A Forrester Total Economic Impact™
Study Commissioned By Locus Robotics
June 2019

The Total Economic Impact™ Of Locus Robotics

Cost Savings And Business Benefits Enabled By Locus Robotics

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Benefits

Total labor savings:
$2,185,989

Avoided overtime pay:
$391,319

Eliminated hardware and supplies spending:
$194,673

Avoided training hours:
$29,588

Executive Summary

A recent Forrester report detailed the impending need for human-machine teaming in the workforce: “As the future of work spans from lightly technology-augmented employees all the way up to full job replacement by robots, the workforce will increasingly become a hybrid of humans and machines. Human-machine teaming will grow into a key workforce technology discipline.”[1]

Locus Robotics provides a collaborative robotic solution that helps its customers solve and optimize their fulfillment center operations. Locus Robotics commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying LocusBots. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Locus on their organizations.

To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed several customers with years of experience using Locus. These customers deployed LocusBots in their owned and operated warehouses to replace traditional fulfillment tools and augment their staffs’ picking procedures. In deploying LocusBots, these customers transformed their fulfillment operation strategies and drastically increased the productivity of their workers — without a large capital investment in machinery and minimal changes to facility layout. Customers ultimately reduced staffing, eliminated facilities and supplies spending, increased throughput, and reduced order errors.

Prior to using LocusBots, the customers used a mix of traditional picking tools, such as RF guns and push carts. However, relying on these tools for order fulfillment was inefficient, limiting the number of picks per hour and total throughput workers could achieve.

Key Findings

Quantified benefits. The following risk-adjusted present value (PV) quantified benefits are representative of those experienced by the companies interviewed:

- **Improved picker productivity by 100%.** With LocusBots deployed in their fulfillment centers, customers saw a drastic increase in picks per hour. Improved productivity allowed organizations to fulfill more orders with less staff during both nonpeak and peak seasons.
- **Reduced overtime spend by 15%.** Due to increased worker productivity and throughput, organizations were able to fulfill more orders during regular business hours during the peak holiday season. Organizations saw a reduction in overtime hours required to fulfill holiday orders and eliminated the related payroll burden.
- **Reduced new hire training by 80%.** Customers found that training new hires and seasonal labor to pick with LocusBots took significantly less time than with traditional means. LocusBots removed many of the manual tasks associated with picking and provided visual and multilingual cues to workers, which accelerated the training process.

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ROI
144%

Benefits PV
$2.8 million

NPV
$1.7 million

Payback
< 3 months

- **Facilitated hardware elimination and savings.** After deploying LocusBots at their facilities, organizations no longer needed to supply pickers with carts and RF guns. With discontinuation of manual tools, organizations avoided maintaining and or replacing broken or end-of-life units in the future.
- **Reduced order errors by 25%.** Workers using LocusBots to fulfill orders committed fewer errors than with traditional manual picking. The visual and multilingual cues provided by LocusBots ensured that workers picked the correct items for orders. With fewer errors, organizations spent less money on expedited shipping to customers who received the wrong items.
- **Reduced operational supply spending by 50%.** As organizations reduced the headcount required to fulfill orders, they also reduced spending on facility supplies to support their staffs.

Unquantified benefits. The interviewed organizations experienced the following benefits, which are not quantified for this study:

- **Enabled flexible and scalable deployments.** Locus offers its solution on a subscription basis, which allows organizations the flexibility of easily altering their deployment based on fulfillment demands. Additionally, Locus deployments involve minimal infrastructure changes and keep organizations from being locked into capital-intensive automation infrastructure.
- **Demonstrated competitive advantage in fulfillment capabilities.** Third-party logistics (3PL) providers used their Locus deployments to demonstrate a competitive advantage over others when bidding on new fulfillment contracts.
- **Increased overall throughput.** Increasing overall throughput of existing facilities enabled 3PLs to achieve service-level agreement (SLA) bonusing and avoid penalties and enabled an eCommerce firm fulfilling its own orders to increase overall sales.
- **Improved employee morale.** Using LocusBots reduced the physical demands on pickers, which improved morale and reduced burnout. Furthermore, Locus offers gamification features that enrich daily workflows, improve satisfaction, and foster friendly competition.
- **Aided in hiring process, reducing costs to acquire seasonal labor.** Locus helped customers in the recruiting process by offering an attractive alternative to traditional fulfillment work. This was exceptionally helpful in a tight labor market where most organizations compete on wages.

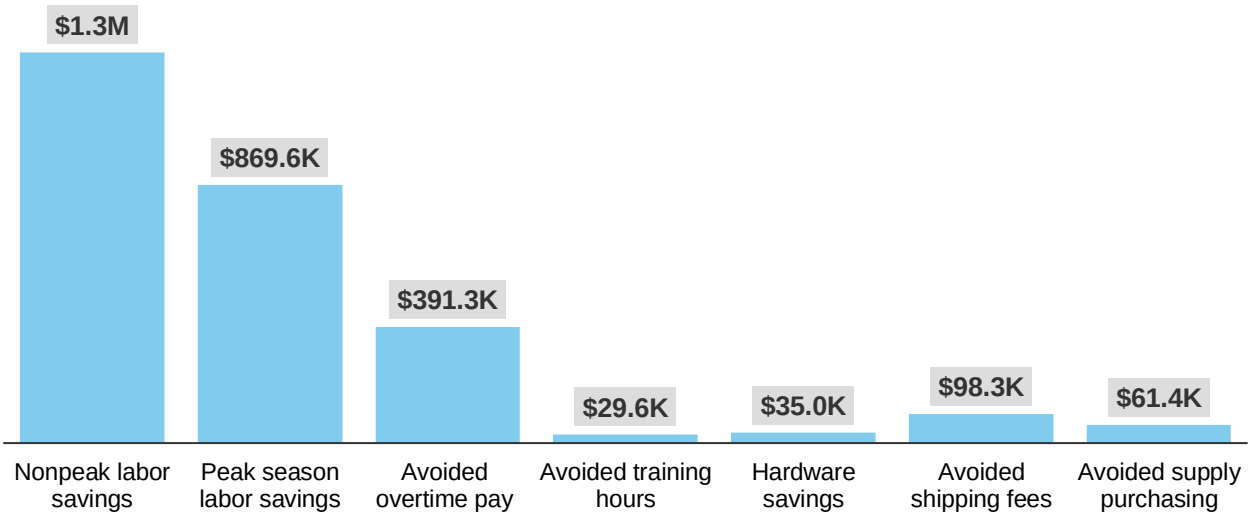
Costs. The interviewed organizations experienced the following risk-adjusted PV costs:

