



# Build Your Case for Robotic Automation

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Many manufacturing businesses are ready for robotic automation, but it's hard to know what challenges to tackle first. Directly compare how suitable your operations are for cobot automation, side by side, in the handy, free tool shared in this webinar. Confidently start automation projects driven by quick deployments and fast ROI.



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**Watch On-Demand: Build your Automation Game Plan: Tools to Prioritize Winning Robot Projects**

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# Introduction

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*Robot automation is increasing rapidly worldwide. According to the International Federation of Robotics (IFR), the average robot density reached a new record of 162 units per 10,000 employees in 2023. South Korea leads, followed by Singapore and China. From a regional perspective, the EU is in the lead, followed by North America. Collaborative robots (cobots), which work together with human workers without a protective fence, play a special role. They provide support for heavy or monotonous tasks and thus increase productivity. They can also fill gaps in the human workforce. Not surprisingly, the proportion of cobots among installed robots is steadily increasing, which underlines their importance in modern manufacturing.*

In 2023, the average robot density rose to 162 units per 10,000 employees, a new record, reported the International Federation of Robotics (IFR) in November 2024.[1] South Korea is still the leader with 1,012 robots and an annual growth rate of 5%, followed by Singapore with 770 and China with 470 robots, both per 10,000 employees. China only overtook Germany from third place in 2023 and is now aiming for second place with an annual growth rate of 12%. The USA is in 10th place worldwide with 95 units.

In regional terms, the European Union (EU) is in first place with 219 robots per 10,000 employees, followed closely by North America with 197 units. Asia is in third place with an average of 182 robots.

## **Cobots: Robots and human workers complement each other...**

The figures therefore impressively show that robot automation is growing strongly worldwide, even in years of crisis. Cobots, i.e. collaborative robots whose main feature is that they can work together with workers without a protective fence, play a special role here. They “collaborate” in the true sense of the word instead of working in their own zones.

Cobots are used, for example, in welding applications - the shortage of qualified welders in particular is expected to reach 330,000 by 2028

in the USA alone<sup>[2]</sup> - where they work directly alongside human workers or assist the welding robots by placing the parts for them to weld. This increases productivity immensely, while secondary processes such as parts handling remain simple.

## **... and increase your productivity**

In short: collaborative robots can be an ideal addition. This finding is underlined by the growing share of cobots in the total number of installed robots: while in 2017 the figure was just under 3 percent with 11,000 installed units, five years later the share had risen to just under 10 percent with 55,000 cobots.<sup>[3]</sup>

So now is exactly the right time to consider whether a cobot could complement your own production. This white paper provides all the tools you need to precisely analyze the economic benefits and make an informed decision based on this. Because at the end of the day, it's all about increasing productivity and quality.

**David Löh**

*Editor-in-chief at Wiley*

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## **References**

[1] Annual report of International Federation of Robotics (IFR): „World Robotics 2024“

[2] American Welding Society (weldingworkforcedata.com)

[3] Annual report of International Federation of Robotics (IFR): „World Robotics 2023“





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White paper

# Building the case for robotic automation

Published in December 2022

WILEY

# Is automation the right investment for your operation?

**This paper lists the steps you'll need to analyze the benefits of collaborative automation, and how to quantify those benefits to secure funding approval within your organization.**

It's critical in any justification process to capture all of the benefits, both direct and indirect. So we'll look at labor savings and capacity gains, but also less obvious and equally important benefits such as reduced insurance costs, reduced turnover and customer retention. The goal: building a clear and convincing case for your company's investment in collaborative automation.

## The numbers you'll need to get started

Before you work through the calculations in this paper, you'll want to first gather the basic financial data listed below.

If needed, you'll find suggestions for which department can provide this information within each calculation category.

- Annual unit production volume
- Standard unit cost
- Average unit sell price
- Standard unit labor hours
- Standard labor hour cost, burdened
- Average workers comp claim cost
- Floor operation cost per square foot
- Warranty cost: percentage of annual sales OR –
- Warranty cost: per unit
- Annual inventory carrying cost, percentage of standard costs

# Creating the foundation for a successful justification

While in the past the primary drivers for investing in automation were simply reducing labor and streamlining processes, today the focus is on overall business operations, which have been quantified by 10 categories of either **decreased costs** or **increased margins**. You may not need all 10 categories to make a case for automation in your particular facility. Depending on the company or application, any or all of these measurables may apply.

## 1 Direct labor savings

This is the simplest and most common argument for justifying automation and can be easily calculated based on annual labor savings or standard unit labor costs. This calculation should always add burden costs that include both wages and benefits. If benefit costs have not been determined, 29.5% is a typical and conservative estimate to add to wage costs.

### The calculation can be made either of two ways:

- Total annual labor hours saved x standard cost per labor hour, or
- Total labor savings per unit (hours) x standard cost per labor hour x annual volume

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Quality Department

Customer Service

Sales

Supply Chain

Facilities

### Note:

if you cannot acquire some of the data needed for any calculation, make a conservative assumption based on industry standards or your own logic.

