INDUSTRY 4.0 eBOOK SERIES

THE ROI OF AI SOLUTIONS

Professional Guide: how discrete manufacturers can estimate the value of AI-based IIoT manufacturing optimization solutions.

PLATAINE®
people-smart automation

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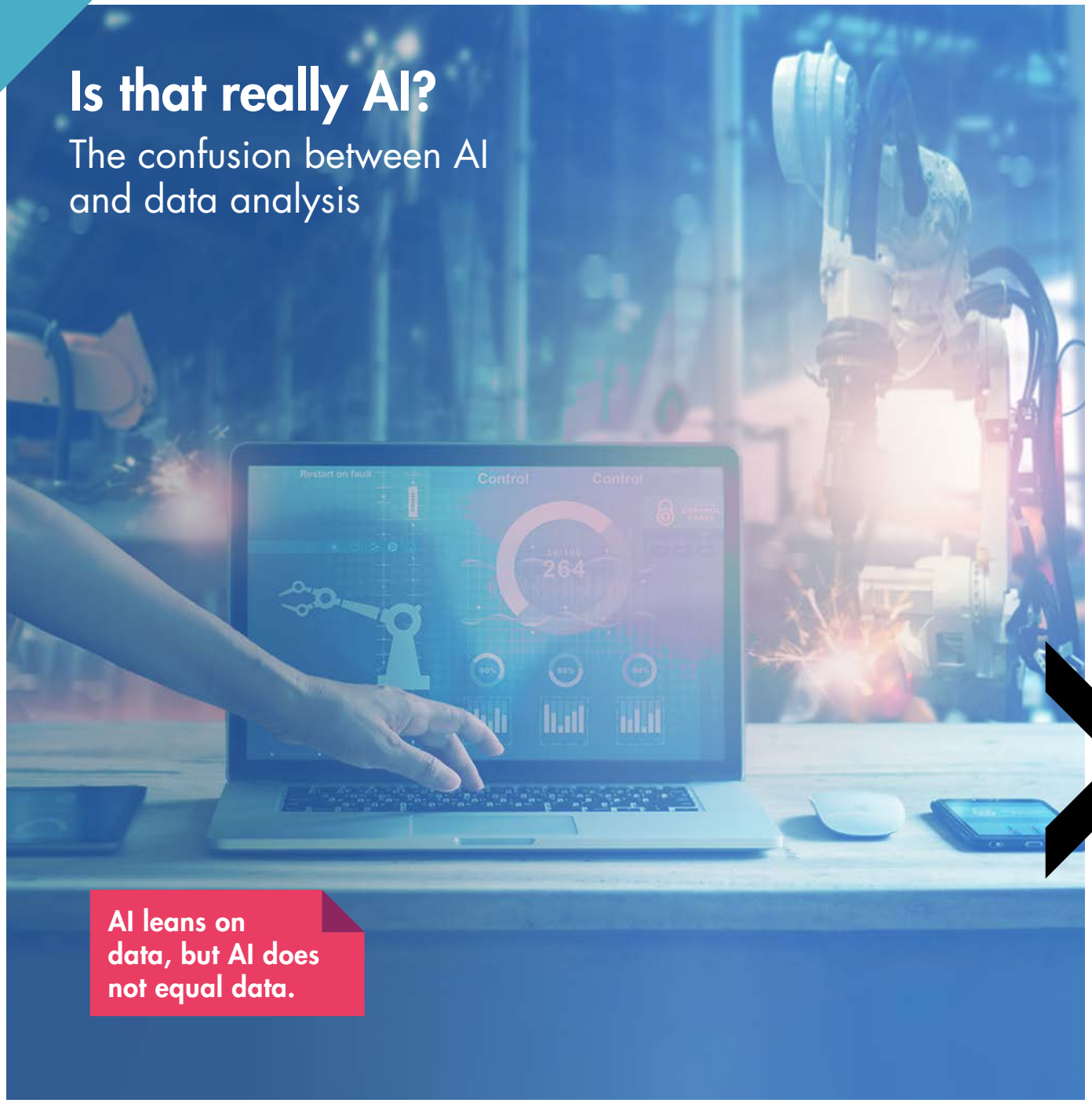
Is that really AI?

