diagram



Bringing AI into milling

Taking the steps from data-driven milling to self-optimizing plants

A vision realized in 16 months

A Turkish wheat miller moves into large-scale pasta production

Improving life on Earth with insights from space

How thin-film coatings enable earth observation satellite imagery

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Milling, **your way.**

“The existing mill, combined with Bühler’s new automation, performed better from the very first moment than I have ever experienced.”

Andreas Seidl, Production Manager at GoodMills Austria

Innovations for a **better world.**

BÜHLER

Dear readers,



Artificial intelligence is a topic on everyone's minds. Expectations for the technology are high, as it shows great potential to increase efficiency, reduce costs, improve decision-making, and more. But there are also questions. That is why – like many of you – we are taking a practical approach to AI, focusing on where it delivers real value, looking at mitigating risks, and ensuring we keep people at the heart of what we do. In this issue of Diagram, we invite you to explore these topics with us.

One theme that emerges is that AI is an acceleration of an ongoing evolution. Machine learning, deep learning, and advanced algorithms have long been part of our solutions. They power sorting systems, predictive maintenance, and process optimization across industries. Now we are combining AI with our over 160 years of expertise in processing technology to realize its potential in a unique way that is tailored to our customers' needs.

Our SmartMill demonstrates this well. We have incorporated AI in milling as the latest step in the digitalization journey. The flour milling company Baiyan in China, for example, has designed its production line based on the SmartMill concept, integrating the technology with data-driven operations and as a result seeing improvements in production efficiency and product quality. You can read about their experience in this issue. I invite you to take a look also at the articles featuring some of our latest technology, like the SORTEX AI700 or the Grinding Optimizer, which are powered by AI and delivering concrete benefits.

At Bühler, exploring new technologies is nothing new. We are approaching AI in the same way, building capabilities across the organization in order to apply it where it makes a real difference for our customers. Of course, we are also aware of the challenges around trust, data security, reliability, accountability, and business risk. For us, addressing these challenges means developing clear use cases, delivering reliable results, protecting data, and ensuring that people stay in control. We believe firmly that AI should be used to support human judgment and never compromise it.

AI has great potential to deliver measurable gains, but not on its own. Its greatest potential is achieved when it is integrated with other key elements, including robust equipment, reliable service, process expertise, and, of course, people. This is where I believe we must place our focus. Because what ultimately matters is not technology itself, but the results it delivers.

Like us, many of you are already exploring what AI can do in your own operations. I hope that the stories in this issue of Diagram provide you with useful insights and that they inspire you to continue collaborating with us. By bringing together the best of human expertise, advanced technologies, and sector-specific knowledge, we can create value where it counts.

Yours sincerely,

Samuel Schär
CEO Bühler Group



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Two different milling systems are brought together on a single platform, delivering unified data for continuous optimization.

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THE MILLER'S VIEW

What can AI do for me?

Text: Janet Anderson
Photos: Jekaterina Gluzman

New technology needs to prove its worth. We asked Stefan Birrer, Head of Milling Solutions at Bühler, what benefits he, as a trained miller, sees in digitalization and AI. How do these tools help millers meet the challenges they face today, and how do they support the industry in providing the world's growing population with delicious, nutritious, and affordable daily bread?



Stefan Birrer, Head of Milling Solutions at Bühler

What benefits do digitalization and AI bring to milling?
Stefan Birrer: The fundamental challenge for milling is that we work with a raw material that is a natural product. The key characteristics of our raw material fluctuate from season to season and batch to batch. This means that defined settings on machines are not always optimal – they do not always lead to the desired outcome. A skilled operator can judge this. But in many places, it is difficult to find enough people with the right skills and experience to keep the operation going 24/7. This is where automation comes in. But for an automation system to be as skilled as a skilled human, it needs assistance to see the variation in detail and make fine adjustments. Digital tools enhanced with AI help the automation system analyze if the settings really are the best for the actual raw material going through the mill at every moment.

What impact does this have on the business?
There are many possibilities. For example, for some millers, wheat quality is defined by its protein range. It is important for the miller to get the right protein range that their customers require. But protein levels vary. The digital tool with AI can analyze the real protein level coming in and adjust the blend accordingly. In standard automation, the recipe is based on average levels. If that average does not exactly reflect the actual protein level, the miller might be giving their customer a more valuable flour without being able to charge for it. This can translate into a loss of money. In the worst case, the miller's customer might not be able to handle higher protein flour, and their product may come out faulty.

How do AI tools help to reduce costs?
Digital tools help ensure not only that the product achieves the required quality, but also that the process is more efficient. An AI-enabled system can constantly adjust so that it uses the least energy and the lowest cost ingredients necessary to hit the nail on the head. Given the scale of production at some mills today, digital tools are indispensable. If you are running a large-scale operation, 24/7, with multiple lines on one site, it would require many skilled millers to manage the process adjustments.

Does AI have benefits mainly for larger mills?
Not at all. Many smaller mills run a lean operation. For these, digitalization and automation mean the difference between running the mill or having to stop because they do not have the skilled personnel for night shifts or weekends. Also, for a small mill to defend its market position against the big players, maximum performance and profitability are key.

How does the investment pay back?
The calculation depends on each mill's circumstances – it is a question of how much more efficient it makes the operation, and by how much it reduces costs. How quickly it pays back depends on whether the mill is running or not. Investments in existing mills tend to pay back faster when assets are running at full capacity. We have seen that return on investment in under two years is a common experience. The speed of payback also depends on how long operators need to adapt to the new ways of working and the new processes. There are multiple factors and steps in the investment and returns journey. We define these together with the customer at the beginning and accompany them at every step.

How does AI change the job of the miller?
In a traditional plant, the operator concentrates on trying to balance production on the machines. In a mill with digitalization and automation, the machines produce according to a plan, and the operator only has to be involved if parameters are outside the planned range. This frees the miller to take care of other important tasks, like solving their customers' issues. The human is not taken out of the process, but given time to focus on higher value tasks. It's similar in aviation. In the early days, pilots could only fly during the day when they could see. Today, planes start and land by themselves. But there are still two pilots so that if a parameter comes up that is not foreseen, they can take over control to bring the plane back to the right environment until the automation can take over again. Millers today are like pilots – they take over only in unusual situations.

What is the best way to approach digitalization and AI?
When you explore something new, you don't know what to expect. You can prepare for what you think might happen, but you have to adapt your decisions based on what you find. It is like pioneering. You have to take one step at a time, look back, and decide if you are going in the right direction. We know that millers are exploring and our job is to help them understand for themselves which tools deliver the best outcome for their individual circumstances. Milling plays a central role in our food systems. AI enables millers to find the optimal solution across so many variables all the time, supporting them in providing an important part of the nutritional needs of the world's population.

> The human is not taken out of the process, but given time to focus on higher value tasks.

Stefan Birrer,
Head of Milling Solutions at Bühler



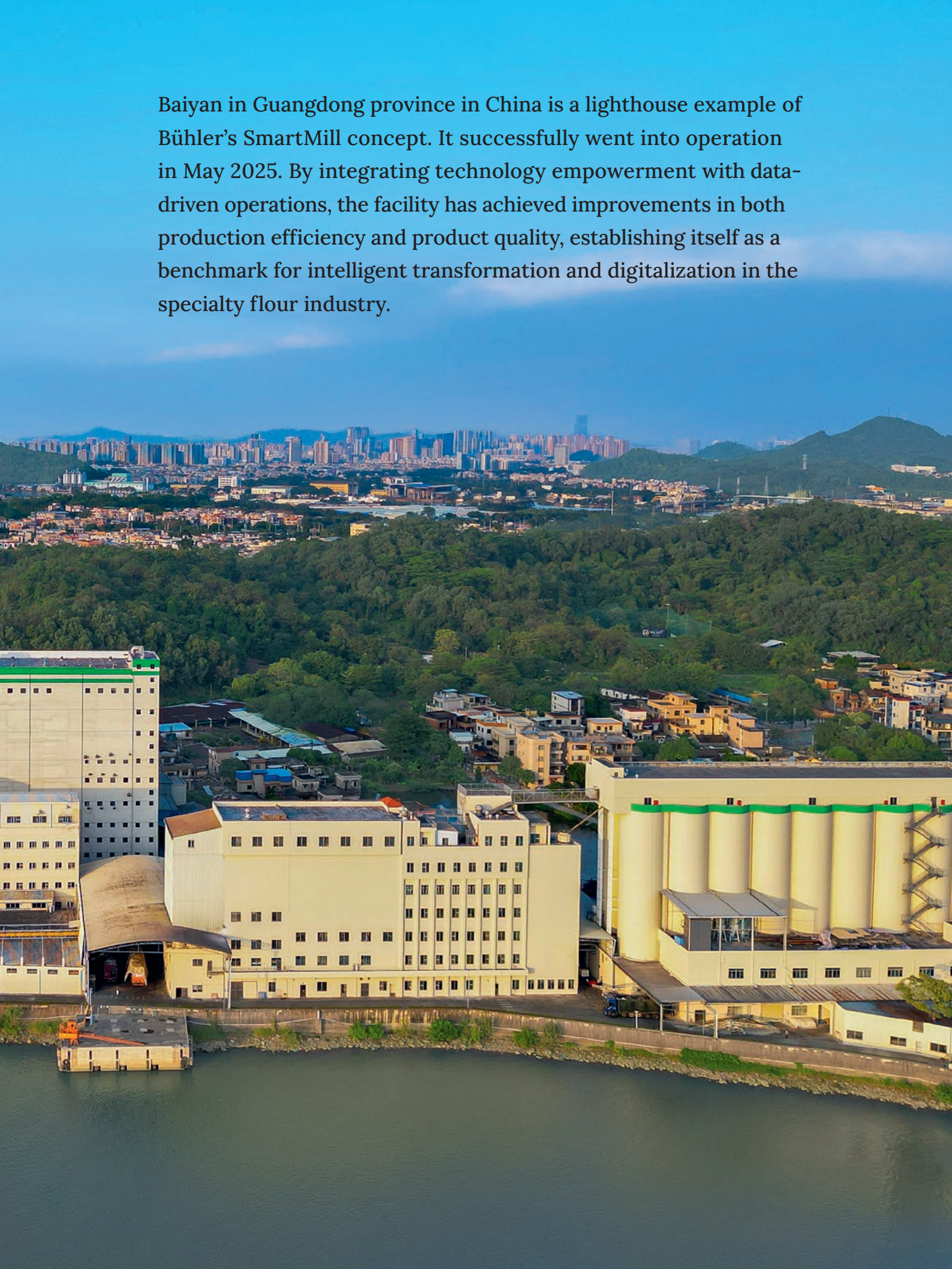
GUANGDONG BAIYAN

The smart way to create exceptional flour

Text: Tony Sun Photos: Cecilia Lian



Baiyan in Guangdong province in China is a lighthouse example of Bühler's SmartMill concept. It successfully went into operation in May 2025. By integrating technology empowerment with data-driven operations, the facility has achieved improvements in both production efficiency and product quality, establishing itself as a benchmark for intelligent transformation and digitalization in the specialty flour industry.





> “With the new system we can meet consumers’ demands for higher quality, offering products that are healthier, more diverse, and tailored to their needs.”

Mr. Liang Haifeng,
General Manager at Baiyan

By the Xijiang Channel of the Pearl River, at the Guangzhou-Foshan border, a cluster of silos stands prominently on the bankside. Nestled amid greenery, a high-rise industrial complex faces the waterways, flanked by three ship-unloading docks. The complex is located in a region rich in culinary tradition, widely considered to be the birthplace of Cantonese cuisine. It is also the home of Guangdong Baiyan – a factory that has borne witness to the dramatic evolution of flour manufacturing, from more traditional milling to modern industrialization and now intelligent production.

Established in 1952, Baiyan has grown into one of China's leading specialty flour milling companies. In 1993, the company introduced Swiss Bühler processing technology and commissioned two milling lines, each with a daily capacity of 300 tonnes. In 2021, driven by the surging demand for high-end specialty flours such as low-ash bread flour, it decided to double its milling capacity by adding a third and fourth milling line to its plant. The company now has a combined daily milling capacity of 1,200 tonnes, or 300,000 tonnes a year.

Alongside the increase in capacity, an important focus for the project was quality. Baiyan wanted to leverage smart manufacturing to optimize its product portfolio and lead the

high-end flour market. “Our aspiration is to become a global benchmark for baking quality,” says Mr. Liang Haifeng, Baiyan’s General Manager.

To achieve this, Baiyan turned to Bühler, its longtime partner.

Meeting the competition

The relationship with Bühler began in 1991. At that time, local flour milling was highly competitive, offering homogeneous products. “Back then, we were surrounded by flour mills. Business seemed bustling, but competition was fierce,” says Mr. Zhou Zhiwei, Director and Deputy General Manager at Baiyan. “Every day, we watched rivals poach our customers. We wondered how to break through.”

Faced with these challenges, Baiyan’s shareholders started looking for new opportunities. The breakthrough came at an international technology exchange where Baiyan met representatives from Bühler. They decided to invest in the Swiss technology and import a complete production line, becoming the first flour mill in China to use an eight-roller mill.

“There were debates about how to use the money – whether it should be used for profit-sharing or for investing. However, finally, a company-wide vote decided to invest in the new production line,” says Zhou Zhiwei.

In 1993, Baiyan’s first production line with Bühler equipment began operating, boosting daily capacity to 200 tonnes a day and making Baiyan bread flour the gold-standard benchmark in the Pearl River Delta’s baking industry. A massive flood in 1994 halted production, but staff worked tirelessly to protect the silos and, thanks to their efforts, Baiyan did not miss a single flour delivery. Bühler’s equipment enabled quick recovery, and this solidified Baiyan’s commitment to pursuing high-end, intelligent development.





Bühler's Mercury MES provides operators with performance transparency. Integrating lab work in Mercury helps tackle a large diversity of products.



> “Bühler supports us throughout the entire life cycle, always ready to tailor solutions to our needs.”

**Mr. Zhou Zhiwei,
Director and Deputy General Manager at Baiyan**

In 2021, the company collaborated with Bühler once again to implement the latest SmartMill solutions.

A smart move

The Bühler SmartMill concept is designed to unlock a plant's true potential, improving product quality and traceability while at the same time reducing energy consumption and environmental footprint. It combines automation equipment, intelligent control systems, and online sensing technology, complemented by digital services, to provide powerful support for operators and managers.

Baiyan invested in Bühler's most advanced equipment, including the integrated grinding system Arrius; plansifters; a bran finisher; four cutting-edge inspection systems that monitor protein, particle size, whiteness, and quality; and a fully automatic bagging station. They also chose the NIR Multi Online Analyzer, a particle size measurement unit, and an online color and specks measurement unit. All this is overseen by the Mercury MES system, Bühler's Manufacturing Execution System, which integrates all processes to increase efficiency and traceability, collecting and analyzing data from over 15,000 sensors. These enable protein loop control, break release loop control, and ash loop control functions.

"Our Phase II facility processes 600 tonnes of wheat daily, achieves 150,000 tonnes annual output, and operates with 24/7 remote monitoring," says Liang Haifeng. Following commissioning of the new line, Baiyan achieved breakthroughs in both cost reduction and efficiency enhancement. Labor costs decreased by 50 percent and annual electricity cost savings were significant. At a time when energy is one of the most volatile costs for many businesses, this was considered to be an important achievement.

Quality above all

All this is impressive, but it is the improvement in flour quality of which Baiyan is most proud. Since it entered the milling business, Baiyan has successfully launched more than 60 varieties of high-grade specialty flours such as Baiyan brand bread flour, cake flour, and pastry flour, which it supplies to households, restaurants, bakery chains, and large food processing plants.

To ensure that the product quality remains high, Baiyan starts with high-quality wheat, which it buys mostly from Canada, the United States, and Australia. However, even with high-quality raw material, there is still variability, with changes in wheat varieties, weather, farming practices, and storage conditions. These variations must be countered through wheat blending, precision grinding and sifting, and flour blending. This is where SmartMill is game-changing.

With online NIR detection technology, Baiyan can analyze changes in wheat quality in real time, dynamically optimize wheat blending, and adjust equipment parameters. With the AI visual inspection system, the accuracy of wheat impurity detection reaches 99.99 percent and ensures that every bag of Baiyan flour meets premium standards. "With the new system, we can meet consumers' demands for higher quality, offering products that are healthier, more diverse, and tailored to their needs," says Liang Haifeng.







Maintenance is made easier as the machines provide all the necessary information, which is displayed at a glance.

The journey to the self-optimizing plant

Bühler's SmartMill solution adds value to both quality and efficiency while reducing manual intervention. More than that, the solution "thinks" for itself. The operator simply sets product characteristics, and the mill continually learns from all variables to self-optimize its production parameters.

This autonomy is reached gradually, not overnight. Just as the auto industry progressed from manual steering to full autonomy through clear, incremental steps, the SmartMill journey follows a similar path: connect the plant, learn from the data, assist people with actionable insights, and then close the loop so the system can adjust parameters continuously within safe guardrails. With continuous AI-driven optimization throughout the whole process, production becomes more intelligent and efficient.

"Every sensor and data point in this facility reflects the DNA of intelligent manufacturing," says Marcel Scherrer, Head of Business Unit Wheat & Rye at Bühler. "We are working closely with Baiyan to advance smart manufacturing in the flour industry."

Redefining industry standards

As Baiyan moves into the future, it relies on the fact that both the partnership with Bühler and the technology it delivers are strong and durable. "The Bühler equipment that we invested in back in 1993 is still running reliably today," says Zhou Zhiwei. "It truly lives up to the saying, 'unchanging reliability across decades.' And furthermore, Bühler supports us throughout the entire life cycle, always ready to tailor solutions to our needs."

With the new facilities already operational, both Baiyan and Bühler are determined to set the trend in premium flour production. "Our partnership with Baiyan is more than business – it's a shared mission to create exceptional flour," says Jacky Zhang, Vice President of Grains Business at Bühler Greater China. "The SmartMill demonstrates the perfect integration of Swiss innovation and Bühler's localized R&D, setting new standards for the industry."

Baiyan's investment in intelligent manufacturing ensures that tradition is supported by innovation. The result is flour that combines consistency, quality, and traceability, helping bakers and food manufacturers deliver outstanding products that are enjoyed by consumers every day.

Since 1952 Bai Yan 白燕

Guangdong Baiyan produces over 60 premium flour varieties and 20 rice strains, distributing to over 30 regions in China, as well as Hong Kong and Southeast Asia. With Bühler's SmartMill, Baiyan is unlocking the full potential of its new plant, improving product quality and traceability, and reducing energy consumption and environmental footprint.



Millers need to make many adjustments across machines, lines, and plants in real time to stay competitive. SmartMill is designed to support them in this – from connecting to monitoring, and assisting to self-optimizing.

Photo: Sagar Shiriskar

THE SMARTMILL JOURNEY

One smart step at a time

Text: Janet Anderson

Artificial intelligence is suddenly everywhere – in the media, in schools, in offices, and increasingly in industrial discussions. For millers, the big question is: can it deliver tangible value on the mill floor? At Bühler, AI is part of a long-term digitalization journey that builds on decades of automation, data collection, and close collaboration with customers. Done wisely, it offers much to gain. SmartMill is a key expression of that approach.

Artificial intelligence has not suddenly emerged out of nowhere. Techniques such as machine learning and data-driven optimization have been part of industrial solutions for years, including at Bühler. What has changed in recent years is accessibility. As Alexis Noël, Head of Product Management, Smart Factory at Bühler, puts it: "We've been working with data for decades – collecting it, recording it, integrating it. What is new is how easily we can now combine data to look at the bigger picture."

Instead of focusing only on individual machines or parameters, digitalization makes it possible to analyze entire processes and operations across multiple sites. "We're no longer just looking locally at one machine or one process," says Noël. "We are making sense of the overall business."

This shift is the foundation on which SmartMill is built – from connecting to monitoring, assisting to self-optimizing.

A well-planned journey

"The SmartMill is a journey of transformation, not a disruption," says Georg Schafler, Head of Wheat and Rye Process Technology at Bühler. "Our customers are right to be cautious about technological promises. We know that in milling, investments are long term, margins are often tight, and reliability is critical. That's why we support customers at each step of the journey and focus on the returns on investment."

