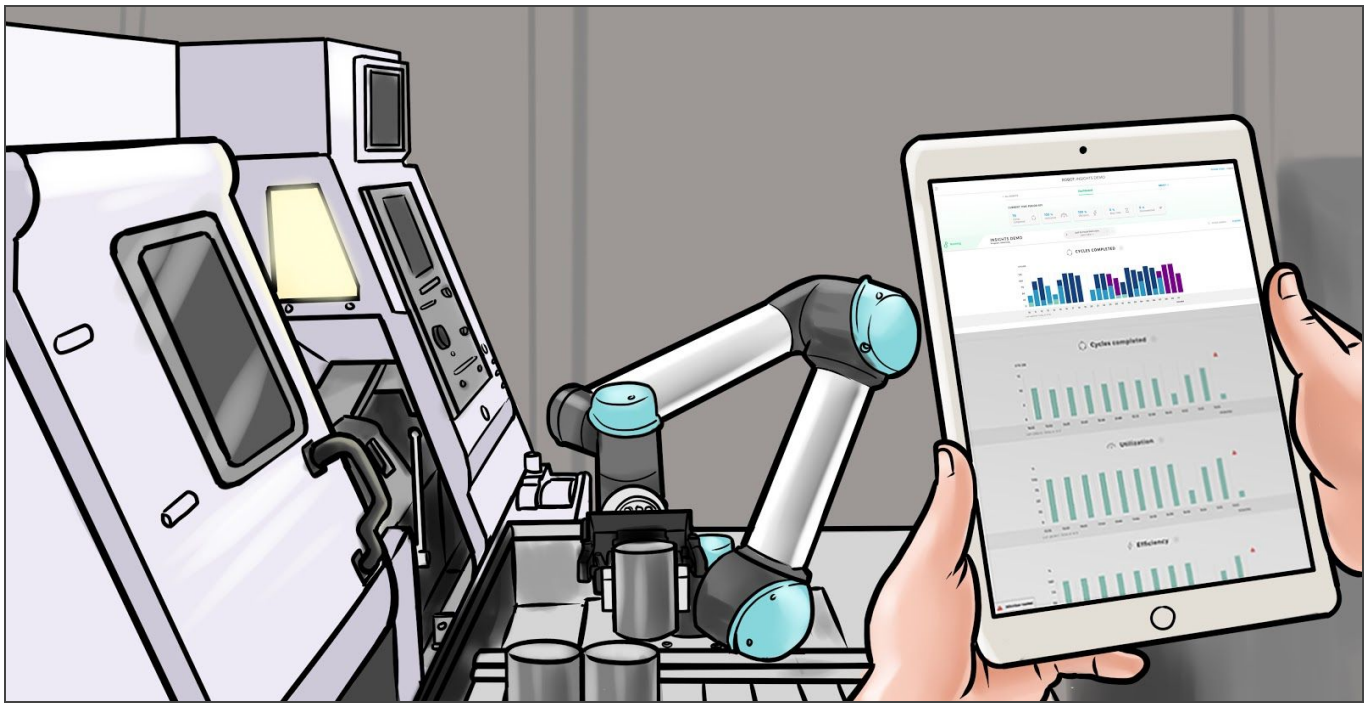
ROBOTIQ

# CAN YOU AFFORD NOT TO HAVE A ROBOT?




**How to decide whether to buy your first cobot**

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Can You Afford NOT to Have a Robot?

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# Lean Robotics: Simplify Robot Cell Deployments

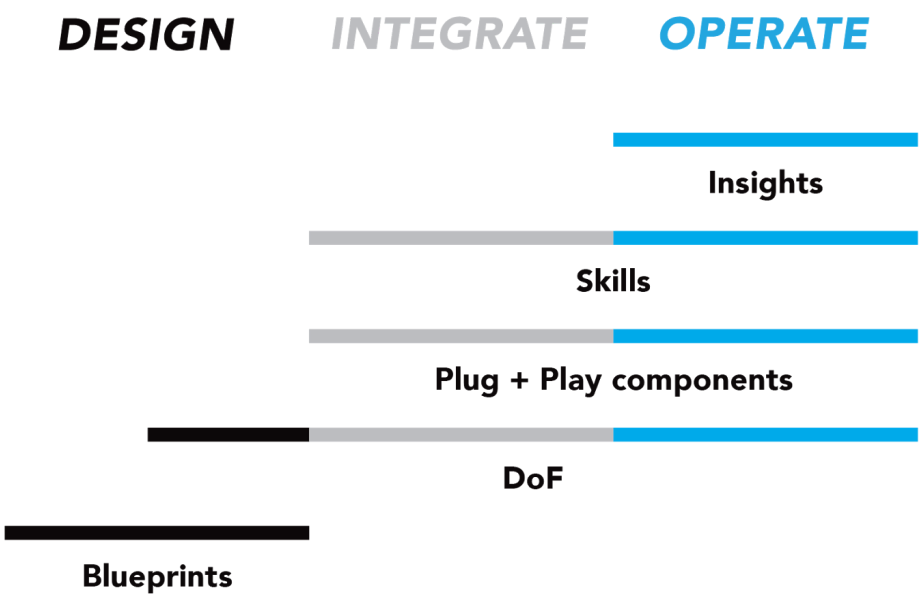
Whenever you ask if robots could work in your factory, the answer you receive is always a hesitant “It depends.” It depends on your factory, your team, which robot you choose, what you want it to do... and a whole lot more.

If you're a first-time robot user, how can you get started? How do you get from your initial idea to a productive, working robot? And if you’ve already got a few robotic deployments under your belt, how can you scale up your robotics efforts throughout your factory—or across multiple factories?

The answers can be found in **lean robotics: a methodology for simplifying robotic cell deployments**.

Lean robotics is a systematic way to complete the robotic cell deployment cycle, from design to integration and operation. It will empower your team to deploy robots quicker and more efficiently than ever before.

Lean robotics divides robotic cell deployments into three phases: Design, Integrate and Operate.




Robotiq’s library of eBooks covers the different phases of the robot cell deployment to ensure that you have access to tips from robotics experts all along.