For example, if figuring Employee Retention Savings, you might assume an automated material handling cell will prevent one employee turnover per year, and that it takes 60 days to train a new operator.

Then the estimated annual savings in this one category would be 60 days salary and benefits, plus hiring costs for advertising, testing and interviewing.



## 2 Re-work savings

These savings are the result of cost-of-quality improvements on work that requires additional manufacturing labor or other costs.

**Rework savings can be calculated on a per hour basis, or a percentage reduction of overall costs:**

- a. Total annual rework hours saved x standard cost per labor hour, or
- b. Current rework costs x rework percentage reduction

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## 3 Scrap savings

Reflects cost-of-quality improvements for issues that cannot be re-worked, where the manufacturing costs and raw materials in the process are lost.

**Scrap savings is calculated on a unit cost or overall improvement basis:**

- a. Yield improvement percentage x annual production volume x standard unit cost, or
- b. Annual units scrap avoidance x unit cost

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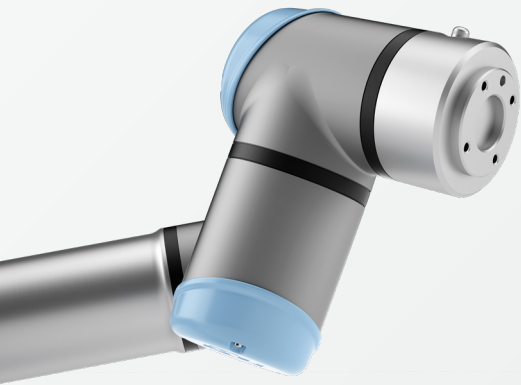
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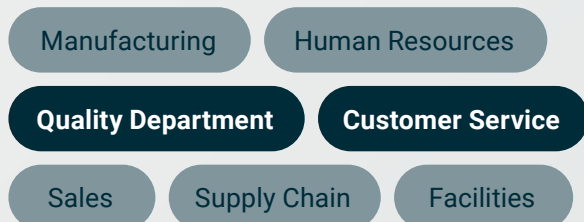
## 4 Warranty savings

These savings represent cost-of-quality issues that result in failures after the sale.

**They can be calculated on a per-unit basis or total-cost basis:**

- Total warranty failure units x warranty improvement percentage x standard unit cost, or
- Current warranty costs x warranty reduction percentage

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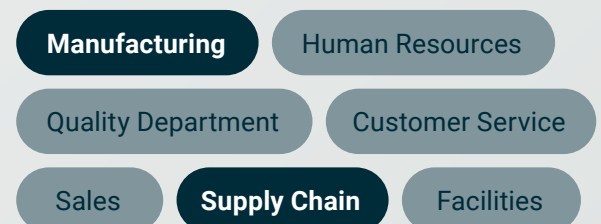
## 5 Scrap savings

Inventory carrying cost is the total of all expenses related to storing unsold goods, including storage floorspace, warehousing, depreciation, shrinkage, and auditing. Inventory carrying costs will generally total about 20% to 30% of the total inventory value. The calculation should also include work-in-process and finished goods if appropriate<sup>1</sup>.

**Inventory reduction is determined by:**

- Work-in-process reduction (units) x standard unit cost x inventory carrying cost percentage, *plus*
- Finished-inventory reduction (units) x standard unit cost x inventory carrying cost percentage
- Inventory carrying costs will generally total about 20% to 30% of total inventory value.

Request data from<sup>2</sup>:



<sup>1</sup> Iowa State University. Cory Lynn Harms. "A Comparison of Inventory Carrying Cost in Literature and in Practice." Management Accounting. D.M. Lambert and B.J. La Londe. "Inventory Carrying Costs." Policy Pages Investopedia policies regarding editorial, advertising, privacy, and terms of use.

<sup>2</sup> Iowa State University. Cory Lynn Harms. "A Comparison of Inventory Carrying Cost in Literature and in Practice." Management Accounting. D.M. Lambert and B.J. La Londe. "Inventory Carrying Costs."



# 6 Floor space savings

This calculation is useful when manufacturing floor space is expensive, as in a semiconductor clean room, or when space is very limited or is landlocked and cannot be expanded. Floor space savings is often tied to tax incentives and other business operating models.<sup>3</sup>

**If operations can be combined to reduce footage, you can use the square foot reduction in the annual floor space cost:**

- Total annual rework hours saved x standard cost per labor hour, or
- Current rework costs x rework percentage reduction

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<sup>3</sup> BOMA Building Owners & Managers Association [www.boma.org](http://www.boma.org)



# 7 Capacity gains

When sales to current customers or markets are constrained by manufacturing capacity, or additional business is being turned away for lack of capacity, this becomes a particularly important calculation. Additional capacity may also be required to maintain key customer relationships. Capacity gains allow a company to increase top line revenue and all the margin associated with the automation adoption.

