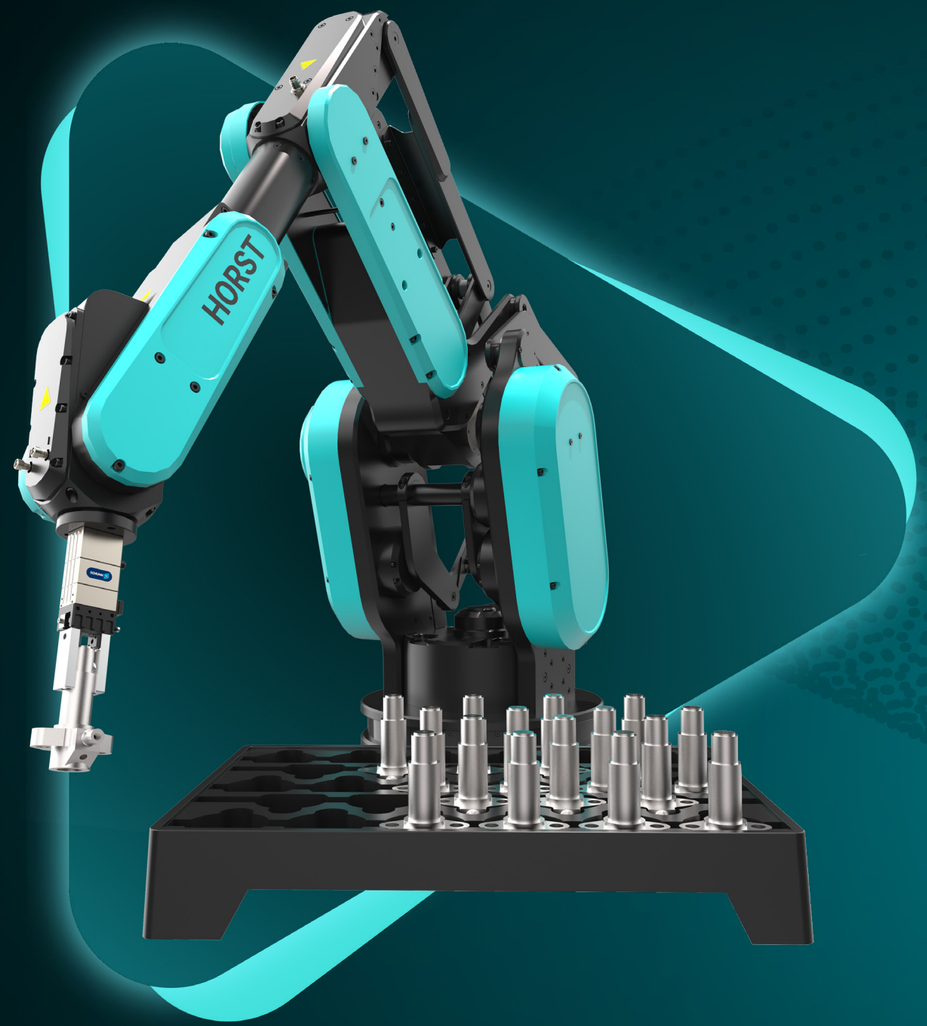
fruitcore robotics



Automated machine loading and unloading

Calculate the ROI for the automotive industry

- Reduce personnel costs
- Increase output
- Cushioning the impact of skills shortages