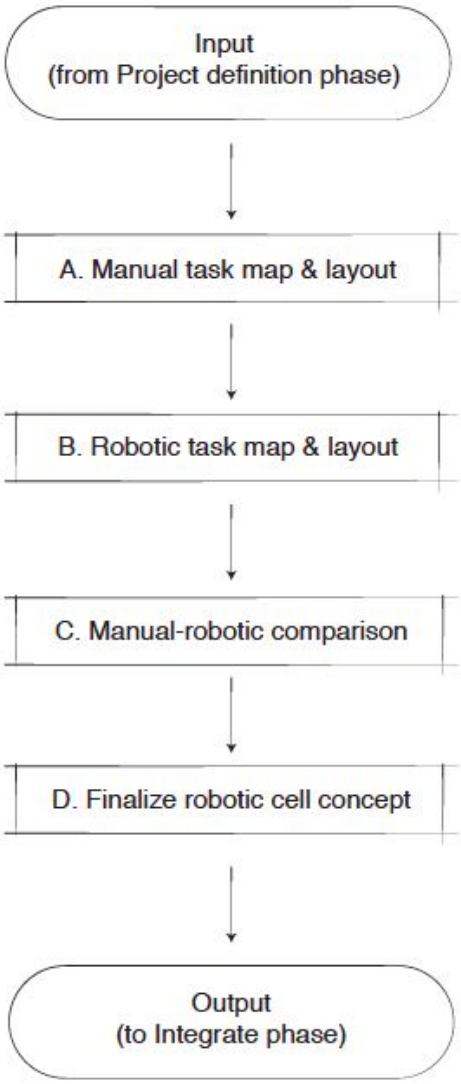
Learn more about Lean Robotics on **leanrobotics.org**.

## This Ebook Covers the Design Phase

The design phase includes all the tasks needed to go from a manual process to having the plan and materials for the robotic cell.

**DESIGN**

You'll be able to task map the robotic equivalent of your process and compare the manual-robotic options. After validation, finalizing the robotic cell concept will be the last step before starting the integrate phase.

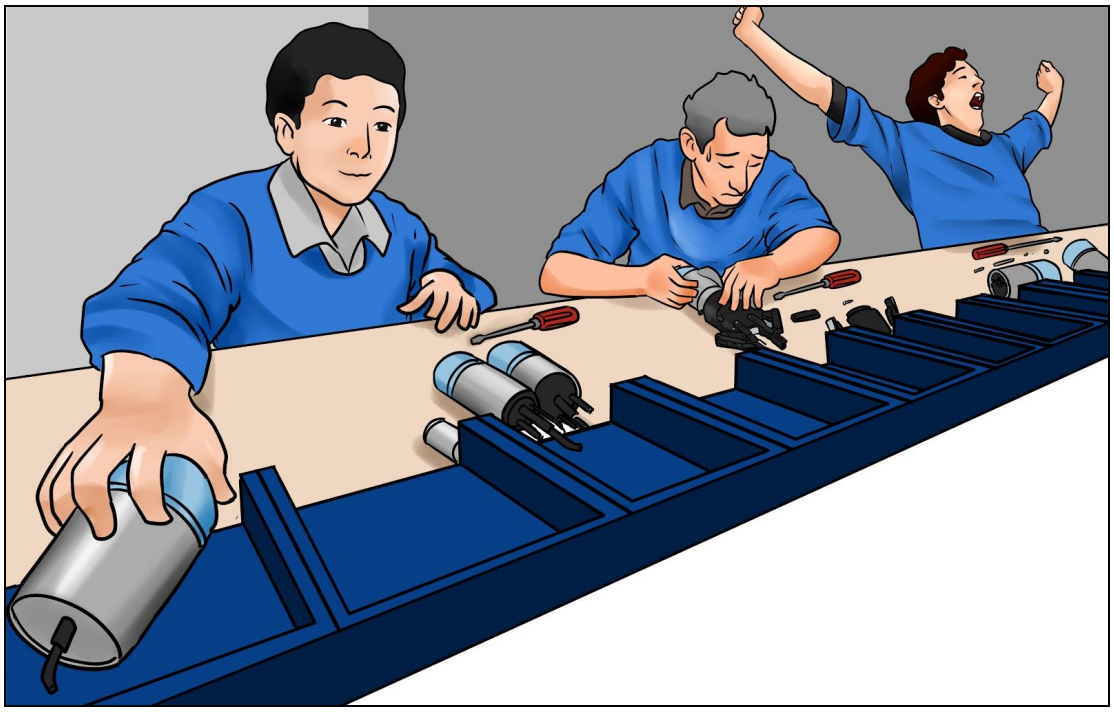


# I can’t handle the pace of production – help!

Let’s say you can start production at the exact moment you receive an order, and your orders are guaranteed to be an exact match for your daily capacity. Wouldn’t that be ideal?

Unfortunately, that never happens. Orders come and go with a variety of sizes and deadlines, so nothing in a manufacturer’s world is constant. This variability can lead the manufacturer (you) to build up a backlog and promise to fill orders with a couple of days’ delay… which soon becomes a couple of weeks’.

If your backlog is continuously growing while delivery times are lengthening, there must be a “bottleneck” in your process.



## bottleneck:

***A department, facility, machine, or resource that’s already working at full capacity and, therefore, cannot handle any additional demands.***

A bottleneck slows down the pace of the entire manufacturing process. Even if some parts of the process are really effective, the process can never be completed more quickly than its slowest component will allow.

There are two ways to resolve a bottleneck: get more people to do the task, or reduce the time it takes to perform it. You can accomplish the latter by using a faster machine, creating a different assembly process, or placing a robot at the station.

**"You are only as strong as your weakest link"**
**– Kahlil Gibran, The Prophet**

Another way to view the two bottleneck-resolution tactics is as follows:

1. You can assign more employees to this task, taking a small hit in terms of cash flow but gaining a moderate increase in productivity.

   OR...

2. You can create a new-and-improved process, which will require a far greater investment, but will also liberate your employees to focus on more interesting, less tedious tasks.

Both solutions have pros and cons, but the main goal is to open the bottleneck and make the process flow more evenly.

**Here's an example of the second tactic in action:**
One factory's CNC lathe was taking a lot more spindle time than any other operation on a part. To smooth out the manufacturing process, the manager installed a robot on the lathe so it could be tended at night. Now as soon as the daytime operators get to work, they can start working on the parts the robot completed the night before.