- **LocusBot deployment and subscription fees.** Organizations paid Locus a one-time deployment fee and a monthly per-bot subscription fee.
- **Internal deployment and integration costs.** Organizations incurred internal labor costs related to the deployment and integration of Locus within their fulfillment operations.
- **Employee training costs.** Organizations incurred internal labor costs while training their employees on the use of LocusBots within the fulfillment centers.

Forrester's interviews with three existing customers and subsequent

financial analysis found that an organization based on these interviewed organizations experiences benefits of $2.8 million over three years versus costs of $1.1 million, adding up to a net present value (NPV) of $1.7 million and an ROI of 144%.

Benefits (Three-Year)



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TEI Framework And Methodology

From the information provided in the interviews, Forrester has constructed a Total Economic Impact™ (TEI) framework for those organizations considering implementing Locus Robotics.

The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision. Forrester took a multistep approach to evaluate the impact that Locus Robotics can have on an organization:

The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

DUE DILIGENCE
Interviewed Locus Robotics stakeholders and Forrester analysts to gather data relative to Locus Robotics.

CUSTOMER INTERVIEWS
Interviewed three organizations using Locus Robotics to obtain data with respect to costs, benefits, and risks.

COMPOSITE ORGANIZATION
Designed a composite organization based on characteristics of the interviewed organizations.

FINANCIAL MODEL FRAMEWORK
Constructed a financial model representative of the interviews using the TEI methodology and risk-adjusted the financial model based on issues and concerns of the interviewed organizations.

CASE STUDY
Employed four fundamental elements of TEI in modeling Locus Robotics' impact: benefits, costs, flexibility, and risks. Given the increasing sophistication that enterprises have regarding ROI analyses related to IT investments, Forrester's TEI methodology serves to provide a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

DISCLOSURES

Readers should be aware of the following:

This study is commissioned by Locus Robotics and delivered by Forrester Consulting. It is not meant to be used as a competitive analysis.

Forrester makes no assumptions as to the potential ROI that other organizations will receive. Forrester strongly advises that readers use their own estimates within the framework provided in the report to determine the appropriateness of an investment in Locus Robotics.

Locus Robotics reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.

Locus Robotics provided the customer names for the interviews but did not participate in the interviews.

The Locus Robotics Customer Journey

BEFORE AND AFTER THE LOCUS ROBOTICS INVESTMENT

Interviewed Organizations

For this study, Forrester conducted three interviews with Locus Robotics customers. Interviewed customers include the following:

INDUSTRY	REGION	USE CASE	NUMBER OF BOTS
Third-party logistics	United States	Deployed bots in a brownfield venture as part of a new contract.	40 bots deployed in one facility
Third-party logistics	Headquartered in Europe (global operations)	Deployed bots in eCommerce apparel fulfillment, retail replenishment, and medical device fulfillment	150 bots deployed across two facilities
eCommerce	United States	Deployed bots in own warehouse, fulfilling custom-made merchandise	20 bots deployed in one facility

Key Challenges

Prior to implementing Locus Robotics, interviewees shared several common challenges and pain points with their fulfillment efforts:

- **Inefficient manual picking and rising labor costs.** Interviewed organizations all used a form of manual picking in their fulfillment operations prior to implementing Locus. This strategy was labor-intensive and unoptimized, and it limited the total throughput of their operations.
- **Difficulty staying competitive in growing eCommerce market.** Interviewees noted that they were either competing against large eCommerce retailers or for eCommerce fulfillment contracts. In both cases, they needed to demonstrate a competitive advantage to win customers or fulfillment contract bids. A principal consultant in third-party logistics said: "The new fulfillment customer had not been landed yet, and going into negotiations on how we're going to meet their needs, we presented the Locus solution as a means to the end. It was very appealing to them. We were able to quickly accommodate the warehouse layout and volume. Traditionally, this would have been done with pick carts — where they throw a bunch of orders on that cart and then ship them. The sheer volume that needed to happen inside the same space and inside the timeframe would not have been possible."
- **Variable fulfillment volumes.** Interviewees operated in environments of variable order volume — with peaks often dictated by holiday shopping patterns. As such, these organizations sought to avoid investing in capital-intensive infrastructure investments — such as automated conveyor-belt systems — that would be underutilized for most of the year.
- **Trouble recruiting and onboarding seasonal labor.** To meet peak season fulfillment demands, interviewees hired seasonal labor. However, as eCommerce popularity has grown, so has competition for labor, resulting in a more difficult recruiting environment. Furthermore, organizations consistently struggled with onboarding seasonal labor, taking weeks to get them up to speed.

> "We were trying to think outside the box and find the solution that didn't require us to use as many people, and we rethought the way that we fulfilled."
>
> *Fulfillment manager, eCommerce*

> "If you can imagine an omnichannel facility, every year if they do more online orders and retail orders, you just need more pickers because the online orders are that much more labor-intensive."
>
> *VP solutions design, third-party*

Solution Requirements

The interviewed organizations searched for a solution that could:

- Raise worker efficiency and cut labor costs.
- Deploy within existing facilities without major infrastructure changes.
- Flexibly scale with seasonal volume demands.
- Rapidly deploy in time for the holiday season and/or new contract inception.