ROI calculation for the automotive industry

The crucial question

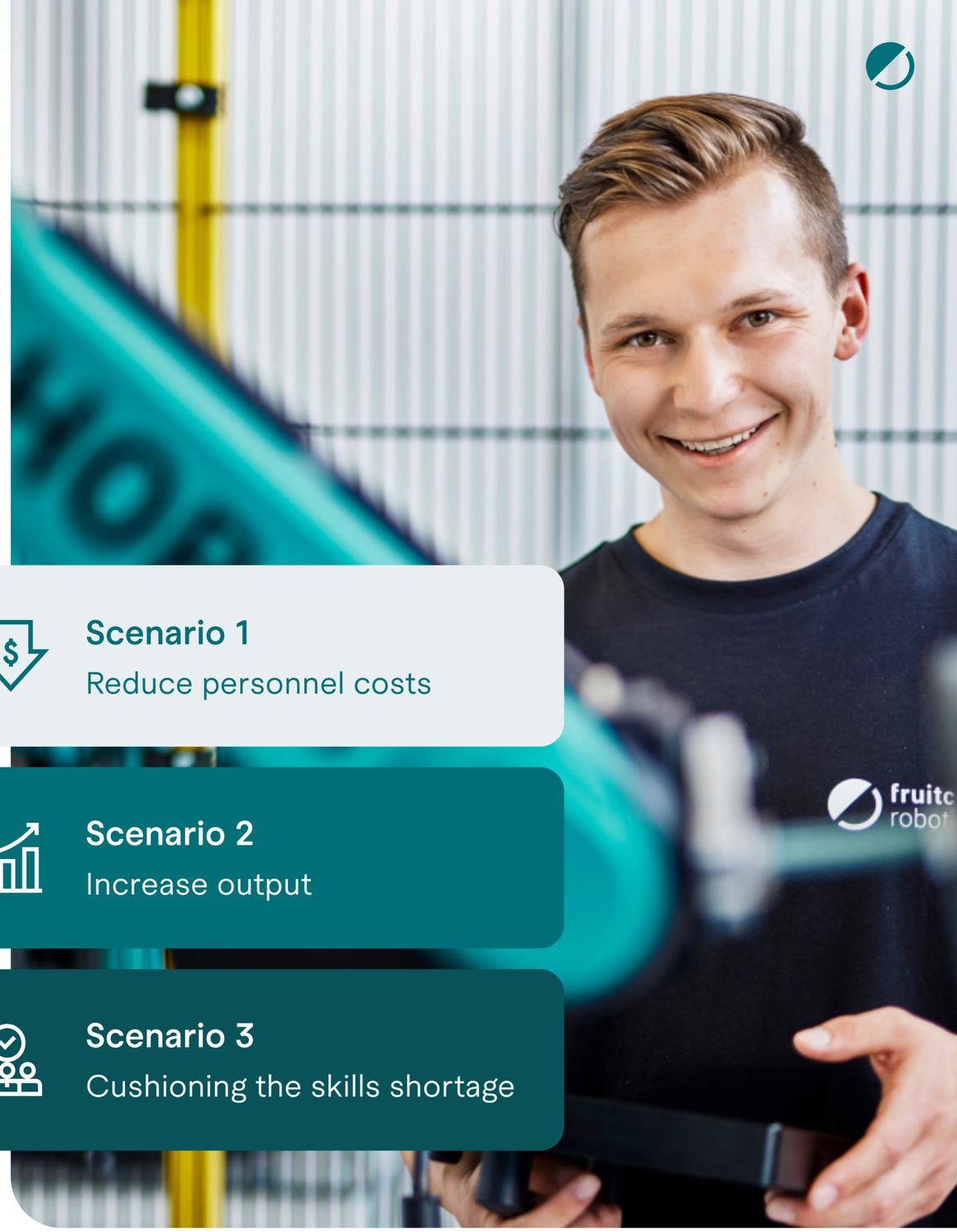
Is automated loading and unloading of machines even worthwhile for automotive suppliers?

To determine whether and when investing in automation will pay off for your company, it is helpful to look at typical use cases. Even if none of them correspond 100 percent to your individual requirements, these common scenarios provide promising guidance.

Decision factors taken into account

- → How much do you need to invest in automation at the outset?
- → What ongoing costs should you expect afterwards?
- → How much can be saved in personnel costs?
- → How much can you increase your output (and therefore your profit)?

To give you the best possible understanding of the factors influencing return on investment, we look at three different target scenarios: **reducing personnel costs, increasing output, and mitigating the shortage of skilled workers.** For the sake of simplicity, financial mathematical issues such as financing costs or the time value of money are not taken into account in this document.



Scenario 1
Reduce personnel costs

Scenario 2
Increase output

Scenario 3
Cushioning the skills shortage

Scenario 1: Reduce personnel costs

Framework conditions

The starting point for the first scenario is the manual loading of a CNC lathe with a precision component such as a crankshaft journal in two-shift operation (key data: Fig. Table 1). An exemplary machining time of 2.5 minutes is assumed. In addition, an employee needs 25 seconds to remove the finished part, clean it of chips, and insert a new blank. During this time, a robot system with a double gripper and blow-off unit can also perform the loading.

