# Finding a good AI use case for your engineering company

The public is unaware of what AI can be used for. This unawareness of AI capabilities is also found in the business world and will lead to two negative outcomes. First, companies not using AI either because they don't understand what it can be used for, or because they don't see a clear application in their work. Secondly, companies attempting to use AI but failing because they misunderstand AI and its applications. This article tackles the issue from an engineering perspective.
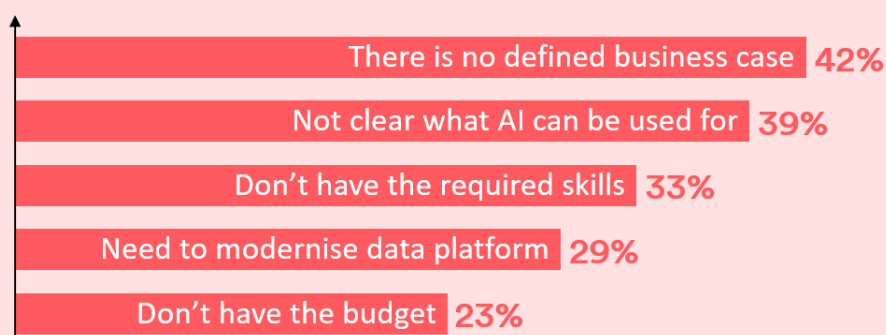
## Introduction

The use of AI is growing fast, and we all know it. Predictions are that over the next 24 months, around two-thirds of large companies will have implemented some sort of AI (*The State of AI 2019: Divergence*). The main reasons for this growth are all the benefits provided by AI (handling repetitive jobs, difficult design space explorations, instantaneous result predictions, …). But with great opportunities come great risks. The current worldwide enthusiasm will lead many companies to "rush" into the world of AI. Gartner predicts that **"through 2022, 85% of AI projects will deliver erroneous outcomes due to bias in data, algorithms, or the teams responsible for managing them".**

In engineering, the scarily high probability of failure is due to a combination of different reasons:

- For some applications, AI should be used to enhance and accelerate the decision-making process of engineers, but not completely replace them.

- But it also indicates that more precautions must be taken when integrating AI within a company's workflow. In particular, it is important to spend some time thinking of the potential use cases for AI before training neural networks each time you see data.

*Forrester* (*2016*, see figure below) investigated the reasons why companies decide not to adopt AI in their development process. The main reasons were not a lack of money or skill, but a lack of understanding of what AI can be used for and, in particular, how it can be used for their company.



There is no defined business case **42%**
Not clear what AI can be used for **39%**
Don't have the required skills **33%**
Need to modernise data platform **29%**
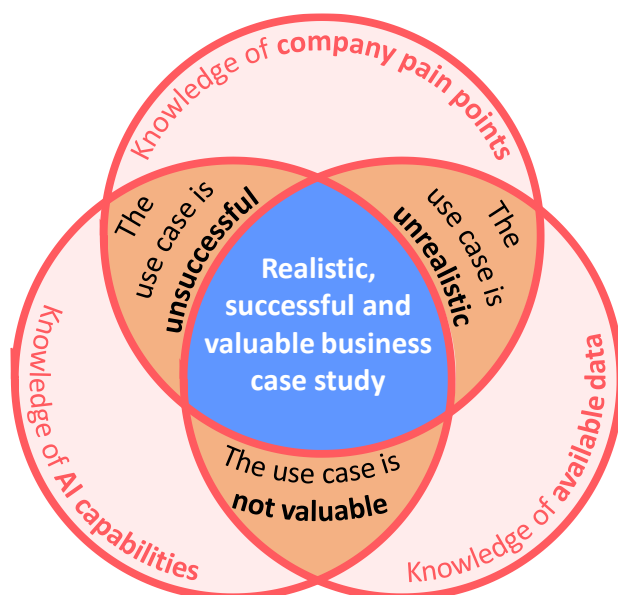Don't have the budget **23%**

Main reasons why companies haven't invested in AI (Forrester, 2016).