The confusion between AI and data analysis



AI leans on data, but AI does not equal data.

Manufacturers easily confuse AI with other data-based tools and approaches. Common mistakes include assigning AI capabilities to 'simple' data analysis or dashboards, for instance. Many software solutions can collect a massive amount of data on an ongoing basis, analyze it, create alerts and offer an advanced user dashboard that nicely present numbers, tasks progress and more.

This is not, in fact, AI. True, AI leans on data, but AI does not equal data.

In order to take data-analysis systems to the next level and add real AI capabilities, we would first need to redefine their mission statement.

Instead of just collecting data and providing an analyzed version of it, AI technologies aim to identify patterns in order to make predictions and create smart recommendations. Just like the human mind does. GPS navigation apps, for instance, don't just provide the current state of the roads and popup alerts, but they also predict time to destination based on multiple parameters and historical data, and they provide an optimal route in accordance.

In short, AI is much more than colorful dashboards and detailed reports.

Manufacturing optimization in the Industry 4.0 era

The role of AI in manufacturing

In today's world, leading a discrete manufacturing organization without embracing AI technology is like running a logistics organization without GPS and cellular comm technologies.

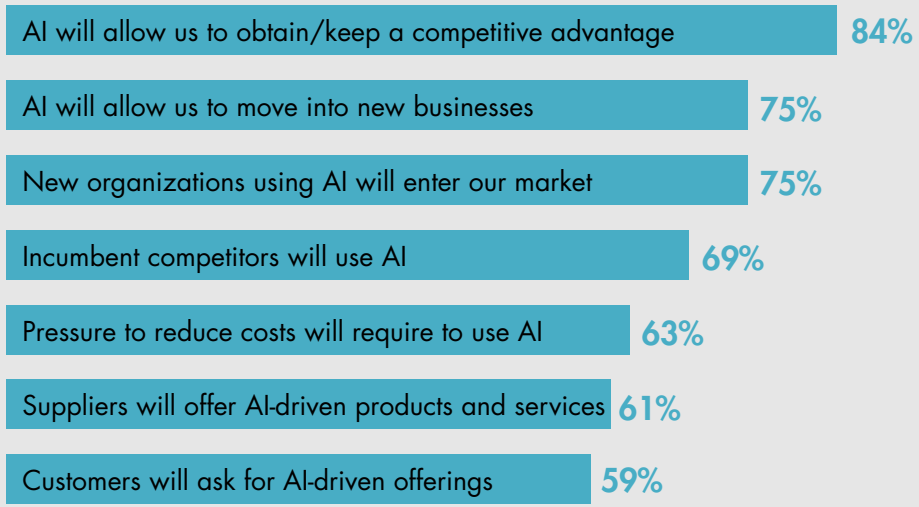
In the manufacturing arena, AI shines as the problem solver it was meant to be, and there are countless ways for this technology to save manufacturers time, material, work, unfortunate mistakes and redundant hassle.

In the competitive landscape of manufacturing AI is no longer a nice-to-have technology, but a key to survive. The demand for much bigger production scale, much shorter time to production, much lower prices all together with much higher quality make it impossible to continue to exist without adding new technologies to the blend.

Unfortunately (but also quite understandably) Manufacturers tend to be over conservative and reluctant to onboard what they perceive as new technologies. They feel have a lot to risk. But, this over being too careful, may set their future in face of the quick transformation in the industry. Once Industry 4.0, the digital thread and IIoT technologies started to be enrolled among some of the biggest discrete manufacturers, their competitive edge can put an end to all others.