The worker in this example can devote his entire shift exclusively to this repetitive task on the lathe. It is obvious that such 100% supervision cannot be efficient, modern, or satisfactory. This is especially true given that the company faces the challenge of machine downtime whenever an employee is sick or on vacation, as no replacement personnel are available.

The company makes a profit of 1 € per part produced. We assume that every additional product could also be sold, as demand for the company‘s goods is high.

If standardized complete modules such as the **Robotic Solution Machine Tending from fruitcore robotics** are used for automation, the initial effort required to set up the application can be kept to a minimum.

Machine operating time	
Working days per year	240
Shifts	2
Ghost shift planned (using robots)	yes
Machine processing	
Machine processing time	2.5 minutes
Part replacement and chip removal	25 seconds
Parts produced per 8-hour shift	approx. 160 pieces
Personnel expenses	
Labor costs (annual)	50.400 €
Machine maintenance	100 %
Employee vacation and sick leave	10 %
Profit	
Profit per component produced	1 €

Table 1: Key data for scenario 1

Scenario 1: Reduce personnel costs

Calculating ROI

Automated loading and unloading significantly reduces the workload for the operator. The components are provided on a pallet with 45 slots. The robot works through this pallet one by one, allowing the automated CNC machine to **run independently during this time.** The employee only has to load a new tray four times per shift and make it available for the robot. Since it takes 10 minutes to load each tray, the employee now **only spends 40 minutes per shift on this machine instead of 8 hours.**

In addition, the now automated machine can run **an additional four-hour ghost shift overnight,** during which a tray prepared at the end of the working day is processed. Unlike manual loading, sick days or vacation days can be covered by another employee, as the effort involved is significantly lower.

This scenario clearly shows that automation **significantly reduces personnel costs while increasing profits through higher output.**

The employee previously responsible for the machine can now devote up to 40 minutes per shift to more productive tasks. Another positive effect results from the reduced machine downtime, as it can also be used during periods of illness or vacation.

All in all, the investment pays for itself in 5 to 6 months. With a term of 6 years, the ROI is 925%!

Costs of automation	
Initial costs	46.495 €
Ongoing costs (year)	2.895 €
Savings and increased profits	
Reduction in MA costs (year)	**90.405 €**
Increase in profit (year)	**18.690 €**
ROI & payback period	
ROI (for a 6-year term)	**925 %**
Payback period of the investment (months)	**5,4**
Increase in output	
Increase in output	26 %

Table 2: Costs, potential savings, and ROI calculation for scenario 1

Scenario 2: Increase output

Framework conditions

The starting point for the second scenario is the manual **loading of a grinding machine that produces one shift per day of valve seats** *(key data: Fig. Table 3)*.

Machining is estimated to take 90 seconds. The complete workpiece change, including cleaning, takes another 25 seconds. A robot optimized for this application would probably only need about half the time for the change. For simplicity, however, we assume the same speed as for the manual process.

The worker spends 75 percent of his working time on the grinding machine. He devotes the remaining quarter to other activities in the immediate vicinity. The company is fortunate: if the machine operator responsible is on vacation or sick, he can be replaced by another employee working 50 percent of the time. However, this means that the grinding machine is idle for the other half of the time.

This time, we are assuming a profit of 1.20 € per valve seat produced. Once again, the additional products can be sold directly and do not end up in storage.

Machine operating time	
Working days per year	240
Shifts	1
Ghost shift planned (using robots)	yes
Machine processing	
Machine processing time	1,5 minutes
Part replacement and chip removal	25 seconds
Parts produced per 8-hour shift	250 pieces
Personnel expenses	
Labor costs (annual)	50.400 €
Machine maintenance	75 %
Employee vacation and sick leave	10 %
Profit	
Profit per component produced	1,20 €

Table 3: Key data for scenario 2

Scenario 2: Increase output

Calculating ROI

Automation significantly increases the output of the grinding machine.