# What are my options?

Most modern manufacturing processes require a human workforce and tools. Whether those tools are computers, torque wrenches, or CNC machines, there are various ways to optimize the manufacturing process and make it more cost-effective.

Today, many manufacturers face the challenges of enhancing productivity, reducing costs, shortening delivery times, and hiring the right workers.

There are three general strategies for increasing your productivity or output:

1. Hire more employees
2. Upgrade equipment and/or buy more of it
3. Automate a process

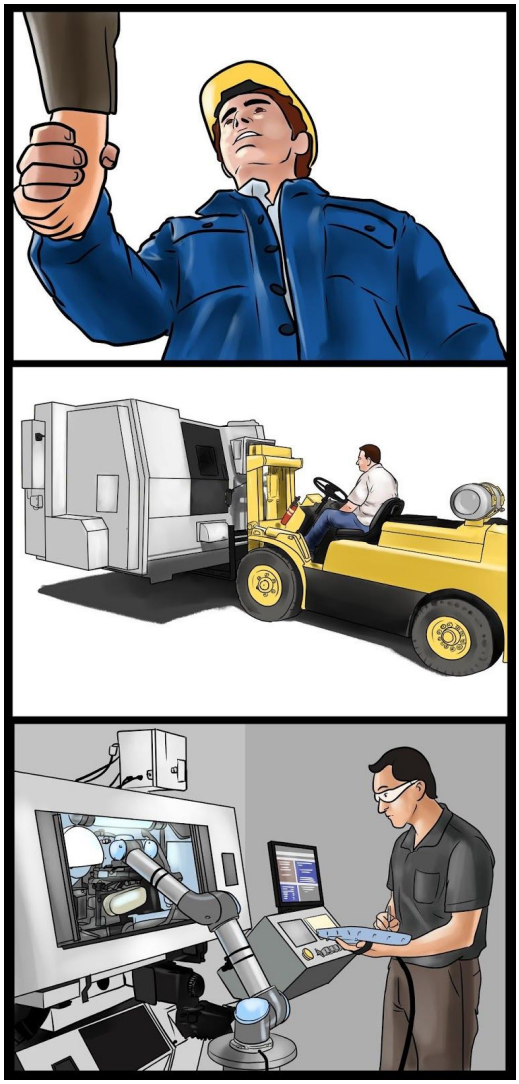
Each option has its pros and cons. Hiring qualified, trustworthy employees takes a lot of effort – not just to find and recruit them, but also to train them. On the other hand, introducing a new machine on the shopfloor entails both a long integration process and a large investment.

Lastly, to automate a process, you need to take a step back from the day-to-day. This means you might need to give up some short-term productivity now in order to be more productive later and in the long-run. It also means that even though your process may already work fairly well, you might still have to introduce new technology.

**"If you're struggling with a shortage of competent employees, late product delivery, or machine downtime, this eBook can help you out."**

So what's the best strategy for your enterprise? The three options we listed above can all increase your productivity, but they may have different costs. When it comes to the time it takes to get a return on your investment, your choice could make the difference between two months and a whole year.

This eBook will guide you through the evaluation phase of a productivity-increase strategy, and show you how to do it the right way so you get the quickest return on your investment. If you're struggling with a shortage of competent employees, late product delivery, or machine downtime, this eBook can help you out.



**"Whereas robots are precise, tireless, consistent machines, humans are creative, intelligent and adaptable."**
**– Samuel Bouchard, CEO of Robotiq & author of *Lean Robotics***

## Option 1: Hire a new employee

> **"Not only are there fewer people in the labor force (by percentage), young people are also less interested in factory work today."**
> **– Samuel Bouchard, CEO of Robotiq & author of *Lean Robotics***

It's hard to hire new employees. Often the task that needs doing is a very specialized one, and few people have the combination of skills you're looking for.

But if you do find the right person, hiring a new employee means bringing some new blood into the company. The new employee might think of different ways to perform the task and is most likely able to do a lot of different tasks.

In fact, a human worker, unlike a machine, can do a lot of different operations that require dexterity and problem-solving abilities. Adding employees is generally a straightforward way to raise production capacity during normal business hours.

Finally, new employees are an economical solution, because they do not require a large up-front investment.

However, it's important to remember that yearly salaries add up as part of the payroll, and employees have a limited amount of time available (i.e. 40 hours per week). There are also various costs associated with having a bigger workforce, including the need for more office space and the potential for more human errors to be made.

## A new employee:

| Pros | Cons |
|---|---|
| Brings new knowledge to the company | Can be tough to recruit |
| Can do a variety of tasks | Might make human errors |
| Can solve complex problems | Works a limited number of hours (and needs breaks, sick days, and holidays) |
| Does not require any major investment | Requires a yearly salary |
| | May not live up to your expectations |

The biggest cons are how hard it is to find good employees and either retain them or, if they leave, replace them with someone who's equally skilled.

At the same time, don't forget that many tasks cannot be done without employees. If the task at hand can only be done by a new employee, it is essential to hire one.

## Option 2: Buy a new machine

A new machine or tool is often a large investment, and it takes time to integrate the solution with the company or manufacturing process. More machines might allow you to increase your production capacity. But first, you will need to calculate whether or not this benefit is worth the costs.

The downside of adding a machine is that you still need a trained employee to run it. Of course, several machines can be run by a single employee, but the bottom line is that someone will have to spend time tending the machine when they could have been doing something else.