> "We revamped the entire way that we fulfilled when we moved to Locus."
>
> *Fulfillment manager, eCommerce*

Key Results

The interviews revealed that key results from the Locus Robotics investment include:

- **Increased worker efficiency and reduced labor costs.** Organizations saw a large increase in worker efficiency as they reduced the amount of manual labor involved in picking. The change in workflow improved the number of picks per hour that staff could perform. Improved per-worker productivity reduced the amount of headcount that organizations required to meet volume demands.
- **Optimized order fulfillment and reduced cycle times.** Locus integrated with customers' warehouse management systems (WMS) and optimized the priority in which orders were fulfilled — based both on distance traveled and order urgency.
- **Avoided large-scale infrastructure changes or capital investments.** LocusBots rapidly deployed in existing facilities with minimal changes to accommodate them. A VP of solutions design in third-party logistics said: "That's what we like about Locus. In those environments where you are doing cart picking, you can introduce Locus robots with minimal changes. You can do it without overhauling your infrastructure and taking down racks to put up several systems."
- **Enabled rapid training for seasonal employees.** Deploying LocusBots reduced the number of tasks individual workers were required to perform — in turn requiring less training. Furthermore, LocusBots accommodated multiple languages and provided visual clues, which aided in the training process.
- **Reduced overhead within facilities.** Organizations recognized savings from discontinuing the use of manual picking hardware, like carts and RF guns. Since they were maintaining lower headcount, organizations also required fewer supplies to support them.

> "Our site was picking at 100 picks per hour and went up to 200. That's driven by the reduction in travel. The picker is no longer traveling the entire warehouse, and the pick assist device is on the robot. The robot stops right in front of the item and the location to pick from, indicates the item in big fonts on the screen, and you just pick it and put it in."
>
> *VP solutions design, third-party logistics*

Composite Organization

Based on the interviews, Forrester constructed a TEI framework, a composite company, and an associated ROI analysis that illustrates the areas financially affected. The composite organization is representative of the three companies that Forrester interviewed and is used to present the aggregate financial analysis in the next section. The composite organization that Forrester synthesized from the customer interviews has the following characteristics:

- The organization is a US-based third-party logistics provider. It operates a number of fulfillment centers serving manufacturers and eCommerce vendors.

- The composite organization has deployed LocusBots in a fulfillment center it operates on behalf of a US-based eCommerce retailer. The composite is operating this facility as a result of winning a new contract. An integral part of winning this contract was demonstrable ability to meet large volume demands at low cost.
- The organization runs two shifts in its facility during nonpeak months and three shifts during the peak holiday shopping season.
- Prior to investing in Locus Robotics, the organization used traditional fulfillment tools such as carts and RF guns in its facility. With legacy tools, workers averaged 90 picks per hour during nonpeak months and 80 picks during peak months.
- The eCommerce retailer's sales are growing at 10% year-on-year. The average amount of items per order during regular months is four, with an average order size of six items during peak season.

Key assumptions

Two shifts: nonpeak season
Three shifts: peak season
90 picks per hour: nonpeak
80 picks per-hour: peak
10% annual eCommerce growth

Analysis Of Benefits

QUANTIFIED BENEFIT DATA AS APPLIED TO THE COMPOSITE

Total Benefits

REF.	BENEFIT	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Atr	Nonpeak labor savings	$432,317	$555,836	$617,595	$1,605,747	$1,316,391
Btr	Peak season labor savings	$314,973	$352,029	$389,085	$1,056,087	$869,598
Ctr	Avoided overtime pay with increased throughput	$141,738	$158,413	$175,088	$475,239	$391,319
Dtr	Avoided training hours	$10,830	$11,970	$13,110	$35,910	$29,588
Etr	Hardware savings	$6,840	$18,240	$18,240	$43,320	$34,997
Ftr	Avoided shipping fees	$36,024	$39,625	$43,596	$119,244	$98,251
Gtr	Avoided supply purchasing	$24,700	$24,700	$24,700	$74,100	$61,425
	Total benefits (risk-adjusted)	$968,334	$1,160,813	$1,281,413	$3,410,560	$2,801,569

The table above shows the total of all benefits across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the composite organization expects risk-adjusted total benefits to be a PV of more than $2.8 million.

Nonpeak Labor Savings

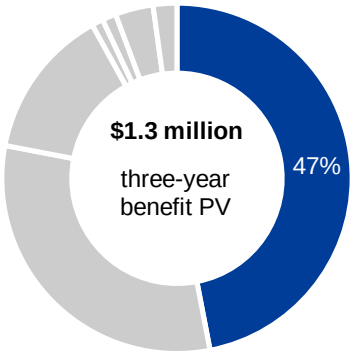
Organizations interviewed for this study used LocusBots to reduce the number of tasks performed by their pickers to fulfill orders. Traditionally, these organizations would push orders from a WMS to pickers on a first-come, first-served basis; pickers would then go find these orders in the warehouse and place them in carts. These orders were not optimized: Items for orders would be picked in the order they were received, not based on how much distance would need to be traveled.

When organizations deployed LocusBots, they integrated them with their WMS systems to optimize order priority based on distance. Furthermore, the bots would do most of the travel, with pickers maintaining a limited zone and picking items for various orders as the bots arrived. This division of labor allowed for items to be picked at a higher rate and more orders to be fulfilled daily. Due to increased productivity, organizations required fewer workers to fulfill their order volumes.

A VP of solutions design said: “Previously, we would have done cart picking; it would have been a more manual approach. Basically, you assign a number of orders to the cart, and you would travel up and down the warehouse and take those orders. It would have been cart picking with an RF gun: That’s a very traditional way to pick orders, and it makes a lot of sense. But typically, the orders that end up on the cart are not optimized; they could just be on a first-come, first-served order. Inevitably pickers would end up traveling the entire warehouse to fill orders instead of picking them in an efficient manner.”

The composite organization used for this study replaces manual picking with carts and RF guns with LocusBot-augmented picking. With this new picking strategy, the organization increases its picks per hour by workers by 100% from 90 to 180. This improvement in productivity allows the organization to reduce required headcount each year, while fulfilling an increasing amount of orders.

In modeling the benefits of nonpeak labor savings, Forrester makes the



Nonpeak labor savings: **47%** of total benefits

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following assumptions:

- The organization runs two shifts per day during nonpeak months.
- The average orders per day grow by 10% year over year.
- The average order size in nonpeak months is four items.
- The average fully burdened hourly rate for pickers is $18.75.