**The calculation is:**

- Capacity unit gains x average selling price per unit x standard margin percentage

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# 8 Customer retention

It is always more expensive to acquire a new customer than to maintain a current customer. Factory automation may enable additional capacity that allows a company to maintain an important customer relationship, or to become a sole-source supplier. The sales department should have data regarding customer acquisition costs – including onboarding a new customer and ramping up their volume.

**Understanding how many customers the investment will save will complete the calculation<sup>4</sup>:**

- Customer acquisition cost x customers retained
- Rule-of thumb: Customer acquisition costs 6-7x customer retention

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# 9 Insurance savings

This is largely associated with workers' compensation; for example, when an operation requires manually palletizing heavy loads that results in injury and incurs a workers comp claim. Automating the process virtually eliminates that risk, resulting in reduced premiums.

**Insurance savings may be calculated on a cost-per-hour basis or a cost-per-claim basis:**

- Total labor hours x workers' comp cost per hour x reduction in claims percentage, or
- Average cost per claim x claims avoided
- Average cost of workers comp insurance is \$0.75 to \$2.74 per \$100 in wages, based on location, job classification and history
- Workers comp claims average \$41,350

Request data from<sup>5</sup>:

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<sup>4</sup> <https://www.americanexpress.com/en-us/business/trends-and-insights/articles/retaining-customers-vs-acquiring-customers/>  
<sup>5</sup> Source: National Council on Compensation Insurance Workers Compensation Statistical Plan. Source: biBERK Berkshire Hathaway



# 10 Employee retention savings

This is a key metric that is frequently overlooked. Automation improves the work environment by making it safer and reducing injuries and repetitive tasks that can otherwise cause employee turnover. Companies considering automation should prioritize “DDD jobs” – dull, dirty, and dangerous operations that are currently performed manually. Cost-to-hire should also be part of this calculus, including advertising, recruiting, temp agencies, executive and management time for screening and interviews, and training.

- a. Average hiring cost per hire x positions saved, *or*
- b. Average new hire training time (hours) x standard labor cost per hour
- c. Average cost to hire is \$4,700
- d. Average cost-to-train is \$1,250
- e. Total replacement costs are 38% of annual earnings: Separation costs, disruption, recruiting, on-boarding and training.

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<sup>6</sup> Source: SHRM Society for Human Resource Management. Source: Association for Talent Development





# Summarizing the benefits and reporting payback

Having determined the financial benefits that will accrue with the adoption of an automated system, you now have the tools to build a case. That justification will be made even stronger with an educated estimate of payback.

Here are the four primary measures that are used in capital investment decisions:

## Simple payback: ROI

The first is the simple payback, the time needed to recoup the cost of the initial investment. This is determined as the ratio of the initial investment to the annual savings generated for the recovery period, and results in a period of days, weeks, or months. It is the most common and easiest method to understand, however it does not factor long-term cash flows or the cost of the capital, and thus is not an absolute measure of profitability.

## Internal rate of return: IRR

Internal rate of return, also referred to as the dollar-weighted rate of return, calculates an "interest rate" that the project investment returns, comparing the present value of the cash flows from the project against the initial investment. For companies that are cash intensive, this is a popular calculus.

## Return on assets: ROA

This metric captures how efficiently a company deploys their assets, and determines what level of after-tax earnings are generated from the investment; the higher the ratio, the better the return on assets. This approach must be balanced against risks, sustainability and other reinvestment demands. This is a sophisticated calculus that some companies prefer to use.

## Equipment and labor

Effectiveness: OEE & OLE Traditional measures rely on static, long term assumptions. OEE and OLE metrics measure the availability and utilization of manufacturing equipment and labor. These metrics are particularly suited for today's VUCA (volatile, uncertain, complex and ambiguous) environment.

# Additional benefits to your organisation

Apart from the financial justifications presented above, many organizations have strategic goals that can be furthered through flexible and collaborative automation. Additional benefits include:

- Flexibility to meet customer demands
- Ability to customize products for each customer
- High product variability
- Short product life cycles
- Broad product lines
- Limit staff count / hiring
- Improve quality of work life, reduce turnover
- Worker safety

For assistance in figuring the benefits of flexible automation for your company.



**Download the free  
Universal Robots  
Justification Calculator**

## About Universal Robots

Universal Robots aims to empower change in the way work is done using its leading-edge robotics platform.

Since introducing the world's first commercially viable collaborative robot (cobot) in 2008, UR has developed a product portfolio including the UR3e, UR5e, UR10e, and UR16e, reflecting a range of reaches and payloads. Each model is supported by a wide selection of end-effectors, software, accessories and application kits in the UR+ ecosystem. This allows the

cobots to be used across a wide range of industries and means that they can be redeployed across diverse tasks.

The company, which is part of Teradyne Inc., is headquartered in Odense, Denmark, and has offices in the USA, Germany, France, Spain, Italy, the Czech Republic, Romania, Turkey, China, India, Japan, South Korea, Singapore and Mexico.

Universal Robots has installed over 50,000 cobots worldwide.



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