## A new machine:

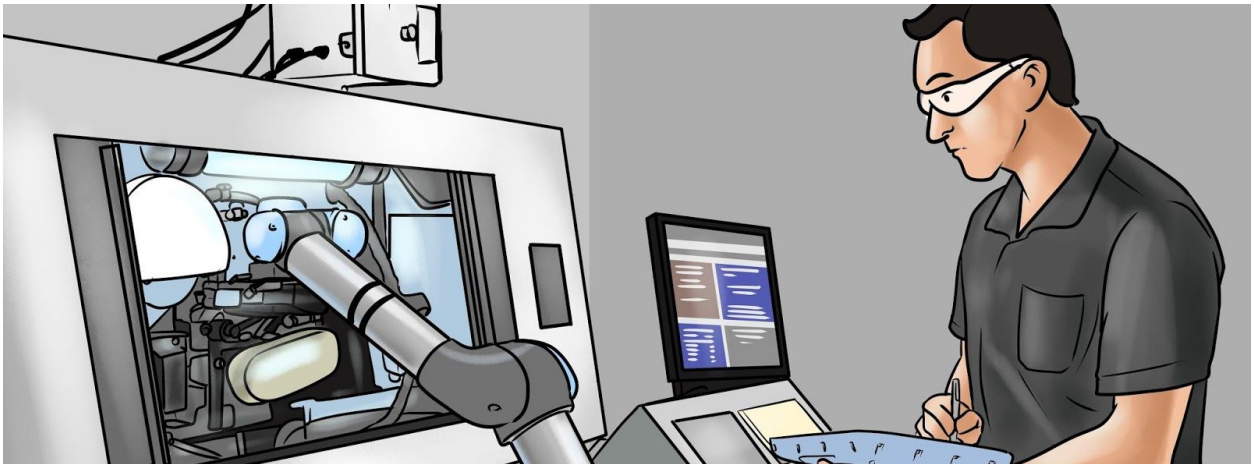
| Pros | Cons |
|---|---|
| Generally stronger and able to work faster than human employees | Must be run by a human |
| Extends the range of manufacturing possibilities | Requires a large investment ($$$) |
| Can run unattended (e.g., CNC, laser table, CMM) | Takes more time and effort to integrate |
| Can be replaced and duplicated | Needs regular maintenance and might fail unexpectedly |

In most cases, a machine can run unattended for an extended period of time. They're easy to duplicate – you can just buy another one if you need to increase your product output. The downsides of buying a new machine are that it requires a trained operator, maintenance tasks will slow down or halt your production process on a regular basis, and it will eventually break down.

## Option 3: Automate

Automation is a lot of work. First, any automation system you choose must be adapted to your process, which is generally not an easy thing to do. (Online platforms like this one can make the job easier – take a look at what they can do before going too far in your process.)

Whether you're planning to introduce a robot or use automated software, there are ways to optimize your process (see the book *Lean Robotics* for examples). Even if your automated process is already up and running, you can still benefit from the tips and tricks shared by others who've done it before.



Automation is complex, but it also has numerous advantages. More automation in your manufacturing process might mean having a robot work overnight, or having it execute tasks that are dangerous or unpleasant for humans. Automation also frees up human workers' time, enabling them to do more interesting tasks that require greater dexterity or problem-solving abilities than robots possess. As a result, you can accomplish more with the same number of employees.

## An automated process:

| Pros | Cons |
|---|---|
| Generally stronger and able to work faster than human employees | Needs a lot of work up-front |
| Shortens cycle time | May reduce your output for a certain time |
| Can run automatically | Must be adapted for the task and environment |
| Can be duplicated | |
| Is consistent, which can improve quality | |

The biggest gain from automation usually takes place over the long run. Although it may look like a big investment up-front, it's all but guaranteed to pay off later.

The automation process can easily be duplicated, and most importantly, it can also improve the quality of your products due to better consistency. You can also "poka-yoke" the automated process (see below for explanation). With fewer errors, greater repeatability, and faster processing times than humans, automated processes are a boon to manufacturers.

**POKA-YOKE**

A poka-yoke device is one that prevents incorrect parts from being made or assembled, or easily identifies a flaw or error. Also known as "mistake-proofing," poka-yoke is a means of providing a visual or other signal to indicate a characteristic state. Often referred to as "error-proofing," poka-yoke is actually the first step in truly error-proofing a system. Error-proofing is a manufacturing technique of preventing errors by designing the manufacturing process, equipment, and tools so that an operation literally cannot be performed incorrectly. Definition from SixSigma website.

### Next steps

At this point you've learned a bit more about the pros and cons of each option, but you still need to make your decision based on hard data (and not just intuition). That's why the next step is gathering data to ensure you're making the right decision for your enterprise. This will not only help demonstrate the viability of your ideas, but also enable you to calculate which investment will be the most worthy.

> **"Even if [robots] don't reduce production time directly, it's better to have a robot waiting for parts to process than it is to have a human employee or a multi-million dollar machine standing idle.**
>
> **And because robots do the exact same operation again and again, they have the potential to improve consistency and reduce the number of defective products."**
>
> **– Samuel Bouchard, CEO of Robotiq & author of *Lean Robotics***

The next section of this eBook will show you how to take the hard data from your situation and analyze it for each of the different possibilities you have in mind. After going through these examples, you'll be ready to make up your mind on which option is best for you.

# What's my opportunity cost?

## opportunity cost:

***"The loss of potential gain from other alternatives when an alternative is chosen."***
***– Oxford English Dictionary***

At its simplest, your opportunity cost is the amount of money you're losing if you are not taking action.

When your production is topped out and your backlog is building up, you cannot increase your profits beyond their current level, because you can't produce beyond your current level. A faster production process will bring more money into the company.

However, each move to improve your process requires an investment. So knowing the opportunity cost allows you to evaluate which option will earn a return the quickest, and which option will bring you the most profit in the near future.

Although there is no official formula for opportunity cost, we will define it according to this simple formula:

**Opportunity cost = potential future returns - actual current returns.**

We'll assume that the higher the opportunity cost, the better the strategy. Please note that for the sake of simplicity, we've left some variables out of the calculation, such as fluctuations in the value of money over time, transportation fees, etc.

We'll also calculate the payback period (the amount of time it takes to earn a return on the investment) for each option, in order to get even more information before making a decision.

The ideal project will have both the shortest payback period and the greatest amount of potential profit.

## Which data should I consider?

When making your calculations, you need to consider any data that help provide an estimate of your current and future production costs.

For each of your options, you will also need to find out the *initial investment ($)* and the *cost of integration ($)*.