Nonpeak labor savings will vary by organization. Specific risk considerations include:

- The number of shifts per day.
- The average order size.
- Baseline picker productivity.

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of $1,316,391.

Impact risk is the risk that the business or technology needs of the organization may not be met by the investment, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for benefit estimates.

Nonpeak Labor Savings: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
A1	Months of nonpeak work		10	10	10
A2	Average working days per month	260/12	21.67	21.67	21.67
A3	Shifts per day		2	2	2
A4	Working hours per shift		7.25	7.25	7.25
A5	Average orders per day	Composite 10% YoY growth	5,000	5,500	6,050
A6	Average items per order	Composite	4	4	4
A7	Total daily picks	A5*A6	20,000	22,000	24,200
A8	Items picked per hour manually		90	90	90
A9	Items picked per hour with Locus		180	180	180
A10	Labor (hours) required to pick manually (rounded)	A7/(A3*A4*A8)	15	17	19
A11	Labor (hours) required to pick with Locus (rounded)	A7/(A3*A4*A9)	8	8	9
A12	Reduction in required labor (hours)	A10-A11	7	9	10
A13	Fully loaded fulfillment center hourly wage	$15*1.25	$18.75	$18.75	$18.75
At	Nonpeak labor savings	A1*A2*A3*8 hours* A12*A13	$455,070	$585,090	$650,100
	Risk adjustment	↓5%			
Atr	Nonpeak labor savings (risk-adjusted)		$432,317	$555,836	$617,595

Peak Season Labor Savings

In addition to nonpeak labor savings, organizations recognized a reduction in labor requirements during the peak holiday season. Traditionally, organizations required an abundance of seasonal labor to

fulfill the spikes in order volume during this period. Interviewees noted that this seasonal labor traditionally operated at a lower-baseline productivity as they only performed this role on a temporary basis.

Organizations found that LocusBots had a had a similar impact on their peak labor requirements, doubling the number of picks per hour. A fulfillment manager said: “Each peak season we would run into a couple of issues. One was how much I would have to teach somebody in how little amount of time. We also knew we should be able to fulfill more; we needed to stay on top of our turnaround time. The way we were doing things manually, we were maxing out our capacity. We were just increasing our personnel, but we were not getting enough good people to make that a viable solution. We were trying to think outside the box and find the solution that didn’t require us to use as many people, and we rethought the way that we fulfilled. We had to bring on less people during Christmas, which was a chief reason it cut our operational workforce budget by a decent amount.”

Forrester assumes that:

- The composite organization runs three shifts per day during peak months.
- The daily order volume increases 10% annually.
- The average order size during peak months is six items.
- The average fully burdened hourly rate for pickers is $18.75.

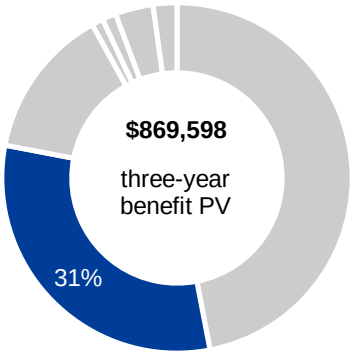
Peak season labor savings will vary with:

- The number of shifts per day.
- The average order size.
- Baseline picker productivity.

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of $869,598.

“We had to bring on less people during Christmas, which was a chief reason it cut our operational workforce budget by a decent amount.”

Fulfillment manager, eCommerce



Peak season labor savings: **31%** of total benefits

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Peak Season Labor Savings: Calculation Table					
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
B1	Months of peak work		2	2	2
B2	Average working days per month	A2	21.67	21.67	21.67
B3	Shifts per day		3	3	3
B4	Working hours per shift		7.25	7.25	7.25
B5	Average orders per day	Composite 10% YoY growth	10,000	11,000	12,100
B6	Average items per order	Composite	6	6	6
B7	Total daily picks	B5*B6	60,000	66,000	72,600
B8	Items picked per hour manually		80	80	80
B9	Items picked per hour with Locus		160	160	160
B10	Labor (hours) required to pick manually (rounded)	B7/(B3*B4*B8)	34	38	42
B11	Labor (hours) required to pick with Locus (rounded)	B7/(B3*B4*B9)	17	19	21
B12	Reduction in required labor	B10-B11	17	19	21
B13	Fully loaded fulfillment center hourly wage	A13	$18.75	$18.75	$18.75
Bt	Peak season labor savings	B1*B2*B3*8 hours*B12*B13	$331,551	$370,557	$409,563
	Risk adjustment	↓5%			
Btr	Peak season labor savings (risk-adjusted)		$314,973	$352,029	$389,085

Avoided Overtime Pay

As organizations improved overall throughput within their facilities, they were able to fulfill more orders within regular hours of operation. During peak months, organizations would normally incur overtime charges as order volume exceeded their staffs' daily capacities.

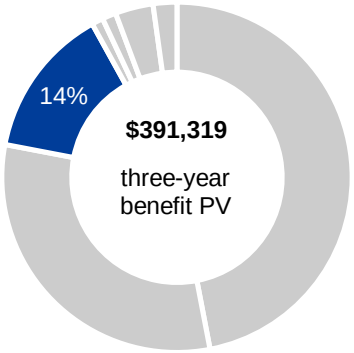
A VP of solutions design said: "Because my cycle time has gone from 4 hours to 2 hours, I can just fulfill more things with that time period. We can handle more volume and empty out the queue faster."

The composite organization increases overall daily throughput in its facility as workers pick more items per hour. During peak season, these orders must be fulfilled during set windows, as the eCommerce retailer has guaranteed shipping times. Reducing the time required to fill orders allows the composite organization to avoid 15% additional overtime hours it had previously projected to pay with manual picking.

Overtime avoidance savings will vary based on:

- Fulfillment use case and prevalence of peak seasons.
- Baseline pick productivity and throughput.

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of $391,319.



