Best of Business AI
Outokumpu case study

You may not have noticed, but chances are high you interacted with stainless steel today. From kitchen utensils to automobile parts to skyscrapers, stainless steel is all around us.

With around 10,000 employees in over 30 countries, Outokumpu is a worldwide leader in stainless steel production. The manufacturer is the only one in the world that handles the full process chain for producing it—from mining chrome ore and smelting ferrochrome to melting, casting, and rolling stainless steel—until eventually, it's part of a product in your kitchen, car, or office.

Stainless steel has been produced since the 19th century, and the industry is often defined by adherence to tradition. "Generally, the big steel companies are extremely proud of themselves because of a legacy in which customers have always longed for their products," says Stefan Erdmann, Chief Technical Officer at Outokumpu. "It means they've never had to question their approach, or to wonder whether they need to change."

Outokumpu thinks differently. Change isn't something to be avoided, but to be embraced.

Using its largest production site as a proving ground, the company has embarked on a comprehensive digital transformation, leveraging the power of analytics and machine learning (ML) to monitor and improve production from end to end. Because Outokumpu performs every step in the manufacturing process, there are many opportunities to increase efficiency, reduce waste, and prevent imperfections. They installed IoT sensors that are capable of tracking variables like temperature and location in parts of the production process. Then they feed the IoT data to ML models that recommend actions to machinery operators about how to optimize timing, temperature, and other controls.

The goal is to create a culture of data-driven decision-making. "We want to make sure that in the future, the operators, the managers, the employees, everybody bases more of their day-to-day decisions and strategic decisions on data," Erdmann says. "It's a transformation of thinking. It's a cultural transformation towards using data to take smarter decisions in stainless steel."

A journey to AI success

Laying the foundation for ML with data

Outokumpu began its journey with an ambitious goal to transform operations at its site in Tornio, Finland, home to 2,000 employees. The first step was to make sure data was stored in one place and in a standardized, usable format for ML models. To accomplish this, Outokumpu developed the Outokumpu Digital Platform in the cloud to combine data siloes from its Tornio-based operations.

Strategy

Erdmann explains how data is foundational for ML and analytics projects: "Imagine a tree. The roots of the tree are data lines from our machines. Then you have the tree trunk, where we store the data—that is the ODP. It feeds the branches of our organization, which are things like quality and maintenance. And then finally you have the leaves on each of those branches, which are the applications we create for quality optimization, quality tracking, efficiency improvement, defect sources identification, best practice comparisons and so on."

Ultimately, the goal is to combine data from production sites around the world. "The platform enables us to have one source of data, in the same coding, across all our different sites," Erdmann says. "This, ultimately, helps us make better decisions everywhere."

Collaboration between data scientists and manufacturing experts
Outokumpu has found that ML projects are most successful when data scientists collaborate with manufacturing experts to develop the ML models.

Culture

Training an ML model involves a lot of decisions that shape how it works and what its goals are – so process experts and machine operators have knowledge that is vital to the data scientists. Having guidance from colleagues helps data scientists understand the real-world problems that need to be solved, which results in better outcomes.

Keeping machine operators in control
Outokumpu's vision for ML is to empower its employees. With that in mind, the company made the decision to keep machine operators at the center of their operations. When the ML model identifies a potential action, it recommends that to an operator, rather than triggering an automatic action from the machinery.

Scale

"Our operators are absolutely needed with all the experience [they] have," says Niklas Wass, Executive Vice President of European Operations. "What we're adding is the data scientists and the programmers and all the brain power of the cloud system. This combination of process knowledge, computer power and computing knowledge, and data science is bringing us into a new level of the game."

However, incorporating ML into workflows can cause an uncomfortable disruption of the status quo. Employees need to trust ML recommendations that are, in some cases, telling them to change tried-and-true processes that have existed for decades.

Gaining support from employees and leadership
Outokumpu learned an important lesson about rolling out an ML solution: according to Erdmann, "You have to get trust from the leadership team, talk to people about rollout and get everybody on board."

Culture

It didn't go perfectly the first time. When the solution was launched, the machine operators and the plant's leadership needed a push to act on an ML recommendation if it went against their traditional habits.

To get past this roadblock, Erdmann's team did two things: They re-educated everyone about the benefits of the solution and demonstrated those benefits with two test cases.

When the test cases were successful, multiple departments were suddenly interested. "That was then the starting point where now everybody is extremely proud to participate," says Erdmann.

Operators were more supportive when they realized the solution could help them improve their own performance. "Giving the operator—who still owns and steers the process—the ability to make better decisions enables them to have higher throughput and lower costs," Erdmann says. "In the end, he's more happy because he has success."

By earning buy-in from employees at its largest plant, Outokumpu has set the stage for a company-wide transformation.

Enabling continuous improvement

Outokumpu understands ML models need to be maintained even after a solution is launched. ML models require careful monitoring to ensure they are still working properly. And even if they are still working well, they should be regularly re-trained with new data to remain as accurate and valuable as possible.

For these reasons, Outokumpu's data scientists continually monitor model performance and update them as needed.

AI in action: A roadmap for more efficient production

Outokumpu's use of machine learning is already paying dividends in its Tornio plant. For certain processes, output has increased by 10-15 percent and quality defects are down as much as 40 percent. In digitized steps of production, operators now have intelligent tools to improve outcomes. In general, ML helps Outokumpu evaluate its processes so that it can repeat successful ones and change unsuccessful ones. It helps machine operators make better decisions, which is especially helpful for those that are new to the industry.

For example, the old process for melting scrap metal relied on an operator's intuition for determining the right timing and temperature. But a host of variables could prevent all the metal from becoming molten, leading to inefficiencies that compounded throughout the steps of production. Now, ML models recommend temperature and timing ranges to optimize melting. As such, the model helps reduce energy input and melting time and improves output quality.

But the ML solution doesn't just recommend improvements for each individual step in isolation. It generates recommendations based on what has happened with a particular batch of steel. Because it's receiving data from the entire process, it can take previous steps into account when making recommendations for operators further down the line.

In terms of company culture, the ML solution is helping shift mindsets in ways that go beyond operators' day-to-day decisions. The culture is moving towards one where all employees question traditional ways of doing things and are more likely to think of innovative ideas.

Moving toward a sustainable future

Outokumpu has the ambitious goal of becoming carbon neutral by 2050, a daunting challenge for the steel industry. But the ML solution improves the overall environmental footprint of the production process.

ML helps lower electricity usage, leading to reduced CO_2 emissions. It also helps Outokumpu reduce the amount of scrap metal it produces, preventing wasted material and further lowering environmental impact. Every ton of scrap represents more than 1.5 tons of carbon emissions released into the atmosphere, according to the German Steel Recycling Association.

"We owe this to our families—especially to our children," Erdmann says. "We want our aspirations to have a legacy, to leave something behind better than it was before. And I think with digitalization, the biggest opportunity that we have in front of us is to increase the efficiency in such a way that we will leave a much greener process behind."

Success begets success

Transforming a company culture is no small feat. But the lessons learned in Tornio have provided Outokumpu with a blueprint to transform its facilities worldwide. As Erdmann puts it, "The nice thing about success is that you get addicted."

Outokumpu gradually integrated ML, securing buy-in among stakeholders along the way. Then: the snowball effect. One department would see another's success and want in.

The leadership at Outokumpu keeps setting its sights higher and higher.

"I think we have the chance to really revolutionize the stainless steel industry here with what we do," Erdmann says. "That's our aspiration."

Stefan Erdmann
CTO, Outokumpu

Niklas Wass
*EVP of European
Operations, Outokumpu*

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