There are three main conditions that we have encountered for successful AI adoption, illustrated in the figure below and described in the next sections.

How to get a realistic, valuable and successful business case study.

## 01/ Know what AI is and what it can do

**Problem:** it is crucial that your employees have a minimum understanding of what AI is and what it can do, if you want them to come up with reasonable use cases for AI in their work. In our experience, some clients have no idea what machine learning is and, as a consequence, they ask for completely unrealistic outcomes. This wastes time and can end up frustrating both sides of the discussion.

**Consequence:** a dramatic mismatch between client expectations and what can be delivered. For instance, a company with no knowledge of AI might ask for fully automated predictions of the maximum stress within a 3D component, with no training at all.

**Solution:** AI is not magic. Using the term "machine learning" reminds us that the AI algorithms have to "learn" before they can "think". Understanding the basics of AI or, at least, the basic concepts can make a huge difference. A single afternoon workshop could be enough to fend off common misconceptions and give an insight into the sorts of problems that AI can help to solve. Looking at case studies from other departments or companies can also highlight the realistic applications of AI in your industry.

## 02/ Know your data

**Problem:** Some companies want to use AI at any cost, but know very little about their data. They don't know what available data they have, they don't know how much data is needed for AI, and they don't know what quality of data are needed. The quality (or even feasibility) of ML models greatly depends on the quantity and quality of the data available. In our experience, some clients have asked us in the past to predict results with an unrealistic accuracy given the amount of data available. The quantity of data needed is also related to the complexity of their problem: more complex problems need more data.

**Consequence:** impossible accuracy targets. For instance, a company has made four versions of a product and wants an accurate prediction of the fifth version. The likelihood of failure is quite high as four data points is not enough to train ML models. As another example, a company might have 100 data points available for training, but 50 varying parameters. In that case, predicting a model with 10% accuracy will probably fail but, instead, AI could be used to assess uncertainty and help choose the next best 100 test points to know your product better.

**Solution:** Spend time understanding what data is available in your company. How many tests have you performed? How many simulations have you run for each version of a product? For each product? Overall? Are the data categorical (e.g. manufacturable vs. non-manufacturable), scalar (e.g. drag coefficient of 0.7 vs. 0.9), or complex (e.g. an entire pressure field on a spoiler)? Knowing the complexity of the problem is also beneficial. How many parameters do you want to study (is it only three parameters or hundreds)? What is the complexity of the relationship between inputs and outputs? Is it as simple as linking the angle of attack to the lift coefficient in laminar flow? Or as hard as capturing the frequency modes on a whole aircraft undergoing turbulent gusts? The answer to these questions will affect the size of your models and therefore the amount of data required to get good results.

*"There is surely nothing quite so useless as doing with great efficiency what should not be done at all."*

## 03/ Identify your pain points

**Problem:** Some companies hear about AI and ML and want to be part of the "buzz", even if they don't need it right now. They understand AI and have good data sets, and want to train models. So far so good, but they then decide to train models for absolutely everything they can think of just for the sake of it. They might not think carefully about what problem they actually want to address with AI. In our experience, clients have asked to use AI in a process to replace their existing analytical model, despite the model already being a series of mathematical functions that made instantaneous predictions. ML would not have accelerated their process.

**Consequence:** a delivered process that works well but is not valuable for the company. It might be predicting results that are not needed, or replacing a process that was already fast and didn't need to be accelerated. It could also be accelerating a part of the development process which is not the bottleneck of the whole process, and therefore does not affect the productivity. Imagine, for instance, that your process has two tasks run in series taking one hour and one week respectively. There would be little value in bringing the first one down to 5 minutes. It would be much more valuable to shorten the second one by a day or two!