Avoided overtime pay: **14%** of total benefits

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Avoided Overtime Pay: Calculation Table					
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
C1	Peak pick hours without Locus	B1*B2*8 hours*B3*B10	35,365	39,526	43,687
C2	Avoided overtime with increased throughput		15%	15%	15%
Ct	Avoided overtime pay	(C1*C2)*(B13*1.5)	$149,198	$166,751	$184,303
	Risk adjustment	↓5%			
Ctr	Avoided overtime pay (risk-adjusted)		$141,738	$158,413	$175,088

Avoided Training Hours

Interviewees stated that training was a key cost component that they aimed to alleviate. Manual picking required a number of tasks, which relied upon memorization and learning to avoid introducing human errors to the fulfillment process. Further, the prevalence of seasonal workers introduced a need to train a large group of workers on an annual basis.

Organizations found that LocusBots were significantly less difficult to train workers on than their traditional picking methods. A VP of solutions design said: “When you have a LocusBot, you can train a picker on it in a matter of minutes. Just say, ‘Hey, look. You’re going to basically go into the aisle, and you’re going to look for LocusBots, and you’re going to pick the items that it shows you and press the button and then go find another bot. That’s it; go start picking.’ That’s opposed to before, when we would have to show them how to operate an RF gun and which key code you needed to type when you approached an item. When the item wasn’t there, there’s another key code you have to enter. Oh, and by the way, there is a certain aisle numbering scheme where there is an aisle number, a payee number, there’s a location number, and so on. It was not an intuitive process, and they would have to memorize not only the layout scheme but also the operations on the RF gun in different situations.”

Due to a simplification of tasks, the composite organization reduces new hire training time from 40 hours to 8 hours. This savings is applied to the seasonal hires required to pick at the new Locus-aided pick rate.

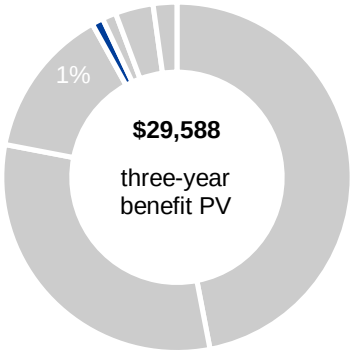
In modeling this benefit, Forrester assumes:

- The fulfillment employee fully burdened hourly rate is $18.75.

Employee training savings will vary based on:

- The baseline complexity of fulfillment use case.
- The quality of seasonal labor.

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of $29,588.



Avoided training hours: **1%** of total benefits

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Avoided Training Hours: Calculation Table					
REF.	**METRIC**	**CALC.**	**YEAR 1**	**YEAR 2**	**YEAR 3**
D1	Required seasonal employees	B10-A10	19	21	23
D2	Hours to train seasonal employee on manual picking		40	40	40
D3	Hours to train seasonal employee on Locus		8	8	8
D4	Fully loaded fulfillment center hourly wage		$18.75	$18.75	$18.75
Dt	Avoided training hours	(D2-D3)*D1*D4	$11,400	$12,600	$13,800
	Risk adjustment	↓5%			
Dtr	Avoided training hours (risk-adjusted)		$10,830	$11,970	$13,110

Hardware Savings

Organizations that transitioned to LocusBot-aided picking were able to discontinue use of carts and RF guns in their facilities. Discontinuation of this hardware enabled them to avoid purchasing additional units as operations scaled up and avoid replacing broken units.

The composite organization avoids purchasing new guns and carts to accommodate its peak shift headcount each year. This headcount increases each year as eCommerce business grows and order volume increases. Furthermore, the organization avoids replacing broken units, which is a semi-frequent occurrence in a high wear-and-tear environment.

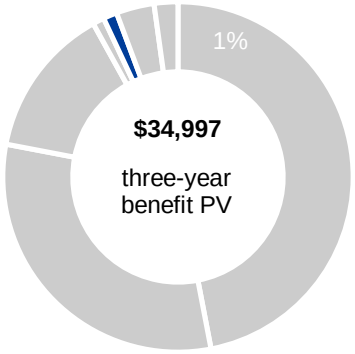
In modeling hardware savings, Forrester assumes:

- One cart and RF gun per picker.
- An RF gun cost of $2,000 and cart cost of $400.
- Replacement rates of 10%.

Hardware savings will vary based on:

- The level of hardware use and related replacement rates.

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of $34,997.



Hardware savings: **1%** of total benefits

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Hardware Savings: Calculation Table					
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
E1	RF guns required	B10*1	34	38	42
E2	RF gun replacement rate		10%	10%	10%
E3	Total RF gun purchases (rounded)	E1(Y2-Y1)+(E1*E2)	3	8	8
E4	Price of RF gun		$2,000	$2,000	$2,000
E5	Total RF gun expenses	E3*E4	$6,000	$16,000	$16,000
E6	Push bins required	B10*1	34	38	42
E7	Push bin replacement rate		10%	10%	10%
E8	Total push bin purchases (rounded)	E6(Y2-Y1)+(E6*E7)	3	8	8
E9	Price of pick cart		$400	$400	$400
E10	Total push bin expenses	E8*E9	$1,200	$3,200	$3,200
Et	Hardware savings	E5+E10	$7,200	$19,200	$19,200
	Risk adjustment	↓5%			
Etr	Hardware savings (risk-adjusted)		$6,840	$18,240	$18,240

Avoided Shipping Fees

Interviewees found that removing manual steps from the order fulfillment process decreased the amount of errors introduced. Normally, when a customer received an order with a missing or incorrect item, organizations would incur an expeditated shipping fee to rectify the issue. With Locus, organizations cut down on the total amount of order errors and the related cost to fix them.

A fulfillment manager stated: “Before it was a completely personnel-driven process. When we moved to Locus, it eliminated a lot of steps and a lot of human error that we had in the process, which was one of our biggest focuses that needed a solution. We went from six steps to just one.”

With LocusBots, the composite organization reduces the amount of manual tasks performed in order fulfillment. Furthermore, LocusBots feature tablets that display item images, further reducing the likelihood that an incorrect item will be picked. Due to this, the composite organization reduces errors by 25%.