To calculate the opportunity cost, you will need:

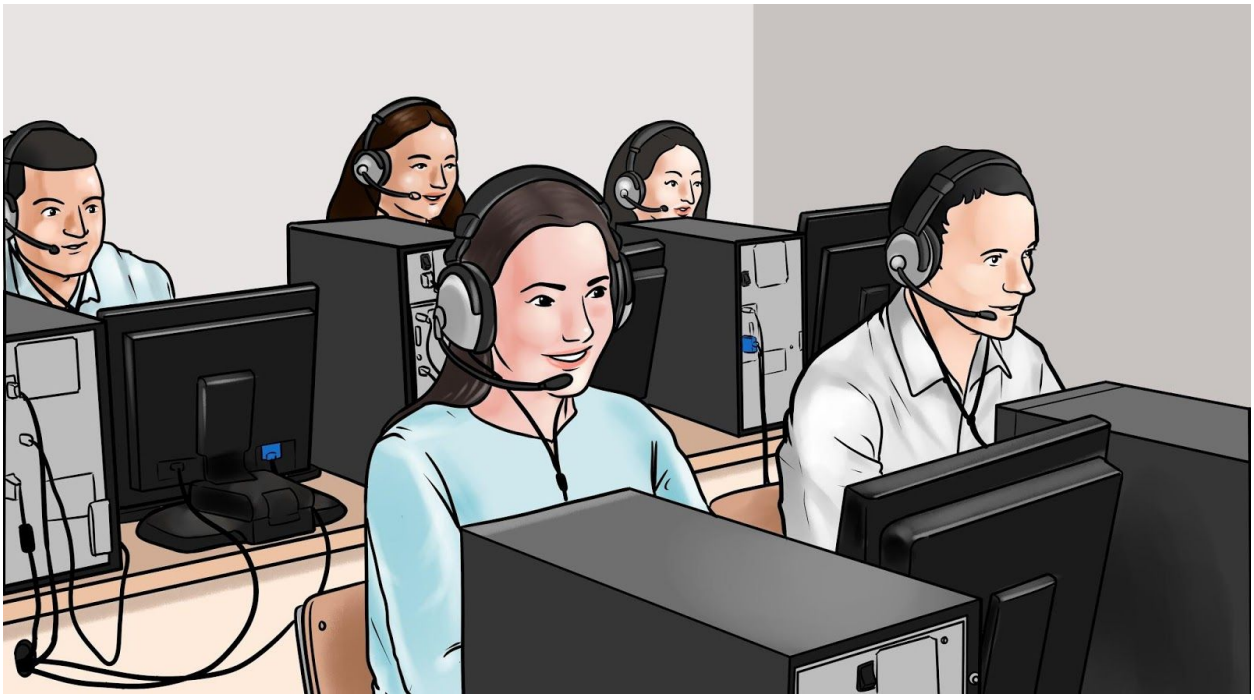
- Initial output (current value of services and/or products being produced, in $)
- Potential output (potential $ value of services and/or products produced in future, in $)
- Initial investment (up-front cost of implementing the new strategy, in $)
- Cost price of the services and/or products (how much it costs to produce, in $)
- Retail price of the services and/or products (how much customers pay, in $)

Even though there are tons of other variables and information you can use when calculating your opportunity cost, try to limit the amount of data you consider to the true necessities.

It's better to do a rough estimation first, because that's all you need if one option is the clear winner. If you find that two options are pretty similar, you may want to conduct a deeper analysis and look for answers to questions such as "How will my customers perceive the changes to the manufacturing process?", "Will this choice lead to improvements in product quality?", and "Will my employees be happier as a result of this choice?". Your answers may be tough to quantify, but they can have a large impact on your decision.

Don't worry if you're not clear on how to do this in practice: we'll discuss two examples below. Take a look to find out how to calculate the opportunity cost and the payback period for the three options.

## Example #1: Healthcare computers



Company X, an insurance business, must record information about prospective clients in order to determine whether the prospect is eligible for insurance.

First the customer speaks to an employee on the phone, who enters the customer's information manually. Once the document is complete, the computer analyzes the information and checks whether the customer can be insured. Finally, the employee takes one last look at the information before sending the document to the main office.

There are three 20-minute tasks here– manual data entry by the employee, confirmation by the computer, and validation and authorization by the employee – so each document takes 1 hour to complete. The company is paid $200 for each document. There are 10 full-time employees working 8 hours/day, and employees are paid $35/hour.

Here's a summary of the information above:

- 20 mins. data entry (manual)
- 20 mins. confirmation (computing time)
- 20 mins. validation and authorization (manual)
- $200/document (retail price)
- 10 employees
- 8-hour shifts
- $35/hour per employee (cost price)

| Situation summary: No investment | |
|---|---|
| Initial investment: | $0 |
| Revenue per document: | $200 |
| Time per document (*takt time*): | 1 hr |
| | |
| Output per employee: | $200/hr |
| Total output: | $2,000/hr |
| Profit: | $1,650/hr |
| | |
| Payback period in hours: | 0 |
| Payback period in days: | 0 |

Since the process takes 1 hour and the company charges $200/document, each employee outputs $200/hr. Employees are each paid $35/hr, so the company makes an hourly profit of $165/employee.

There are 10 employees, so the company's total hourly profit is **$1650**. This figure is our baseline: it represents the situation where no investment is made and the backlog is continuously increasing.

To increase production, the manager has three options: hire a new employee, buy new computers, or use automation software.

## Option 1: Hire a new employee

To reduce the backlog, the manager could decide to hire a new employee. After a long period of searching, let's assume the company is finally able to hire a good candidate.

It will take an entire week to train the new employee, which also requires the manager's full-time presence. During that time, the employee will not output any real documents. After training, the employee will be able to output documents at the same pace as the other employees.

In this case the company would have 11 employees doing the job. The cost of the new employee would be the cost of the training period, which is one week's salary (40 hours at $35/hour) plus one week of the manager's time (40 hours at $60/hour).

In other words, the initial investment is:

**40 hrs x ($35 + $60) = $3,800.**

| Situation summary: New employee | |
|---|---|
| Initial investment: | $3,800 |
| Revenue per document: | $200 |
| Time per document (*takt time*): | 1 hr |
| | |
| Output per employee: | $200/hr |
| Total output: | $2,200/hr |
| Profit: | $1,815/hr |
| | |
| Payback period in hours: | 23.03 |
| Payback period in days: | 2.9 |

The output per employee is still the same at 1 document/hour, but with 11 employees, output is $2200/hour compared to the previous $2000/hour. The hourly profit is $1815, compared to $1650 initially. With a small investment of $3,800, the payback period for hiring a new employee is just three days!