Schafler works closely with customers and operators embarking on this journey and says that a gradual approach is essential. "We tackle the topic step by step. Not everything at once," he says.

The first steps focus on connecting existing equipment and making data visible. With a digital record of production, dashboards, and analytics, the system provides actionable insights for improving yield, quality, and energy use. These first steps are intentionally low risk. By using data already available from the plant control system, mills can gain transparency without major additional investment.

Operators begin to see patterns, deviations, and trends – and gradually become comfortable working with digital tools as part of their daily routine.

From this foundation, SmartMill builds toward more advanced capabilities. The next step is to move toward self-optimization for a selected function. Once this is established, the whole system can become self-optimizing. With the help of continuous learning, the system adapts parameters to the specific characteristics of the raw materials and the conditions in real time.

The difference that AI makes is that it can go beyond a single task with a single solution and can take over many tasks in real-life situations with complex and changing parameters. For millers, dealing with natural raw materials, this is where the story gets interesting. Even with this level of complexity, and where there are many variables, AI can find an optimization strategy.

"All this doesn't have to happen overnight," says Noël. "And it doesn't have to mean a completely new plant. We can also start by retrofitting older equipment – that too is a first step on the journey to the fully-fledged SmartMill."

At its heart, the miller's expertise

Although artificial intelligence is fueling this – meaning that a computer system performs tasks that normally require human intelligence – that does not mean that human intelligence is out of the picture. In fact, the approach taken by Bühler keeps human intelligence and expertise at the very heart of everything.

Rather than developing solutions in isolation, Bühler has worked closely with customers for years to identify real pain points and define what success looks like. "Our approach has always been to work closely with customers. We started with co-creation workshops to explore what is possible and what is important to them. From that, we identified the areas to address, and then we developed solutions together," says Noël. "It's always a close collaboration between the data scientists, the technologists, and the customer to build something that makes sense from a process point of view, that works technically, and that provides a real benefit."

Far from adopting new technology for technology's sake, Bühler's approach to implementing AI in milling begins by working together with customers to determine in each case which tasks can be automated, which ones should remain with the human operator, and which can be a combination – where AI augments the human. "We approach this by asking: what value does it deliver? We look for the use cases where AI makes sense; where it can augment human judgment rather than replace it," says Noël.

The resulting system also allows for more transparency. SmartMill tracks all the metrics the customer wants to monitor and all the changes in the process configuration. "This is not a black box operating on its own. Human operators can check the input data that are used to build it," explains Noël.

Equally important is the application of safety guardrails. Powerful technology demands responsibility. For Bühler, responsible use of AI means being transparent about where and how AI is applied, protecting personal and business-sensitive data, validating outputs before acting on them, and keeping humans accountable for the decisions that are important.

In practice, this means Bühler uses its own AI models and trains them in-house with data that is 100 percent relevant for the task. All the operations Bühler carries out to develop or maintain software are externally audited and ISO certified. "We maintain the highest standard in cyber security, and we are ready for the introduction of the Cyber Resilience Act in the European Union. We have developed a secure link between the cloud and plants so that we can deploy security patches," says Noël.

Every change is also a cultural change

Safety is also enhanced by Bühler's step-by-step approach to the SmartMill. "We don't do it all at once. It starts with one recipe, one passage, one roller mill, and then it expands. This makes it easier for operators to adapt," says Schafler. "We are not asking anyone to go straight from driving a manual car to letting an autonomous vehicle do the driving. We know that trust has to be built up."

This does entail a change in working habits, but the change can happen with the people at their pace and with the right support. "As we move away from pushing buttons to monitoring screens, it requires a mindset change for operators and management alike," says Schafler. "To help with this, we provide training and support to use these tools and functions. It is an investment in time, but it is important to take these first steps, rather than skip them and try to jump in at the final stage."

Bühler takes training equally seriously in-house. Its apprenticeship programs are embracing AI with a focus on questions of responsibility, transparency, fairness, and data

protection. The next generation is already being trained to think about who bears responsibility for the decisions and consequences of AI systems, and also about how a conscious and secure approach to AI can be developed.

"AI is a collaboration between humans and machines taken to the next level. If we do this right – choosing the right tasks to tackle, using the right data, and with the right people in charge at the right points in the process – there is much to be gained," says Schafler.

Relying on unique expertise

Since AI went mainstream in 2022, people everywhere have started experimenting with the technology – at home, at work, and at school.

"It has become so commonplace that the younger generation already takes AI for granted," says Noël. "But building an AI feature into a piece of software is much easier than integrating it into a machine and running it in an industrial process in real time. That is where we stand out – we have the capabilities to take a scientific breakthrough like this and learn how to use it to deliver real value in a traditional industry like milling."

Other providers might be developing interesting concepts in this space, but Bühler, uniquely, is able to build on its deep process expertise and knowledge of the industry to embed AI in its solutions and create a seamless interaction between the equipment and the software. "Because we provide equipment, process expertise, and services, we occupy a central position in the whole ecosystem," says Noël. "With Bühler's solutions, you know that everything is aligned, from the machine to the software – all with the same quality. And we promise that the development will not stop. We continue to add further functionality as the AI frontiers expand."

"We have worked closely with our customers in some cases for generations and know their pain points very well. We know that millers want to increase capacity, efficiency, and quality, and reduce costs. We know that in many places they face a skills shortage, rising energy prices, and increasing fluctuations in the raw materials. And we know that the ability to make adjustments across a number of variables, across machines, lines, and plants in real time can mean winning on margins and staying competitive. We develop solutions to these challenges with our customers and accompany them on every step of this journey," says Noël.

"We also know that running machines is not the primary goal of a miller. Millers are in the business of grain processing – in the art of flour production – their expertise is in getting the right raw materials and developing the right recipes to produce the products their customers want. Maintaining equipment and knowing how to adjust it is just an enabler of this. Our aim is to support them with this, so that millers around the world can achieve their goals."

> "The SmartMill is a journey of transformation, not a disruption."



Georg Schafler, Head of Wheat and Rye Process Technology at Bühler

If you would like to find out more about the SmartMill, please read the white paper.



Photo: Andreas Zuber

MIND THE GAP

Grinding optimized

One critical parameter can make a decisive difference to the performance, reliability, and efficiency of grain milling operations – the grinding gap. Setting the gap correctly is a skilled task. Bühler is working with customers to build an AI system that can work like an expert miller to keep the grinding gap optimized.

Text: Jonathan Ward

Ensuring that each roller stand in a mill applies precisely the right amount of force needed to reduce the grain into flour is a key part of milling operations. Applying too little means the machines will not sufficiently process the grain, reducing yields and affecting product quality. Applying too much increases energy consumption and accelerates wear on the rollers.

In roller grinding, the grinding force is controlled by adjusting the gap between the rollers. Yet the relationship between roller gap and grinding results is notoriously complex. Finding the optimum settings is a highly skilled task, relying on the miller's experience and process knowledge.

"Usually, a miller takes a sample of the product going into and coming out of each stage and assesses its temperature and granulation, either by hand or in the lab, to determine whether the machine is working as expected," says Marcus Toma, a data scientist at Bühler. "If it does not look or feel right, or it does not pass the lab test, the miller may make adjustments." The variability of milling further complicates optimum machine adjustment. Different gap settings may be required to produce different

recipes of flour intended for different end uses or specific customers. In addition, factors such as product mass flow distribution and roller wear profile have to be taken into account. The output of each grinding stage can also be affected by changes in grain characteristics or variations in ambient temperature and humidity.

From intuition to data

In recent years, Bühler technologists have been working on ways to give millers better information about the performance of their machines. One key innovation has been the development of smart rollers with built-in temperature and vibration measurement (TVM) sensors.

Installed inside the roller beneath its working surface, these sensors provide millers with a real-time view of conditions inside the machine. Each roller contains an array of temperature sensors along its length, allowing the miller to spot unwanted inconsistencies across the working surfaces.

Smart rollers have been operating at customer sites for several years, giving skilled millers valuable insights into process performance. "Using the system, millers gain an understanding of the temperature profile they should expect when their machines are running well," says Toma. "If they see a significant deviation from that profile, they use it as a cue to check the machine and potentially adjust the roller gap."

Spotting potential problems is one step toward improved mill performance and reliability. Fixing those problems is another. The first smart roller installations still relied on the miller's skill and experience to make the right changes to roller gap settings. A key goal of Bühler's SmartMill journey has been to find more effective ways to support that decision-making process.

This has been Toma's focus. "The relationship between gap settings, temperature profiles, and grinding performance in a roller mill is complex," he says. "It is not easy for a computer to decide what changes to recommend and when to optimize the process."

Learning to think like a miller

To build a system capable of making such recommendations, Toma and his colleagues needed to create an algorithm that could think more like a miller. "We started this project in close collaboration with a major customer in Europe," he says. "They were already operating a highly advanced mill with smart rollers." Working with that customer gave the Bühler team access to rich data on the way millers



Photo: Sagar Shiriskar

Marcus Toma drove the development of the Grinding Optimizer in collaboration with customers.



If you would like to find out more about the Grinding Optimizer, please read the white paper.

operate their equipment in the real world. They could analyze historical machine data to see when millers chose to adjust gap settings, what adjustments they made, and how those changes affected machine performance.

"We used that data to train an AI system to respond in a similar way," says Toma. "It monitors machines in real time, identifies situations where adjusting the grinding gap is likely to improve performance, and recommends the right adjustment based on interventions that worked well in the past."

The partner customer has been using the new AI system, called Grinding Optimizer, since 2024. The system's recommendations are already delivering measurable benefits. In one documented case, an AI-suggested adjustment reduced power consumption in a single roller pair by as much as 38 percent while keeping quality parameters within the target range.

Early successes demonstrate value

Bühler estimates that AI-supported grinding optimization can reduce the energy consumption of the roller mills by 8 to 10 percent, while also improving yield and product quality. Savings in energy costs, labor costs, moisture loss reduction, and reduced roller refurbishment frequency mean that installations can deliver a positive return on investment within one to two years for most customers.

With early successes demonstrating the value of the Grinding Optimizer system, Toma and his Bühler colleagues are now working to extend and improve the technology on multiple fronts.

"One piece of early feedback from our customer was that they did not want to be overwhelmed with recommendations for small adjustments that might only deliver marginal performance improvements," says Toma. "Millers are busy people, and they want to focus their efforts on actions that will have the biggest impact."

In response, the Bühler team continues to train its AI system by evaluating when millers are most likely to adopt its recommendations, then accordingly adjusting the nature and timing of future recommendations.

Separately, the team is working to evolve the Grinding Optimizer into a full commercial product, testing the system with different customers and processes, extending compatibility to include the different types of software used in mill operations, and supporting a wider range of equipment types. "We want to make the system accessible to as many mills as possible," says Toma. "Even if they are not operating the most advanced machines or process-control software."

As of 2026, several pilot mills are operating Bühler's Grinding Optimizer system ahead of a broader product launch planned for later this year. After that, Bühler expects the smart milling journey to continue, using additional data sources, more advanced AI models, and integration across different processes in the mill to further enhance optimization potential. "Ultimately, the vision is for milling to evolve into a digitally orchestrated system that continuously adapts to raw material variability, final product specifications, and commercial objectives," says Toma.



GOODMILLS GROUP

Short downtime, enduring impact

What started as the automation of a new mill quickly turned into something bigger: connecting an older, third-party plant with Bühler's latest technology. The goal was ambitious – two mills working seamlessly as one, delivering the data needed for optimization and reliability. GoodMills and Bühler pulled it off with a very short downtime. Thanks to thorough preparation, extensive pre-testing, and deep retrofit expertise, the old mill is now also state-of-the-art and fit for the future.

Text: Janet Anderson **Photos: Sagar Shiriskar**

Schwechat's history is closely tied to milling. For centuries, fertile land and the power of the river shaped the region's prosperity. Today, the city stands at the heart of Austria's flour production. At the center of this story is a mill on Schmidgasse that has been operating for over a century. Acquired in 1979 by Leipnik-Lundenburger Invest Beteiligungs AG, it is now part of the GoodMills Group, one of Europe's leading milling companies.

GoodMills operates 25 mills across seven countries. It has three Austrian sites, two of which have recently been consolidated in Schwechat. The site already processes around 600 tonnes of grain per day, making it the country's largest milling facility. A new organic mill has now been added, while production in Rannersdorf is being phased out and the plant repurposed for storage.

This transformation reflects a broader shift in the industry. Demand is changing, with organic products gaining importance, and energy costs and raw material prices volatile. For GoodMills, the answer is clear: invest in technology. That is why they built a new organic flour mill.

Bühler supplied the equipment and automation for the new organic plant. But the real challenge soon became apparent: integration. The new mill runs on Bühler's Mercury MES system, while the existing mill was controlled by a third-party platform. To unlock the full potential, both systems needed to be brought together.

A challenging retrofit

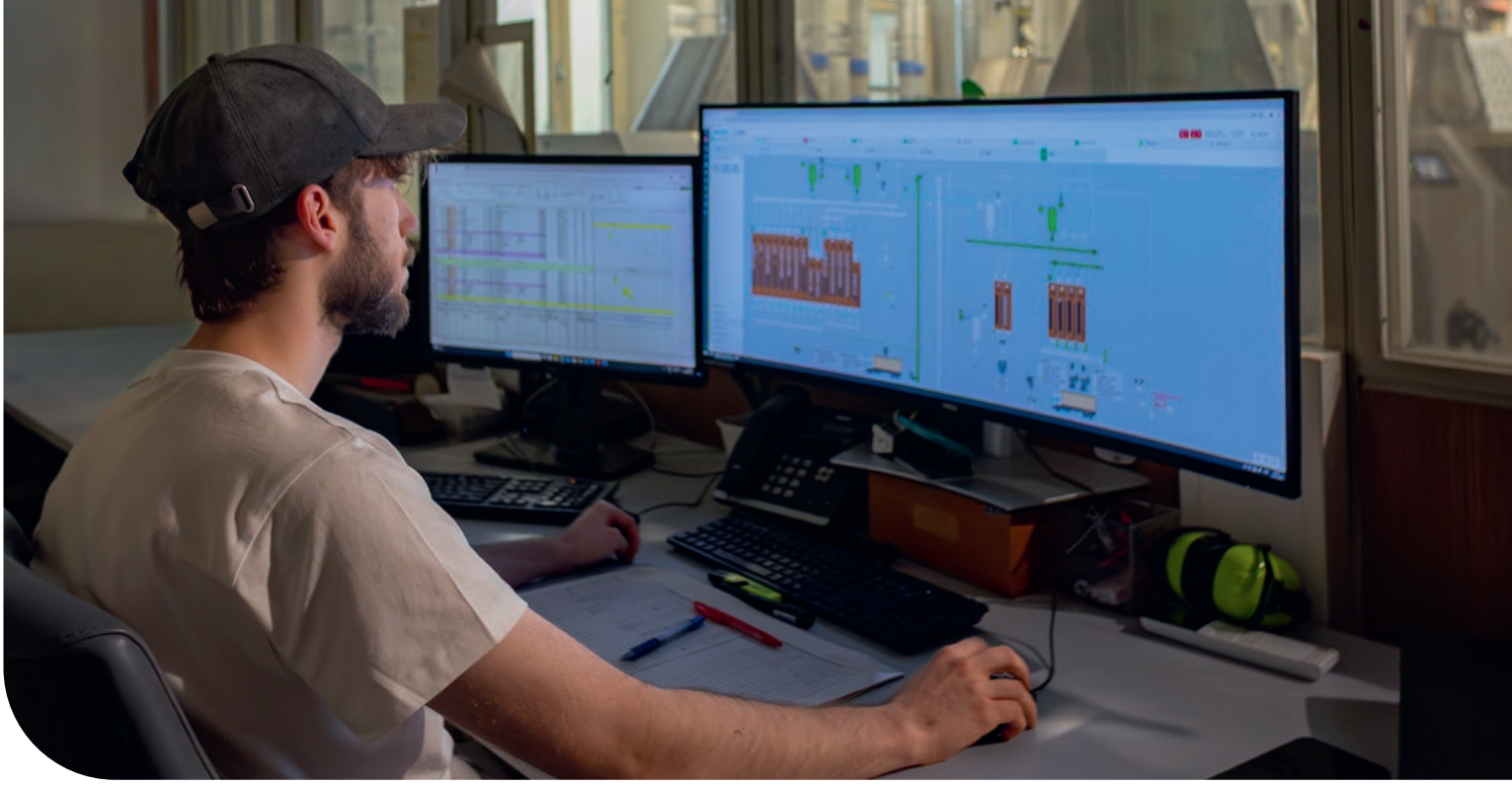
The objective was to create a fully connected production environment – one digital network spanning old and new lines, supported by modern automation and tools such as Mercury MES and Bühler Insights.

This step was the missing piece of the puzzle needed to create a fully modern, future-ready facility. It was also the most technically demanding part of the project. "The biggest challenge at the beginning was integrating new equipment with legacy and third-party systems. We needed a unified, networked automation system," explains Peter Pscheidl, Director Technology & Engineering at GoodMills Austria. "This was more than a simple retrofit. We needed a partner capable of handling such a complex project – and Bühler was the right company for this task."

Before implementing a modern control system in the existing plant, Bühler first had to assess the current state of the facility. The old mill, which had been supplied by a third party decades ago, was expanded several times over the years, and the documentation available was not always correct or easy to find.

Preparation is everything

The entire plant therefore had to be documented in detail. Every motor and sensor was noted and recorded in a fully updated system. At the same time, obsolete hardware components that could no longer be replaced were removed – a step that significantly improved operational reliability. "The new control components we installed are still available on the market and can be easily replaced if needed. Another major advantage is the fully updated plant documentation," says Christian Haldner, Automation Project Manager at Bühler.



In addition, all interfaces had to be clearly identified and integrated, and hardware carefully incorporated into the overall system. Wherever possible, components were pre-tested in-house in Uzwil to minimize downtime at GoodMills. Server cabinets were also assembled in Switzerland to enable rapid installation on site. After several intensive weekends in Schwechat, during which every individual digital input and output was tested, the old mill was finally shut down and the new Bühler Mercury MES control system was installed and commissioned.

GoodMills set a clear requirement: only ten days of shutdown to bring the new system into operation. This was essential to maintain deliveries while one mill was offline. Meeting this tight timeline required manpower, experience, and strong teamwork. Commissioning began with complete disconnection from the existing system, followed by hardware conversion and the connection of all signals to the Bühler Mercury MES system. The plant was then restarted, with all functions tested and operating states verified to ensure smooth operations.

"Key for us was to involve GoodMills from an early stage," says Haldner. "We provided training for their employees in multiple sessions over six months, so they were already confident using the new system when we transitioned."

A team of more than 20 people worked in shifts around the clock at the beginning in order to meet the tight schedule. "And in the end, we were even faster than planned – that says it all," says



> "The existing mill, combined with Bühler's new automation, performed better from the very first moment than I have ever experienced."

Andreas Seidl, Production Manager at GoodMills Austria



> Today, we have two milling systems that function as one and provide us with data for continuous optimization and high production reliability.

Peter Pscheidl, Director Technology & Engineering at GoodMills Austria



Data together with AI helps to simplify daily work and optimize processes in the mill.

Andreas Seidl, Production Manager at GoodMills Austria. “The existing mill, combined with Bühler’s new automation, performed better from the very first moment than I have ever experienced.”

Two systems, one platform

The objective was achieved. “Today, we have two milling systems that function as one and provide us with data for continuous optimization and high production reliability,” says Pscheidl. For GoodMills, digitalization is not just a “nice-to-have”; it is essential for survival. The entire industry faces major challenges, including tight margins, high energy costs, skilled labor shortages, and strong competition. At the same time, mills play a vital role in supplying a key staple food. “Milling is not high-margin business – that’s why we need data to be efficient in terms of affordability and availability, while ensuring perfect quality and first-class decisions,” says Erwin Langela, Group Operations Director at GoodMills Group.

This is where Bühler Insights creates added value. It allows GoodMills to compare the Schwechat plant with its other facilities across Europe based on consistent and comparable criteria. “The challenge for management is to bring key performance indicators across all locations to a common denominator and clearly explain why we do what we do,” says Pscheidl. This transparency supports informed decision-making in plant

operations. “It allows us to understand why a parameter differs from one site to another – not to defend it, but proactively to enable better decisions.”