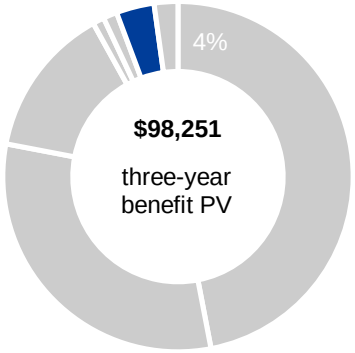
In modeling shipping costs reductions, Forrester assumes:

- A baseline error rate of 1%.
- An average expediated shipping cost of $10.

Shipping cost savings will vary based on:

- The types of items, distance shipped, enterprise contracts, and other variables impacting shipping prices.

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of $98,251.



Avoided shipping fees: **4%** of total benefits

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Avoided Shipping Fees: Calculation Table					
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
F1	Total shipments per year	(A1*A2*A5)+(B1*B2*B5)	1,516,900	1,668,590	1,835,449
F2	Average order error rate with manual picking		1%	1%	1%
F3	Reduction in errors with Locus-aided picking		25%	25%	25%
F4	Total reduction in erroneous orders	F1*F2*F3	3,792	4,171	4,589
F5	Average cost for expedited two-day shipping		$10	$10	$10
Ft	Avoided shipping fees	F4*F5	$37,920	$41,710	$45,890
	Risk adjustment	↓5%			
Ftr	Avoided shipping fees (risk-adjusted)		$36,024	$39,625	$43,596

Avoided Supply Purchasing

Reducing fulfillment staff also reduced the required amount of supplies to support them in facilities. Interviewees highlighted that their organizations eliminated spending on cleaning supplies, cafeteria supplies, and bathroom supplies. Simplifying the picking process also reduced spend on labels across organizations.

The composite organization reduces its operation supply spending by 50% and reduces label spending by 4% annually.

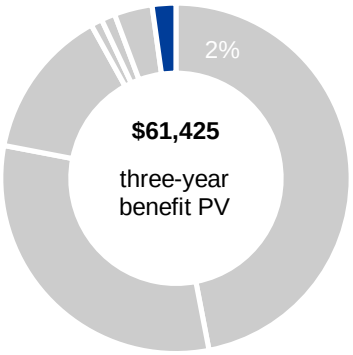
In modeling supply savings, Forrester assumes:

- An annual operational supply spending of $28,000.
- An annual label spend of $300,000.

Supply savings benefits will vary based on:

- Annual operation and label requirements.

To account for these risks, Forrester adjusted this benefit downward by 5%, yielding a three-year risk-adjusted total PV of $61,425.



Avoided supply purchasing: **2%** of total benefits

Avoided Supply Purchasing: Calculation Table					
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
G1	Normal annual operational spend		$28,000	$28,000	$28,000
G2	Reduction in operational supplies per purchase		50%	50%	50%
G3	Total operational supply savings	G1*G2	$14,000	$14,000	$14,000
G4	Normal annual label spend		$300,000	$300,000	$300,000
G5	Reduction in order label purchases		4%	4%	4%
G6	Total label spend savings	G4*G5	$12,000	$12,000	$12,000
Gt	Avoided supply purchasing	G3+G6	$26,000	$26,000	$26,000
	Risk adjustment	↓5%			
Gtr	Avoided supply purchasing (risk-adjusted)		$24,700	$24,700	$24,700

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Unquantified Benefits

Interviewees also identified a variety of benefits achieved with Locus Robotics that could not be quantified for this study. Organizations:

- **Improved overall revenue.** The eCommerce organization using LocusBots to fulfill its own merchandise increased its total order output and increased annual revenue. The increased capacity to fulfill orders meant that the organization could extend the cutoff date at which it could accept orders and still have them delivered in time for the holidays. A fulfillment manager said: “Locus was a huge benefit during the Christmas season, and the fact that we were able to stay open accepting orders longer meant that much more revenue we could generate. We were able to stay open the longest we’ve ever been able to during this Christmas season.”
- **Improved ability to compete with major eCommerce vendors.** The eCommerce organization used its improved turnaround time as a competitive advantage when advertising to customers. The fulfillment manager said: “We have the expected delivery time on the front page of the website. We try to limit how much we change it, but if there are production delays or we are having trouble fulfilling orders, it will bump up the estimated time. That definitely affects our incoming orders.”
- **Demonstrated competitive advantage in fulfillment capabilities.** Third-party logistic providers used their Locus deployments in pitches when bidding on new fulfillment contracts.
- **Improved employee morale.** Using LocusBots reduced the physical demands on pickers, which improved morale and reduced burnout. Furthermore, Locus offers gamification features that enrich daily workflows, improve satisfaction, and foster friendly competition. A VP of solutions design said: “If they have to push a cart around and deal with an RF gun, they might not want to come back to work the next day. We think the bots have helped with that a lot.”
- **Eased recruiting process and reduced related costs.** A VP of solutions design said: “The bots help you attract labor too. We’ve heard from employees that it’s cooler to work with the cutting-edge robots and to interact with them instead of the old tools. They get to work with a robot and a tablet instead of some bulky hardware. It’s a little more fun and they do less physical work.”

Flexibility

The value of flexibility is clearly unique to each customer, and the measure of its value varies from organization to organization. There are multiple scenarios in which a customer might choose to implement Locus and later realize additional uses and business opportunities, including:

- **Taking on new contracts within existing infrastructure.** Organizations can take on new contracts within their current facilities without the fear of restructuring.
- **Quickly launching new greenfield ventures.** Because LocusBots require minimal structure changes, organizations can launch new facilities with ease.
- **Fulfilling items outside of traditional areas of expertise.** Organizations can use LocusBots to fulfill items outside of their traditional picking operations, such as low-density clothing.

Flexibility, as defined by TEI, represents an investment in additional capacity or capability that could be turned into business benefit for a future additional investment. This provides an organization with the "right" or the ability to engage in future initiatives but not the obligation to do so.

