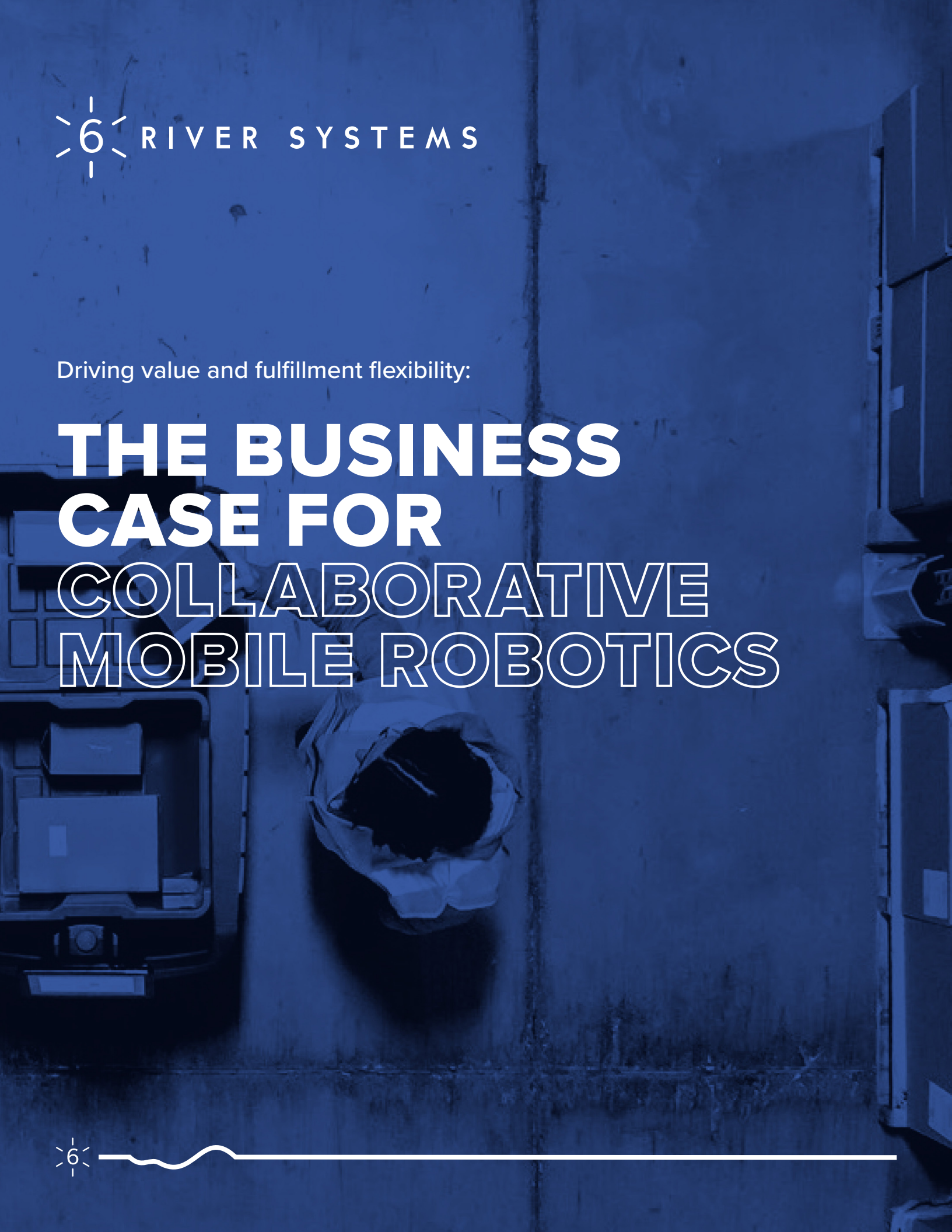


6 RIVER SYSTEMS

Driving value and fulfillment flexibility:

THE BUSINESS CASE FOR COLLABORATIVE MOBILE ROBOTICS



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EXECUTIVE SUMMARY

6 RIVER SYSTEMS

ASSESSING THE FULFILLMENT CHALLENGE

Transform fulfillment with the flexibility to meet increased demand and reduce costs.

The COVID-19 pandemic changed our world overnight. Buying behaviors that were predicted to become the norm by 2026 are suddenly a reality. *FORBES* reported that COVID-19 has accelerated ecommerce growth by four to six years and it shows no signs of slowing down.

Prior to COVID-19, ecommerce and B2B fulfillment operators were increasingly turning to Collaborative Mobile Robots (CMRs) to gain operational flexibility and maintain growth. Early efforts to meet the unexpected demand have included retooling warehouses to handle the increase in each picking and launching or expanding fulfill-from-store initiatives.