The workpieces are placed on a tray holding 250 parts. The robot system gradually loads the machine from this tray, which corresponds to an autonomy time of 8 hours. The operator responsible needs an average of 35 minutes to prepare the tray for machining and to change it. Thanks to its **long autonomy,** the grinding machine can run an 8-hour ghost shift, **which significantly increases output – by a whopping 111 percent!**

And: In addition to higher output, the company also benefits from **lower personnel costs.** These are less significant in this scenario, as the employee still spends 25 percent of their time on other tasks, as described above.

In this example, the investment pays for itself in less than 6 months, with a ROI of 890 percent over a 6-year period!

Costs of automation	
Initial costs	46.495 €
Ongoing costs	2.895 €
Savings and increased profits	
Reduction in MA costs (year)	29.715 €
Increase in profit (year)	75.600 €
ROI & payback period	
ROI (for a 6-year term)	**890 %**
Payback period of the investment (months)	**5,6**
Increase in output	
Increase in output	**111 %**

Table 4: Costs, potential savings, and ROI calculation for scenario 2

Scenario 3: Cushioning the impact of skilled labor shortages

Framework conditions

The third scenario is based on a CNC lathe that **only produces half a shift‘s worth of pistons.** The reason: as is so often the case these days, the company is short-staffed (key data: Fig. Table 5).

In this case, CNC machining of the component takes two minutes. We estimate that cleaning the finished component and completely retooling for a new blank takes one minute. This process also takes the same amount of time in both manual and automated machining in the example calculation.

The machine operator spends an entire workday operating the machine. If he goes on vacation or becomes ill, the machine stands idle because the company has no replacement.

In this case, a profit of 2.90 € per piston produced is assumed. Unlike the previous scenario, the goal here is not to increase output, but to achieve the annual target quantity. This is because in this example, potential additional products are not purchased. Therefore, no ghost shifts need to be taken into account.

Machine operating time	
Working days per year	240
Shifts	1
Employees available	50 %
Ghost shift planned (using robots)	no
Machine processing	
Machine processing time	2 minutes
Part replacement and chip removal	1 minute
Parts produced per 8-hour shift	160 pieces
Personnel expenses	
Labor costs (annual)	50.400 €
Machine maintenance	100 %
Employee vacation and sick leave	10 %
Profit	
Profit per component produced	2,90 €

Table 5: Key data for scenario 3

Scenario 3: Compensating for the shortage of skilled workers

Calculating ROI

How is the company now able to achieve the planned production volume by automating the CNC lathe?

The basis is the use of a pallet on which 90 parts are provided for the robot. This results in autonomous operation of the application for 4 hours. An employee needs an average of 20 minutes to load the pallet.

One advantage for the company is that even in the event of acute staff shortages, it should be possible to bridge this gap. If downtime cannot be avoided, an additional ghost shift can be scheduled at a later date.

If the company decides against automation despite the labor market situation, the plant will produce less than half of its annual target. This means that the target annual profit for the component cannot be achieved—in the example, **the shortfall amounts to more than 60.000 Euro!**

Automation, on the other hand, makes it possible to produce the quantity planned for the year and also frees up valuable personnel capacity that can be used to operate other plants.

Costs of automation	
Initial costs	46.495 €
Ongoing costs (year)	2.895 €
Savings and increased profits	
Reduction in MA costs (year)	**20.580 €**
Target missed without automation (year)	**- 61.248 €**
ROI & payback period	
ROI (for a 6-year term)	**670 %**
Payback period of the investment (months)	**7,2**
Application	
Proportional output without automation	**45 %**

Table 6: Costs, potential savings, and ROI calculation for scenario 3

Summary

How automation becomes a factor for success

The three scenarios described above for machine loading and unloading illustrate the different motivations for automated production in the automotive industry. However, the following factors are particularly important for calculating ROI:

Reduction in personnel costs

Increase in output

For this reason, this white paper focuses particularly on these factors. Of course, there are numerous other factors that speak in favor of automating the loading and unloading of machine tools, e.g.:

Quality improvement

Increased flexibility

Creating an attractive working environment

Faster scalability

And what goal do you want to achieve with automation?

Get in touch with us. We will be happy to calculate your individual ROI.

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Status: December 2024