**Opportunity Cost:**
**$1815/hr - $1650/hr = $165/hr.**

**Payback period:**
**$3,800 / ($165/hr) = 23 hours or 2.9 workdays.**

This is a very short payback period – the company will start seeing a profit after a mere few days of work. But although this is a great option, let's see what the other options have to offer.

## Option 2: Buy new computers

Replacing the computers would cut the document processing time in half, enabling employees to save 10 minutes on each document.

Each new computer costs $1000 and takes 10 hours to install. Fortunately the installation is quite straightforward, so employees can do it themselves.

Given that there are 10 employees, the starting investment is the price of 10 computers plus 100 hours of labour:

**(10 computers x $1,000) + ((10 employees x 10 hours) x $35) = $13,500.**

Once the computers are up and running, employees can process a document in 50 minutes total. This means each employee has an hourly output of $240, and the company has a total profit of:

(10 employees * $240) - (10 employees * $35) = $2,050/hour.

| **Situation summary: New computers** | |
|---|---|
| Initial investment: | $13,500 |
| Revenue per document: | $200 |
| Time per document (*takt time*): | 0.833 hrs |
| | |
| Output per employee: | $240/hr |
| Total output: | $2,400/hr |
| Profit: | $2,050/hr |
| | |
| Payback period in hours: | 33.75 |
| Payback period in days: | 4.2 |

This option would leave the company with an hourly output of $2,050/hour, compared to its current profit of $1,650/hour.

**Opportunity Cost:**
**$2,050/hr - $1,650/hr = $400/hr.**

**Payback period:**
**$13,500 / ($400/hr) = 33.75 hrs or 4.2 workdays.**

Upgrading the computers would allow the company to unload their backlog while keeping the same number of employees. This option does require a $13,500 investment, but the payback period is short enough to be worth it. Another viable strategy!

## Option 3: Automate with software

The manager's third option is to purchase software that allows customers to enter information themselves, and then automatically analyzes the customers' eligibility.

Since employees will no longer have to spend time communicating by phone and waiting for documents to be processed, the only task that remains is verifying the information and sending it to the

main office (for which the employees are already well-trained). This means each employee can analyze three documents per hour.

The initial investment is **$50,000**, which includes the software itself, the integration, and some custom programming to ensure the software meets the company's needs.

| **Situation summary: New software** | |
|---|---|
| Initial investment: | $50,000 |
| Revenue per document: | $200 |
| Time per document (*takt time*): | 0.33 hrs |
| | |
| Output per employee: | $606/hr |
| Total output: | $6,061/hr |
| Profit: | $5,711/hr |
| | |
| Payback period in hours: | 12.31 |
| Payback period in days: | 1.5 |

As a result of the new software, the company's hourly output is $6,061/hour, compared to $2,000/hour initially. This brings its profit to $5,711/hour, as opposed to the previous $1,650/hour. Finally, despite the $50,000 investment, the software payback period is barely 2 days.

**Opportunity Cost:**
**$5,711/hr - $1,650/hr = $4,061/hr.**

**Payback period:**
**$50,000 / ($4,061/hr) = 12 hours or 1.5 workdays.**

So as it turns out, the project with the biggest up-front investment is also the one with the biggest opportunity cost and the shortest payback period. That's because this option enables all the employees to process far more documents in a workday.

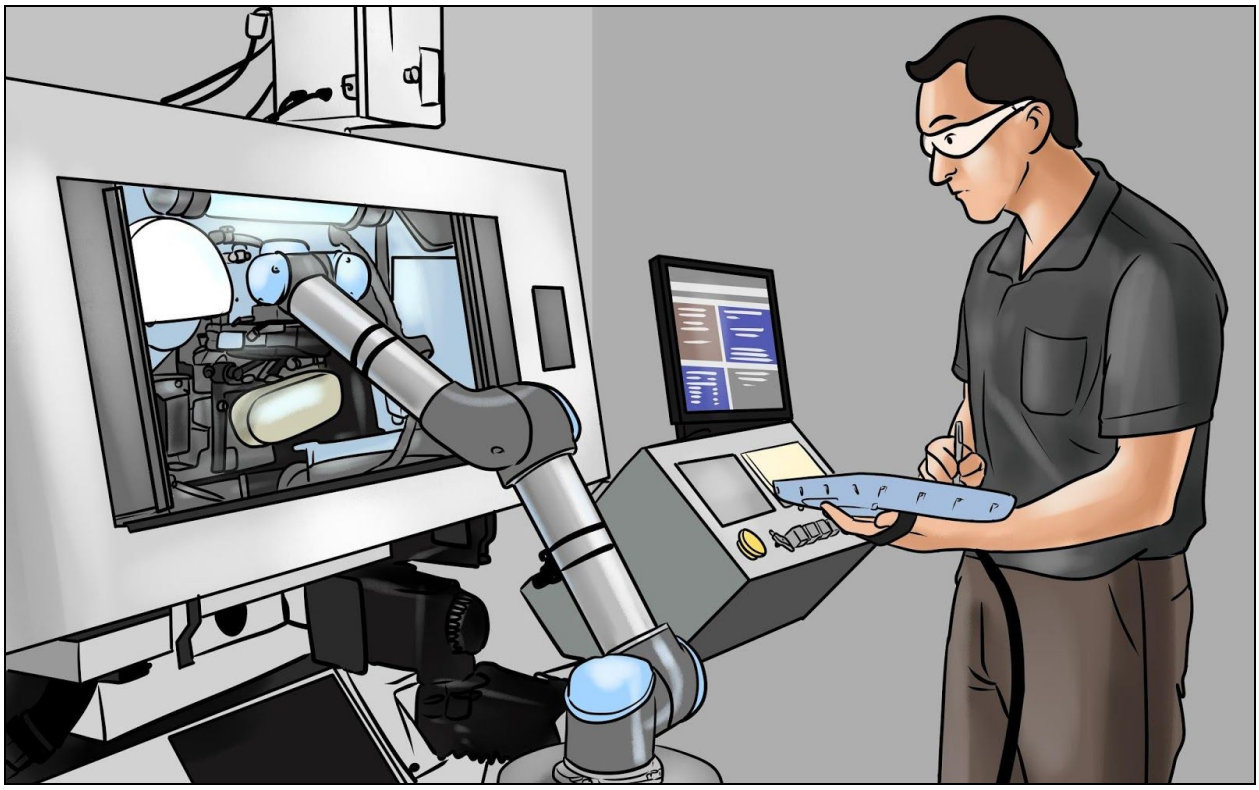
With the automation software, they'll be able to empty the backlog and provide better customer service. And that's not all: the software also reduces errors in the documents, because it prompts customers to fill out all their information correctly before they can move on to the next step. This results in fewer typos and other human errors.