Now, more than ever, supply chain leaders know that fulfillment is the key to differentiation, and in some cases, survival. Because of this new reality, CMR providers expect to see a surge in demand as operators implement new strategies to provide cost-effective fulfillment services in an uncertain labor market.

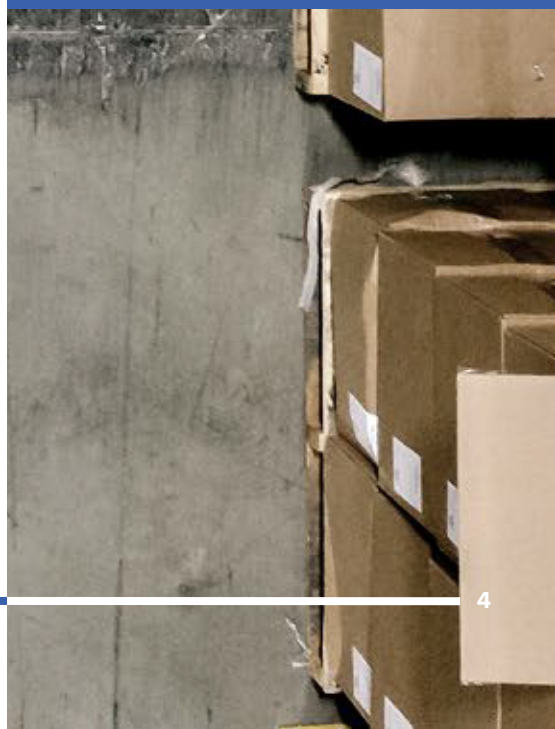
Based on interviews with more than 25 supply chain leaders worldwide who were early adopters of CMR solutions, this report provides insights on how to transform fulfillment operations, yield a multi-million dollar net present value and deliver a fast return on investment.

6 River Systems customer case study

ROI
15 MONTHS

Projected 5-Year Savings
$8,506,707

Projected NPV
$7,109,888



KEY FINDINGS

All of the interviewees deployed 6 River Systems. Their collective insights are included throughout the paper.

This case study demonstrates the projected value of the 6 River Systems' (6RS) solution over five years. The customer replaced manual cart and RF picking with 6RS' fulfillment solutions in an ecommerce operation with 15% annual growth.

The operation had Year 1 volume of more than 7.5 million units and 5 million lines. Using 6RS, the operation was able to perform the work with 20 single-shift picking associates. The solution delivered a return on investment in 15 months. The projected 5-year net present value of the solution is more than $7.1 million, with over $8.5 million in cumulative cost savings.

	Year 1	Year 2	Year 3	Year 4	Year 5
6RS benefit	$1,840,533	$2,112,612	$2,425,304	$2,784,690	$3,197,763
Total Investments	$1,886,119	$442,400	$472,370	$506,836	$546,471
Cash flow	$(45,586)	$1,670,212	$1,952,934	$2,277,854	$2,651,292
Net cumulative benefit	$(45,586)	$1,624,626	$3,577,560	$5,855,415	$8,506,707

ROI → **15 MONTHS**

NPV* → **$7,109,888**

*Calculated at 5% cost of capital.

Savings drivers

Increased pick rate by 252%. The increase enabled the operation to fulfill 15% more orders in 67% fewer picking hours than the previous year.

Reduced supervisor costs by more than $80,000 in Year 1. Chuck's directed workflow, on-board scanner and put-to-light enabled associates to perform near-perfect work. This increased customer satisfaction and retention and reduced internal order auditing and rework costs.

Reduced training time by more than 80%. Chuck's onboard lighting and on-screen images and prompts accelerated training. New associates reached performance standards in hours, which saved the operator more than $1,000 in training costs for every new hire.

Reduced operational supplies spending. On average, operators spend $750-$1,250 on supplies annually per associate. As the average labor hours required to fulfill orders decreased, spending on facility supplies decreased as well.

Reduced licensing and hardware costs. Prior to deploying 6RS, associates used a manual cart and RF picking solution. Chuck, 6 River Systems' collaborative mobile robot, has an on-board scanner. This eliminated approximately $2,000 in annual RF device costs and WMS license fees per user.

Reduced replenishment and packout costs by 15%. 6RS' system-directed workflows increased replenishment productivity, improved product availability and reduced congestion. 6RS' packout functionality expedited order packing processing time and improved SLA compliance.

Unquantified savings

Extended facility life. With 15% annual growth, the operation would have outgrown the facility capacity in two years with their manual cart solution. 6RS helped to extend the projected useful life of the building by 6 years, deferring millions of dollars in relocation or expansion costs.

Reduced picking errors by 30%. Chuck's directed workflow, on-board scanner and put-to-light enabled associates to perform near-perfect work. This increased customer satisfaction and retention. Error reductions also lessened internal order auditing and rework costs. Year 1 savings were estimated at $500,000.