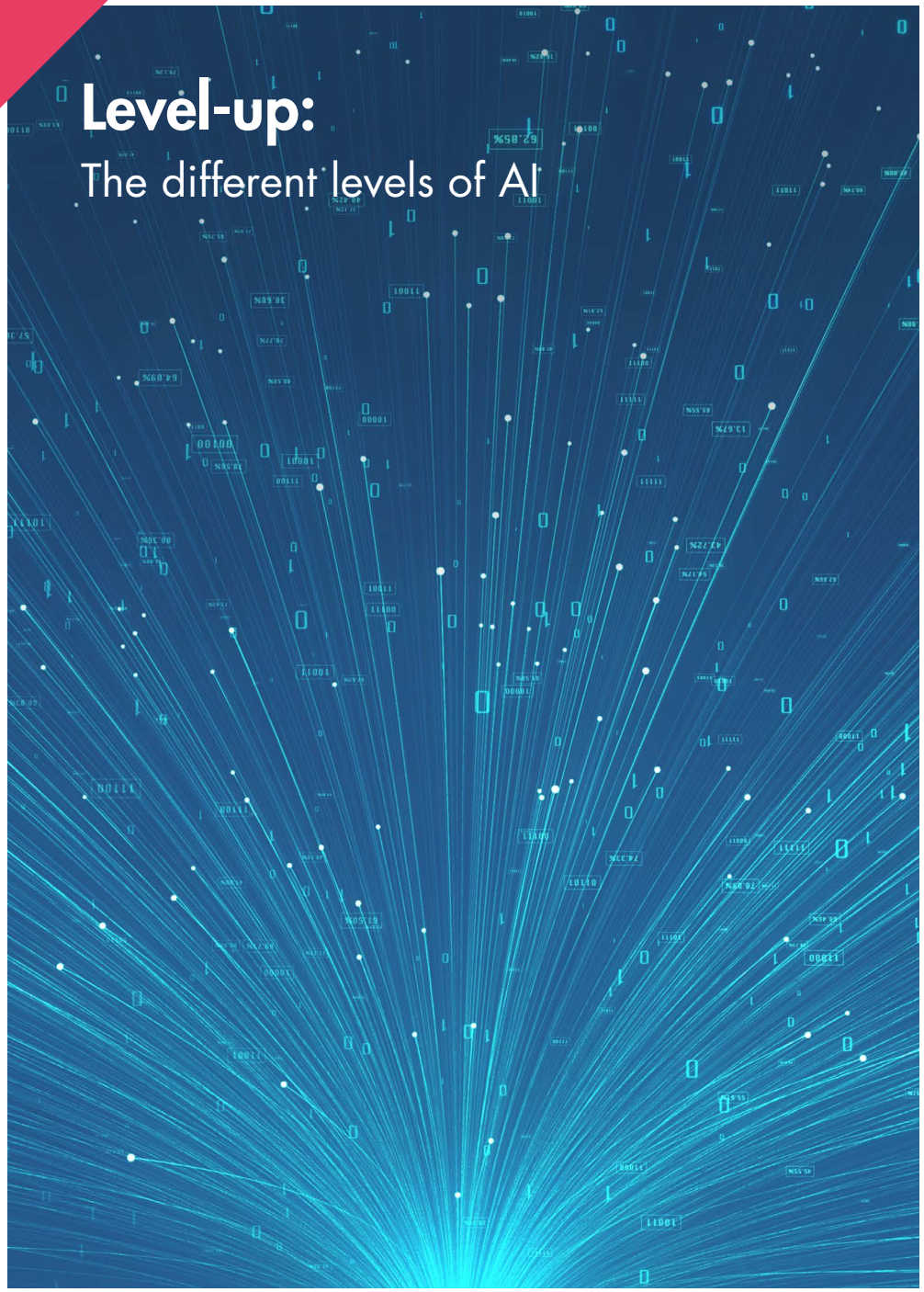
In the next few pages of this guide, we'll discuss in detail the specific ways in which AI can improve manufacturing production and boost industrial corporations, productivity and profitability. We will also discuss how these contributions can be measured, ROI wise.