For production manager Seidl, data transparency is of extremely high value. “It is becoming increasingly important to extract clean data from the system. It gives us the tools to produce the best possible flour. And with Bühler Mercury MES, we can now do this perfectly. We can trace exactly where an issue occurred, identify bottlenecks, and monitor energy efficiency – an increasingly important topic.”

At the same time, data together with AI can help to simplify daily work and optimize processes. AI is expected to handle standard processes and continuously improve through self-learning – an important advantage in times of skilled labor shortages. At first glance, AI may seem far removed from traditional milling, but it is a good fit because raw material characteristics constantly vary, as do requirements for the final product, from wholewheat flour to lighter or darker flours or specialty semolina. “These variations make the task very complex, but also perfectly suited to AI and very worthwhile: to produce consistent quality tailored precisely to our customers’ needs, and at the same time, reduce stress for our employees,” says Pscheidl. “Digitalization helps us both to centralize and to meet diverse requirements. That’s the direction we want to go in.”

Watch this video to learn more about how Bühler supports GoodMills.

AI is already being used in Schwechat on a smaller scale, for example in color sorting machines. Here, it helps remove foreign material efficiently, improving sorting quality while saving resources.



> “Milling is not high-margin business – that's why we need data to be efficient in terms of affordability and availability, while ensuring perfect quality and first-class decisions.”
>
> **Erwin Langela, Group Operations Director at GoodMills Group**

It also supports incoming grain inspections and increases production efficiency.

Seen in this light, the mill in Schwechat is an active automation project. “The path toward digitalization is clearly mapped out, and we are pursuing it at speed. But of course, we need to ensure that people can keep pace,” says Pscheidl. Employees are therefore trained as part of the project. It starts with the team leaders, who act as multipliers, training their teams to work with the new digital tools and systems. “First top-down, then selectively,” says Pscheidl. After a period of operation, the approach is fine-tuned.

People remain at the center

“Large milling operations know that they cannot succeed without AI, but also not without people,” says Pscheidl. While physical labor is becoming less important, operating digital systems and analyzing data is becoming more critical. Millers must understand both the machinery and the data and be able to assess its quality and draw the right conclusions. “The need for highly skilled workers will remain,” says Pscheidl. “There will never be a fully unmanned operation. People will always be at the center.”

GoodMills

GoodMills Group, headquartered in Vienna, Austria, was founded in 1979 and is one of the largest milling groups in Europe. At its Schwechat site, around 600 tonnes of grain are milled every day. Bühler supplied a fully automated organic mill and integrated it, together with the existing conventional plant, into the Mercury MES control system, creating a unified and future-ready automation architecture.

SEEING THE DIFFERENCE

AI redefines optical sorting

Text: Chris Ward

Sorting oats for gluten-free markets is one of the most demanding challenges in food processing. When defects look almost identical to good grain, traditional color sorting reaches its limits. The new SORTEX AI700 is Bühler's most advanced optical sorter yet, a deep learning machine that moves beyond color and shape to see what no sorter has seen before. From greater food safety for consumers to improved profits and reliability, it is a game-changer for food processors.

In food processing, not all defects are easy to see. Some look almost identical to the product they contaminate, especially in grains such as oats, barley, and rye. For processors supplying gluten-free markets, visual similarity creates a serious safety and commercial challenge. This is where artificial intelligence can be a game-changer.

Traditional optical sorters, which rely primarily on color and shape, perform well when defects are visually distinct, but are pushed to their limits when sorting visually similar product. Bühler's new SORTEX AI700 is a leading example of AI usage in food processing that helps to bring safer food to consumers and better yield and profitability to millers.

The SORTEX AI700 is an optical sorter that doesn't use chatbot AI, but instead dives into the world of Convolutional Neural Networks (CNN) and deep learning. With these tools it analyzes images at pixel level, learning to recognize subtle patterns that distinguish acceptable product from defects, even when they look almost the same. With this technology, SORTEX has been able to achieve the highest yield quality ever in oats, and the journey into other products is just getting started.

Why change is needed

In recent years, the pressure from food standards has intensified. Processors are contending with rising input costs, tightening supply chains, escalating regulatory requirements, and a consumer base that is better informed and more demanding than in the past. The industry is being asked to do more, with less margin, to a higher standard. Technology is not optional in that environment, but the difference between a business that adapts and one that does not.

Beyond the heightened consumer and regulation standards, climate change is altering harvest conditions in every major growing region. Droughts, flooding events, and temperature extremes are increasing the prevalence of damaged, diseased, and contaminated grain in ways that were not anticipated when many existing processing lines were designed. Defect profiles that were once predictable are becoming less so. For processors relying on sorting technology



SORTEX AI700 is Bühler's powerful new optical sorter, with deep learning technology for increased food purity and profit.

configured for a stable input, that unpredictability is a growing liability. The equipment of yesterday is being asked to solve the problems of tomorrow.

How AI is changing optical sorting

Place a grain of oat, barley, and rye side by side, and the human eye struggles to tell them apart. Now tip a kilogram combination of the three onto a conveyor belt, and the challenge of sorting them becomes all but impossible. This is the opportunity of AI, and the inherent limitation of traditional color sorting.

The SORTEX AI700 breaks through this limitation. At its core is a CNN, the same class of AI that underpins image recognition in advanced medical diagnostics and autonomous systems. Where a traditional sorter asks, "Is this grain too dark?", the CNN processes color, shape, and texture together, building a comprehensive picture of each grain on the belt.

"In the past, our machine learning systems relied on engineer setup and tracking algorithms to improve upon initial parameters," says Melvyn Penna, Senior Product Manager at Bühler SORTEX, an expert who has spent 35 years at the forefront of optical sorting innovation. For Penna, the AI700 is the most exciting project yet. "Now, with the AI700, the machine is trained with millions of labeled images. It develops a deep understanding of what is acceptable and what is not. It doesn't just see a defect; it knows a defect."

The gluten-free challenge

The AI700's first application targets one of the industry's most persistent problems: removing gluten-containing grains from oats. This is an area where safety meets commercial pressure.

Oats are naturally gluten-free, but they are routinely co-harvested and co-transported with barley, wheat, and rye, all of which are allergenic. Visual separation is extremely difficult. The consequences of failure – product recall, regulatory sanction, and harm to the consumer – are severe.

"We've achieved unprecedented levels of removal for barley, wheat, and rye from oats," says Penna. "Traditional sorters, while meeting regulatory standards, cannot match the precision of the AI700. For processors supplying certified



> We built this machine to answer the questions processors are already facing, and the ones they will face tomorrow.

Janine Wegmann, Head of Product Management at Bühler SORTEX

gluten-free markets, that gap matters enormously." It matters commercially, too. Higher output purity means more product reaching the market, stronger relationships with retailers and certification bodies, and reduced write-offs from rejected batches. The AI700 achieves this not by rejecting more, but by rejecting more accurately. Its CNN-powered classification resolves uncertainty with understanding rather than caution, accepting what should be accepted and rejecting only what should be rejected.

The numbers clearly make the case. "A 5 to 10 per-cent improvement in reject concentration, sustained over a full production year, can translate to hundreds of thousands in revenue that would otherwise have been lost," says Penna. "The yield lost or gained is a key catalyst in the success of a business."

For processors in the gluten-free segment, this is not just a marginal gain. It is a structural improvement in how the line performs and in the quality assurance story that they can tell every partner in their supply chain.

Built to work from the start

While traditional sorters require specialist setup and ongoing calibration, the SORTEX AI700 is designed to eliminate that dependency; because it arrives pre-trained on millions of images, minimal manual configuration is required. The machine is ready to sort accurately from day one, applying consistent decisions derived from deep learning regardless of who is operating it or when. Shift changes, staff turnover, varying operator experience – none of this affects output quality. "It essentially works straight out of the box," says Penna. "The risk of human error is removed. Consistent quality is guaranteed regardless of shift or operator experience."

In a food safety context, that consistency is critical. A sorter that performs differently depending on how it was set up introduces variability into a process that demands certainty. The pre-trained intelligence of the AI700 eliminates that variability at source.

Shaping the industry's future

The AI700 is not a response to a single customer need, it is a response to a convergence of pressures that are reshaping the economics of food processing.

Raw material costs are on the increase. Every percentage point of improved yield carries greater financial weight than it did just five years ago, while climate change is increasing the variability and prevalence of defects in harvested grains.

"The future presents global challenges in food processing which, if left unaddressed, will damage both processors and consumers," says Janine Wegmann, Head of Product Management at Bühler SORTEX. "We built this

To find out more about the SORTEX AI700, scan the code or email sortex@buhlergroup.com.





SORTEX AI700 provides real-time data on raw material quality, empowering decision-making.

machine to answer the questions that processors are already facing, and the ones that they will face tomorrow."

The AI700's architecture is built for this uncertainty. Trained initially for oats, it is already being prepared for expansion into almonds, various other tree nuts, and additional grain applications. Each new commodity capability will be deployed via the cloud, meaning that machines which are in the field today will become more capable over time, adapting to new markets, new regulations, and new challenges without the need for replacement.

Already delivering results

The SORTEX AI700 launched in London in May 2025 and is already operating in oat processing facilities. Early adopters in the gluten-free market report improved defect detection, yield, and ease of use.

"This is the most sophisticated optical sorting solution that we've ever developed," says Wegmann. "SORTEX AI700 doesn't just meet existing standards, it sets new ones."

For processors that are ready to move beyond the limitations of color sorting, AI700 offers a clear and proven path forward: safer product, better yields, smarter operations, and a platform that grows with the demands of the industry.



Melvyn Penna, Senior Product Manager at Bühler SORTEX.

How Bühler turns AI into customer value

Successfully implementing digitalization and AI into industrial processes is a journey with many steps. Building on a solid foundation, Bühler is making progress on that journey, weaving powerful new digital and AI tools into its solutions and services, experimenting, developing expertise, and sharing the benefits. And at every step, creating provable value for customers.

VisionBoost Grain Analyzer

Why

Whiteness and uniformity are the key characteristics rice millers strive for in their product. Today, quality is monitored by manually testing a subset of samples. Could AI technology provide a better, affordable solution?

What

VisionBoost is a cost-effective grain analyzer that can predict the quality of the product on the production line and give more transparency on product process flow, enabling rice millers to balance quality and yield.

How

With a dedicated imaging system, AI algorithms, and edge computing, it captures grain images, classifies kernels, calculates quality statistics, and displays results through a plug-and-play touch interface.

Where

Already implemented in Bühler's milling laboratory in Wuxi and field-tested at Huanghai Farm in Yancheng, Jiangsu, China, it has achieved 94% overall accuracy in predicting head rice, broken rice, and bran streak grades.

Fully automated roller casting

Rollers are key to many processing steps in the food, feed, and advanced materials industries. Manufacturing them requires high temperatures and creates dust. Can AI help to increase manufacturing capacity while guaranteeing a stable and reliable casting process and the safety of operators?

A new fully automated centrifugal casting line integrates AI-powered visual monitoring, intelligent control systems, and rail-guided vehicles (RGVs) to transport molten iron from the furnace to the spinning machines. This improves transparency and traceability while reducing safety and environmental risks.

The sensors installed on RGVs and spinning machines collect real-time data and monitor the process. AI-trained cameras automatically set off an alarm when human movement is detected in the casting area.

The system has been successfully piloted in highly complex environments like Bühler's manufacturing site in Wuxi, China. It is being rolled out to more areas including assembly and warehousing.

AI-enabled smart manufacturing

Bühler continuously pursues efficiency improvements in its manufacturing processes. AI-enabled smart manufacturing combines human-centered leadership, lean-based operations, and technology-led transformation to deliver better product quality, improved delivery performance, faster response to market changes, and stronger long-term competitiveness.

Building on clear and stable lean processes, Bühler is embedding technologies like AI, digital twins, and robotics in its daily manufacturing processes.

"Transformation rather than disruption" is the motto, meaning that change is implemented step by step on a solid operational foundation. The approach is human-centered, with a focus on upskilling employees.

Smart manufacturing is currently being driven across Bühler's global manufacturing network, with Greater China serving as an important benchmark and pilot region.


AZİM GROUP HOLDİNG
AKHAN MAKARNA
AKHAN MAKARNA



AKHAN UN

A vision born in the fields of Mesopotamia

Text: Ellen Thalmann

Photos: Emre Boyoğlu

The milling company Akhan Un has been in the flour business for decades – today milling 33 different kinds of flour from the high-protein wheat grown in Türkiye. In 2024, founder and Chairman Orhan İlhan decided to make a play for the fast-growing global pasta sector, aiming to have a factory with multiple lines producing high-quality pasta in just 16 months. To fulfill this vision, he chose Bühler as the company's partner.

Seen from the sky, the wheat fields around the city of Mardin in southeastern Türkiye might be mistaken for a desert – acres and acres of honey-colored tracts patchworked across the landscape. But this area, which belonged to ancient Mesopotamia along with neighboring Syria, Iraq, and parts further south, is known as the "fertile crescent," one of the most agriculturally rich regions on Earth. Situated between the Tigris and Euphrates rivers, it is considered the birthplace of civilization. The region is also the world's largest producer of durum wheat, the high-protein staple of cuisines around the world – and the basis for semolina used in making pasta.

In the late 1990s, Orhan İlhan, the owner and founder of today's well-known flour miller, Akhan Un, had begun producing animal feed at a plant in Mardin, situated in the midst of Türkiye's durum wheat-producing region. Coming from a family of farmers, İlhan knew the raw material well. "There is very valuable durum wheat in Mesopotamia," he says. "Some of the world's highest-quality wheat is grown in Mardin."

His company reflects both the history and the aspiration: Akhan is a Turkic name meaning "noble leader", while Un means simply "flour." In 2008, Akhan Un began milling flour, adding factories in Mersin and Adana in southern Türkiye that today produce 33 different types of flour – used for everything from pizza to baklava.

Expanding into pasta

As regional demand surged during the Iraq War, Akhan Un expanded their production significantly. But by the early 2020s, Orhan İlhan recognized the need to diversify. He decided to pursue a vision inspired by the golden durum wheat fields of southeastern Türkiye, lending their color to a new golden product. His vision was underpinned by the fast-growing global market for nutritious, high-protein, and high-quality semolina pasta.

In 2024, the company decided to act. "We needed to make this change. We used to export mainly to Iraq and the Middle East with our flour mills," says İlhan. "We have four flour mills – one in Mersin, one in Adana, and two in Mardin. We transformed the fourth facility, here in Mardin, into a semolina mill and added a new pasta factory next to it." To do so in the short time that Orhan İlhan envisioned was no easy task. It meant finding the right partner who could provide top-of-the-line machinery and also get the plant up and running as quickly as possible – starting with multiple different lines of pasta.

"Of course, we are good researchers. Before making this investment, together with my teams and engineers, we traveled around the world. Which machines should we buy?" says İlhan. "In our research, we decided on Bühler as the best machinery in the world. We visited and toured many Bühler factories. We were in Switzerland, then went to Germany, and spent time in Italy to examine these plants."

Nenad Stamenkovic, Project Manager at Bühler, remembers the day he got the call. The executives at Akhan Un outlined their ideas and also their ambitious timeline of 16 months. "From the beginning, we



Akhan Un has two long-good lines and two short-good lines. The first three were installed in 16 months.



The relationship with Bühler goes beyond technology – it is more like a close partnership.

worked very closely together to better understand their needs and their commitment to quality, which motivated me to act fast," says Stamenkovic. "We spent one year and four months from the first contact to running three lines – which is amazing."

The right raw material and technology

For Akhan Un, diversifying into pasta was a logical step. "The raw material is the same and we thought if we produce flour we can produce semolina. If you produce high quality semolina, the pasta is absolutely going to be better," says Muhammed Musa İlhan, General Manager at Akhan Un. But without the right technology, consistent daily production of a high-quality pasta wouldn't be possible, he says. "Of course, technology is really important. That's why we chose Bühler."

Grown in Central Anatolia and southeastern Türkiye, durum wheat is the hardest variety of wheat, known for its high protein and high gluten content. One hundred grams of durum wheat pasta contains 12 to 15 percent protein. When coarsely milled, it becomes semolina. The grind is important: the difference between flour and semolina comes down simply to how finely or coarsely the durum wheat is milled.

Watch this video to learn more about how Bühler supports Akhan Un.

Factory production of pasta in Türkiye began around a hundred years ago in the 1920s and shifted to an industrial scale in the 1950s. Today, Türkiye is the third-largest pasta producer in the world and the second-largest exporter after Italy. An affordable staple with a long shelf life, pasta is also an easy way to provide a nutritious meal for families that

can be highly varied with sauces or other ingredients, says Muhammed İlhan. The growing demand for pasta worldwide factored strongly in Akhan Un's decision to enter the market. As of 2023, the global consumption market for dry pasta was more than 16 million tonnes or USD 29.5 billion value worldwide. In 2025, Türkiye was set to soon become the world's largest pasta exporter head-to-head with Italy, with an estimated 1.5 million tonnes exported last year. That is up considerably from 2023 when Türkiye exported 1.246 million tonnes, compared to Italy's 1.941 million.

"We will make Turkish pasta a global brand," says Orhan İlhan. That's the ambition of the company, with its focus on quality and superior raw materials. "We will break the perception of Turkish pasta in foreign markets. The world will meet a pasta taste it has never experienced before." The goal is to export around 80 percent of their capacity and sell the other 20 percent locally.

From Turkish cuisine to the world

At home, as in many parts of the world, pasta is a staple of Turkish cuisine – with beloved dishes that reflect the regional palate, such as eriste, egg noodles served with a yogurt-garlic sauce and walnuts. An alternative to the traditional manti – meat-filled dumplings – has become popular with families who turn to yalancı manti – "fake dumplings" – as a time-saver. The meat filling is served as a sauce over short pasta. "Pasta consumption in Türkiye is eight kilograms per capita annually," says Orhan İlhan. "It is one of the top ten consumers worldwide."

Gaining a foothold in high-quality markets is the aim. "With Bühler equipment, we can control every step of our production, and we can

> "With Bühler equipment, we can control every step of our production, and we can produce stable quality for our customers."
>
> **Muhammed Musa İlhan, General Manager at Akhan Un**

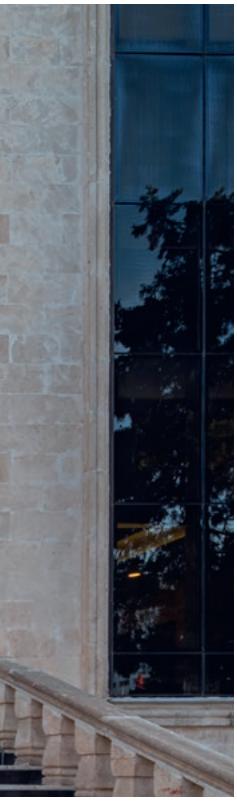




Muhammed Musa İlhan checks the quality of the freshly produced spaghetti during the drying process.

> “From the beginning, we worked very closely together to better understand their needs and their commitment to quality.”
>
> Nenad Stamenkovic,
> Project Manager at Bühler





produce stable quality for our customers,” says Muhammed İlhan. “Thanks to the controlled dough preparation, pasta extrusion, and optimal climate control in the dryer and cooler, we achieve the highest product quality – which is why we chose Bühler.”

The plant’s pasta lines use Bühler Priomatik presses – a pasta press designed to process coarse semolina. The Priomatik enables hydration of the dough for perfect gluten development and has hygienic components that align with strict food safety rules. The pasta lines are also equipped with a full vacuum system – one of the first installed in the region – which helps remove air bubbles from the dough and ensures consistent quality. Drying machines, such as a shaking pre-dryer and a C-line dryer, are also key for ensuring a long shelf-life. Moreover, the long-goods lines are equipped with the latest Bühler cutting machine available on the market.

“We can be proud of the modern solution when we walk through the plant,” says Nenad Stamenkovic. “We can see high-end machines. We can see high-end automation solutions. We can also see services from Bühler. So overall, it's one of the most qualitative plants.” When Bühler is not onsite, the engineers are monitoring the production line remotely

and can control the processes. Muhammed İlhan says this allows him to focus on key aspects of the business, such as the quality of the raw materials, analysis of production, and exports.

Closing a circle

Even before considering quality and efficiency, Akhan Un looks at sustainability. The company uses solar energy to power parts of its production. Closing the circle with its animal feed business, the factory reduces waste by saving any broken pasta as a high-protein additive in animal feed mills.

