

Calculating the True Cost of Productivity

White Paper

Warehouse labor—whether deployed in a manufacturing or distribution operation—is frequently the dominant cost of a facility, no matter where it is located within the U.S. Discover how implementing automated, dynamic storage and retrieval systems can positively impact labor productivity, and the bottom line, in three areas: reduced labor costs, improved throughput and decreased liability.



Introduction: Productivity = Throughput – Labor Costs

Regardless of where a manufacturing or distribution facility is located within the U.S., labor is widely accepted to be one of the biggest operational costs—anywhere from 50 to 70%.¹ According to the U.S. Department of Labor’s (DOL) Bureau of Labor Statistics (BLS) most recent figures, companies in the Warehousing and Storage subsector (North American Industry Classification System / NAICS 493), saw rising hourly compensation rates (2%), unit labor costs (8%) and labor hours worked (9%) in 2015 over the previous year, while productivity declined by 4.4%.²

Further, finding warehousing labor has become increasingly challenging. Overall U.S. Unemployment Rates have dropped steadily from a high of 10% in October 2009 to a low of 4.6% in November 2016³, while unemployment within the BLS Warehousing and Storage parent sector, Transportation and Warehousing has dropped from 5.1% in August 2016 to 3.1% in November 2016.⁴

Contributing to the difficulty in finding warehouse workers, companies were anticipated to have been creating 270,000 new warehousing jobs per year since 2013, increasing the field’s workforce by as many as 1.4 million by 2018.⁵ Yet, keeping those workers on the job can be equally tough, with the BLS reporting warehouse workers quit at a rate of 36%.⁶

Industry research backs these statistics up. When surveyed, more than 250 top logistics and supply chain managers said their three biggest workforce challenges are:

1. Finding and keeping qualified/skilled/dependable workers (62%)
2. Increasing workforce productivity (57%)
3. Controlling labor costs (45%)⁷

Compelled by such labor and throughput challenges, more manufacturing and distribution operations are considering dynamic, automated storage and retrieval systems as a means to boost operational productivity. These technologies—including horizontal carousels, vertical carousels and vertical lift

¹ Peerless Research Group. “Labor management strategies in the warehouse.” *Logistics Management*. September 10, 2014. Accessed December 1, 2016.

http://www.logisticsmgmt.com/article/labor_management_strategies_in_the_warehouse

² U.S. Department of Labor > Bureau of Labor Statistics. “Productivity and Costs by Industry: Selected Service-Providing Industries, 2015.” May 18, 2016. Accessed December 1, 2016.

<http://www.bls.gov/news.release/prin2.nr0.htm>

³ U.S. Department of Labor > Bureau of Labor Statistics. “Databases, Tables & Calculators by Subject: Labor Force Statistics from the Current Population Survey > Unemployment Rate.” Accessed December 7, 2016.

<http://data.bls.gov/timeseries/LNS14000000>

⁴ U.S. Department of Labor > Bureau of Labor Statistics. “Industries at a Glance> Transportation and Warehousing: NAICS 48-49.” Employment and Unemployment Workforce Statistics. Accessed December 7, 2016.

<http://www.bls.gov/iag/tgs/iag48-49.htm>

⁵ Gue, Kevin, Ed., et al. “The U.S. Roadmap for Material Handling & Logistics.” MHI. January 2014. Accessed December 1, 2016. <http://www.mhlroadmap.org/roadmap.html>

⁶ Peerless Research Group. “Labor management strategies in the warehouse.” *Logistics Management*. September 10, 2014. Accessed December 1, 2016.

http://www.logisticsmgmt.com/article/labor_management_strategies_in_the_warehouse

⁷ Ibid.

modules (VLMs)—replace standard, static shelving and rack used to hold and handle products in cases or as single item eaches.

Horizontal Carousels – Consisting of bins mounted on an oval track that rotate horizontally to deliver stored items to an operator. These automated storage and retrieval systems save up to 60% of floor space when compared to standard shelving and rack.



Vertical Carousels – Comprised of a series of shelves that rotate around a track—similar to a Ferris wheel—these automated storage and retrieval systems quickly deliver stored items to an ergonomically positioned work counter at the operator’s command. When compared to static shelving and rack, they save up to 75% of floor space.