Why is your organization interested in AI?



Source: Iflexion

But in short, it's safe to say that thanks to artificial intelligence, instead of relying on very limited human capabilities, manufacturers can optimize nearly every action taken during production.



Level-up:

The different levels of AI

Just as there are many different ways of implementing AI in manufacturing and beyond, there are also different scales of intelligence that can be reached. In other words, if two companies in a certain field both embrace AI, it doesn't mean that they do so in the same manner and will reach the same results.

When forming their AI strategy, Manufacturers should consider the level of the intelligence that is provided by the technology and how it serves their goals. For instance, we've developed Plataine's AI solution to pay close attention to the context. We know that every task in the production floor should consider important facts that can be indirectly related to it. Considering the context when "thinking" about recommendations is what humans do many times in their day-to-day life, and it is a 'higher' intelligence compared to thinking only about the immediate task without paying attention to the environment.

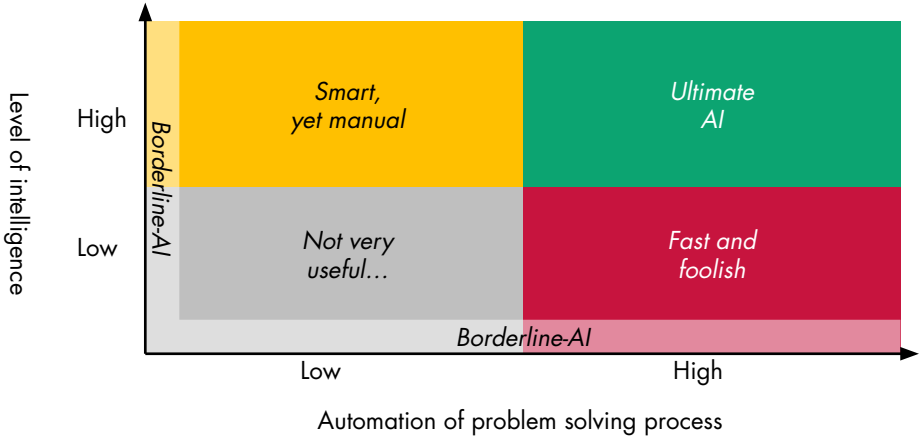
In general and In order to decide which technology level is required, companies can use the table below and ask themselves what questions they would like AI to answer:

Where are we? What is happening?	Context Recognition ("Descriptive Analytics") e.g. Pattern Recognition algorithms
Where are we heading? What is going to happen?	Predicting potential evolution/implications ("Predictive Analytics") e.g. Predictive Modeling algorithms
What to do about it?	Selecting optimal action (Prescriptive Analytics") e.g. Optimization/Search algorithms

Level-up:

The different levels of AI

If you setup the level of both intelligence and automation that you need, you may toggle between smart but manual solutions to ultimate ones:



The level of sophistication also depends on the scope of data collected. Manufacturers that long before implementing AI (or even considering it) had data-based mechanisms in place are likely to enjoy this historical information when making the transition to AI. As we've mentioned before, data analysis is very different from AI, but the foundations enabling data analysis very much contribute to AI-driven efforts.

That doesn't mean that manufacturers who lack historical data should be put off. They will see clear immediate benefits, and as time goes by and more and more data is being collected, the higher the level of optimization.

Put things in context:

The importance of context for AI

We've briefly mentioned the context in the previous chapter. Regardless of the sophistication level or the actions we wish AI-based IIoT (Industrial Internet of Things) tools to perform, and learning from natural human behaviour, things should always be examined from a context-dependent point of view. Context is what turns pure data into solutions using algorithmic capabilities. When we combine these factors together - artificial intelligence is born.

We defined the transition from data analysis to AI as going from collecting data to offering a deeper understanding that is capable of producing insights, predictions and recommendations.