Today, the pasta lines in Mardin are run 24 hours, seven days a week, and therefore Akhan Un analyzes the consistency of quality day and night. The factory has a capacity of 10,800 tonnes per month, with 250 employees running three production lines: one for making long-good pasta, such as spaghetti or vermicelli, and two for making short goods, like fusilli or penne. An additional long-goods line was ordered during the installation of the first three lines and will be ready for production in September 2026. One reason for starting with multiple lines is that for any brand to gain a foothold, they must offer more than one type of pasta, says Muhammed İlhan. This is especially important for the export markets like Asia, Europe, and the Americas, which Akhan Un is targeting.

Getting three lines up and running in 16 months was no small feat: “I split the whole project into several shipments. And this helped us to start the installation very early,” says Nenad Stamenkovic. “We started with one line, then with the second line, then with the third line. Then we went back to the first line to complete it. With this approach we had a very fast installation time.”

A partnership for new ideas

Working with Bühler goes beyond technology, Muhammed İlhan says. “Anytime, night or day, I can call them, and I can ask something different. For example, I can get help for new investments and we brainstorm together. It is like a partnership; we are almost like family.”

The ability of manufacturers to discuss major investments with local teams from Bühler creates trust in a project like the one with Akhan Un. “We know their pain points, and they know us,” says Bülent Özşahin, Head of Sales Grains & Food at Bühler Türkiye. “People feel much more comfortable when they are talking in their mother tongue, and this creates a good synergy with the customer. We can support customers locally with our service and back-office teams.”

Akhan Un has big plans for the coming years. It wants to be a major food player in Türkiye and abroad. “Currently, our four-line pasta investment is not sufficient for us. We are planning and targeting additional investments because our current 360 tonnes daily capacity is not enough. We are planning further expansion. The Group is growing and diversifying,” says Orhan İlhan. To raise money, the company started trading on the Istanbul Stock Exchange in 2026 – a move toward the development that İlhan envisions: “From frozen products to fresh products to pasta – you will find all of them. All of these will, one by one, turn into investments when the time comes.”

“Pasta was our dream investment,” says his son Muhammed İlhan. “Bühler has one of the best technologies for producing pasta. That's why we met with Bühler, we decided to work with Bühler – and now we will continue.”

AKHAN UN

Akhan Un, in Mardin, Türkiye, began producing animal feed at the end of the 1990s and has been milling flour for the food industry since 2008. In 2024, they decided to expand into pasta production and invested in four pasta lines from Bühler. Akhan Un's goal is to make Turkish pasta a global brand.



“In our research, we decided on Bühler as the best machinery in the world.”

Orhan İlhan,
owner and founder
of Akhan Un


VET-CONCEPT
08 00 / 66 55 220



VET-CONCEPT

The well-being of pets starts before the bowl

Text: Katja Hartmann

Photos: Fabio Reichmuth

What do dogs and cats need to thrive? This question has shaped Vet-Concept since its foundation. As a development partner for the new Nutrex 7 Series extrusion solution, the company contributed its experience, translating its commitment to quality, safety, and responsibility for animal well-being directly into the production technology of the next generation of extruders.

Just a few kilometers from Trier, Germany's oldest city, Vet-Concept is exploring a modern-day question: what kind of food do dogs and cats need to thrive?

Even in Roman Trier, animals lived closely alongside people – dogs as companions and cats primarily as valued helpers that kept mice and other pests at bay. This relationship has changed significantly over the centuries. Companions have become family members, and food has become an important building block for health and well-being. This is precisely where Vet-Concept comes in. At its site in Föhren, the company produces high-quality food for dogs and cats, tailored to different health needs and stages of life.

Since its foundation in 1999, Vet-Concept has been guided by a clear conviction: nutrition can do more than meet an animal's daily requirements. It can support animal health, promote well-being, and provide pet owners with guidance and reassurance. This commitment runs through every area of the company, from product development and nutritional advice to pet-food production.

At its production site, where two Bühler PolyTwin extrusion lines have been in operation since 2015 and 2017, Nutrex 7 Series, the twin-screw extrusion system, now marks the next step. The expansion is more than an investment in new processing technology. Vet-Concept has chosen an extrusion solution it actively helped develop. The company was able to provide its requirements for hygiene, flexibility, product safety, and process stability at an early stage and sees these consistently reflected in the new generation of extruders.

An idea born in a veterinary waiting room

Vet-Concept's founders, Anita Theis and Torsten Hertz, met at a vet practice. Both owned a dog, and both were concerned with the question of proper nutrition. "From the very beginning, we firmly believed that every animal is different, and that specific circumstances and illnesses require a much more individual approach," says Dr. Anne Kinast-Dörries, Head Veterinarian at Vet-Concept, who has been responsible for the company's scientific and veterinary development since 2003.

This sparked the ambition to develop food for dogs and cats with different needs – from puppies and kittens to senior animals – as well as animals with illnesses or specific dietary requirements, like lowering blood sugar level or allergies. At the time, veterinary diets were not as widely available in the German market as they are today.

Vet-Concept does not view pet food as a lifestyle product, but rather as a responsibility towards the animal. Love and appreciation are essential, says Dr. Kinast-Dörries. However, it is equally important not to humanize dogs and cats, but to respect their natural needs. "Our animals are members of the family – but they remain dogs and cats with their own species-specific needs," she says. The focus is on healthy nutrition that meets the needs of the individual animal and its species.



> “Our animals are members of the family – but they remain dogs and cats with their own species-specific needs.”

Dr. Anne Kinast-Dörries, Head Veterinarian at Vet-Concept

Close collaboration with veterinarians and veterinary practices plays a key role in this. Nutrition can only be tailored to an animal’s needs if you know the animal and its individual circumstances. For Vet-Concept, advice is therefore not an additional service, but an integral part of its holistic nutritional approach. When it comes to raw materials, quality also takes precedence over price. Stefan Spiegel, a certified miller and Production Manager at Vet-Concept, says, “Our aim is to purchase based on quality, not price; only then can we use higher-quality raw materials.” Anyone producing food for sensitive animals and special requirements must take a consistent approach to quality, from the selection of raw materials and production through to the finished kibble.

Small batches, precise requirements

For pet owners, individually tailored nutrition means providing food that meets their animal’s specific needs. For companies producing pet food, however, this requirement presents specific challenges. Alongside larger standard production runs, Vet-Concept manufactures a wide range of specialized recipes in varying batch sizes. Frequent product changes and changeovers are part of everyday production. At the same time, every recipe must meet the highest standards of process reliability, hygiene, and product quality. Each variety must be produced reliably and reproducibly, with consistently high quality.

Vet-Concept also supports scientific projects in collaboration with universities and research institutions. For some of these projects, batches of just 500 kilograms are extruded. This helps researchers investigate specific questions under real-world production conditions.

“With our products, it is important to produce each variety without cross-contamination and ensure consistently high product quality. That requires planning, cleaning, and a production setup designed for sensitive recipes,” says Spiegel. The sequence in which standard and highly sensitive foods are produced must be carefully planned. Cleaning and short changeover times also play an important role in efficiency.

This is complemented by an understanding of quality that extends beyond the external shape of the kibble. What matters is how the raw materials,



Extruded kibble must be uniform in shape and size to ensure that dogs and cats accept it.

recipe, processing, structure and, ultimately, digestion in the animal interact. Particularly with sensitive recipes, this requires precise coordination across every stage of the process.

Achieving this level of precision takes experience. Spiegel has been familiar with these processes since the beginning of his career. As a trained miller, he began working with Bühler equipment early on. Vet-Concept's former production partners also used Bühler technology. When the company brought production in-house in 2015, it chose two Bühler PolyTwin lines. The initial goal was to produce its proven recipes reliably in-house. In practice, the benefits went further. Some challenging recipes, particularly potato-based products, performed better on the company's own lines. Extrusion had a noticeable effect on the kibble, the degree of processing, and consequently the animals' acceptance of the food.

For Vet-Concept, technology is therefore closely linked to its own commitment to quality. At the same time, a growing company needs production capacity that can keep pace with demand without compromising on quality or safety.

"We saw the exacting requirements that Vet-Concept places on the production of small batches and sensitive recipes," says Andreas Moster, Area Sales Manager at Bühler. "We wanted not only to understand these requirements, but also to incorporate them specifically into the development process. It was therefore an obvious choice for us to involve Vet-Concept in the development of the Nutrex 7 Series at an early stage."

When practical experience shapes development

Four decades of experience in extrusion and hundreds of installations worldwide provided Bühler with the foundation for developing the Nutrex 7 Series. But the perspective of the equipment manufacturer alone would not be enough for the next generation of twin-screw extrusion. "The benefits of the Nutrex 7 Series are strongly rooted in experience gained in industrial production environments, where equipment must be operated, cleaned, changed over, and maintained every day. The key was to take a holistic view of the extrusion system within the food and feed processing chain," explains David Meile, Project Manager R&D at Bühler.

Bühler approached customers in the food and feed industries to incorporate their experience into the development process at an early stage. Vet-Concept was invited to contribute its requirements and expectations for pet food production. Over the course of several months, meetings and discussions with the Bühler team developed into a productive, practice-oriented collaboration. "We were able to contribute our experience particularly in the area of hygiene. Issues such as better access for cleaning and the arrangement of technical components are crucial in day-to-day operations. Bühler took on board and implemented a great deal of our input," says Spiegel.

Watch this video to learn more about how Bühler supports Vet-Concept.



> The benefits of the Nutrex 7 Series are strongly rooted in experience gained in industrial production environments, where equipment must be operated, cleaned, changed over, and maintained every day.

David Meile,
Project Manager R&D
at Bühler

Technology that simplifies everyday operations
With the Nutrex 7 Series, Bühler is pursuing a holistic approach. “We focused on four main categories: hygienic design, process stability, integrated intelligence, and service excellence. The aim of all four is to increase overall equipment effectiveness, or OEE, for our customers,” says Stefanie Hardtmann, Product Management Value Nutrition at Bühler.

For Vet-Concept, these categories are most relevant when their benefits can be felt in everyday operations. A system has to not only deliver high performance, it also has to remain predictable, accessible, and easy to manage. This is particularly the case where product changes are frequent and recipes are sensitive. What matters in this case is how easily processes can be monitored, how quickly operators can respond, and how reliably the system can be brought into a stable production state.

The Nutrex 7 Series is therefore designed for short and efficient cleaning processes. The system is made of stainless steel and designed for wet cleaning both inside and outside. The hygiene concept is complemented by solutions such as the patented cleaning lance, which supports effective internal cleaning while also helping to improve operator safety.



Careful examination of the kibble’s shape and pore structure provides insights into its properties and enables precise control of the production process.



The hygienic design of the Nutrex 7 Series twin-screw extruder shortens cleaning times.



"Externally, we opted for a more streamlined extruder design. The raised base frame provides greater ground clearance, while the hydraulic unit has been moved from beneath the extruder to its side. This provides direct access for cleaning equipment, simplifying the cleaning process, and reducing cleaning time," explains Meile.

The control system has also been redesigned. It provides a schematic overview of the individual process steps – from weighing, preconditioning, and extrusion through to cutting. The browser-based control system enables monitoring and operation from any location. Messages and alarms can be identified quickly, allowing operators to respond more effectively.

Another component is StepFlow. When an extrusion process is started, it often initially produces material that does not yet meet the required quality standards. Vet-Concept is also familiar with this start-up material. "We send material like this for biogas production, where it is used to generate electricity," says Spiegel. But avoiding waste is better than recovering it: every reduction in start-up losses saves raw materials, time, and energy. This is precisely where the strength of StepFlow lies. "The StepFlow function automatically executes the fastest start-up procedure based on predefined production

> "When you see that your own experience has been taken on board and implemented, it creates trust – and that is an essential prerequisite for an investment."

Stefan Spiegel, Production Manager at Vet-Concept

parameters. This can reduce waste by up to 30 percent per production run," says Adrian Staerkle, Team Manager R&D Automation Software at Bühler.

Co-development builds trust

The Nutrex 7 Series is designed as a modular extrusion platform that is capable of meeting a wide range of requirements in food and feed applications. The Vet-Concept project provides a strong example of why Bühler involved customers in the development process at an early stage, as many of the requirements emerge not at the drawing board, but only when day-to-day operations begin.

For Vet-Concept, the collaboration was therefore more than just a technical exchange. "It is important to us that a system is designed with real-world production in mind," says Spiegel. "When you see that your own experience has been taken on board and implemented, it creates trust – and that is an essential prerequisite for an investment."

The expansion in Föhren therefore brings two developments together: the growth of a company that consistently puts animal health at the heart of its work, and a new generation of extruders co-developed based on practical industrial experience. Vet-Concept's story began in a veterinary waiting room. Today, it continues in a production environment where quality, responsibility, and technology come together – long before the food reaches the bowl.

VET-CONCEPT

Founded in 1999 in Föhren, Germany, Vet-Concept produces premium dietary food for dogs and cats of all ages and nutritional needs. The direct-to-consumer supplier for German-speaking Europe has used Bühler extrusion technology since 2015 and is now adding the twin-screw extrusion system Nutrex 7 Series and a two-pass conveyor dryer SmartFeed II.



Close collaboration during development has resulted in a new extruder that is practical and user-friendly.

QINGDAO PORT

The age of the smart port has arrived

Text: Rocco Chen

Photos: Cecilia Lian

At Qingdao Port in China, two PortaSmart Ship Unloaders are redefining how bulk grain moves through one of the world's busiest maritime hubs. Combining LiDAR scanning, real-time sensing, and autonomous control, Qingdao Port has achieved record-breaking unloading performance – pointing the way toward the next generation of smart ports.


山东港口
SHANDONG PORT GROUP
青島港
Qingdao Port
限高：6.2m
自重：600t
产量：1250t/h
BÜHLER

As global trade patterns shift and countries strengthen food security and supply chains, the pressure on ports is increasing. Nations are investing heavily in import infrastructure – from high-capacity silos to advanced terminals – to handle growing volumes efficiently and reliably.

In this environment, competition between ports is intensifying. To attract shipping companies, operators must offer not only capacity, but also speed, reliability, and consistent performance. Fast vessel turnaround times, minimal berthing delays, and high safety standards have become decisive factors.

At the center of this transformation lies automation. Traditional, operator-dependent unloading processes can limit efficiency, create variability, and introduce downtime. At the same time, ports face labor shortages, rising safety requirements, and the need for greater process transparency.

Qingdao Port: a gateway to global trade

Located on the Yellow Sea, Qingdao Port is one of China's largest and most technologically advanced maritime hubs. It connects to more than 700 ports in over 180 countries and regions. Since it opened to international shipping routes in 1992, it has continued to expand, investing in automation, advanced digital infrastructure, and green logistics.

Today it is one of the world's busiest multipurpose ports and a key hub for bulk dry cargo such as grain and oilseeds. It is the fourth-largest port in China, with a cargo throughput of more than 700 million tonnes in 2025, and regularly sets world records for container handling efficiency. Qingdao Port's scale, efficiency, and regional connectivity make it strategically vital to China's trade and logistics system.

Qingdao Port offers fast turnaround and high safety standards to attract shipping companies.



"Qingdao Port has always been at the forefront of port innovation," says Liu Minghui, Equipment Supervisor of the Fixed Machinery Dept, Dongjiakou Branch, Qingdao Port. "We are continuously improving our facilities and our services for our customers. For this project, we decided to introduce fully Smart Ship Unloaders in order to improve efficiency, reduce berthing times, and lower service costs."

To meet these goals, Qingdao Port partnered with Bühler to deploy two Smart Ship Unloaders – the first of their kind for bulk grain handling worldwide. It also helped that Bühler has a strong local presence and implementation expertise in China.

Turning ambition into reality

From the outset, expectations were high. "When we met the team from Qingdao Port in 2022, they told us they wanted the most advanced, safest, fastest, and highest-quality solution," says Jacky Zhang, Vice President of Grain at Bühler Greater China. "With our digital solutions, advanced automation, and industry knowledge, we were confident we could deliver this."

The Bühler team carried out a comprehensive investigation to better understand how to convert these requirements into detailed specifications. It meant using emerging technology and collaborating closely with the customer and partners. The solution was developed using LiDAR (Light Detection and Ranging) scanning technology, advanced algorithm-driven 3D modeling, digital twins, and intelligent monitoring.

"The team at Qingdao Port already had experience of applying cutting-edge technology such as LiDAR and cloud-based systems – they have their own terminal operation and equipment control system. Our task went beyond simple connectivity. We fully integrated our unloader into their operational ecosystem and automated the machine itself, from positioning and hatch detection to optimized unloading and autonomous repositioning," says Jacky Zhang. "We turned a manually operated unloader into an autonomous system at the heart of a complete smart solution."

One challenge the team faced was that the port was so busy that there was no time to carry out every physical test on site. "We established a dedicated task force to review the plan and adapt



> “The team from Qingdao Port told us they wanted the most advanced, safest, fastest, and highest-quality solution. With our advanced digital and automation solutions, and our deep industry knowledge, we were confident we could deliver this.”
>
> **Jacky Zhang,**
> **Vice President of Grain**
> **at Bühler Greater China**

it to the demanding on-site conditions, allowing us to deliver reliably despite the port’s intensive schedule,” says Andy Li, Director of Grain Quality at Bühler Greater China.

Another challenge was the continuous vertical movement of the vessel during unloading caused by tidal changes and the shifting cargo load. The system had to be able to compensate for these movements in real time.

“This is quite demanding and combined with the harsh environmental conditions at the terminal requires a robust real-time control system. We built digital twins of the complete system, covering both its geometry and the live position of the unloader,” says Andy Li. The algorithms continuously identify the optimal unloading point within each hatch and automatically reposition the unloader as the operation progresses. In parallel, a separate condition-monitoring module tracks vibration and temperature to safeguard the equipment’s maintenance status.

From manual to autonomous operation

The process of unloading the grain is carefully orchestrated at every step. The LiDAR system scans the ship to determine its geometry and the location of the hatch. GPS-based positioning combined with LiDAR and multi-sensor arrays enable precise location tracking and reliable collision avoidance. The smart control system continuously calculates the optimal path using real-time sensor data. This enables it to deliver smooth, efficient, and uninterrupted loading and unloading operations.

Previously, this was handled manually by an operator sitting high up in the operator’s cabin, often working in hazardous conditions. With the

> “The PortaSmart is a true game-changer. With the successful completion of this project, Qingdao Port has set a new benchmark for smart port operations.”

Liu Minghui, Equipment Supervisor of the Fixed Machinery Department at Dongjiakou Branch, Qingdao Port

new PortaSmart unloaders, the machines operate autonomously – no operator is needed at the machine or on the pier. From a remote-control room, a single supervisor can monitor and manage several unloaders at once, with the option to take full manual control remotely at any time. Removing personnel from the pier during operations markedly improves safety and raises productivity.

Intelligent operations mean real-time information collection and calculation, closed-loop control, and continuous optimization of the operation process, dynamically adjusting the ship loading and unloading schedule through data analysis to improve efficiency.

Advanced algorithms minimize downtime by optimizing every movement – significantly increasing throughput while reducing both time and operational costs. Multidirectional sensor arrays ensure precise positioning and deliver enhanced equipment protection, all based on live data and real-time feedback.

All this translates into increased productivity, reduced labor intensity, and improved safety. Faster shift changeovers and smarter equipment positioning reduce delays, and equipment downtime is reduced by up to three hours per day.

Breakthrough performance

For Qingdao Port, the benefits go far beyond operational improvements. Faster unloading reduces vessel waiting times and enhances service levels, strengthening the port’s competitiveness in global trade.

The new Smart Ship Unloaders are also breaking records. On April 25, 2025, thanks to PortaSmart, Qingdao Port set a new industry record for grain terminal unloading by unloading 66,626 tonnes of bulk grain in just 22 hours and 57 minutes. Then on November 26, 2025, the record was broken again with the unloading of 68,250 tonnes of wheat in just 21 hours.

The smart and automated functions come on top of the existing advantages of Bühler’s unloaders, with their low energy consumption, low grain breakage, and environmentally friendly operation. The enhancements significantly improve handling efficiency and operational stability.