Improved labor retention. Chuck replaced cumbersome and dangerous manual carts, eliminated long walks to receive and deliver work and improved associates' jobs. This helped the company to recruit and retain the best associates.

Costs

Deployment and annual support fees. Organizations can procure 6RS as a capital purchase, a rental or a hybrid model. This case study was a capital purchase with annual support and maintenance fees. To handle increased volume, Chucks were added after Year 1 and Year 2 (at additional costs). The operation expects to make similar additions to the fleet in subsequent years. The presumptive costs are included in the financial calculations.

Internal costs. The customer allocated an IT resource to work with 6RS on deployment and integration for two weeks.

Increased induct labor by approximately $40,000. This labor increase was required to prepare the Chucks for picking and replenishment assignments.

Projected 5-year savings

See full financial information on page 16



Reduced picking labor
$8,674,148



Training benefits
$1,301,122



Cost avoidance - licensing and hardware
$1,178,737



Reduced Supervisor Hours
$539,437



Reduced packout labor
$269,695



Reduced replenishment labor
$134,848

FULFILLMENT SOLUTION REQUIREMENTS: OVERVIEW

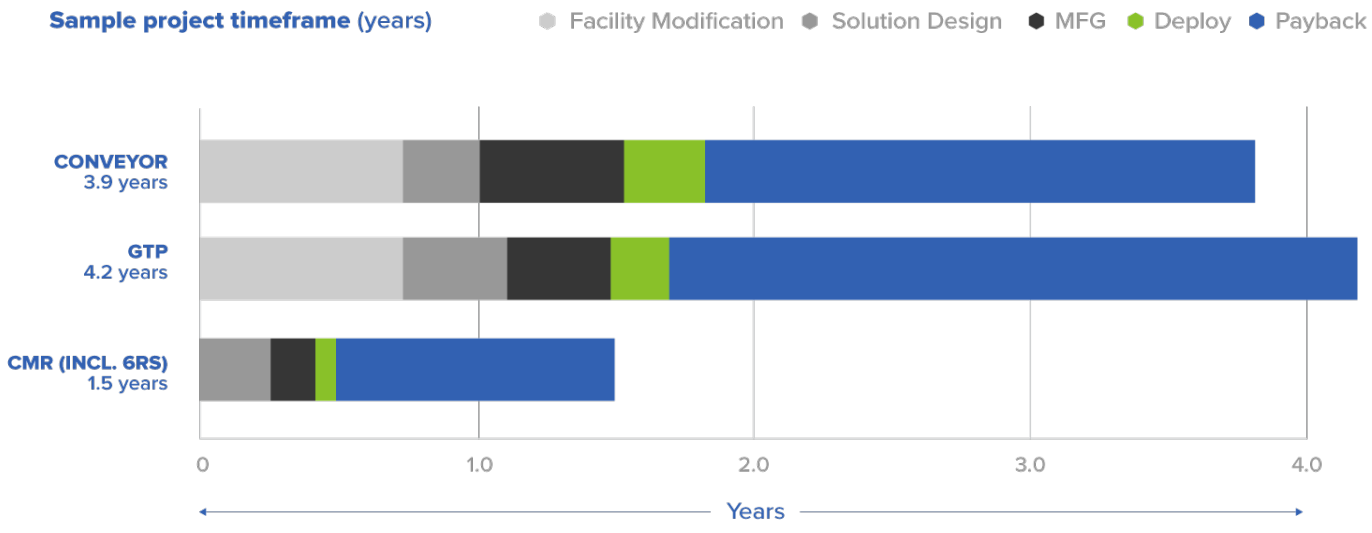
The interviews revealed that operators–despite spanning diverse industries, geographies, and operation environments–had similar requirements:

- Improve labor productivity and engagement
- Flexibility to deploy quickly without any new infrastructure and adapt to business changes
- Deliver ongoing value

These requirements disqualified expanding or installing conveyor or goods-to-person systems that would take too long to address the immediate challenges and cost several times more than collaborative robotics.

Those traditional automation solutions also are very rigid, costly to modify as order profiles change and do not become more productive over time.

The interviewees also ruled out trying to increase capacity of their existing solution by adding labor. If available, additional labor would have been cost prohibitive and created congestion and confusion on the floor without guaranteeing SLA compliance.