## Summary

When we consider all the options, automation is clearly the best one. Although it requires the biggest investment, the short payback period means it's practically a no-brainer.

| | No investment: | New employee: | New computers: | New software: |
|---|---|---|---|---|
| Initial investment: | $0 | $3,800 | $13,500 | $50,000 |
| Revenue per document: | $200 | $200 | $200 | $200 |
| Time per document (*takt time*): | 1 hr | 1 hr | 0.833 hrs | 0.33 hrs |
| Output per employee: | $200/hr | $200/hr | $240/hr | $606/hr |
| Total output: | $2,000/hr | $2,200/hr | $2,400/hr | $6,061/hr |
| Profit: | $1,650/hr | $1,815/hr | $2,050/hr | $5,711/hr |
| Payback period in hours: | 0 | 23.03 | 33.75 | 12.31 |
| Payback period in days: | 0 | 2.9 | 4.2 | 1.5 |

## Example #2: Machine tending



This next scenario is about a machine shop that can barely keep up with demand. The machine shop currently has four employees who run five CNC machines during an eight-hour shift. Employees are paid $35/hour.

Most parts take 30 minutes to machine. While the CNCs run, employees carry out quality checks on a CMM and another measuring tool, and fill out paperwork. The finished parts are sold for $200 each. However, every day employees must halt the CNCs for about two hours in order to perform setup and maintenance tasks.

The shop is super busy, and employees don't have much time left in their day. The company has a four-week backlog and it's getting longer. The manager's goal is to shorten delivery time.

We'll assume that the actual CNC machines have been paid for, and customers cover the costs of tooling and raw stock, so the shop's only expenses are employee salaries.

Here's a summary of the information above:

- 2 hours/day setup time
- 6 hours/day spindle time
- 30 mins./part
- $200/part (retail price)
- 4 employees

- 5 CNC machines
- 8-hour shifts
- $35/hour per employee

| Situation summary: No investment | |
|---|---|
| Initial investment: | $0 |
| Price per part: | $200 |
| Time per part: | 0.5 hr |
| Setups per day: | 1 |
| Time per setup: | 2 hrs |
| Spindle time per day: | 6 hrs |
| M1 parts per day: | 12 |
| M2 parts per day: | 12 |
| M3 parts per day: | 12 |
| M4 parts per day: | 12 |
| M5 parts per day: | n/a |
| Total parts per day: | 48 |
| Output per employee: | $2,400/day |
| Total output: | $9,600/day |
| Costs: | $1,120/day |
| Profit: | $8,480/day |
| Payback period: | 0 days |

To shorten delivery times, the manager has three choices: hire a new employee, buy another CNC machine, or automate by introducing a robot.

## Option 1: Hire a new employee

To reduce the backlog, the manager could decide to hire a new employee. After a long period of searching, let's assume the company is finally able to hire a good candidate. It will take an entire week to train the new employee, which also requires the manager's full-time presence. During that time the employee will not output parts. After training, the employee will output parts at the same pace as the other employees.

In this case the company would have 5 employees doing the job. The cost of the new employee would be the cost of the training period: one week's salary (40 hours at $35/hour) plus one week of the manager's time (40 hours at $60/hour).

In other words, the initial investment is:

**40 hrs x (($35 + $60)/hrs) = $3,800.**

| Situation summary: New employee | |
|---|---|
| Initial investment: | $3,800 |
| Price per part: | $200 |
| Time per part: | 0.5 hrs |
| Setups per day: | 1 |
| Time per setup: | 2 hrs |
| Spindle time per day: | 6 hrs |
| M1 parts per day: | 12 |
| M2 parts per day: | 12 |
| M3 parts per day: | 12 |
| M4 parts per day: | 12 |
| M5 parts per day: | **12** |
| Total parts per day: | 60 |
| Output per employee: | $2,400/day |
| Total output: | $12,000/day |
| Costs: | $1,400/day |
| Profit: | **$10,600/day** |
| Payback period: | **1.8 days** |

The output per employee is still the same at 12 parts per day, but with 5 employees, output would be $12,000/day compared to the current $9,600/day. The daily profit would be $10,600, compared to $8,480 now. With a small investment of $3,800, the payback period for hiring a new employee is less than two days!

**Opportunity Cost:**
**$10,600/day - $8,480/day = $2,120/day.**

**Payback period:**
**$3,800 / ($2,120/day) = 1.79 days.**

This is a very short payback period – the company will start seeing a profit after just a couple days' work. But although this is a great option, let's see what the other strategies have to offer.

## Option 2: Buy another CNC machine

The company could buy a single machine that can produce parts in 15 minutes instead of 30 minutes. The machine costs $250,000, and one employee would have to spend a week setting it up. The company will also need to buy tooling (another $30,000).

So the initial investment is $250,000 for the machine, $30,000 for the tooling, and one week of employee labour at $35/hour:

**$250,000 + $30,000 + (40 hours x $35/hour) = $281,400.**

With the new machine, the company could produce 12 more parts per day with the exact same amount of employees. The production pace would then be 60 parts per day.

Since parts are sold for $200 each, this would mean a daily output of:

**60 parts/day * $200/part = $12,000/day.**

| **Situation summary: New CNC machine** | |
|---|---|
| Initial investment: | $281,400 |
| Price per part: | $200 |
| Time per part: | 0.5 hrs |
| Setups per day: | 1 |
| Time per setup: | 2 hrs |
| Spindle time per day: | 6 hrs |
| M1 parts per day: | 12 |
| M2 parts per day: | 12 |
| M3 parts per day: | 12 |
| M4 parts per day: | **24** |
| M5 parts per day: | n/a |
| Total parts per day: | 60 |
| Output per employee: | $3,000/day |
| Total output: | $12,000/day |
| Costs: | $1,120/day |
| Profit: | **$10,880/day** |
| Payback period: | **117.08 days** |

Even though there's the same number of employees on the shop floor, the daily profit would be $10,880 instead of the current $8,480. However, the payback time is a bit longer than with Option 1, due to the large investment in the machine and tooling.