Vertical Lift Modules (VLMs) – An enclosed automated storage and retrieval system that incorporates two columns of trays with a central inserter/extractor that automatically locates and retrieves stored trays from both columns, then presents them to the operator at a waist-high pick window. These systems save up to 85% of floor space compared to static shelving and rack.



Not only do these systems maximize storage density, they also eliminate the need for pickers to walk to and search for stored items—an activity that can waste as much as 60% of their productive time.⁸ This makes current workers less fatigued and more productive, as well as reduces the number of personnel required to complete such picking tasks. Installing one of these systems can cut labor requirements by as much as 66%, enabling current employees to be reassigned to more value-added work while easing hiring pressures and labor expenses.

Further reducing labor costs associated with injuries, liability insurance and downtime, automated storage and retrieval systems minimize the risk of injuries. That’s because they deliver products to operators stationed at ergonomic workstations at the optimal work height: waist-high. The workstations are designed to minimize stretching, pulling, bending, twisting and reaching, preventing the overexertion that leads to musculoskeletal injuries (which cost U.S. businesses \$19.37 billion in direct workers’ compensation claims in 2012.⁹)

⁸ Ruriani, Deborah Catalano. “Improving Picking Practices.” *Inbound Logistics*. September 2006. Accessed December 7, 2016. <http://www.inboundlogistics.com/cms/article/improving-picking-practices/>

⁹ Smith, Sandy. “Top 10 Workplace Injuries Cost U.S. Business \$1 Billion Per Week.” *EHS Today*. January 7, 2015. Accessed December 7, 2016. http://ehstoday.com/safety-leadership/top-10-workplace-injuries-cost-us-business-1-billion-week-photo-gallery#slide-9-field_images-37621

In addition, goods-to-person picking systems can also speed up item picking for a boost in throughput, yielding higher rates of product picked or moved through the facility within a given period of time. This allows an operation to extend order cutoff times, so more orders can be filled within a day, or to pick up to 400% more items with the same number of workers during the same amount of time.

This white paper demonstrates two calculations that contribute to calculating the true cost of productivity within a manufacturing or distribution storage facility—labor costs and throughput—and details the potential costs of worker liability insurance and downtime. It also shows how an investment in a dynamic, automated storage and retrieval system as a replacement for static shelving or rack will yield significant productivity gains for a facility in each of these areas.

Do the Math: How Much Does Labor Cost?

Picking involves much more than grabbing an item off a static storage rack or shelf. In the typical manual operation, picking means a warehouse associate receives a paper list of instructions about what to pick and where, travels to the correct storage location, refers to the paper pick list to determine the number of items required from the pick face, picks the items, confirms the pick by marking the paper, then delivers the items for packing.

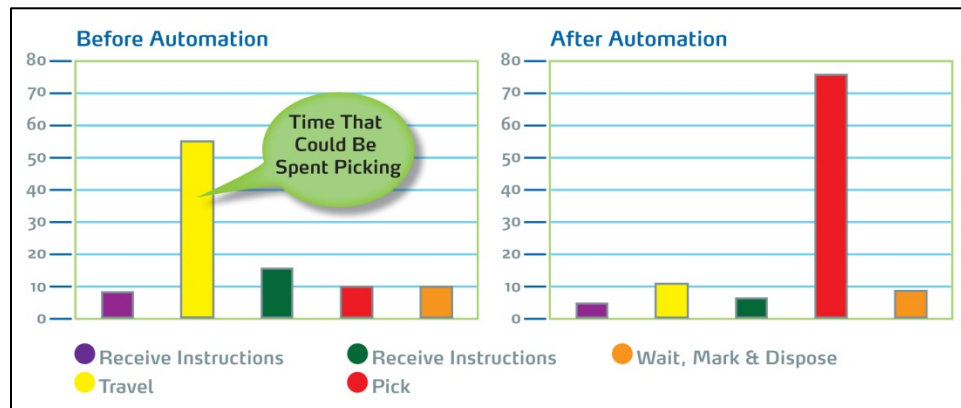


Figure 1: Breakdown of Picker Time Required to Complete Picking Tasks Before and After Implementation of an Automated Storage and Retrieval System

In a manufacturing facility, components and maintenance and repair operations (MRO) parts storage is frequently a considerable distance away from the production line. Likewise, most distribution centers are packed with pallets, cases and pieces. For these reasons picking is frequently described as, “the most labor-intensive and costly activity for almost every warehouse, where the cost of order picking is

estimated to be as much as 55% of the total warehouse operating expense.”¹⁰ That’s because travel in a conventional, manual storage operation can account for as much as 60-65%¹¹ of a picker’s time.