SOLUTION REQUIREMENTS: INCREASE LABOR PRODUCTIVITY

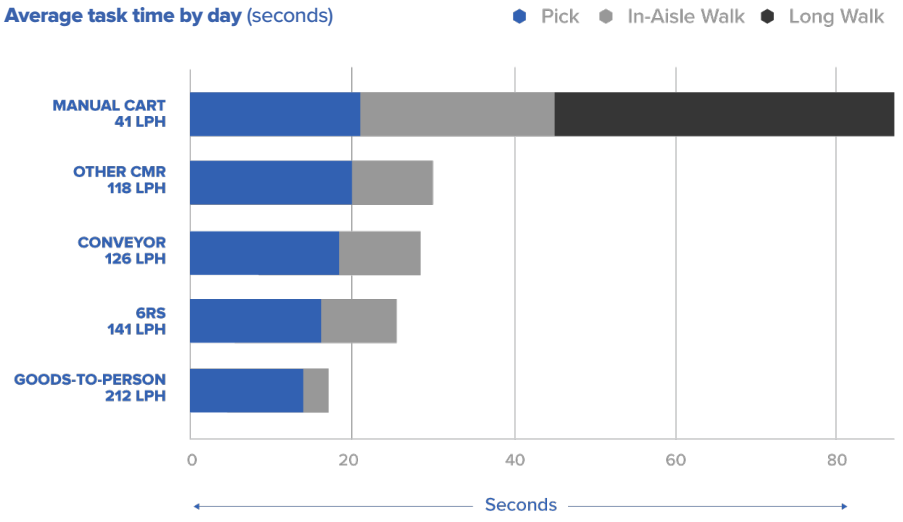
Reduce costs, meet SLA requirements

The key productivity concerns for the interviewees focused on increasing order volume at a lower cost while gaining day-to-day operations performance predictability. To achieve these objectives, the interviewees pursued solutions that could maximize assignment density, increase the associates' focus and direct the associates to the right task at the right time.

Maximize work density – more working, less walking

CMRs work alongside and guide warehouse associates through value-added tasks, eliminating the long walk to receive and deliver work. Chuck provides more than double the workspace and capacity of any other CMR without sacrificing the agility required for two-way travel or navigating in narrow aisles.

6RS increases pick density through intelligent work assignment and dynamic zone picking. Associates avoid multiple trips to the same pick location and minimize long walks to retrieve slow-moving SKUs in a single order. The result is increased pick rates, decreased cycle time and reduced in-aisle travel.



* **LPH** = Lines per hour

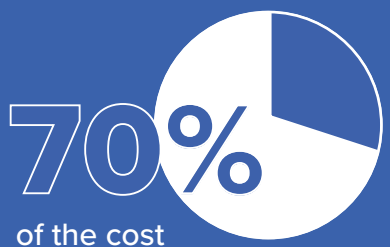
Compared to goods-to-person solutions, 6RS generates 67% of the value at 20% of the costs in 36% of the time.

"6 River Systems is helping us improve productivity, accuracy and our time to fulfillment."

- GORDON MACKENZIE
VP OF TECHNOLOGY, CSAT SOLUTIONS

"Using 6 River Systems, single-shift capacity has increased by 65% and average turn time from order entry to generating a tracking number has been reduced by approximately five hours."

- MIKE MYERS
ENGINEERING MANAGER, ODW LOGISTICS



of the cost to run a warehouse is **labor.**

70%

of warehouse associates' time is spent **walking around.**

Focus on the task

Associates are more focused and engaged when working with CMRs than other automation tools. Manual pushcarts are cumbersome for associates to use and become heavier throughout picking assignments. When operators replace manual carts with CMRs, the associates are less physically taxed and are better able to focus on picking.

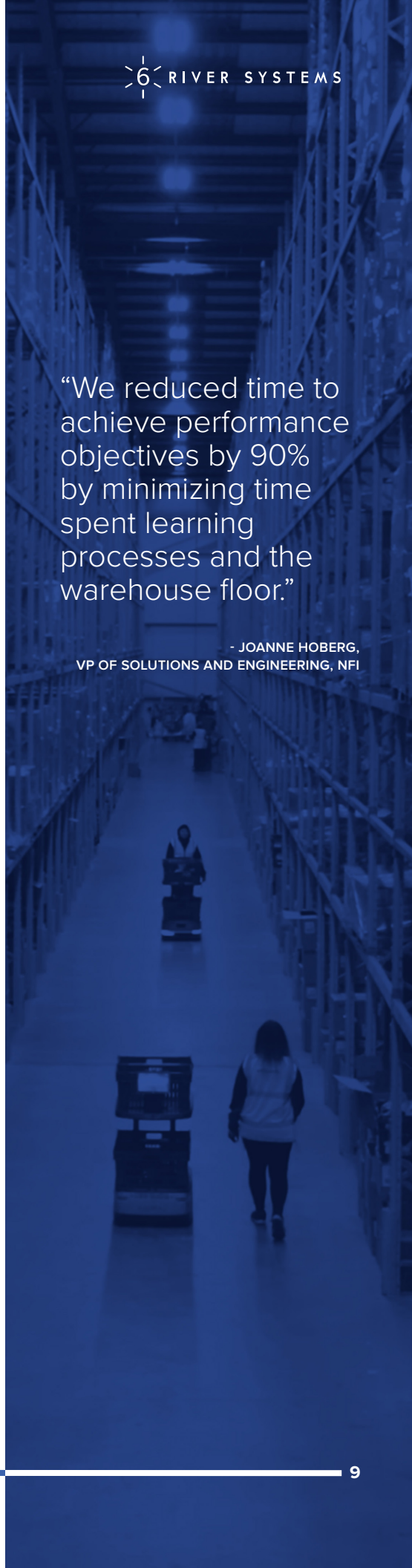
6RS' directed approach starts with easy-to-follow work instructions on Chuck's interactive graphical user interface (GUI). The instructions enable associates to prepare for the work ahead and save time throughout the picking process:

1. **Finding/scanning the bin:** Chuck stops in front of the bin, eliminating the need for a bin scan.
2. **Searching for the item:** Chuck displays the product image, helping the associate to find the right SKU.
3. **Confirming the pick:** Associate performs a hands-free scan using the onboard scanner.
4. **Putting the item:** Chuck's lights direct the associate where to put the picked item.
5. **Transition:** After completing the pick, Chuck leads the associate to the next task.

These time savings help 6RS to drive significant performance improvements over manual cart picking. Consider the case study results:

Manual Cart	Chuck	Benefit
90 seconds per line	**25.5** seconds per line	**71.63%** reduction
40 lines per hour	**141** lines per hour	**252.50%** improvement

MORE THAN **3.5x** LINES PER HOUR

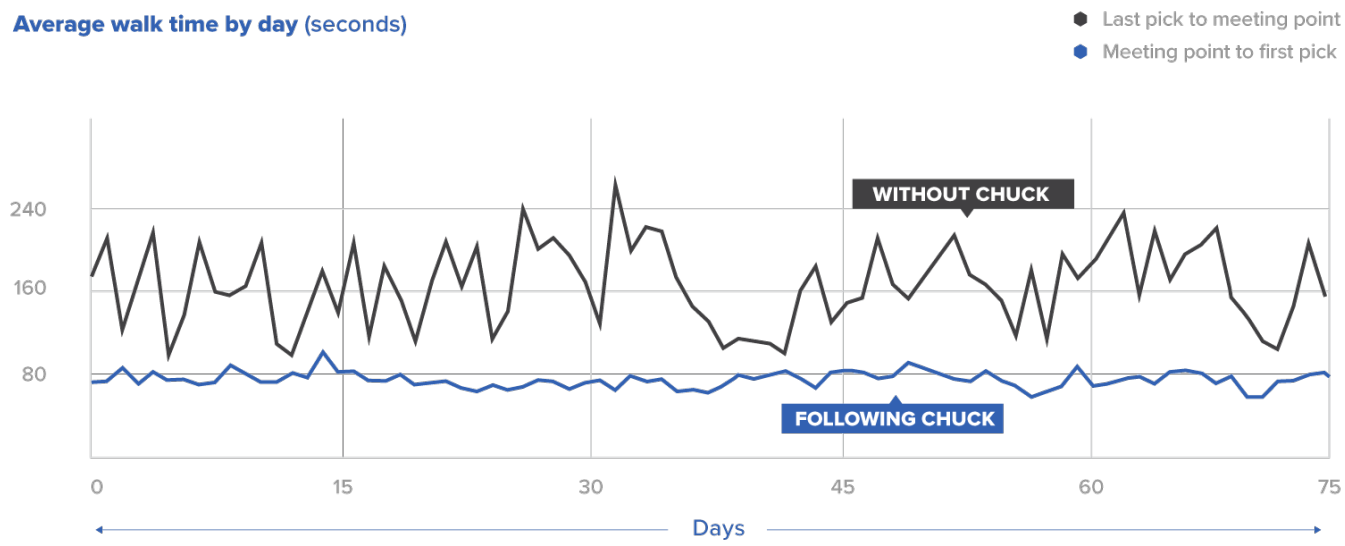


"We reduced time to achieve performance objectives by 90% by minimizing time spent learning processes and the warehouse floor."