**Opportunity cost:**
**$10,880/day - $8,480/day = $2,400/day.**

**Payback period:**
**$281,000 / ($2,400/day) = 117 days.**

Although this is a fairly short payback period, it takes a lot longer than simply getting a new employee onboard.

On the other hand, the opportunity cost is also greater. So in the long run, it's worth more to buy a new machine. After six months you'll be earning a higher daily profit, and who knows – you may be able to reduce production time and increase your daily profit even more.

## Option 3: Automate with a robot

The third option that's available to the manager is buying a robot. Since one of the machines is easy to use with a collaborative robot, it is relatively simple to put a robot in front of the machine without any major modifications.

The robotic arm, a gripper, and some simple tooling can be bought for $75,000. One employee will be trained for an entire week (40 hours at a rate of $35/hour). Since the employee won't be running the CNC machine during that period, the training period involves an additional expense of $15,000 (5 days at a rate of $3000/day). So the initial investment is:

**$75,000 + (40 hours * $35/hour)+(5 days * $3000/day) = $91,400.**

In this scenario, the trained employee will set up the robot and will let it run around the clock. The robot will need to be stopped for two hours each day so employees can do setups and maintenance tasks.

While the robot takes over the tasks that one employee used to do, the manager will assign this employee to handle more setup tasks and assist co-workers with quality checks. This employee can prepare the setups off-line, which takes him 1.5 hours. Then the other employees only need to install the right vice and tools in the machine when they start work, which takes them 30 minutes. As a result, the employees assigned to the machines can run their machines for 7.5 hours per day, instead of only 6.

In other words, the worker that has been replaced by the robot is now free to do more setups so the other employees can focus on production.

| Situation summary: New robot | |
|---|---|
| Initial investment: | $91,400 |
| Price per part: | $200 |
| Time per part: | 0.5 hrs |
| Setups per day: | 1 |
| Time per setup: | 2 hrs |
| Spindle time per day: | 7.5 hrs |
| M1 parts per day: | 15 |
| M2 parts per day: | 15 |
| M3 parts per day: | 15 |
| M4 parts per day: | 44 |
| M5 parts per day: | n/a |
| Total parts per day: | 89 |
| Output per employee: | $4,450/day |
| Total output: | $17,800/day |
| Costs: | $1,120/day |
| Profit: | $16,680/day |
| Payback period: | 11.1 days |

With a daily production of 89 parts, and a daily profit of $16,680, it seems like this scenario is the best for the company. The opportunity cost and payback period support that statement.

**Opportunity Cost:**
**$16,680/day - $8,480/day = $8,200/day.**

**Payback Period:**
**$91,400 / ($8,200/day) = 11.1 days.**

Since this option has the shortest payback period, it has the most potential to quickly reduce the backlog and enable the company to start producing more than ever before. At this rate the company will soon be free to take on more contracts and start making more money.

## Summary

| | No investment: | New employee: | New machine: | New robot: |
|---|---|---|---|---|
| Initial investment: | $0 | $3,800 | $281,400 | $91,400 |
| Price per part: | $200 | $200 | $200 | $200 |
| Time per part: | 0.5 hr | 0.5 hrs | 0.5 hrs | 0.5 hrs |
| Setups per day: | 1 | 1 | 1 | 1 |
| Time per setup: | 2 hrs | 2 hrs | 2 hrs | 2 hrs |
| Spindle time per day: | 6 hrs | 6 hrs | 6 hrs | 7.5 hrs |
| M1 parts per day: | 12 | 12 | 12 | 15 |
| M2 parts per day: | 12 | 12 | 12 | 15 |
| M3 parts per day: | 12 | 12 | 12 | 15 |
| M4 parts per day: | 12 | 12 | **24** | 44 |
| M5 parts per day: | n/a | **12** | n/a | n/a |
| Total parts per day: | 48 | 60 | 60 | 89 |
| Output per employee: | $2,400/day | $2,400/day | $3,000/day | $4,450/day |
| Total output: | $9,600/day | $12,000/day | $12,000/day | $17,800/day |
| Costs: | $1,120/day | $1,400/day | $1,120/day | $1,120/day |
| Profit: | $8,480/day | **$10,600/day** | **$10,880/day** | $16,680/day |
| Payback period: | 0 days | 1.8 days | 117 days | 11.1 days |

# Conclusion

These examples are simplistic, but they give an idea of the different data that must considered when evaluating ways to resolve bottlenecks. Many of our customers have faced this dilemma, so we hope this eBook helps people who find themselves in a similar situation.

Remember that if you cannot produce more with your current resources, adding an employee, a machine, or a form of automation will increase your output. Your task now is to decide which option is best for you.

One final word of advice is to make sure you consider how the different options may be perceived socially. Whether you're introducing another employee or your first robot, it must be done correctly so the new player "fits in" with your existing team!

# How productive was your robot today?

Whichever option you choose, you will need to evaluate if your choice was right. There are very few options out there for monitoring the efficiency of your machines or robot.

We are entering the age of Industry 4.0, where machines that are connected together or on the cloud will allow you to see their efficiency in detail. You can then adjust your pricing according to the exact amount of time it took you to produce a certain part.

But even though this sort of analysis is common with CNC machines, it's unusual in the robotic world. In fact, once you've installed your robot you might have no clue how effective it is, how many part it runs, or how long it takes to do a complete cycle. This is where Insights comes into play. Insights is the first software that allows you to monitor your Universal Robot from your computer or your mobile device.

Check out what Insights can do for you by visiting https://robotiq.com/products/insights.

# About Robotiq

At Robotiq, we free human hands from repetitive tasks.

We help manufacturers overcome their workforce challenges by enabling them to install robots on their own. They succeed with our robotic plug + play tools and the support of our automation experts community.

Robotiq is the humans behind the robots: an employee-owned business with a passionate team and an international partner network.

# Let’s keep in touch

For any questions concerning robotic and automated handling or if you want to learn more about the advantages of using flexible electric handling tools, contact us.

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