For that to happen, we have to "teach" the algorithms the language we use, the context in which we use it and the reasons we take each step along the way.

In the IIoT vertical, the context is very specific and unique to each industry. We have to ask the right questions to define each perimeter, the way systems like Plataine's do.

The examples in the upcoming chapters will allow you to explore how exactly AI can leverage not only historical data but also contextual data in order to make smart predictions and offer clear recommendations that save time, money and serve as a 'robotic force of experts'.

Crunching numbers:

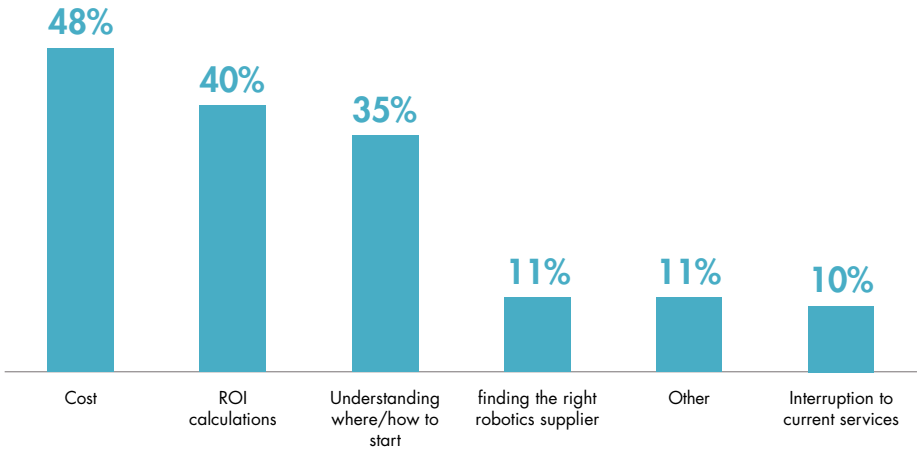
How Manufacturers can estimate the ROI

The ROI discussion must come, as buying-in (internally) the decision to implement new technologies is never easy. Technologies that include a clear ROI are much easier to buy-in as they are less risky to the corporate.

If you pay for a solution that will save you more money than its cost (direct of indirect) that's a no brainer.

Calculating the exact ROI of an AI based IIOT optimization solution for a discrete manufacturing corporation isn't easy, as the domain is relatively new, and a large amount of the operational data needed to calculate ROI is usually not being measured or monitored and is not available.

What are/have been the biggest barriers when implementing technology?



Source: SpendMatters

But there are ways that manufacturers can run rough estimations that can be very much needed in order to reach a decision.

How to calculate your ROI

1. **Can you name the goals:** The ROI is always measured based on predetermined objectives and clear KPIs. You must start with listing all of yours. Sure, some blessings will be unexpected, but if you're looking to save production costs, improve your delivery times and overall productivity, or prolong the lives of your machines - these factors should all be taken into account before you begin your AI endeavours. Each goal should also include clear benchmarks in percentages or numbers. Exactly how much time and money do you plan on saving? Write it down to make it happen. Here are a couple of examples:
   a. Cut material losses by X (you can always call a system vendor, like us, and ask what % of improvement should be feasible in your specific case. This is their expertise and they can surely help you run the analysis.
   b. Decrease unexpected bottlenecks by X%
   c. Reduce quality faults due to human errors by X
   d. Increase production rates without hiring more employees by X% …and more.
2. **Run some errands:** If your company does not have annual revenue and efficiency reports in place, you'll find it harder to know if the (future) AI system really performed as expected. Can you make the effort and calculate your exact profitability rate, rework costs and everything that could and should improve based on the predetermined goals we've mentioned earlier? Same here, you can use the software vendors for help with that, too. They know that some manufacturers deal with major gaps and they are used to supporting them with the foundations as well.
3. **List the costs:** AI is great, but it does come with a cost. List every cost category (direct and indirect) related to implementing your IIoT solution: time spent on training, install-related changes to the production floor, the price of the solution license, integration… it should all be taken into account.
4. **Look in all directions:** Consider the indirect implications of the AI efforts and examine them in your estimation too. For instance, will such system help your brand seem more reliable and advanced? Will workers will be more happy to develop a career in your cooperation as a consequence?