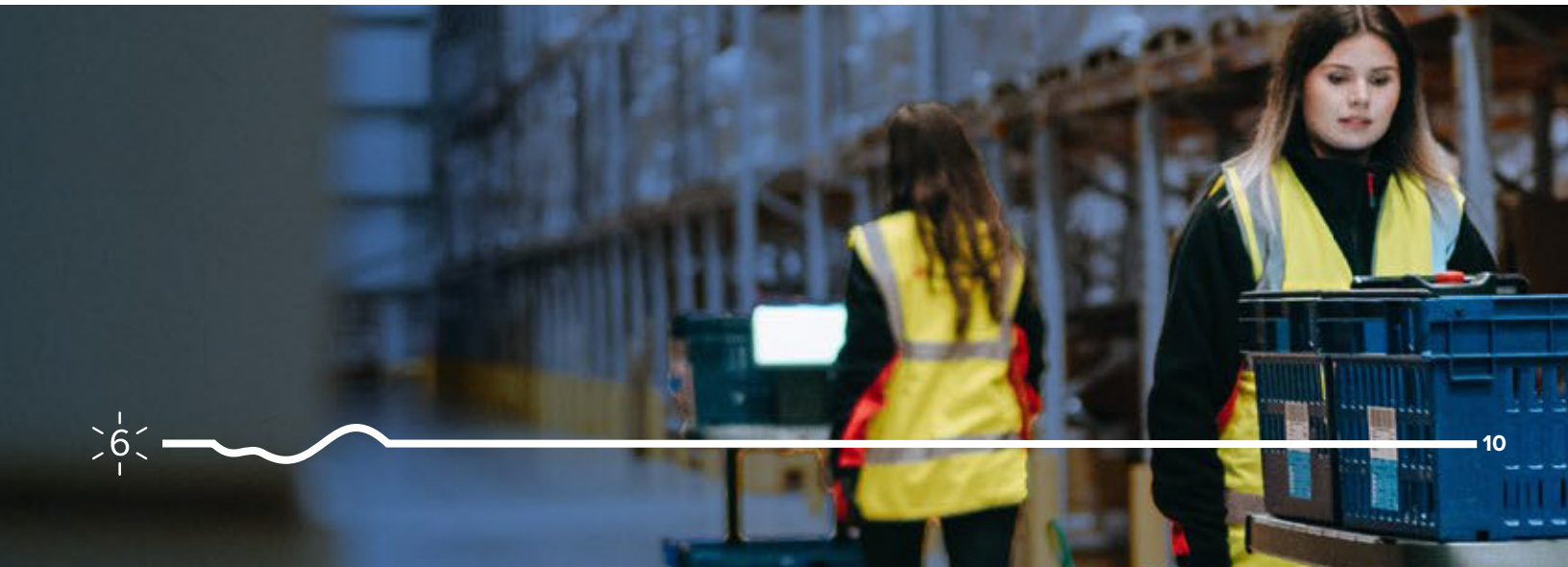
- JOANNE HOBERG,
VP OF SOLUTIONS AND ENGINEERING, NFI

Focus on the travel

On average, associates who set their own pace travel only half as fast as when they follow Chuck. Over the course of a day, their speed without Chuck also fluctuates wildly, making it difficult to establish operational predictability. Magnifying the inefficiencies, associates working with lower-capacity robots have to transition to a new robot at almost every pick location rather than after 10-35 locations with Chuck (depending on order profile and task).



An additional performance variable among CMRs is how associates transition to a new task. After completing an assignment with other CMR solutions, associates choose their next assignment option. They often do not choose the closest or highest-priority assignment, passing available robots or taking poor routes to the next robot. 6RS is a “Directed System” that takes all of the guesswork away from the associate by directing every assignment.



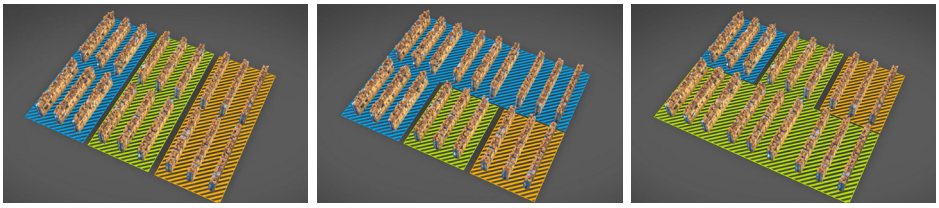
Direct your people to the right place at the right time with the right robot

In deciding how to best address labor effectiveness, the interviewees required a solution with the brains to establish the right balance of associate and equipment utilization.

While "static zones" are available in the 6RS solution, operators have found dynamic zoning to be a more effective and flexible approach. Dynamic zoning leverages software to do the heavy lifting and balance two of the most expensive warehouse resources, people and equipment, to achieve optimal productivity and SLA compliance.

To optimize productivity, 6RS reviews the available order pool and assigns work to virtual zones that expand and contract dynamically as SKU commonality, order priority and congestion changes. This removes the constraints of physical zones, mitigates the imbalances between hot and cold zones and reduces the need to continually re-slot inventory to balance zones.

To ensure SLA compliance, orders closest to the ship-by dates/time are the highest priorities. Other assignments are bundled opportunistically with high-priority orders to allow the operation to keep up with demand and to create pick density.



"The best thing about the system is the way it groups picks together to enhance productivity across the facility. Out of 100 picks, 20 of them are in the same general area."