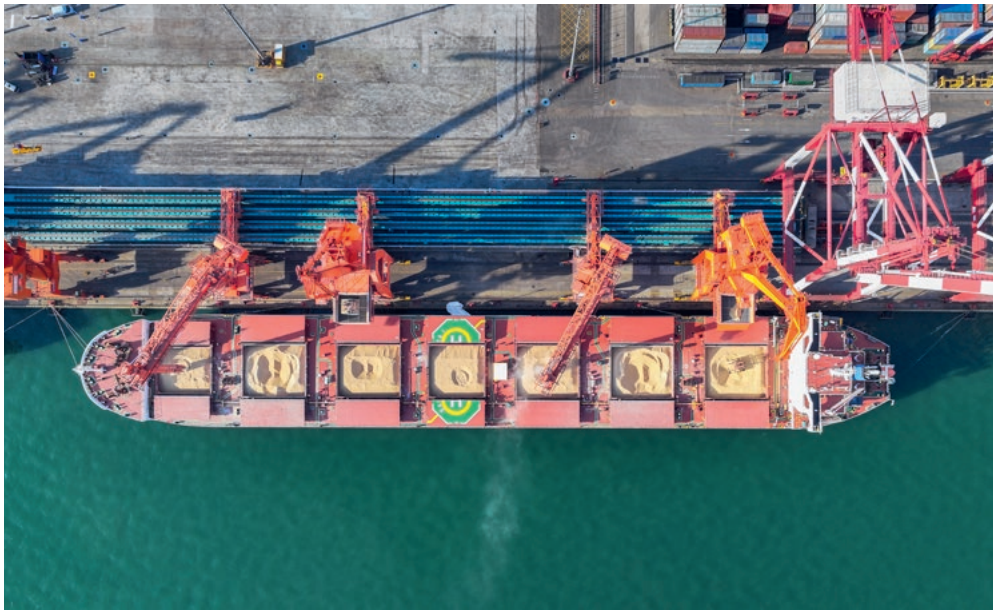
“This was a great example of open innovation with our customer and partners to introduce the latest technology and build a solution,” says Jacky Zhang. “We continuously work to support ports in moving towards automation, intelligence, and informatization, and contribute to the efficient circulation of global bulk grain trade.”

“The PortaSmart is a true game-changer,” says Liu Minghui. “With the successful completion of this project, Qingdao Port has set a new benchmark for smart port operations. And the positive impact of this will be felt more widely as it helps to strengthen the processes that safeguard China’s food security.”

山东港口 SHANDONG PORT GROUP | 青岛港 Qingdao Port

Qingdao Port, located in Jiaozhou Bay, China, is one of China’s largest and most technologically advanced maritime hubs, connecting ports in over 180 countries and regions worldwide. Bühler installed two PortaSmart automated unloaders which autonomously plan optimal unloading paths and sequences.

Right: Continuous improvement of facilities and services is key to staying competitive.



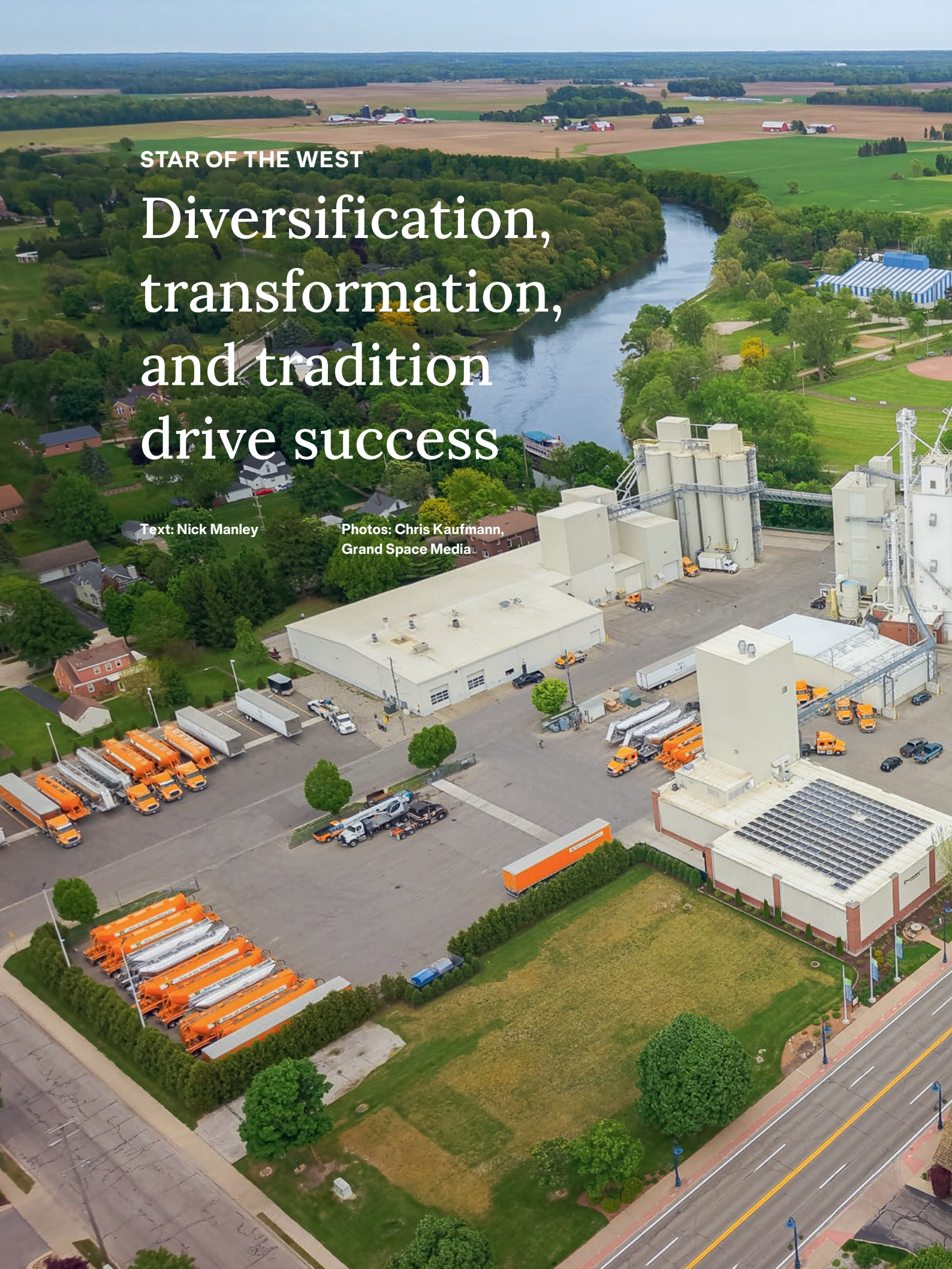
Learn more about Bühler's ship loading and unloading technology.

STAR OF THE WEST

Diversification, transformation, and tradition drive success

Text: Nick Manley

Photos: Chris Kaufmann, Grand Space Media





With two centuries of milling experience under their belt, the team at Star of the West believe that what has brought them this far is transformation and innovation – and that is what will lead them into the future. With a passion for modernization, a diversified product portfolio, a courageous approach, and a close partnership with Bühler, they are driving the company toward success.

Ask anyone from Michigan where in the state they are from, and they will hold up their right hand, fingers straight up and thumb slightly open, and point to an area on their hand. They do this for good reason – the state of Michigan, in the Midwest of the US – is shaped like a mitten. Four fingers together, thumb slightly open. The town of Frankenmuth sits just below that dip between the thumb and the first finger. The town's name translates loosely to "courage of the Franconians". It is a fitting backdrop for Star of the West, a business that has spent generations evolving, investing, and pushing beyond convention.

At first glance, Frankenmuth, with its Bavarian character and old-world charm, does not seem the obvious home for one of the more innovative milling companies in the agri-business segment. Yet that contrast is part of what makes the story of Star of the West so compelling. Beneath the familiar setting is a business that has built its reputation on progress, resilience, and the courage to evolve.

The story of Star of the West is one of continuity and reinvention. Its origins trace back to the Hubinger family, whose milling expertise spans more than two centuries in Germany. When this heritage crossed the Atlantic, it laid the foundation for what would become a well-established Midwest agribusiness. Over time, ownership transitioned to a group of local farmers – embedding the company firmly within the agricultural community it serves.

Today, Star of the West continues to build on that foundation by serving a broad mix of customers, markets, and product needs. Flour remains central to the business, but the company's development is defined by a determination to go further than standard offerings. "In many ways this makes our job a little more difficult," says Karina Spencer, Executive Vice President of Flour Milling for Star of the West. "Because each customer has their own individual needs, their own preferences when it comes to their flour and wheat ingredient inputs. But it also makes our job pretty exciting every day."

Harking back to that courage of the town's founders, Star of the West continually rises to their customers' challenges. "We've never shied away from a challenge," Spencer says. "We like to think of ourselves as innovators. When a customer needs something that doesn't exist in the marketplace, we would like them to come to us and to think of us as their partner in finding the right solution."

And they do. A good example of that is the investment that Star of the West made in its new mill in Ligonier, Indiana. The industry had been challenged with finding a way to reduce pathogens by five logs and still maintain flour functionality. It took several years of research to discover a pathway forward for that, and in the Ligonier mill the company was successfully able to install a novel pasteurization system that is seated right in the middle of the milling process, producing a pasteurized flour for the industry



> We come to Bühler for solutions. We are not only interested in the equipment that they provide. We're looking for a new approach. We don't always take a conventional approach to what we do. We do a lot of unique and innovative things.

Karina Spencer,
Executive Vice President of Flour Milling at Star of the West



Tanner Elliott inspects product off the flaking line.



A Star of the West transport truck gets weighed on the Frankenmuth scales.

that has no impact on the flour's functional characteristics or use in processing.

In normal applications of wheat flour and wheat ingredients, the baker or other processor performs the kill step for pathogens. In certain applications, where consumers can buy refrigerated doughs or baking mixes or cookie dough, the cook step, or kill step, resides with the consumer. Using a pasteurized flour in these applications ensures that the pathogen kill step has already been performed, making the product safe even before a baking or cooking step.

Going beyond the conventional

As long ago as the 1940s, when the company acquired their first dry edible bean processing facility, Star of the West determined that they would "do more than offer conventional flour," as Spencer says. Adopting the broader business mindset of moving from commodity supply toward differentiated solutions, stronger customer relevance, and a more future-ready portfolio has led to the company managing more than 30 locations across six different states. This includes four mills that are producing 46,000 hundredweights (2,337 tonnes) of flour a day.



Sven Kunz and Tanner Elliott review the mill's control system.

"We became diverse as an agribusiness with the intent of sustaining our flour milling business," says Spencer. As the company developed their network of elevators, it was to secure the grain that was grown in the region. As they developed their agronomic services and retail locations, it was to help support the farmers so that they are successful in implementing high yield management practices, ensuring they are profitable in what they do. As they moved into dry edible bean processing, the aim was to facilitate the long crop rotations that are experienced in the state of Michigan.

This dual focus – depth in milling and serving customers across adjacent agricultural segments – positions Star of the West as a responsive partner to customers and reduces reliance on a single commodity, adeptly navigating changing consumer demands.

> Using myBühler improves our workflow by having that access at the tip of our fingers, on any mobile device or tablets.

Tanner Elliott,
Corporate Milling Superintendent
at Star of the West



Sustaining more than business

In a market where customers increasingly expect transparency and measurable progress, sustainability is no longer separate from operational performance. It is central to Star of the West's operations. "We take a commonsense approach when it comes to sustainability," says Spencer. "We are not necessarily interested in just posting solar panels on top of our roof or investing in wind farms. What we're interested in is where social responsibility and business continuity intersect." For Star of the West, this translated into working with their farmers on regenerative agriculture and efficiently operating their mills.

In 2024, the company partnered with Bühler's Environmental Impact Services to conduct a full assessment of its Scopes 1, 2, and 3 greenhouse gas emissions. Along with that, it conducted a life cycle analysis on its flour, giving it the means to quantify the carbon footprint of every pound of flour it produces. The company identified several thousand acres of wheat that its farmers had and worked with them to collect the data on their fields. These efforts combined to give Star of the West an accurate emissions assessment of the flour. "What we were able to find is that, compared to the national average, we achieved a 46 percent reduction of carbon," says Spencer. That paved the way for it to introduce its Star Patent 360° flour, which is a low emission flour. "It does not require any identity preserved program for the grain, and it doesn't require any special handling or processing," says Spencer. "It is a very simple solution for our customers who are seeking to reduce their carbon footprint and meet their own sustainability goals."

Partners in innovation and modernization

"We've been a longtime customer of Bühler, and I think that Bühler has secured its position in the milling equipment industry as the gold standard," says Spencer. "They've earned that reputation." Indeed, Star of the West has made considerable investments over the last ten years in Bühler equipment. In 2016, Star of the West commissioned a greenfield mill, which was a full mill solution provided by Bühler. In 2025, it commissioned an additional three milling units in Ligonier, Indiana. Again, it relied on Bühler technology from start to finish. Then there are the investments made in Frankenmuth. "We've replaced all our roll stands here recently with Bühler equipment," says Spencer. "And in 2021, we commissioned a new Bühler state-of-the-art flaking system."

The flaking system in Frankenmuth is an extension of an already robust product portfolio. It gives the company the opportunity to flake other grains and different inputs. "We have the capability of flaking corn and ancient grains," says Spencer.

"I like to say, if you can grow it, we can flake it." In collaboration with their edible bean division, they've even flaked small red beans and pinto beans. "We can bring beans to more eating occasions, like breakfast, snacking, and on-the-go foods," says Spencer. "They are a nutritional powerhouse that just require a little innovation to deliver them in a new format."

The relationship between the two companies is symbiotic. Star of the West pushes Bühler to innovate, and Bühler provides the solutions to Star of the West that allow it to stretch its creative muscles. "We come to Bühler for solutions," says Spencer. "We are not only interested in the equipment that they provide. We're looking for a new approach. We don't always take a conventional approach to what we do. We do a lot of unique and innovative things."

Star of the West was the first company to help commission Bühler's Food Application Center in Plymouth, Minnesota. And they've returned on several occasions. "We appreciate the ability to do pilot trials with the tools and expertise that Bühler has made accessible to the industry, and we take full advantage of it."

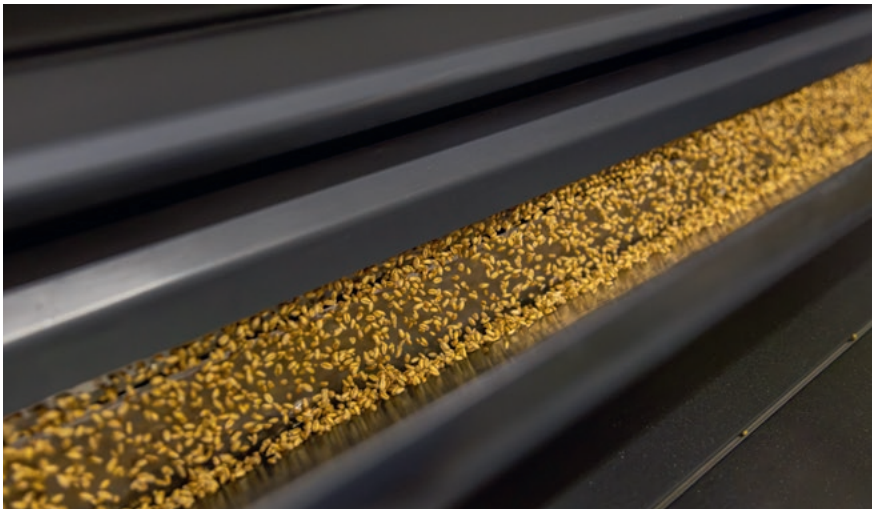
Star of the West's drive to innovate is something that is felt in a very real way by Sven Kunz, Bühler's Sales Director for Milling Solutions in North America. "The approach Star of the West have to their finished products pushes us into a new way of thinking," says Kunz. "It's not just the traditional flour milling way. They push us to come up with new solutions and new innovations."

This is most evident in the pasteurized flour project. How that came to be is another story in itself. Suffice to say it involved wheat being air freighted to France, followed by a trip to Uzwil, Switzerland for a round of successful milling trials in Bühler's Grain Innovation Center. This resulted in a unique process being built into the new Ligonier plant. "The knowledge and the know-how behind the relationship is really what's made Bühler a gold standard in the industry," says Spencer. "And it's why we've partnered with them on these projects."

Star of the West's corporate milling superintendent, Tanner Elliott, echoes Spencer's enthusiasm for Bühler. "It's pretty well known that Bühler makes the best milling equipment in the world," says Elliott. "They also have the technical expertise to help back it up."

Star of the West has a reputation for achieving high outputs compared to other mills. "If that is our reputation, I'd be very proud of that," says Elliott. "I think our group is pretty fantastic in not accepting the standard as our ceiling and really striving to see what we can add or improve on as we go day to day," he says. To help with that, it relies on the performance of Bühler milling equipment. According to Elliott, Bühler systems perform best in class in terms of both quality and performance. The equipment is painless to adjust and can be trusted to hold those adjustments to run a consistent, continuous operation. He backs that up saying: "Not only does it hold well, it's easy to work on, and you can just trust it to do the job you're tasking it to do."

The Bühler flaking line in Frankenmuth allows Star of the West to flake oats, ancient grains, and even dry edible beans.







Tanner Elliott, Karina Spencer, and Sven Kunz inspect the operation of the Bühler fluid bed dryer in the flaking line.

Elliott's praise doesn't stop at the equipment, though. The digital platform myBühler further enhances his experience, offering new ways to troubleshoot, perform maintenance, and increase uptime. "Using myBühler improves our workflow by having access to user manuals at the tip of our fingers, on any mobile device or tablet," says Elliott. He touts the ability to quickly resolve issues at the machine. "You can easily look up the error code that the equipment is giving you and pull it up right on your phone or tablet and troubleshoot it at the machine, which I think is a huge benefit."

Transition as a corporate value

The constant through the Star of the West timeline is transition. It's clear the company's team is comfortable not pigeonholing themselves or living the status quo, a collective cultural trait Spencer attributes to her predecessor, Mike Fassezke. "He's been a true visionary," she says. "I have a great appreciation for his strategic and intentional approach to growing our business." She is taking over leadership of the flour milling division from him after his nearly 50-year career with the company and gives him credit for Star of the West's record of "growing responsibly and synchronously with our supply chain, both upstream and downstream."

That type of thinking has propelled Star of the West since 1870, quietly cementing its place in the food supply chain and building incredible experience. It is an experience that rather than keeping it tied to the past, instead provides a base from which to modernize – with confidence. From Frankenmuth to Ligonier, from conventional flour to differentiated products, and from established operations to new digital and sustainability tools, Star of the West is shaping a new chapter while staying rooted in what made it strong in the first place.

STAR OF THE WEST MILLING CO.

Founded in 1870, Star of the West produces premium wheat flour products and dry edible beans, as well as offering agronomy services to its farmer suppliers. It has four flour mills in New York, Indiana, Michigan, and Ohio, US. Bühler supplies these locations with complete milling technology solutions and ongoing services.

KRBL LIMITED

Redefining basmati excellence, one innovation at a time

Text: Chris Ward Photos: D Muralidharan





Basmati is unforgiving. The very qualities that make it the world's most prized rice – its length and its delicate structure and aroma – also make it difficult to process without compromise. For KRBL Limited, the world's leading basmati rice exporter, accepting compromise is not an option. When a new longer variety was introduced, KRBL worked with long-term partner Bühler to re-engineer the entire process, preserving the grain length that makes it so exceptional.

The global basmati market is booming, valued at over USD 14.4 billion in 2025 and forecast to double by 2035. Yet behind that growth lies a set of challenges that are becoming harder, not easier, to manage. Rising consumer expectations, intensifying food safety regulation, climate volatility, and the relentless pressure of global competition are collectively raising the bar for every producer in the market. For those who fail to meet it, the consequences are immediate and severe.

Food safety regulation is perhaps the most acute pressure point. Over 50 percent of export markets now require strict certification, and standards are tightening year on year. For Indian exporters, the margin for error is very thin: a single batch rejected for exceeding contaminant limits can damage relationships built over decades and trigger reputation loss across an entire supply chain.