Conversely, implementing one or more dynamic, automated storage and retrieval systems in a facility lets these associates work more productively. That’s because these technologies present stored items directly to an operator. The “goods to person” method eliminates time spent walking from one pick location to another within a warehouse. They are also equipped with indicator lights that illuminate the item’s location and pick quantity required, dramatically reducing the time spent searching for a specific stock keeping unit (SKU). The result is more time to spend picking.

Further, because the automated solution interfaces with both inventory management and order management software, the picks are sequenced so that machine’s movement is optimized to match the required picks. This means all items can be picked in one rotation, or cycle, of the machine’s storage bins or trays, further maximizing pick time.

All three of these functions can optimize an existing labor force, increasing productivity from 200% to 600%. Because an automated solution enables just one worker to handle the picking assignments of multiple operators, as many as two-thirds of a facility’s workforce can be reassigned to other, non-picking tasks—without a loss of throughput.

Facilities implementing an automated solution to increase picking capacities most often choose to maintain current labor levels. Increased picking capabilities enable the consolidation of multiple picking operations, meet increasing order demands and accommodate the addition of more SKUs to inventory. Alternately, implementing these automated storage solutions can compensate for scarce or unreliable labor.

Regionally, the annual mean (average) wage by state for workers who pick inventory—what the BLS terms as “Material Moving Workers”—ranges from \$20,890 to \$56,760, as shown in Figure 2 at right.¹²

Nationally, the BLS reports 23,880 persons employed in this occupation, making a mean hourly wage of \$16.61 and a mean annual wage of \$34,540 (neither of these numbers are fully

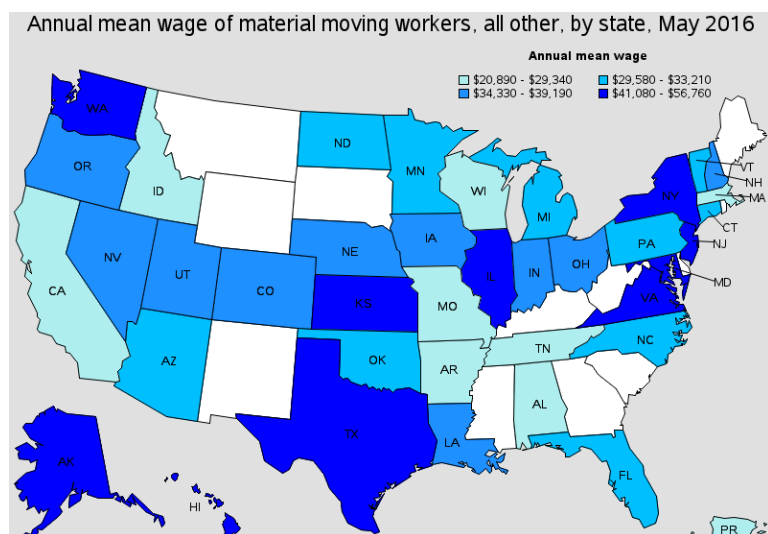


Figure 2: BLS Annual Mean Wage Map of Material Moving Workers by State

¹⁰ Martin Murray, “Order Picking in the Warehouse,” About.com Logistics and Supply Chain Guide, accessed January 5, 2014, http://logistics.about.com/od/operationalsupplychain/a/order_pick.htm

¹¹ Lee Rector, “Warehouse Slotting,” Toolbox.com SCM Blogs, accessed January 5, 2014, <http://it.toolbox.com/blogs/warehouse-planning/warehouse-slotting-6655>

¹² U.S. Department of Labor > Bureau of Labor Statistics. “Occupational Employment Statistics > Employment and Wages, May 2015 > 53-7199 Material Moving Workers, All Other.” Accessed May 2, 2017. <https://www.bls.gov/oes/current/oes537199.htm>

burdened.¹³ To calculate the approximate cost of benefits—such as health insurance and retirement savings—add another 36%¹⁴ to these wages). For the purposes of this calculation, the fully burdened mean annual wage of \$48,974 used in Table 1 below in the green sample columns (\$34,540 mean annual wage plus 36% for benefits). To calculate your own, provide the information shaded in blue – Cost of Employee per Year and Number of Employees Order Picking and then do some simple math.