- **Adding gamification for additional employee incentives.** LocusBots come equipped with the capability to add gamification elements — rewards and or rankings based on worker accomplishments — to workflows for added incentive.

Flexibility would also be quantified when evaluated as part of a specific project (described in more detail in Appendix A).

Analysis Of Costs

QUANTIFIED COST DATA AS APPLIED TO THE COMPOSITE

Total Costs

REF.	COST	INITIAL	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Htr	Locus Bot subscription and deployment fees	$82,500	$384,560	$390,830	$445,170	$1,303,060	$1,089,563
Itr	Internal deployment and integration costs	$53,156	$0	$0	$0	$53,156	$53,156
Jtr	Employee training costs	$591	$1,713	$1,910	$2,107	$6,320	$5,309
	Total costs (risk-adjusted)	$136,247	$386,273	$392,740	$447,277	$1,362,536	$1,148,028

The table above shows the total of all costs across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the composite organization expects risk-adjusted total costs to be a PV of more than $1.1 million.

Locus Bot Subscription And Deployment Fees

Organizations paid a one-time deployment fee to Locus to integrate the bots with their WMS systems and prepare their facilities for bot use. Additionally, organizations paid a monthly subscription fee — per bot — to Locus.

In modeling the subscription and deployment fee cost, Forrester assumes:

- A bot-to-picker support ratio of 3.5 to 1.
- A monthly bot subscription of $950.

Implementation risk is the risk that a proposed investment may deviate from the original or expected requirements, resulting in higher costs than anticipated. The greater the uncertainty, the wider the potential range of cost estimates. Bot subscription and deployment fees may vary based on:

- The size and scope of deployment

To account for these risks, Forrester adjusted this cost upward by 10%, yielding a three-year risk-adjusted total PV of $1,089,563.

Locus Bot Subscription And Deployment Fees: Calculation Table						
REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
H1	Locus bots deployed (rounded)	A11*3.5		28	28	32
H2	Additional peak bots (rounded)	(B11-A11)*1.75		16	19	21
H3	Locus bot monthly subscription cost			$950	$950	$950
H4	Locus bot lease costs	(H1*12*H3)+(H 2*2*H3)		$349,600	$355,300	$404,700
H5	One-time deployment fee paid to Locus		$75,000			
Ht	Locus Bot subscription and deployment fees	H4+H5	$75,000	$349,600	$355,300	$404,700
	Risk adjustment	↑10%				
Htr	Locus Bot subscription and deployment fees (risk-adjusted)		$82,500	$384,560	$390,830	$445,170

Internal Deployment And Integration Costs

The composite organization required three months to integrate and deploy the Locus solution in its facility. During this time, the organization dedicated 50% of an operation manager's time to overseeing deployment, and three IT team members spent 75% of their time ensuring that systems were properly integrated.

In modeling the internal costs of deployment and integration, Forrester assumes:

- A fully burdened operations manager salary of $90,000.
- A fully burdened IT salary of $70,000.

Internal costs will vary based on:

- Geography and prevailing labor costs.
- The size, scope, and complexity of operations.

To account for these risks, Forrester adjusted this cost upward by 5%, yielding a three-year risk-adjusted total PV of $53,156.

Three months
Total implementation and deployment time

Internal Deployment and Integration Costs: Calculation Table						
REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
I1	Initial deployment and integration time (months)		3			
I2	Operations manager involved		1			
I3	Percentage of operations manager's time spent on Locus integration and deployment		50%			
I4	Fully loaded operation manager salary		$90,000			
I5	Operations manager cost	I1*I2*I3*(I4/12)	$11,250			
I6	IT team members involved in deployment and ongoing management		3			
I7	Percentage of IT team members' time spend on Locus deployment and management		75%			
I8	Fully loaded IT salary		$70,000			
I9	IT team cost	I1*I6*I7*(I8/12)	$39,375			
It	Internal deployment and integration costs	I5+I9	$50,625			
	Risk adjustment	↑5%				
Itr	Internal deployment and integration costs (risk-adjusted)		$53,156			

Employee Training Costs

The composite organization required initial training for its existing full-time staff to train them in the use of LocusBots and requires ongoing training for new full-time employees already experienced and trained on normal fulfillment operations.

In modeling training costs, Forrester assumes:

- A fully burdened hourly picker rate of $18.75.

Training costs may vary based on:

- The size, scope, and complexity of operations.
- The existing talent pool and ability to learn new skills.

To account for these risks, Forrester adjusted this cost upward by 5%, yielding a three-year risk-adjusted total PV of $5,309.

2 hours of required training per full-time employee

Employee Training Costs: Calculation Table						
REF.	**METRIC**	**CALC.**	**INITIAL**	**YEAR 1**	**YEAR 2**	**YEAR 3**
J1	Permanent fulfillment employees	A10	15	15	17	19
J2	Hours of training required per employee		2	2	2	2
J3	Seasonal employees	D1		19	21	23
J4	Hours of training required per seasonal employee			3	3	3
J5	Total training hours	(J1*J2)+(J3*J4)	30	87	97	107
J6	Fully loaded fulfillment center hourly wage	A13	$18.75	$18.75	$18.75	$18.75
Jt	Employee training costs	J5*J6	$563	$1,631	$1,819	$2,006
	Risk adjustment	↑5%				
Jtr	Employee training costs (risk-adjusted)		$591	$1,713	$1,910	$2,107

Locus Robotics Overview

The following information is provided by Locus Robotics. Forrester has not validated any claims and does not endorse Locus Robotics or its offerings.

Locus Robotics' revolutionary, multibot solution incorporates powerful and intelligent autonomous mobile robots that operate collaboratively alongside human workers to dramatically improve piece-handling productivity by 2x to 3x, with less labor compared to traditional picking systems. The system lowers labor costs and turnover rates while improving workplace quality.

Locus's award-winning solution helps retailers, 3PLs, and specialty warehouses efficiently meet and exceed the growing, increasingly complex, and demanding requirements of fulfillment environments. The Locus system easily and seamlessly integrates into existing warehouse infrastructures without disrupting workflows, flexibly scaling to meet changing demand and growth to instantly transform productivity.