Quality is an equally unforgiving challenge. The premium value of basmati depends entirely on the integrity of the grain: its length, its aroma profile, and its appearance in the pack. Yet rice losses, especially in long delicate basmati varieties, are a real risk, driven by brokens during milling, discoloration from improper parboiling/steaming and drying, and defects that slip through due to inadequate sorting. For premium basmati, this loss rate is not profitable or sustainable.

KRBL is the world's leading exporter of basmati rice and has built a premium reputation through an unwavering commitment to quality. KRBL's India Gate brand reaches over 90 countries and more than 11 million households annually.

Maintaining the quality consistency that justifies a global brand premium, not just across one facility, but across multiple high-throughput mills processing millions of kilograms of rice each year, requires a level of technological precision and operational integration that cannot be improvised; it has to be engineered. "Each grain matters to us," says Anil Kumar Mittal, Chairman and Managing Director at KRBL Limited. "To deliver consistent quality worldwide, we rely on precision, consistency, and innovation, and on a technology partner who shares these values. We found that partner in Bühler."

Partnership forged by challenge and opportunity

The collaboration between KRBL and Bühler began more than 30 years ago with cleaning solutions and grew into one of the most influential partnerships in the global rice industry. KRBL's ambition was clear: to build world-class processing capability in India, for the world. The real test of the partnership, however, came with a grain. The introduction of the PUSA 1121 basmati variety transformed the market. Its exceptional



extra-long grain length created fierce consumer demand but posed unprecedented processing challenges. Conventional equipment simply could not handle it without brokens. Together, KRBL and Bühler re-engineered machine designs, process flows, and automation logic from first principles, preserving grain length, quality, and authenticity. That joint innovation became a template for the wider industry.

Addressing the industry challenges of brokens and raw material cost requires intervening at every stage of the milling process, not just at the end. At KRBL, Bühler's technology forms a continuous chain of precision from paddy intake to final packaging – it is a line designed to identify and eliminate losses wherever they occur and to ensure KRBL takes the maximum amount of good product to market.

> “Bühler works with us, not just for us.”



Anil Kumar Mittal,
Chairman and Managing Director
at KRBL Limited



The partnership is not just about machines. “It is about co-creating solutions together, from grain handling to final sorters,” says Prashant Gokhale, Managing Director at Bühler India. “We provide end-to-end systems that meet KRBL standards. Their trust fuels our R&D. That’s how, together, we set industry benchmarks.”

This is a perspective shared by KRBL. “Bühler works with us – not just for us. It is one of the many factors that have helped India Gate Basmati establish a strong leadership position globally,” says Anil Kumar Mittal.



Precision and care at every stage

Most milling brokens do not begin at the mill; they begin at the dryer. Basmati paddy harvested at the wrong moisture level, or subjected to aggressive drying temperatures, develops micro-fractures that are invisible to the naked eye but are devastating to yield.

Here, Bühler’s automatic continuous paddy dryers, deployed at KRBL's facilities, apply gentle drying curves calibrated specifically for the structural fragility of extra-long grain basmati, bringing paddy to the optimal consistent moisture window without inducing the stress fractures that cause brokens downstream.

Above: Optical sorting with the SORTEX R500 substantially improves reject concentration.

Right: Manoj Saxena, Vice President at KRBL Limited (right) in discussion with Jaiprakash Sharma, Key Account Manager at Bühler India (left). KRBL wanted to rethink machine concepts, plant layout, and automation logic from the ground up.





> “It is about co-creating solutions together, from grain handling to final sorters. We provide end-to-end systems that meet KRBL standards. Their trust fuels our R&D. That’s how together we set industry benchmarks.”
>
> **Prashant Gokhale, Managing Director at Bühler India**

In the milling section, the Rubber-Roller Huller TopHusk confronts the challenge of broken rice head-on. A pre-acceleration chute guides each grain precisely between two rubber rollers, minimizing the mechanical shock that causes fracture. Automatic pressure control adapts in real time to changing grain profiles and roller temperature, maintaining consistent hulling performance across long production runs regardless of incoming material variation. The TopHusk Husk Separator follows, using closed-circuit airflow to distribute product evenly across the separating zone, ensuring that clean, accurate husk removal is achieved without a third fraction that would require reprocessing.

Whitening, the removal of the bran layer, is where heat-induced fragility poses the next risk. Bühler’s whitener TopWhite addresses this through a vertical abrasive top-to-bottom working principle that produces the highest whole-grain yield in class, cooling the grain and extracting bran dust, while preventing the thermal stress that causes a higher amount of broken rice.

Bühler’s Polisher UltraPoly then delivers the surface quality that premium basmati demands. The polishing section brings the grain to the smooth, bran-streak-free finish that international markets expect and gives KRBL its signature premium quality.

If the upstream process controls the risk of broken rice, the downstream optical sorting process controls the risk of defect contamination. For export-market basmati, facing tough food safety scrutiny, this stage is not optional; it is absolutely essential. The SORTEX R500, Bühler’s latest rice-specialist sorter deployed at KRBL, is built from the ground up for exactly this challenge. Engineered for easy operation, its high-definition cameras and intelligent algorithms, configured specifically for basmati’s defect profiles, identify and remove discolored grains, chalky kernels, and foreign materials that earlier-generation equipment would have missed. Reject concentration is improved substantially compared to previous sorter generations, giving KRBL the peace of mind to pass regulation standards, every time.

Proven at scale

Today, KRBL operates leading rice mills at two flagship sites: Dhuri, Punjab (120 tonnes per hour) and Ghaziabad, Uttar Pradesh (57 tonnes per hour), along with additional major facilities across India, all powered by Bühler technology. KRBL’s trust in Bühler extends to the innovation process itself: many of Bühler’s new solutions in drying, milling, and sorting are preferably validated at KRBL’s facilities before wider global rollout, making KRBL an active co-developer of next-generation processing technology, not merely a customer.

Watch this video to learn more about how Bühler supports KRBL.

> “Each grain matters to us. To deliver consistent quality worldwide, we rely on precision, consistency, and innovation – and on a technology partner who shares these values. We found that partner in Bühler.”

Anil Kumar Mittal,
Chairman and Managing Director
at KRBL Limited



The grains in KRBL's leading brand, India Gate basmati rice, are naturally long and slender.

The same precision that protects quality also protects the environment. At the scale KRBL operates, the difference between an optimized process and a poorly managed one translates into millions of kilograms of wasted grain, thousands of megawatt hours of unnecessary energy, and a significant volume of water.

In an industry where regulation and consumer demands of food safety are intensifying, the ability to demonstrate measurable environmental performance is no longer a differentiator. It is a requirement for market access.

Shaping the future of basmati

The pressures facing the basmati industry will not ease. Regulations will tighten further. Consumer expectations will continue to rise. And the premium that India Gate commands in over 90 countries worldwide will remain – thanks to KRBL's ability to deliver, consistently, a grain that justifies it. That is not a challenge that can be solved once and forgotten; it must be engineered, monitored, and continuously improved.

By blending tradition with innovation, KRBL and Bühler continue to redefine what is possible in rice processing, one grain, one innovation, and one partnership at a time. For the farmers who grow the rice, the teams who process it, and the millions of consumers worldwide who open a packet of India Gate basmati expecting something exceptional, that partnership is not an abstraction – it is the reason why every grain counts.

KRBL Limited

KRBL Limited is India's first integrated rice company, focused on manufacturing and marketing premium rice products. India Gate basmati is enjoyed in over 90 countries and by 11 million households annually. The partnership with Bühler has grown over 30 years from basic cleaning solutions into one of the most influential collaborations in the global rice industry.


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TWO TRACK MALTING

A story in every sip

From regenerative barley fields in North Dakota to advanced modular malting technology, Two Track Malting is helping brewers and distillers in the US reconnect with origin. By combining agricultural expertise, sustainability, and process innovation, the company is proving that great flavor and a compelling story begin in the field and can be fortified as the business grows.

Text: Nick Manley
Photos: Nick Manley / D&N Cinematics




TWO TRACK
MALTING COMPANY
FIELD
TO
PINT.™



> “I think it’s a pretty world class craft facility. It functions very well, it’s high tech, and doesn’t take a lot of labor. So we’re very proud of what we put together here.”

Greg Kessel, Chairman of the Board at Two Track

Any craft beer aficionado will tell you the most important quality of a great beer is its taste. The second, they will say, is the story behind it – a story shaped by soil and weather, by the choices of farmers and the skill of makers, by local economies and regional identity. For brewers and distillers working in the craft segment, ingredients are narrative building blocks as much as functional inputs. Among those, malt plays a defining role.

Malt influences flavor, color, aroma, mouthfeel, and performance. It also carries something less measurable but equally powerful: a sense of place. Place is at the heart of Two Track Malting. Based in Menoken, North Dakota, Two Track was built on a simple but compelling idea: great malt begins long before grain reaches a mash tun or brewhouse. It begins in the field. The company’s “Field to Pint” and “Field to Spirit” philosophies link brewers and distillers directly to the origin story of their grain – an important way in which they differentiate themselves.

“There are brewers and distillers out there for whom that story is as important as the malt,” says Greg Kessel, Chairman of the Board at Two Track. “And they want to tell the story of where it came from.”

Two Track’s story began with two barley farms – Arrow K Farms and Stober Farms – which moved from commodity grain production to developing their own barley varieties. Using a small, self-built system in nearby Lincoln, North Dakota, Two Track began malting barley in 2015. The company built technical expertise, established a customer base, and proved there was real demand for malt with a strong field-level story. But with demand came limitations, and Two Track needed to grow.

For a craft maltster, growth is not just a matter of upping production via industrial scaling. Customers expect both character and consistency. Brewers and distillers rely on predictable performance from batch to batch – including when they are working with distinctive, regional ingredients.

In searching for a solution that would balance these requirements, Two Track evaluated multiple options before selecting Bühler’s RimoMalt system – a modular malting platform designed to provide industrial-grade process control for craft and specialty producers, while maintaining the bespoke characteristics of a particular malt.

“For us smaller guys, there were no systems we could entertain because they were just too large scale,” says Tyler Unger, Head Maltster at Two Track. “The RimoMalt system has filled that gap.”

Rooted in barley, built on place

Two Track supplies regionally grown, carefully processed malt, linking the finished beer or spirit back to a specific landscape, a farming system, and a set of values. Barley grown in different climates, soils, and with different farming practices can express itself in subtle but meaningful ways in a final product.

Watch this video to learn more about how Bühler supports Two Track Malting.

Working with North Dakota State University, the company cultivated barley suited specifically to local growing conditions and the needs of craft malt customers. This reflects how the concept of terroir – long associated with wine – has gained importance in craft brewing and distilling. Traceability, authenticity, and transparency are increasingly important for consumers, and for many, ingredient origin is key to how beverages are perceived.

For brewers and distillers, this creates opportunities for differentiation. By connecting them directly to the field, Two Track helps strengthen their narrative and stand out in a competitive market. A beer brewed with Two Track malt allows a brewery to highlight regional grain, local expertise, and the specific sensory contribution of well-crafted malt. Origin narratives are already central to many spirits, and malt plays a crucial role in fermentation performance and flavor development.

A system designed for craft scale

As is the case with many craft-focused businesses, the early years of Two Track were defined by hands-on experimentation, close customer relationships, and an entrepreneurial mindset. As the business grew, capacity constraints, labor intensity, and the complexity of malting – a biological process that requires precise control of moisture, temperature, airflow, and time – put pressure on the business to expand. Then, during the Covid-19 pandemic, demand exploded.

"When the Covid pandemic started, we weren't exactly sure what was going to become of us," says Kessel. "But about two months into the pandemic, our business picked up substantially to the tune of more than we could handle."

The appeal of Bühler's RimoMalt lay in its combination of flexibility and precision. "Since the RimoMalt is an all-in-one solution and requires no building to house the equipment, it was a perfect fit for Two Track," says Bob Frassenei, North American sales manager for malting and brewing at Bühler. "They were able to build what they needed today. And then, as they grow, they can add germination and kilning units (GKU) and different features to it."

The system introduces a range of capabilities: automated control, modular expansion, remote monitoring, energy-efficient processing, and integration with packaging. Together, these features provide a structured and scalable production platform. Instead of improvised processes, Two Track can now manage malting with greater precision. Critical stages – steeping, germination, and kilning – can be more tightly controlled, helping ensure consistent product quality. Importantly, automation does not replace the craft element. It supports it.

RimoMalt's automated operation and user-friendly interface reduce the burden of constant manual oversight, allowing maltsters to focus on quality and customer needs rather than routine adjustments. Remote operation is particularly





Left: Jared Stober, CEO at Two Track Malting.

Right: After steeping, barley is moved to the RimoMalt's GKU, where germination and kilning take place.

> “For us smaller guys, there were no systems that we could entertain because they were just too large scale. The RimoMalt system has filled that gap.”

Tyler Unger, Head Maltster at Two Track



valuable for Two Track. “We’re not staffed right now to be here 24 hours a day,” says Unger. “So, we’re able to operate from home, which is huge. And it’s given us full control over the system, as well as being able to track trends.”

This level of insight and control supports both repeatability and continuous improvement – a critical requirement for customers. For a craft maltster, that balance between consistency and flexibility is essential. Brewers and distillers depend on stable enzyme development, predictable performance, and reliable flavor contributions. At the same time, they seek distinctive profiles that set their products apart.

Sustainability from the ground up

The connection between the quality of the malt and the condition of the field matters – both for Two Track’s customers and for their finished product. Brewers and distillers are increasingly asked to demonstrate sustainability in their supply chains. Working with a maltster that can trace its grain back to regenerative farming adds credibility to their own sustainability efforts.

That is why sustainability at Two Track begins in the field. Since its earliest days, the company has been committed to regenerative farming practices. These include no-till cultivation, the use of cover crops, and track-based equipment to reduce soil compaction. While protecting soil health, improving water retention, and reducing erosion are worthy environmental goals, for Two Track, they are fundamental to maintaining the quality and consistency of their grain.

As Two Track expanded, the challenge was to align this agricultural philosophy with industrial-scale processing. Malting can be energy-intensive, particularly during kilning. RimoMalt addresses this by using heat pump technology, which recovers and reuses thermal energy. In a process where temperature control is critical, this approach can significantly reduce overall energy demand. This reduces environmental impact and operating costs and is true to Two Track’s guiding principles – responsible resource use, long-term thinking, and reduced impact.

“I think it’s a pretty world-class craft facility,” says Two Track’s Kessel. “It functions very well, it’s high tech, and it doesn’t take a lot of labor. We’re very proud of what we put together here.”

Flexibility for a dynamic market

The craft beverage market is defined by change. Brewers experiment with seasonal releases, regional collaborations, and specialty styles. Distillers explore new grain profiles and flavor expressions. For Two Track, this creates both opportunity and complexity. Beyond traditional

barley malts, the company is exploring alternative grains and new applications, including products such as sprouted oats, which have a lot in common with germinating barley.

"We uncovered the sprouted oats opportunity in talking with industry people," says Jared Stober, CEO at Two Track. "There is more interest in functional foods, which opens doors for food manufacturers to be creative in their offerings." This plays well into Two Track's growth objectives.

While malting is the company's core, Stober sees the flexibility of the RimoMalt allowing for expansion into new products and markets. Modularity allows production to adapt to different batch sizes, product types, and customer requirements. It supports both experimentation and efficiency – an essential combination for a craft-focused business.

The key for a craft operation is to grow without diluting what makes it distinctive. Two Track sees the more advanced malting system of RimoMalt as protecting its founding vision. Through increasing capacity, the company can serve a growing customer base. Through improving efficiency, it can align operations with its sustainability values. Through adopting automation, it can maintain quality as volumes increase. This reflects a broader model for growth in the craft sector: expansion that reinforces identity rather than eroding it.

At its core, craft malting connects growers with makers, agriculture with processing, and raw materials with finished products. From barley varieties developed with local farms, to regenerative practices that protect the soil, to a modern malting system that ensures consistent quality, Two Track's philosophy of "Field to Pint" and "Field to Spirit" spans its entire value chain. In a market where consumers increasingly care about what they drink, where it comes from, and how it was made, that matters. Because, in the end, every pint tells a story.



As a craft malt supplier since 2015, Two Track Malting provides unique and specialized malts to craft brewers and distillers across North America. Bühler's RimoMalt modular malting system allows them to deliver their custom offerings at scale while retaining the "sense of place" that has helped create their success.

FLAKING MILL OLFC

Getting more from every oilseed

Text: Janet Anderson



The demands placed on modern oilseed processors are high. Production has to run around the clock. Every oilseed must be used to its full potential. Quality needs to be consistent. Bühler's new OLFC flaking mill was designed together with customers to address all these challenges.

In oilseed processing, the scale of operations means even the smallest differences in how oilseeds are processed have a significant impact on yield. Flaking – the process of pressing oilseeds into thin flakes – plays a key role, as the thickness and variation in the thickness of the flakes heavily influence the efficacy of downstream oil extraction. Because processing lines run continuously, and each flaker handles up to 500 tonnes of material per day, they must be robust, precise, and user-friendly.

Bühler's new OLFC oilseed flaker was specifically developed to meet these requirements. Building on proven flaking technology, it was developed by a team from Bühler working in close collaboration with customers, incorporating their feedback to drive improvements. Thanks to this collaboration, the result is a flaker that is more efficient and reliable in daily operation, even during peak loads.

The improvements start with the size of the rolls themselves. "Traditionally, in the oilseed industry, rolls are 800 millimeters in diameter. The OLFC rolls are 820 millimeters with an increased usable diameter, meaning they can be used two and a half times longer. A sturdier frame and dampening reduce vibration by up to 25 percent. This maximizes their usable life," says Abdulqadir Abshir, Product Manager for the OLFC at Bühler.

The team not only optimized the machine design; they also designed it to work differently from competitors' flakers. A mechanical end stop added to the hydraulic system ensures that variations in the hardness of oilseeds do not lead to variation in the thickness of the flakes because the OLFC optimizes for roll gap distance, not roll pressure.

Efficient and easy to use

Energy efficiency is also a major factor for oil processors. Instead of using the typical V-belt for the main drive, the OLFC is equipped with a timing belt. "This eliminates slippage and increases efficiency by up to 4 percent compared to the V-belt," says Lukas Spannagl, R&D Project Manager at Bühler.

Ease of operation is equally important for efficient and safe production. On the OLFC, five easily accessible sampling ports simplify quality control while the machine is running. It also has a more user-friendly interface, with a touchscreen displaying a graphical representation of the machine and its most operation-relevant

> We forecast a roll lifetime increase of 150%, significantly affecting the total cost of ownership for our customers.



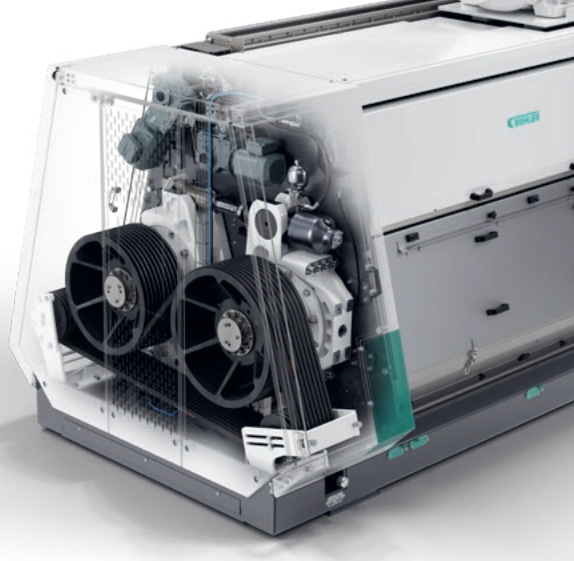
Abdulqadir Abshir,
Product Manager at Bühler

components. “Operators can see at a glance what's happening in the process,” says Abshir. “Color coding shows whether it is running as it should or if something needs to be reviewed.”

Just as critically, the OLFC has been designed to be easy to maintain. Oil processors need to carry out maintenance on their rolls on average three times a year. With the OLFC, operators can use the newly designed auxiliary drive accessory to slow down the roll speed to optimize roll maintenance operations. The procedure of fitting third-party auxiliary drives to flakers can take customers up to two hours. The Bühler team came up with an auxiliary drive that works out-of-the-box and reduces roll speed by the amount necessary. “It takes a minute and 30 seconds to install,” says Spannagl. “Two hours saved in fitting the auxiliary drive means that the flaker is back in operation two hours earlier. This represents another 41 tonnes of production.”