- KEITH GRIBBLE
OPERATIONS MANAGER, MD LOGISTICS

SOLUTION REQUIREMENTS: FLEXIBILITY

CMRs can be implemented quickly and adapt to your needs

Highly seasonal operations were wary of bolting fixed infrastructure into the ground and third-party logistics providers realized a capital intensive automation investment would not deliver a payback within a customer contract period.

CMR flexibility factors

Stage	Capability	Impact
Purchasing	Rent, buy and hybrid options are available. This enables operators to purchase for average volume and rent additional robots to scale for forecasted demand spikes, such as peak.	Align cost with operational benefit to make it easier for companies of all sizes to purchase a system. Rental option reduces the upfront cost.
Deployment	With no additional physical or network infrastructure required, operators can quickly deploy CMRs within their existing facility footprint and IT network.	Decrease deployment time, reduce project risk and accelerate time to realized benefit. Receive a full ROI in less time than a traditional automation or goods-to-person system can be implemented.
Operations	Operators can add capacity as needed to meet demand. CMRs can also be moved easily across facilities to ensure operational continuity if orders need to be reallocated to another location.	Optimize SLA compliance and reduce cost-to-serve by improving facility, labor and equipment utilization. The solution also decreases the risk of operations disruption.



"The 6 River Systems solution is very scalable, and flexible. I know that if I have a surge in business they can ship more Chucks here in under a week. I also know that if we continue to grow and we need to leave this facility, I can take the Chucks with me."

- SID LAKHANI
CEO, HEALING HANDS

In addition to the flexibility factors, the interviewees identified unique value from 6RS:

- **Meet changing demand:** To accommodate real-time order profile and service level changes, 6RS customers can change picking methods quickly. Operators can deploy discrete, batch, cluster and zone picking within and across assignments.

- **Simplify operations:** To optimize pick rates, 6RS often splits orders across multiple Chucks. The solution's consolidation function removes the guesswork from merging items that have been picked across multiple Chucks into orders for shipment, assuring optimal pick rates and efficient downstream processing.



SOLUTION REQUIREMENTS: ONGOING VALUE

Improve year-over-year rates; increase utilization and value with enhancements and new applications

Unlike conveyor systems and other infrastructure-heavy automation solutions rejected by the interviewees, robotics offer the unique potential to improve after deployment. The benefits can be realized in ongoing over-the-air and cloud-based software enhancements to direct activities more effectively and new applications to increase system utilization and value.

Software enhancements

6RS' data team analyzes all assignments and tasks to find performance improvement opportunities, which are quickly turned into product enhancements and deployed to customer sites.

These efforts enable 6RS to deliver on its promise of year-over-year improvements that increase the value of the system and accelerate or amplify the return on investment. On average, year-over-year productivity at customer sites was improved by 10% in 2019. Significant improvements included:

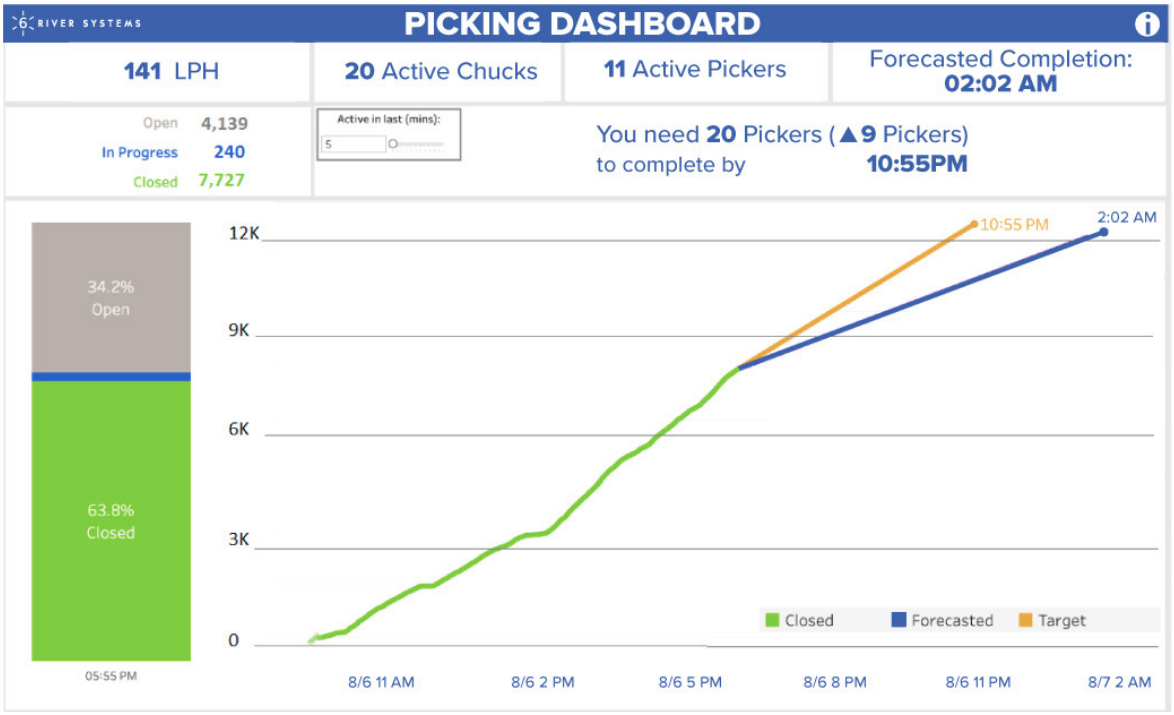
- Directing associates to place the bins used most often in an assignment in the most easy-to-reach locations on the Chuck
- Increasing pick density through assignment creation enhancements
- Refining algorithms to better predict where and when a Chuck should be sent to an associate
- Reducing the travel time from meeting point to first pick by more than 22%
- Increasing Chuck speed by 4.6% without compromising safety