Table 1: Calculate Labor Cost Savings

| | Manufacturing/Distribution Sample Costs | | Compare Your Own Numbers! | |
|-----------------------------------|---|--------------------------|---------------------------|--------------------------|
| | Standard Shelving or Rack | Dynamic Storage Solution | YOUR Current System | Dynamic Storage Solution |
| Cost of Employee per Year** | \$48,974 | \$48,974 | | Same As Current |
| Number of Employees Order Picking | 6 | 2 | | Reduce by 66% |
| Total Labor Cost per Year | \$293,844 | \$97,948 | Multiply Above | Multiply Above |
| Cost Savings per Year | None | \$195,896 | None | Subtract Totals Above |

Do the Math: How Much Does Static Storage Throughput Cost?

Operators picking manually are often restricted to filling one order at a time, which severely limits productivity. Restricted to paper pick lists and a lack of picking optimization software, they may visit the same popular SKU pick faces multiple times in a day. For a facility with static shelving or pallet rack, this translates into pick rates of approximately 50 lines per hour.

Alternately, an automated storage and picking solution facilitates batch picking. The process groups orders with a common item, or items, together so that multiples of the same item are picked during one

¹³ U.S. Department of Labor > Bureau of Labor Statistics. “Occupational Employment Statistics > Frequently Asked Questions.” Accessed December 12, 2016. http://www.bls.gov/oes/oes_ques.htm

¹⁴ U.S. Department of Labor > Bureau of Labor Statistics. “National Compensation Survey: Employer Costs for Employee Compensation, Historical Listing,” Table 18: Private industry workers, by industry group: employer costs per hours worked for employee compensation and costs as a percentage of total compensation, 2004-2016, Transportation and warehousing, page 418. Accessed December 12, 2016. <http://www.bls.gov/ncs/ect/sp/ececqrtn.pdf>

visit to the pick location, then sorted to their appropriate orders for shipping at a nearby workstation.¹⁵ This means multiple orders can be filled at one time—up to 750 lines per hour, as shown in Table 3.

Table 2: System Comparison – Picking Rates

| System | Bag & Tag (lines per hour) | Pick & Toss (lines per hour) |
|---------------------|-------------------------------|---------------------------------|
| Shelving | 10 – 35 | 30 – 75 |
| Drawers | 10 – 35 | 30 – 50 |
| Flow Rack | 25 – 45 | 75 – 150 |
| Pallet Rack | 35 – 60 | 95 – 200 |
| Horizontal Carousel | 75 – 200 | 225 – 750 |
| Vertical Carousel | 50 – 175 | 150 – 225 |
| VLM | 50 – 150 | 125 –175 |

Because horizontal carousels, vertical carousels and VLMs utilize integrated inventory management software, batch picks can be completed in a single rotation, or cycle, of the unit. Batch picking with an automated system eliminates bottlenecks associated with waiting for one last item to complete an order or finish a manufacturing process. Should a “hot pick” crop up, the automated systems easily accommodate a pause in the batch picking sequence, allowing a non-batched order to be fulfilled on demand to prevent additional holdups.

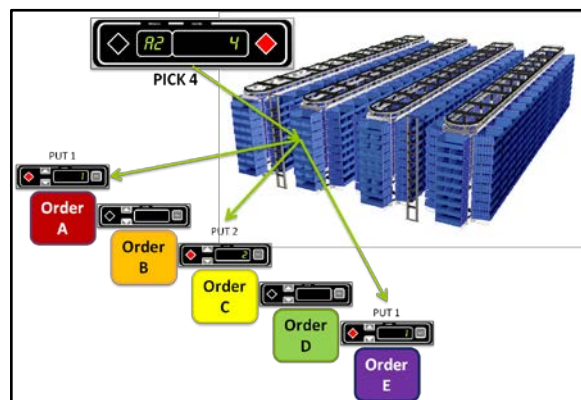


Figure 3: How Batch Picking Works

Batch picking can also be used to prioritize orders by importance or by inventory availability. This enables customer order cut-off times to be extended, increasing a company’s competitiveness and customer satisfaction.