To make maintenance more predictable, sensors provide continuous data on roll speed and hydraulic pressure. A roll temperature sensor measures the temperature profile along the length of the roll, helping operators to identify uneven use of the rolls, as well as hot spots caused by foreign objects. Vibration sensors provide a precise assessment of roll condition and help

Watch this video to learn more about the OLFC oilseed flaker.



Side view of the overdrive system, featuring the newly designed belt swap mechanism.

determine the optimal time for regrinding. This allows production teams to effectively schedule maintenance. They can also consolidate data from multiple flakers to compare performance. Using the Oilseed Process Intelligence insights dashboard, they can monitor long-term trends.

Benefitting from wide experience

Mechanical upgrades and software and usability design changes have all been validated in the field over the past two years. “For us, it was vital to understand the value creation from the customer perspective,” says Abshir. “We listened closely to what the customers needed and to the insights they got from the data. All of this information was fed into the new design.”

The OLFC benefits not only from customer input but also from Bühler’s own process know-how from flaking machines all over the world and at different customer sites. All this experience was built into the new machine.

“Our aim throughout the development of the OLFC was to help oil processors make more from every oilseed,” says Spannagl.

Key facts about OLFC

150% roll lifetime increase

up to **4%** energy savings with the new belt system

up to **25%** reduced vibration



BEZOS CENTRE FOR SUSTAINABLE PROTEIN

How knowledge and industry are transforming our food systems

Interviewer: Ian Roberts **Photos: Lucy Pope, Thomas Angus**



When supply chains are disrupted, it reveals the vulnerability in our global food system. Whatever the cause – and we have seen several in recent years, from geopolitics to climate – we know that to nourish a growing global population sustainably, we need to increase the system's resilience. One way of doing this is to better utilize the science of engineering biology. It provides solutions that can reduce cost, improve quality, increase yield, and reduce downstream processing in a targeted way to produce food that is safe and more nutritious. Understanding is already being advanced in labs and scientific institutes around the world. What is required now is implementation. This is where industry plays a role, turning scientific potential into reality at scale. The Bezos Centre for Sustainable Protein (BCSP) at Imperial College in London, UK is one of the scientific institutes leading the way, providing the knowledge and capabilities to drive forward research and, very importantly, partnering with players from across industry, like Bühler, that share the ambition to create a more sustainable and resilient food system. Bühler's Chief Technology Officer Ian Roberts talked to BCSP Director Rodrigo Ledesma-Amaro about the role of engineering biology in the food system, and how collaborations between science and industry are driving sustainable transformation.

Ian Roberts: The food system needs sustainable and resilient supply chains. What is the contribution that biotechnology can make?
Rodrigo Ledesma-Amaro: Biotechnology has the potential to make many of the food and food ingredients that we need in more resilient and climate-, land-, and water-independent ways, which is essential to release some of the pressure in our agricultural systems. Recent developments in biotechnology, engineering biology, and bioprocessing, combined with higher demand from governments, the public, and industry, make this question very timely.

We've seen an evolution in technology and readiness to deploy technology in the last few years. Has this made food production a more attractive space for high-caliber scientists to work?
Absolutely. I think we are a good example of that. Imperial College is not a food university traditionally, but in the last few years, we've become a place for food biotechnology activities. That's because of the push we're getting from students who want to work in this space and make our food system more sustainable. That attraction of talent is going to have a big impact.

Imperial already has a fantastic reputation as a science and engineering school. How does the BCSP build on that?
We focus on what we call the enabling technologies that come from science and engineering. Specifically, we focus on bringing engineering, biology, and artificial intelligence into the food system space.

How do you bring those capabilities together?
We started by selecting researchers who are making great advances with these technologies that we believe, if applied to the food system, might have a big impact. Then we grew the network, bringing in collaborations and working more with industry. Ecosystem building is fundamental in order to make the change. It connects different disciplines to start thinking about the same problems.

Why is the relationship between academia and industry so important for you?
Our ambition is to make an impact on planetary health and human health through food systems. As academics, we are able to create solutions. But it is industry that puts products in the market or starts using a technology that is more sustainable. And that is what will make the impact on people and on the planet.

Do you have an example of an unusual academic field that is now more interested in food because of BCSP?
The one that has been interesting to work with is AI. Artificial intelligence is so trendy at the moment that people want to work where the short-term impact is, and that's usually not food. It has been very interesting to convince those people of the long-term high impact they can make if they work on the food system. The other one may be obvious, but as academics we don't usually work with chefs. Now, we are working closely with them and with consumers. It helps us think about the whole process from the flask to the plate.

When we talk about biotechnology and AI in food, it sounds like new science. Yet fermentation, for example, isn't new to food, is it?
Absolutely not. One-third of the food we consume nowadays comes from fermentation in one way or another. We have been doing fermentation for thousands of years. What is new is the evolution of the technologies around fermentation in the last decade. Here we come back to engineering biology. We can now screen a diversity of microorganisms, model how they will perform, understand their metabolic capabilities, and engineer them to be better at producing specific molecules using precision fermentation or biomass fermentation to make proteins or fats. We are working on developing novel bioprocesses that reduce cost, improve quality, reduce downstream processing, and convert the feedstock into a product that has maximum yields and properties.







The Bezos Centre for Sustainable Protein at Imperial College in London is a leading scientific institute that partners with industry players like Bühler, with the aim of creating a more sustainable and resilient food system.

Science will allow us to do this precisely in a very targeted way that is safe and more nutritious. This is exciting, but can it be off-putting for the non-scientific community?
When I talk about precision fermentation, it sounds like science fiction to some people. But breakfast cereals are often enriched with vitamin B2, which has been made by fermentation. This has been around for over three decades, and we know it's safe, scalable, and can be affordable. There are many other examples in our daily diet.

What do you see as the value of partnering with a company like Bühler?
I'm very excited about it. It's probably our flagship partnership at the moment. That comes from the complementarity in skills, capabilities, and activities, and our focus on science, technology, and novel ideas. Bühler can make these ideas come true and can think about scaling them and integrating them into our food system. We usually start at a smaller scale thinking about microorganism strains and how to make them more efficient. You think about how to make them at a larger scale and supply them to companies to use in food products.

We need to get better at not duplicating what is already built in another place and give each other access. For example, I would love to see students from the BCSP use The Cultured Hub that we've built here in Switzerland.
That is a great example of where you have a capability that we don't have that can help accelerate our science, but also your scaling process. That's where we should be working together. More broadly, I agree, we shouldn't be replicating, we should be coordinating, especially when resources are scarce.

What is your personal measure of success for the BCSP?
Our team is growing monthly, because there are so many opportunities and we want to tackle them all. The more time I spend there, the more I realize that our capacity to change things is bigger – that I can dream bigger and think about larger problems. For me, it is about creating a network that can solve the problems that we have in our food system, change consumer perception, and steer governments in the right direction. By that I mean a direction that can, in the end, make better use of natural resources and can feed more

Rodrigo Ledesma-Amaro
Dr. Rodrigo Ledesma-Amaro is the founder and Director of the Bezos Centre for Sustainable Protein at Imperial College London, UK. He is also a Professor at the Department of Bioengineering, Director of the Microbial Food Hub at Imperial, and he leads a research group at the interface of synthetic biology and metabolic engineering. He joined Imperial in 2017 after conducting postdoctoral and doctoral studies focused on engineering yeast to produce sustainable food ingredients.



> “We work on developing novel bioprocesses that reduce cost, improve quality, reduce downstream processing, and convert the feedstock into a product that has maximum yields and properties.”

Rodrigo Ledesma-Amaro, Director at the Bezos Centre for Sustainable Protein

people in a better way everywhere. That's a very ambitious goal, right? I would like to keep growing our capability as a hub to connect everyone going in that direction.

Bühler's customers feed 2 to 3 billion people every day. What message would you like to convey to our customers about the role that biotechnology can play in the food system and in their businesses?
Biotechnology is the future. I believe that this is the technology that is going to feed most of the people and animals on the planet. These complementary processing methods are going to come, and are going to stay. That is for many reasons, such as sustainability, food security, and affordability. We need to be thinking already about how the world will be in 20 to 50 years' time and start deploying technologies now that allow us to get there faster. So, my message is, be aware of the potential of biotechnology and start thinking of how it can help improve your processes and products in the short, medium, and longer term. We are very happy to talk to everyone and see how we can help in facilitating that.

Inspiration from around the world

Our customers have great ambitions. Our aim is to support them in achieving their goals.



Brazil



New integrated rice processing plant boosts Camnpal's production capacity.

From a cooperative of 28 farmers to a world-class rice processing plant

A cooperative that was born in 1963 from the determination of 28 small-scale farmers in southern Brazil has now become one of the most advanced rice processing operations in the whole country. The numbers are impressive, but they only tell one part of the story.

Camnpal – the Portuguese abbreviation for Cooperativa Agrícola Mista Nova Palma – which in 2026 brings together more than 8,000 members across 17 units in Rio Grande do Sul, invested over BRL 100 million (approximately CHF 15.5 million) in a new 14,332 square meter facility equipped with technology from Bühler. The goal was to modernize and expand production while reducing the 24-hour operating schedule. The result has far exceeded expectations: production capacity has been tripled.

Before choosing their technology, the cooperative's executives benchmarked operations across South America. The answers they received were consistent. "We asked every professional we could which machinery was the best, and the answer always confirmed the Bühler name," says Euclides Vestena, Vice President at Camnpal.

The new plant, which began operations in early 2024, runs on a fully integrated Bühler line from grain intake to finished product. Two innovations deliver the sharpest gains: the SORTEX optical sorter cuts final residue in the sorting process from 20 percent to near zero, while the degerminator recovers up to 25 percent of the material that was previously discarded.

For Vestena, the rice plant reflects the cooperative's founding ethic: no waste, shared benefit, and long-term thinking. What began as a communal act of courage is now a benchmark for Brazilian agribusiness.

China



At the core of Bühler's battery mixing system is a twin-screw extruder.

Demand for battery mixing systems on the rise

Bühler's continuous mixing technology used to produce battery slurry reached a milestone as global demand for battery energy storage solutions (BESS) continues to accelerate. One of the top five battery producers in China placed the largest order in the history of Bühler's battery business. The order for 50 battery mixing lines catapults the installed capacity of Bühler's battery mixing systems from 150 to 300 gigawatt hours.

The customer will use the systems to produce stationary batteries for energy storage systems. Equivalent to the output of six to seven gigafactories, these could equip about 2 million electric vehicles with 70 kilowatt hours a year. "Selling 50 systems to one customer underlines the trust our customers put in our battery mixing technology," says Adrian Spillmann, Head of Market Segment Battery Electrode Compounds at Bühler. "Reliability, consistency, and the ability to deliver at large scale were the key drivers behind this order. We're proud to support the customer in their mission to transform the way we convert, store, and consume energy."

Demand for BESS is growing across a range of applications, such as storing excess energy from renewable energy sources, ensuring stable power output to the grid. BESS is also deployed in power grids to reduce the need for peaking power plants and to provide backup power. Their use lowers energy costs for users and also prevents costly downtime – which explains why demand is predicted to grow to 15 percent of global total battery demand by 2030.

Canada



David Castellan and SOMA's Zonda roaster – a perfect roast with a perfect aroma.

Where indulgence comes to life

SOMA Chocolatemaker began as a small bean-to-bar business that has since grown into three shops and a small factory. At their Cacao Bean Lab in Toronto, Canada, chocolate-making feels less like manufacturing and more like a craft built on patience and care – with a Bühler Zonda roaster sitting at the heart of it.

The roasting step is especially important, because this is where the bean's personality is either preserved or lost. Too light, and the chocolate can taste sour or thin; too dark, and its unique character disappears under one heavy note. For SOMA co-owner David Castellan, roasting is the best part of the process, because it allows him to control the flavor and obtain consistent product quality.

With batch sizes of 70–100 kilograms, the Zonda roaster allows artisan chocolate producers like SOMA to experiment with roasting times and control the process for flavor development.

While SOMA's business has grown, its mindset remains the same: a love of getting things right rather than simply getting them done. SOMA's chocolates are a strong reminder that when something is made with care, people taste the difference.



The science of seeing from space

Text: Jonathan Ward **Photos: Benjamin Béchet**

From monitoring crop health to forecasting extreme weather, many aspects of life today depend on, and are improved by, data that is gathered from space. The instruments that are used to generate this vital information rely on advanced optical coatings – coatings that are engineered to perform in one of the harshest environments imaginable.





Julien Lumeau
Dr. Julien Lumeau is Head of the Optical Thin Films Research Group and Deputy Director of the Institute Fresnel, as well as Research Director at the French National Center for Scientific Research (CNRS). Prior to joining the Institute Fresnel in 2012, he spent eight years in the United States as a researcher at the College of Optics and Photonics at the University of Central Florida and as an engineer at OptiGrate.

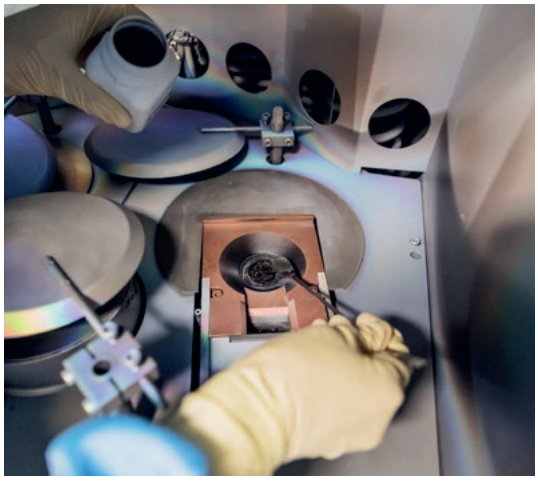
Spaceflight has changed the way we see the world. The earliest photographs of Earth from space were taken in the middle of the 20th century. Then in 1972, the crew of the Apollo 17 mission captured the "Blue Marble" image of our planet – one of the most famous photographs ever taken.

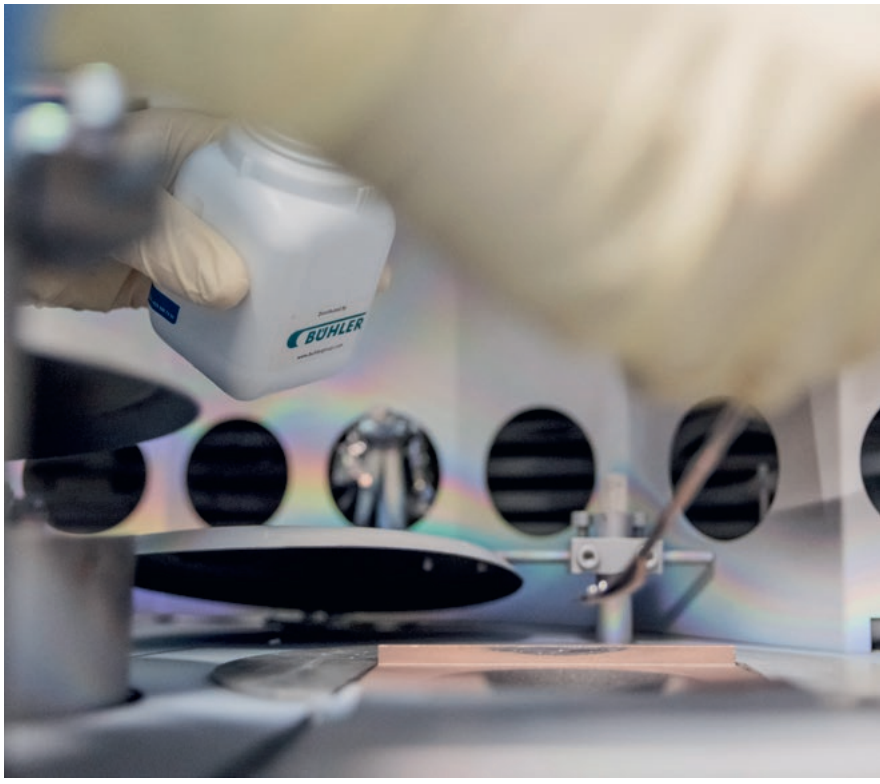
Today, the ability to capture images from hundreds of kilometers above the Earth has evolved from the extraordinary to the everyday. By 2023, there were around 1,300 Earth observation satellites in orbit, and more have been launched every year since then. The information they transmit is used in a vast range of applications, from mapmaking and weather forecasting to intelligence gathering and national security.

Data from space plays a critical role in the global food and agriculture industry. Earth observation systems help make agriculture more sustainable by enabling smarter farming practices. Satellite instruments can measure crop health, water stress, and nutrient status, allowing farmers to optimize irrigation, reduce fertilizer and pesticide use, and increase yields per hectare. At the same time, weather satellites improve storm forecasting and drought monitoring, helping producers plan harvests and logistics more effectively, reducing spoilage and supply-chain disruption.

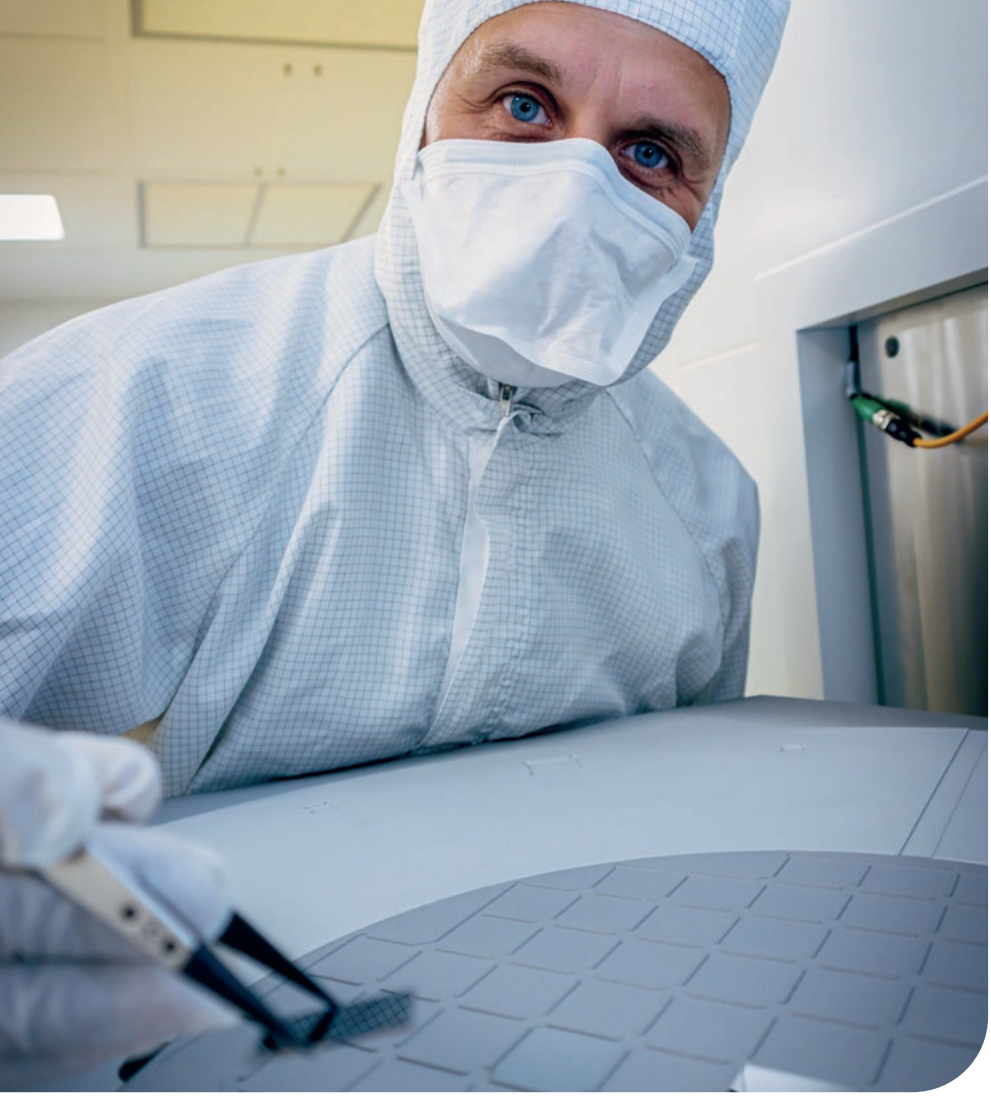
Space-based sensing also contributes to more resilient food systems. Spectrometers aboard satellites can track greenhouse gases such as CO_2







Bühler Leybold Optics' coating machines produce optical filters in the same vacuum that is found 100 km above the Earth – so when the object they are mounted on arrives at its planned orbit, the optical filters are already well suited to the environment.