LocusBot Specifications	
Dimensions	22" (55.88 cm) diameter; 57.75" (146.69 cm) height
Weight	100 lbs (45 kg)
Container size	Highly flexible design allows for use of a wide range of containers, bins, and shipping packaging
Payload capacity	100 lbs (45 kg) overall payload 40 lbs (18.2 kg) with adjustable tray, 100 lbs (45 kg) with fixed lower tray
Battery type	2 - Lithium Iron Phosphate (LiFePO4); 32Ah 12V
Operation time	14 hours per charge
Charging time	Less than 50 minutes to full charge; software automatically detects charge levels and instructs robot to auto-charge to maintain useful operational level
Battery charge cycles	Operates for 14 hours between charges using an average load. Battery life 1500 cycles to 80% capacity.
Operating environment	32° F to 104° F (0° to 40° C)
Operating surfaces	Most common surfaces such as concrete, ResinDek®; Locus can evaluate and certify other surfaces
Onboard user interface	• Automatic language detection and display • Integrated barcode scanner and Wi-Fi link to Server and WMS

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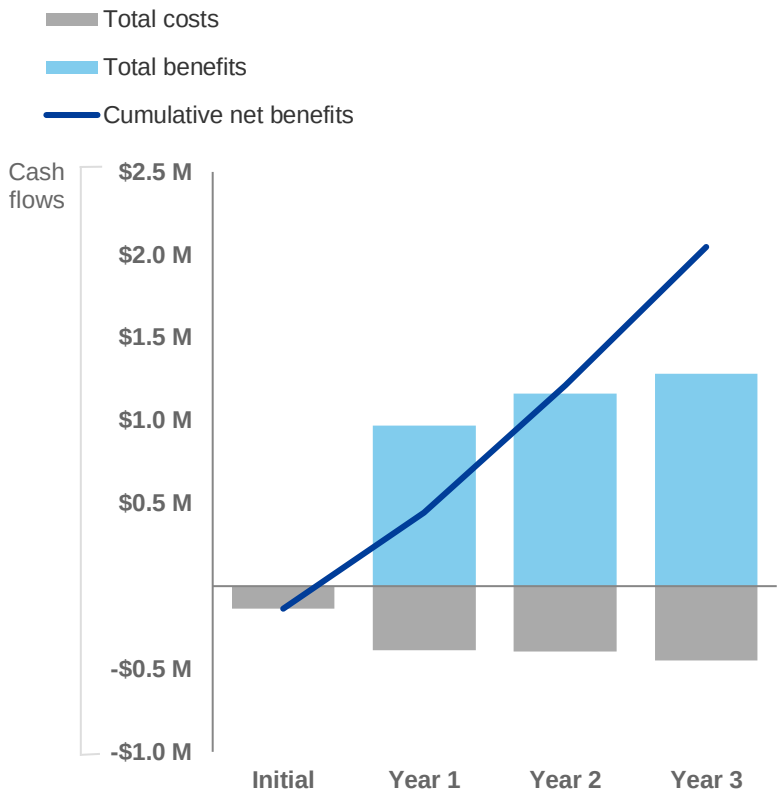
Financial Summary

CONSOLIDATED THREE-YEAR RISK-ADJUSTED METRICS

Cash Flow Chart (Risk-Adjusted)



The financial results calculated in the Benefits and Costs sections can be used to determine the ROI, NPV, and payback period for the composite organization's investment. Forrester assumes a yearly discount rate of 10% for this analysis.

These risk-adjusted ROI, NPV, and payback period values are determined by applying risk-adjustment factors to the unadjusted results in each Benefit and Cost section.

Cash Flow Table (Risk-Adjusted)

	INITIAL	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Total costs	($136,247)	($386,273)	($392,740)	($447,277)	($1,362,536)	($1,148,028)
Total benefits	$0	$967,422	$1,160,813	$1,281,413	$3,409,648	$2,801,569
Net benefits	($136,247)	$581,149	$768,073	$834,137	$2,047,112	$1,653,541
ROI						144%
Payback period						<3 months

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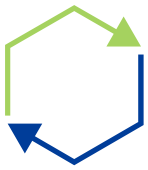
Appendix A: Total Economic Impact

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

Total Economic Impact Approach

Benefits represent the value delivered to the business by the product. The TEI methodology places equal weight on the measure of benefits and the measure of costs, allowing for a full examination of the effect of the technology on the entire organization.

Costs consider all expenses necessary to deliver the proposed value, or benefits, of the product. The cost category within TEI captures incremental costs over the existing environment for ongoing costs associated with the solution.



Flexibility represents the strategic value that can be obtained for some future additional investment building on top of the initial investment already made. Having the ability to capture that benefit has a PV that can be estimated.

Risks measure the uncertainty of benefit and cost estimates given: 1) the likelihood that estimates will meet original projections and 2) the likelihood that estimates will be tracked over time. TEI risk factors are based on "triangular distribution."

The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1 that are not discounted. All other cash flows are discounted using the discount rate at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations in the summary tables are the sum of the initial investment and the discounted cash flows in each year. Sums and present value calculations of the Total Benefits, Total Costs, and Cash Flow tables may not exactly add up, as some rounding may occur.

Present value (PV)

The present or current value of (discounted) cost and benefit estimates given at an interest rate (the discount rate). The PV of costs and benefits feed into the total NPV of cash flows.

Net present value (NPV)

The present or current value of (discounted) future net cash flows given an interest rate (the discount rate). A positive project NPV normally indicates that the investment should be made, unless other projects have higher NPVs.

Return on investment (ROI)

A project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits less costs) by costs.

Discount rate

The interest rate used in cash flow analysis to take into account the time value of money. Organizations typically use discount rates between 8% and 16%.

Payback period

The breakeven point for an investment. This is the point in time at which net benefits (benefits minus costs) equal initial investment or cost.

Appendix B: Endnotes

[1] Source: “The Technology-Augmented Employee,” Forrester Research, Inc., February 13, 2018.