARC Advisory Group's research around the industry, "a full 49% of respondents are expected to invest in shuttle system-robot hybrid solutions. Furthermore, autonomous mobile robotics (AMR), such as [Locus Robotics](#) and [6 River Systems](#), are on practitioners' radars for near-future adoption. Zone-based AMR, such as [Geek+](#) and [GreyOrange](#), are also being given due consideration by many."⁴²

"Dark warehouses," which are almost fully automated, use "warehouse execution systems doing the work without the actual warehouse workers. It's run with automated storage and retrieval systems, high-speed conveyor belts, internet of things (IoT) sensors to guide driverless forklifts in moving pallets. It includes ware-

house robots acting as pickers after artificial intelligence configures that picking order and issues instructions. In general, there's a lack of human input."⁴³ While dark warehouses are not expected to displace traditional warehouses in the near term, they are on the horizon. British grocer Ocado has embraced the dark warehouse concept for fulfillment and can process 65,000 orders or 3.5 million individual items per week.⁴⁴

Beyond the trend toward emerging robotics technology, there is another technology investment trend toward more accurate real-time location systems (RTLS) to better track shipments using passive radio-frequency identification (RFID).

According to recent reports from *Logistics Management*, there is a strong use case for it:

- "It is accurate enough to discern if a load is being staged at the correct dock area or whether a lift truck has left or arrived at a cross-dock area."
- "A key benefit of this type of reader is that it doesn't require an operator to trigger an RFID scan or move a load through a narrow reader portal since the readers are stationed above each work area to be monitored. The end result is real-time visibility into how inventory or assets are moving."
- "Bar codes are good for transactional visibility, but RFID provides for real-time visibility. That's a whole different level of visibility that an execution system can make use of."
- "For RTLS to be more effective, a couple of key capabilities are needed. One is to reduce the networking infrastructure that user companies have to put in place for RTLS. The other is actionable analytics."
- Some new tags now have communications infrastructure embedded in each tag. Some are partnering with T-Mobile so these tags can communicate data directly to the cloud using [T-Mobile's Narrowband \(NB\)-IoT](#) network service (such as [Roambee](#)). This essentially sends the data straight from the tags to the cloud in a dedicated lane of cellular service for IoT sensors.⁴⁵

The demand is clear and the trend could not be more apparent—robots, IoT, and automation are here to stay. Impervious to the virus, available around the clock, robots were called upon to fill in gaps in these facilities owing to disease and worker shortages. Warehouse workers grappled with quirkier peak times involving all kinds of bulky goods – grills, guitars, mattresses, lawnmowers, and microwave ovens – while also doing their best to gear up, sanitize spaces, keep apart and keep pace with leaner crews. "The coronavirus outbreak has thrust automation into the spotlight like no other time in history, and this interest will only continue to accelerate," said Santagate. "Based on inquiries, we're about to see robot deployment go through the roof – especially in warehouses."⁴⁶

About the Researcher

Engine Group helps global leaders uncover the truth about their business and fuel their most important decisions so they can optimize today, differentiate tomorrow, and transform in the future. A top 20 global business intelligence firm, Engine Group, works with some of the world's leading organizations to better understand their employees, customers, and markets and drive their business performance. Unlike traditional research companies, Engine goes beyond data and insight to give clients the tools to take action. Engine Group provides its clients in over 50 countries strategic guidance on everything from launching a new product to undergoing organizational transformation. Engine Group is an independent, collaborative agency network born in the digital age and designed to help businesses successfully master disruption.

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