Now, estimate the values behind the improvement areas (the %) and again, consult the potential software vendor to fully understand the costs (use your list of parameters and see if there are more parameters that they can name).

Like in any industry, your colleagues (yes, professionals in other manufacturing corporates) may hold valuable knowledge. Don't hesitate to consult with them.

Example #1

Better late? Never! Predicting bottlenecks & quality issues

Long before AI was in the picture, manufacturing companies were looking for ways to make predictions. Traditional MES systems (Manufacturing Execution Systems) could try and assess the ETA of work orders and predict latency to a certain degree, and they tend to be very inaccurate.

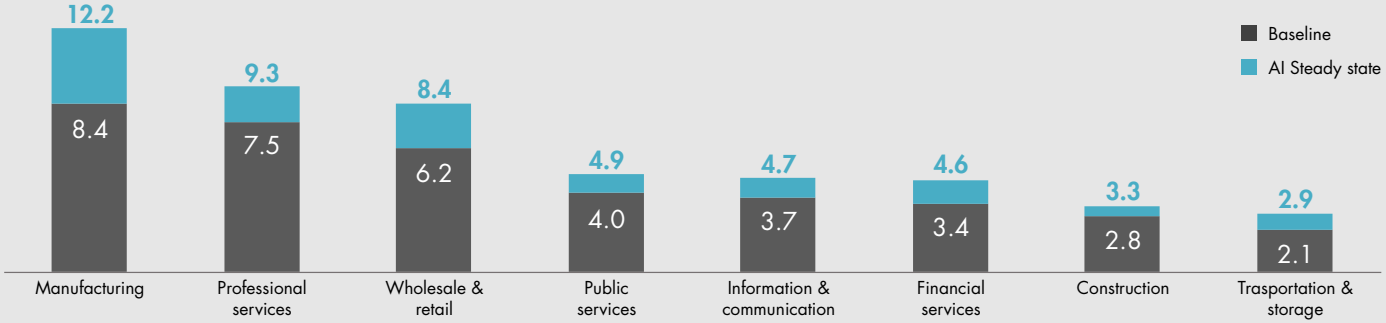
That's because they are very limited in their 'intelligence' and they don't know how to work with dynamic context.

AI takes these simple capabilities a few steps further and adds many more factors to the calculation. AI considers historical data regarding elements such as station workload, tool availability and function, material shelf life, and more. By doing so, AI is able to predict bottlenecks much more accurately and prepare in advance (by creating recommendations that prevent the bottleneck, e.g. "replace to another workstation").

AI calculates the workstations' average pace, alert us when a required material is about to expire, and measures the distance to the warehouse where specific tools are stored.

With so much contextual information entering the mix, deadline risks become more accurate and latencies are noticed ahead when there's time to prevent them.

The inpuct of AI on industry output



Source: World Economic Forum

The bottom line

Up to 15% improvement

Research shows that timing-related costs, such as late delivery and slow time to market can improve profitability by 10-15%. These capabilities translate to satisfied and loyal customers.