"Our solution from 6 River Systems enables us to increase our throughput and get more orders out the door and into customers' hands. We are excited about 6 River Systems' commitment to continually improving and developing their product."

- GLEN SUTTON, SVP AMERICAS, INGRAM MICRO COMMERCE & LIFECYCLE SERVICES

Additionally, 6RS deployed an expanded range of configurable and actionable dashboards that help operators to optimize performance and SLA compliance. This visibility helps customers to proactively address "problem orders," view order progress, forecast labor needs and gain detailed insights into labor and equipment utilization.



Capabilities beyond picking

The CMR providers considered by the interviewees all offered picking solutions. The interviewees said that it was important for them to work with a provider with the vision and capability to drive value beyond picking. Only 6RS offered replenishment, sortation and packout capabilities.



FINANCIALS

Return millions of dollars to the bottom line

The projected 5-year benefits below are from an ecommerce fulfillment operation with 15% annual growth in the area where 6RS replaced cart picking. The operation had Year 1 volume of more than 7.5 million units and 5 million lines. Using 6RS, the operation was able to perform the work with 20 order pickers, 72% less than with manual carts. The solution delivered a return on investment in 15 months and a projected $7.1 million dollar net present value in the 5-year period.

	Year 1	Year 2	Year 3	Year 4	Year 5
6RS benefit	$1,840,533	$2,112,612	$2,425,304	$2,784,690	$3,197,763
Total Investments	$1,886,119	$442,400	$472,370	$506,836	$546,471
Cash flow	$(45,586)	$1,670,212	$1,952,934	$2,277,854	$2,651,292
Net cumulative benefit	$(45,586)	$1,624,626	$3,577,560	$5,855,415	$8,506,707

ROI → **15 MONTHS**

NPV* → **$7,109,888**

*Calculated at 5% cost of capital.

6RS benefits

Cost Impact Area	Year 1	Year 2	Year 3	Year 4	Year 5
Reduced picking labor	$1,286,511	$1,479,488	$1,701,411	$1,956,623	$2,250,116
Induct labor costs	$(40,407)	$(46,468)	$(53,438)	$(61,454)	$(70,672)
Pick ticket management	$40,000	$42,000	$44,100	$46,305	$48,620
Reduced supervisor hours	$80,007	$92,008	$105,809	$121,681	$139,933
Training benefits	$192,977	$221,923	$255,212	$293,493	$337,517
Cost avoidance - reduced supplies	$46,620	$53,613	$61,655	$70,903	$81,539
Cost avoidance - WMS fees, RF devices	$174,825	$201,049	$231,206	$265,887	$305,770
Reduced replenishment labor *	**$20,000**	**$23,000**	**$26,450**	**$30,418**	**$34,980**
Reduced packout labor *	**$40,000**	**$46,000**	**$52,900**	**$60,835**	**$69,960**
Total benefits	**$1,840,533**	**$2,112,612**	**$2,425,304**	**$2,784,690**	**$3,197,763**

* **The projected five-year benefit includes $134,848 savings in replenishment and $269,695 savings in packout. These applications were not available in other CMR solutions.**



6 RIVER SYSTEMS

ABOUT 6 RIVER SYSTEMS

Founded in Waltham, Mass. in 2015, 6 River Systems is a leading collaborative mobile robotics fulfillment solution provider and part of global commerce company Shopify Inc. Founders Jerome Dubois and Rylan Hamilton were previously executives at Kiva Systems (now Amazon Robotics).

The 6 River Systems solution is operating in more than 50 facilities in the U.S., Canada and Europe, fulfilling millions of units each week for companies including Lockheed Martin, CSAT Solutions, ACT Fulfillment, DHL, XPO Logistics and Office Depot.

To learn about 6 River Systems and its wall-to-wall fulfillment solution, please visit

www.6river.com