Implementing an automated storage and retrieval system for batch picking can increase the number of line items picked per hour anywhere from 125 to 750, for the purposes of this calculation, the conservative number of 120 is used in Table 4 below in the green sample columns. To calculate your own, provide the information shaded in blue – Revenue Generated, Number of People Order Picking and Sustained Number of Line Items Picked Per Person Per Hour and do some simple math.

¹⁵ Mark Del Franco, “Batch vs. Wave Picking,” Multichannel Merchant, June 1, 2006. Accessed December 8, 2016. <http://multichannelmerchant.com/opsandfulfillment/batch-vs-wave-picking-01062006/>

Table 3: Calculate Throughput Increases

| | Sample Manufacturing & Distribution Figures | | Compare Your Own Numbers! | |
|--|---|--|--|--|
| | Standard Shelving or Rack | Dynamic Storage Solution | YOUR Current System | Dynamic Storage Solution |
| Revenue Generated | \$2,500,000 | \$7,500,000 | | (lines per year new – lines per year current) multiply by revenue per line item |
| Number of People Order Picking | 6 | 6 | | (same as current) |
| Sustained Number of Line Items Picked Per Person Per Hour* | 30 | 120 | | (increase up to 400%, multiply by 4) |
| Sustained Number of Line Items Picked as a Company Total Per Year** | 345,600 <small>(6 people x 30 lines x 8 hours/day x 240 days/year)</small> | 1,382,400 <small>(6 people x 120 lines x 8 hours/day x 240 days/year)</small> | <small>(multiply above people x above lines x working hours/day x working days/year)</small> | <small>(multiply above people x above lines x working hours/day x working days/year)</small> |
| Average Revenue per Line Item Picked | \$7.23 <small>(divide revenue by lines per year)</small> | \$7.23 | <small>(divide revenue by lines per year)</small> | (same as current) |
| Additional Revenue Opportunity per Year** | None | \$5,000,000 | None | (future revenue – current revenue) |
| <p>*assumes standard rack and shelving without software, picklights or batching, assumes dynamic solution includes multiple machines in a workstation with software, picklights and batching</p> <p>**assumes 240 single shift working days per year</p> | | | | |

Other Costs: Losses Associated with Worker Injuries and Liability

Manual picking operations utilizing shelving or pallet rack for item storage frequently require a picker to reach, bend, lift, twist, stretch, push or pull to retrieve inventory. That's because these storage units are characterized by poor visibility of products in the back or up high, and unsafe picks due to the stored products' height or distance from the pickface.

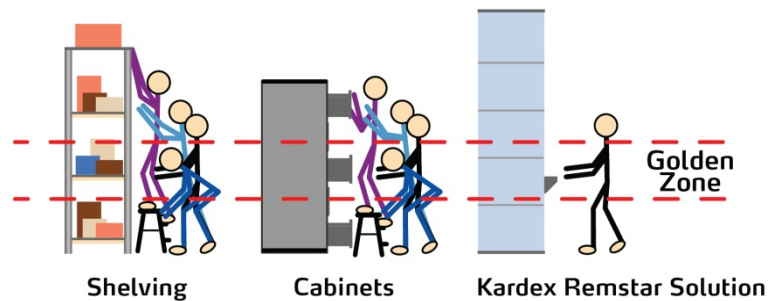


Figure 4: Comparison of Picking from Shelving, Cabinets and Automated Storage and Retrieval Systems

To avoid potential injury, it is often recommended that workers pick items from the “golden zone,” which extends from the belt height to the shoulder height of the average individual. Items within this zone can be grabbed or moved without either stretching or bending.”¹⁶

In contrast, automated storage systems present stored items at the proper ergonomic, waist-high work height. This creates a safe working environment that minimizes injuries from bending, reaching and stretching. Further, walking and climbing are no longer necessary. Not only does this reduce fatigue, but also the chance of worker injury is substantially lessened. In turn, absenteeism, insurance premiums and claims for worker's compensation will be reduced.