**Solution:** Don't use AI because it sounds cool. Do you need it? Look for bottlenecks in your process, particularly what is slow and what is expensive. For instance, it will be valuable to predict physical test results ahead of time before manufacturing expensive prototypes of your product. It could also just be accurate and expensive simulations. On the opposite, if you can 3D print a prototype of your product in the basement in 10 minutes for 20p, or if you have fast analytical simulations, AI would bring less value to your company. There is no point in using AI if you have a lot of data but no genuine problem!
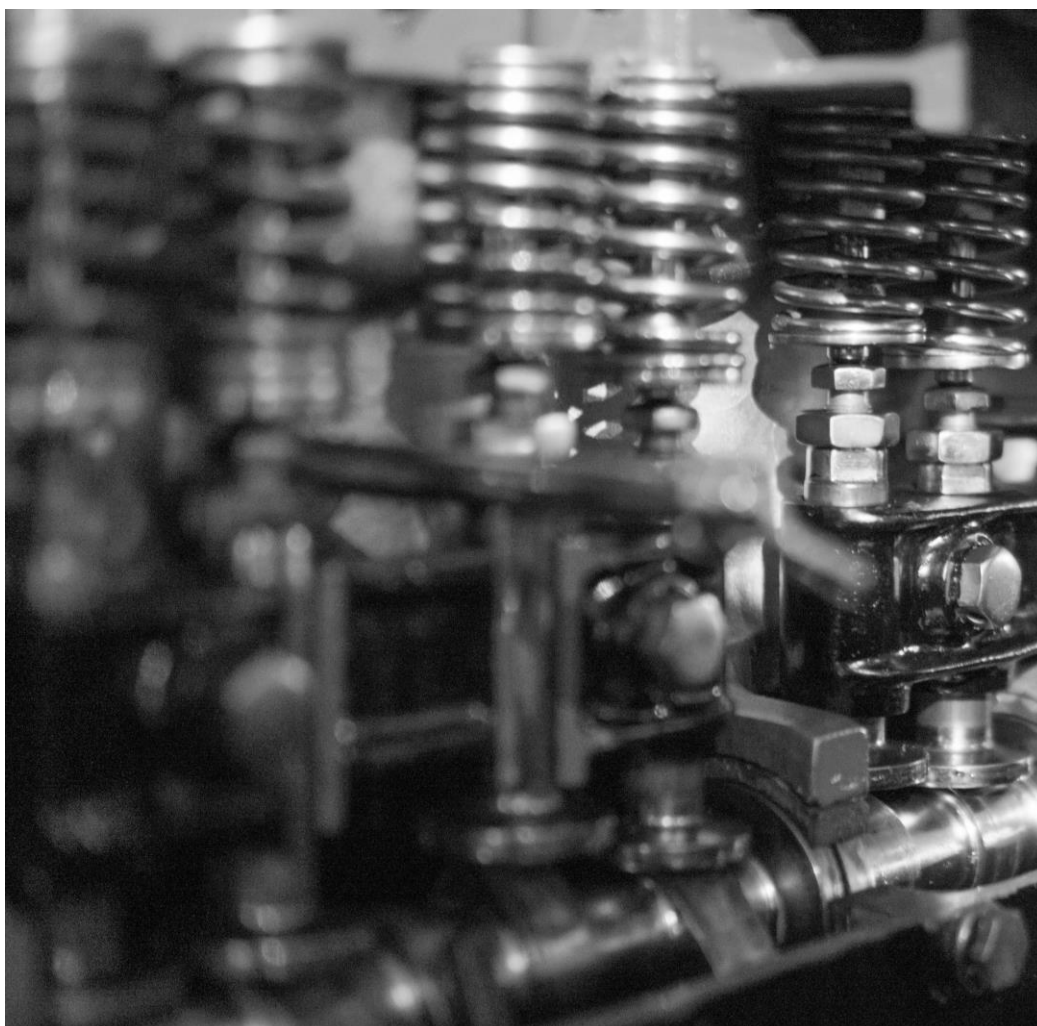
## Conclusion

There are many ways in which trying to incorporate AI in your business can lead to failure. A successful business case can be identified by having a good understanding of:

- What is AI and what it can do,

- What data is available, in what formats, and with what quality,

- What problems are most valuable to solve.

The most valuable projects arise when your employees/engineers know what the pain points are, and they know what data they have gathered over the years. Educate them, introduce them to AI so that they understand its capability, and they will come up with realistic, successful and valuable use cases.

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