Example #2

All over the place: Part misplacement alerts

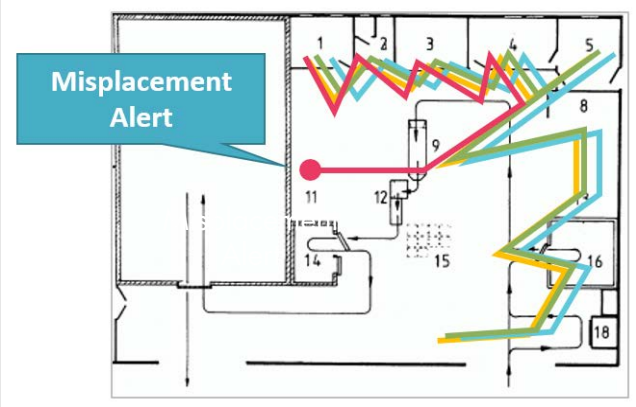
We've briefly mentioned the whereabouts of parts and tools in the previous example, but now it's time to focus on this aspect more closely.

Discrete manufacturing production sites are normally quite large (to say the least) and require a strict level of organization to prevent the creation of more bottlenecks and latencies due to congestion areas and misplacement of items.

Previous technologies have helped manufacturers in tracking and managing warehouses. AI now makes another leap.

Each part usually has its own route, which the AI system automatically learns. When it deviates from its regular route in position or schedule, the AI-based system alerts us immediately. AI enables us to not only fix mistakes as they happen, but also to identify patterns and prevent these mistakes in the first place.

In the image - A deviation is identified and alerted, to prevent this misplacement from causing expensive delays in production.



The bottom line

Missing parts might cause manufacturing businesses to lose hours, and in some cases, days of production, leading to missed deadlines and the repurchasing of parts that should be available, but are not found. Implementing AI on top of multiple IIoT capabilities that communicate with one another can boost productivity across the board, with the area of part or tool misplacement alone reaching a **5% improvement.**

Example #3

Quality time: Quality-control and management

So far, we've discussed examples that have more to do with the production process than with the outcome, and it's time to take a closer look at the manufactured products themselves. After all, deadlines are incredibly important, but producing high-quality results is top priority for discrete manufacturers. When manufacturers in our industry fail to do so, the unfortunate result can not only be deadly to the business, it can even be dangerous and life-risking.

Human mistakes do (and will always continue to) occur, and when they do, manufacturers must run in-depth investigations that take all factors into consideration, in order to identify the root cause with precision.

AI is served to prevent many mistakes in advance and lead to much higher quality, but even in case the product ends up being of poor quality, we can use algorithms to compare patterns and identify any deviations, calculate a long list of factors, and discover the exact reason why we've missed our target.

AI systems learn from quality faults incidents and identify risky patterns. These patterns are used to prevent future quality issues. Manufacturers that struggle with a major increase in the production are extremely dependant on such help with identifying and working to prevent quality issues as these tend to arise, when the workload grows.

The bottom line

Calculating the cost of quality faults in discrete manufacturing is always challenging, as it can go from minor to tragic, especially when it comes to the aerospace, automotive, medical devices and other industries.

Take, for example, the 2019 crisis over Boeing's 737 Max jets. About 4,600 Aircrafts that were ordered and their status remains unclear, company shares have dropped by 11% following the first crash, and the company still has to deal with the costs of compensations, legal fees, reputation recovery, and more.

In addition, it might take quite some time for manufacturers to investigate and detect the exact root cause for quality issues. Investigating costs a hefty amount and when it is underway, production is often down. Saving these and other costs adds to the business' positive ROI significantly.

Example #4

Spin the bottle: Preventing future bottlenecks

We've mentioned bottlenecks earlier when discussing the topic of work latency. But AI does much more than just let us know we're about to miss a deadline. In fact, algorithms can help us overcome challenges and eliminate issues, so that we end up meeting said deadlines and completing our tasks as planned.

For example, an alert regarding expired material can be translated into an action as AI-based optimization tools will order a new supply automatically, or send a nearly expired sample to a lab to extend its expiration date.

Predictive maintenance can stop machinery-related bottlenecks from taking place, and so on.

By taking into account the capacity of each workstation, as well as it's routine pace, AI-based systems can provide alternative routes that will overcome delays based on the ability of each station to handle the pressure.

These goals are achieved by algorithms that use the data to learn the patterns of our manufacturing business and then implementing predetermined solutions in real time.