And those costs can be high. The Occupational Safety and Health Administration's (OSHA) has found that:

...warehouses produce an above average number of worker injuries when compared to other industries. Citations against employers for safety violations begin at \$7,000 each, and costs run high for medical care and legal battles related to injured workers.... When an accident hurts a warehouse worker, the direct expenses, like medical care, reach an average cost of \$38,000. Indirect costs equal \$150,000 on average per accident victim. If an OSHA investigation finds that an employer repeated a previously cited offense, the fine could rise to \$70,000.¹⁷

¹⁶ Kenneth B. Ackerman, Art Van Bodegraven, “Fundamentals of Supply Chain Management: An Essential Guide for 21st Century Managers,” accessed January 3, 2014, books.google.com/books?isbn=0979597609

¹⁷ Donald Noack, Noack Law Office. “High costs associated with warehouse worker injuries,” November 3, 2015. Accessed December 8, 2016. <http://www.noacklawoffice.com/blog/2015/11/high-costs-associated-with-warehouse-worker-injuries.shtml>

Diversco Supply Expands Vertically with Shuttle VLMs

Three Shuttle VLMs help Diversco Supply expand inventory by recovering 92% floor space and increase order fulfillment productivity by 460%.

Canadian company Diversco Supply is a leading equipment wholesaler in the gas industry, specializing in equipment and supplies for propane and gas, compressed air, scuba and watersports. At the company's largest warehouse (52,000 square feet) in Cambridge, Ontario, it had become a struggle to manage the diverse inventory: a combination of smaller parts (valves, regulators, hoses, snorkels, fins, etc.) and large parts (kayaks, paddle boards, etc.).



Within the Cambridge facility, Diversco installed a combination of three, 32-foot tall Shuttle Vertical Lift Modules (VLMs) backed by Power Pick Global (PPG) inventory management software to manage the smaller parts inventory (4,500 SKUs), while large item inventory (400 SKUs) is kept in standard rack and shelving and picked with handheld RF scanners.

Previously, Diversco's small parts inventory was stored on 5,000 square feet of shelving. Using handheld RF scanning technology workers would walk through the shelving scanning and picking parts as directed by the RF gun, each worker often walking several miles per day. Now, these parts are inventoried in three VLMs that occupy just under 360 square feet – a 92% floor space savings.

For small parts picking, the web-based ERP sends orders to the inventory management software for fulfillment. A tote is assigned an order ID and a customer ID and is placed in an open position on the batch station. When ready, the operator starts the fulfillment process with the click of a button and the VLMs move to retrieve the parts required for the selected orders.

Light-directed picking systems integrated into each VLM direct the operator to the exact item location within the tray. The operator picks the correct quantity of the item, confirms the pick and turns to the batch station to distribute the items among the orders. Simultaneously, the other VLMs retrieve additional inventory required for the batch of orders. The operator is rarely waiting for parts, the VLMs are always working one step ahead of the operator, contributing to a significant boost in productivity.



While labor requirements have remained the same, efficiencies have skyrocketed. With five full time workers (one worker in the small parts VLM area, two workers in the large item rack area and two workers in shipping) Diversco is filing orders faster than ever. Productivity has increased from 25 lines



per hour to 115 lines per hour (and accommodated an additional new bag-and-tag step), resulting in a 460% increase in productivity.

Adding the VLMs prompted “a complete transformation from a manual picking environment of walking and searching to a semi-automated process,” said James Huddle, purchasing and operations manager at Diversco Supply, “The compact storage, time savings and ease of use completely offset the cost of the system.”

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To learn more about how automated storage systems can better maximize your facility’s productivity by reducing labor costs and increasing throughput, contact your Kardex Remstar representative today.

About Kardex Remstar

Kardex Remstar, LLC, a company of the Kardex Group, is a leading provider of automated storage and retrieval systems for manufacturing, distribution, warehousing, offices and institutions. For information about the company’s dynamic storage solutions, call 800-639-5805 or visit www.KardexRemstar.com.