The bottom line

Accelerated delivery time can boost productivity by approximately 10-15%.

In addition, by assigning the right workload to each station, AI can prevent employees from wearing out and machines from breaking, hence reduce the company's maintenance costs.

Example #5

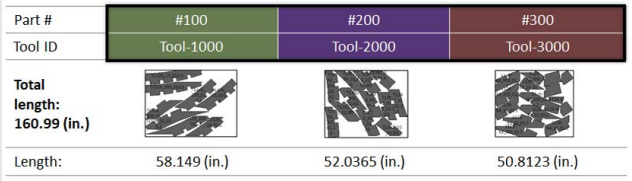
AI makes the cut: Optimization in cut planning

Discrete manufacturing professionals know that what may seem like easy and simple procedures to outsiders are in fact the biggest challenges of the business.

Cut planning, for instance, the process of cutting parts out of raw material, is exactly that. That is because the materials used in the industrial arena are extremely expensive, making any cutting mistakes or having wasted materials will dramatically harm profitability.

AI assists manufacturers in achieving two goals. The first is to cut materials perfectly for their intended use by optimizing cutting patterns and calculating every related factor, and the second is to maximize the usage of raw materials by optimizing the way cutting patterns are planned.

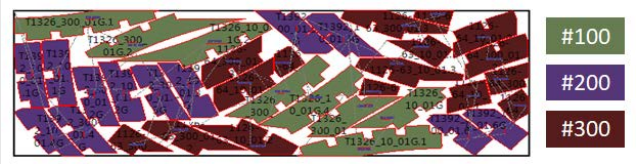
The traditional approach to material cutting, where each part is inserted separately, looks something like this:



Part #	#100	#200	#300
Tool ID	Tool-1000	Tool-2000	Tool-3000
Total length: 160.99 (in.)			
Length:	58.149 (in.)	52.0365 (in.)	50.8123 (in.)

Figure 1: Traditional cutting

In comparison, here's an example of AI-based optimized cutting (~20% of material was saved). All different parts are cut together, from the same raw material:



Figur 2: Optimized cutting

The system also considers the expiration date of each material and the ideal cutting speed and order, as well as other relevant factors.

The bottom line

Up to 20% of materials that are saved thanks to AI-based cut planning.

Based on manufacturing materials' price tag, these calculations end up saving businesses major expenses. Preventing materials from expiring and optimizing every aspect related to material storage, maintenance and usage saves manufacturers even more money and creates ROI that is clear cut.

Summary

The final countdown

AI is not an easy technology to explain, and in a way, its countless benefits make it overwhelming and harder to implement. The examples we've listed in this guide should help industrial companies put a price tag and an action plan that'll turn AI into an even more common reality in the manufacturing world.

We feel positive that any manufacturing pro will be able to recognize familiar problems that could be better dealt with using AI-based optimization solutions. The IIoT field is already taking on and improves many manufacturing tasks, and AI is a major player.

As we look at any challenge and goal we would like AI to help us tackle, let us remember that context is key, and that we must begin by asking the right questions before we demand that AI provides us with the correct answers.

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Professional Guide | Brought by Plataine

ABOUT PLATAINE: Plataine is the leading provider of Industrial IoT and AI-based optimization solutions for advanced manufacturing. Plataine's solutions provide intelligent, connected Digital Assistants for production floor management and staff, empowering manufacturers to make optimized decisions in real-time, every time. Plataine's patent-protected technologies are used by leading manufacturers worldwide, including Airbus, GE, Renault F1® Team, IAI, Triumph, General Atomics, TPI Composites, MT Aerospace, Kaman, Steelcase, and AAT Composites. Plataine partners with Google Cloud, Siemens PLM, McKinsey & Company, TE W&C, Airborne, the AMRC with Boeing, and CTC GmbH (an Airbus Company), to advance the 'Factory of the Future' worldwide.

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