Marcus Trost
Dr. Trost is Executive Vice President at optiX fab, Germany, which he joined in 2023. He is responsible for highly customized coatings for extremely short wavelengths such as the Multi-Slit Solar Explorer (MUSE) mission. Prior to that, he headed the group for surface and thin film characterization at Fraunhofer Institute for Applied Optics and Precision Engineering IOF in Jena, Germany, where he focused on light scattering and analysis of flight hardware.

and methane, as well as monitor air quality and pollution. The resulting data helps guide policies and operational decisions that protect soil health, support crop productivity, and strengthen long-term food security.

Coatings matter

The optical instruments used to generate this data are not simple cameras. Many Earth observation tasks depend on the ability to differentiate between specific wavelengths of light reflected or absorbed by different materials. Sensors that track soil and crop moisture levels, for example, may infer the water content of an area by comparing the relative amounts of red light and near-infrared light reflected into the sky.

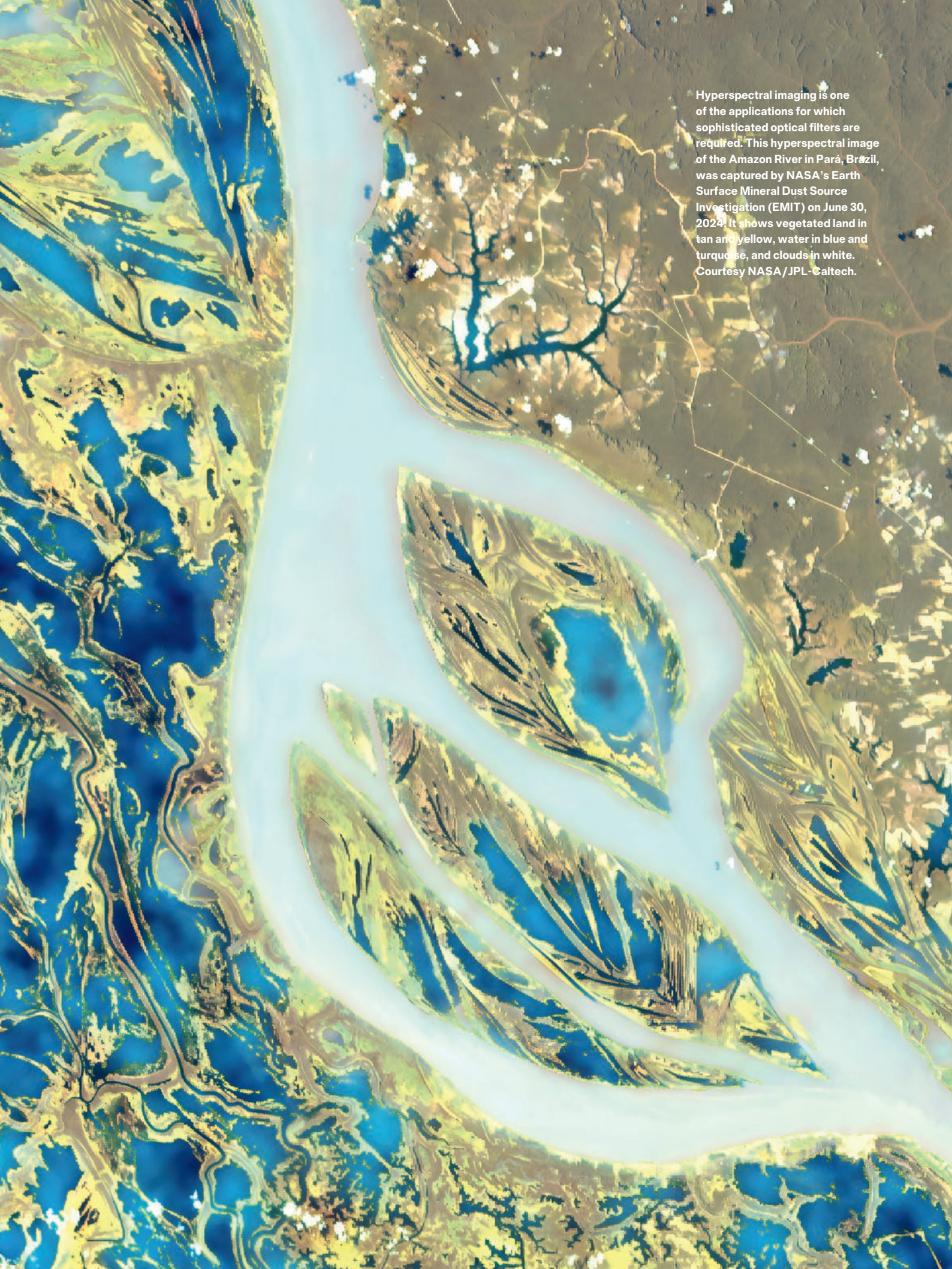
To make such measurements, space-based instruments must be able to distinguish between different wavelengths with exceptional accuracy. They rely on sophisticated optical filters designed to pass only specific wavelengths of light through to the instrument's sensor.

These filters are complex nanoscale structures that are created by building up alternating layers of different materials, each only a few nanometers thick. The final coating stack in an advanced filter may contain more than 200 individual layers. As a producer of thin-film coating equipment, Bühler helps its customers to translate demanding requirements of the space industry into stable, repeatable deposition processes.

Why space is hard

Research scientist Julien Lumeau is head of the Optical Thin Films Research Group at the Institute Fresnel in Marseille, France. His group develops specialist coating solutions for a broad range of applications that includes not only space optics but also filters for microscopes, high-powered lasers, and even for the jewelry and watch-making industries.

"Typically, our customers know the wavelengths they want to study, and they'll approach us with a specification," he says. "We need to translate that



Hyperspectral imaging is one of the applications for which sophisticated optical filters are required. This hyperspectral image of the Amazon River in Pará, Brazil, was captured by NASA's Earth Surface Mineral Dust Source Investigation (EMIT) on June 30, 2024. It shows vegetated land in tan and yellow, water in blue and turquoise, and clouds in white. Courtesy NASA/JPL-Caltech.



Photo: Michael Zimmermann

Harro Hagedorn, Head of R&D at Bühler Leybold Optics

Learn more about Bühler Leybold Optics' thin-film vacuum coating technology.

into a filter design that can be fabricated reliably and that is sufficiently durable."

Those durability challenges begin long before instruments leave the ground, he explains. "An instrument might be manufactured in Europe, then transported to a launch site in South America," he says. "It might stay there in a hot and humid environment for some time before riding a rocket to a place that is mostly cold and very dry."

Filter designers must ensure that their systems perform exactly as intended once they reach orbit. Those filters must continue to function for years or even decades while enduring dramatic temperature fluctuations and high levels of radiation. Satellites in low Earth orbit face additional challenges from the outer traces of the Earth's atmosphere, including atomic oxygen, which can rapidly erode some materials and alter the optical properties of others.

Years of research characterizing the performance of different coating systems through terrestrial testing and orbital experiments have led space optics designers toward a set of proven materials and manufacturing approaches. "We typically favor oxide materials for their stability, and the Bühler machines we use can produce hard, dense coatings," says Lumeau.

Weight is money

For mainstream instruments, which typically operate in the visible spectrum and nearby wavelengths, filter design and fabrication are now well understood, says Lumeau. Current challenges focus on making sensors more capable while also making them smaller and lighter. "In most applications, you are interested in a range of different wavelengths, so you need multiple filters," he says. Traditionally, this has been achieved using a rotating wheel or similar mechanism to move different filters in front of a single sensor. These multispectral instruments collect data in several broad, disconnected wavelength bands.

A more advanced alternative is hyperspectral imaging, which uses filters whose optical characteristics vary across their surface. Such filters can capture precise data across a broad

spectrum of wavelengths, albeit with greater fabrication and data-processing complexity.

"In space, weight is money," says Lumeau. "The high cost of putting payloads into orbit creates a strong incentive to make instruments lighter and more compact." Optics engineers are responding to this by pushing fabrication capabilities further. This includes the development of ultra-compact hyperspectral filters that are suitable for miniaturized instruments.

At the extremes

Others are working to push space optics into entirely new territory. Marcus Trost is Executive Vice President and Space Project Lead at optiX fab in Jena, Germany. The company, a spin-out from the Fraunhofer Institute, specializes in coatings for extreme ultraviolet (EUV) applications.

On Earth, these ultra-short wavelengths are critical for producing the tiny features used in the most advanced semiconductor devices. In space, they can reveal phenomena that cannot be measured in any other way.

One major target of research is our Sun – the closest star – where strong extreme ultraviolet emissions can provide early warning of solar storms capable of bathing Earth in charged particles, disrupting communications, damaging satellites, and knocking out electricity grids.

Working with EUV light introduces a different set of design and fabrication challenges. "Even though the Sun is very bright to us, when you are looking at single emission lines, you reduce the amount of available light drastically," says Trost. "This leads to a photon-starved detection scenario requiring optical systems with very high optical throughput."

EUV instruments use mirrors not lenses, and those mirrors tend to be both large and extraordinarily precise. "For the current generation of instruments, you are talking about mirror diameters of more than 300 millimeters, with coating thickness control in the range of single-digit picometers," says Trost. At that scale, individual atoms can make a decisive difference to performance.

To complicate matters further, robust oxide materials such as those used for applications in the visible spectral range strongly absorb light at EUV wavelengths. Engineers therefore rely on metallic layer stacks, which have a greater tendency to react with one another, requiring highly dedicated interface engineering.

Meeting the challenge

For Harro Hagedorn, head of R&D at Bühler Leybold Optics, creating coating machines that are capable of meeting the needs of the most advanced space missions is not fundamentally different from supporting customers in other highly demanding industries.

"Our machines produce optical filters in the same vacuum you get 100 kilometers above the Earth," he says. "Normally, you face the problem that properties can change once they encounter air. If you launch the filter into space, it is going back to where it started in a way."

Bühler machines continuously measure the optical properties of filters as they are built up layer by layer, helping ensure that the finished product meets specification. Verifying that performance can be maintained after extreme temperature cycling and radiation exposure depends on a combination of laboratory testing by customers and decades of operational experience from satellites already in orbit.

And filters are not the only elements in space optical systems that rely on advanced coating technologies. Instruments also use a wide range of specialist coatings, from highly reflective mirror surfaces to highly absorbent coatings that suppress stray light within the instrument. Other coatings help protect systems from temperature fluctuations that could otherwise damage or distort delicate components.

Looking ahead, Hagedorn expects demand for some space-optics systems to increase dramatically, creating new requirements for faster and lower-cost production. "There are perhaps 10,000 satellites of all types in space today, but that may grow in the coming years to a million or more. Many of those satellites will need optical coatings, not just for imaging but also for laser-based communication," he says. "To reach those volumes, you need to think much more carefully about component costs and the time required to develop, qualify, and manufacture them. And that is what we are working on every day at Bühler."

MEGACASTING

Next generation manufacturing for global automotive



Text: Janet Anderson / Lukas Hofstetter
Photos: LM Media

The global shift toward electric and hybrid vehicles is redefining how cars are built. The new requirements are making manufacturers rethink vehicle architectures from the ground up. Megacasting, the next generation of large structural castings, provides numerous benefits and plays a pivotal role in driving this transformation. Bühler, with its deep experience and global setup, supports customers large and small with expertise, research capabilities, and the power to deliver around the world.





Megacasting parts in a car: rear underbody, battery tray, and front underbody.

The global automotive landscape is undergoing a profound transformation, driven by the accelerating shift toward electric mobility. In 2025, over 20 million electric cars, including battery and plug-in hybrid vehicles, were sold worldwide, representing one-quarter of all new cars, according to the International Energy Agency (IEA). China remains the dominant force, with electric cars reaching nearly 55 percent of all new vehicle sales in the country in 2025, solidifying its position as the world's largest electric vehicle (EV) market. Europe, meanwhile, continues its recovery after a slower 2024: EV sales rose by more than 30 percent, bringing the region to an estimated 28 percent EV market share for the year, with strong rebounds in Germany and the UK in particular.

Driving efficiency gains

The increased focus on electrification is driving Original Equipment Manufacturers (OEMs) like Ford, Toyota, and Volvo to rethink car body structures for efficiency, range, and manufacturing simplicity. With batteries and electronics making vehicles heavier, finding ways to reduce the overall weight of the vehicle becomes even more essential. One approach is to substitute steel-stamped components in the vehicle body with lightweight aluminum castings. These can vary from smaller elements, such as shock towers and longitudinal members, to complete rear or front underbody structures or battery frames. Such large aluminum megacastings can replace up to 100 smaller components, cutting the total part count and eliminating many intermediate steps such as welding. This not only reduces overall vehicle weight but also streamlines production.

While the global rise in electric mobility is a major contributor to this shift, it is not the only factor accelerating the redesign of automotive production. "Although megacasting is often associated with electric vehicles, the technology is not dependent on drivetrain concepts," says Michael Cinelli, Director Global Product Management & Marketing Die Casting at Bühler. "It is fundamentally about the car body, which means conventional vehicles can benefit equally from integrating more aluminum structural castings into the car body, too."

As megacasting becomes more widespread, this in turn has become a catalyst for further changes within the industry. The reason lies in the sheer size of the die-cast parts. While aluminum structural die casting has been used since the 1990s, today's ever larger parts – megacastings – mark a major leap in manufacturing scale, with parts measuring up to 1.8 by 2.0 meters. Transporting such large components can be costly and complex, making local, integrated manufacturing the smarter option. Additionally, implementing megacasting is a strategic decision and requires more alignment between manufacturing and engineering. As a result, more and more automotive brands are setting up their own foundry capabilities instead of relying on suppliers – in some cases for the first time, in others as an expansion of existing competence.

Ahead of the curve

Megacasting is built on structural casting technology, which Bühler added to its portfolio in the 1990s. Since the introduction of megacasting in 2019, Bühler has sold more than 50 such solutions from its Carat series. With the shift toward megacasting, it increasingly supplies global OEMs directly – rather than Tier 1 or 2 suppliers – which it can do successfully by leveraging its own global footprint.

Eight of the world's top ten carmakers have embraced megacasting technology, and five of them have placed orders with Bühler. Meeting this growing demand requires more than just advanced equipment; it also calls for global expertise and strong local support. This is especially important given the size of some equipment, since the larger Carat cell solutions are as big as a single-family house. With long-standing die-casting hubs in Switzerland, China, and the United States, Bühler is well positioned to support global OEMs across key markets. This international footprint spreads expertise across regions and ensures customers receive the support needed to move into megacasting, wherever they are in the world.

"We work closely with customers to ensure their start in megacasting is

successful. That often begins long before production begins – at the earliest stages of part design and its integration in the car body – to ensure their megacasting project achieves the maximum advantages," says Dirk Schmidtbleicher, Director of Global Sales Die Casting at Bühler. "With former OEM engineers on our team and extensive experience from global projects, we are able to share valuable insights and best practices, guiding customers on megacasting integration, structural requirements, and manufacturing readiness."

A global operator with local presence

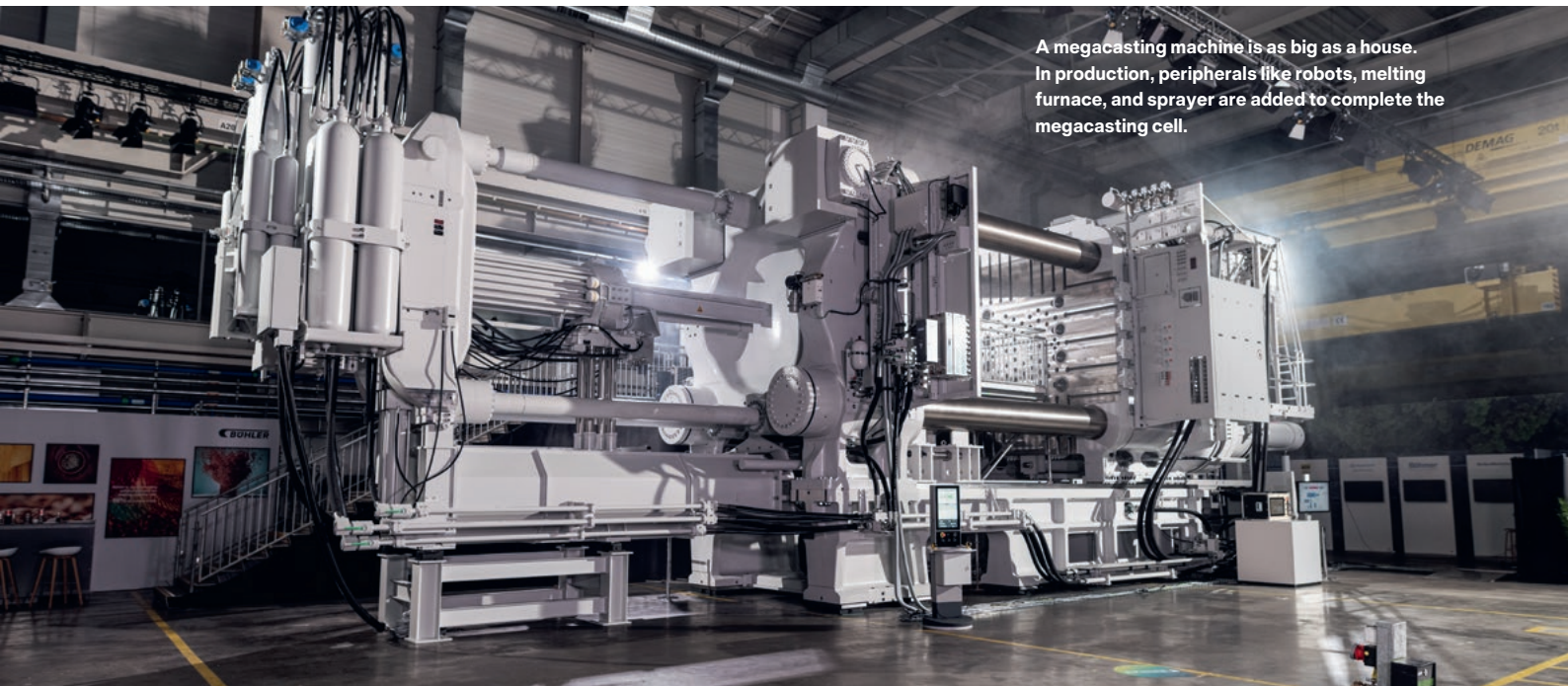
In practice, this means working closely with the customer locally while exploiting Bühler's global footprint. For example, a major automaker faced a challenge, as its R&D cell and production cells were on different continents. It looked for a partner with a strong presence in both locations, supported by a global network, and capable of delivering multiple megacasting solutions. The collaboration with Bühler began with an initial order for a Carat 610 cell which the customer used as the R&D cell in their home country. Shortly after, an order for more Carat 610 solutions followed that were set up at the company's production site overseas. The machines were built using equipment sourced from across Bühler's global manufacturing network and leveraging the strength and integration of its worldwide footprint.

With such megacasting projects, the team from Bühler Die Casting finds itself in a relatively novel position. In traditional die-casting projects, it is usually the bigger player compared with the customer. In megacasting projects, by contrast, Bühler works with much bigger organizations, which have complex structures with more stakeholders, and projects that are significantly larger, meaning the coordination effort grows too. Fortunately, Bühler's Die Casting business draws on the structures and experience available across the entire Bühler Group. As a major player in food and feed markets globally, the company has ample experience executing large projects, such as major food parks, around the world. This experience is leveraged in megacasting projects, enabling Bühler to bring to its OEM customers the kind of capacity they need from a supplier.

One challenge lies in the complexity of managing projects that bring together stakeholders across continents and cultures. "Most of our collaboration happens online, with teams spread across continents and time zones – someone in the US is joining at dawn while colleagues in Asia dial in late at night. But, despite the efficiency of virtual work, bringing everyone together from time to time is invaluable. In-person sessions build trust, accelerate alignment, and consistently lead to better collaboration; something we actively recommend to our customers," says Schmidtbleicher.

A trend with clear momentum

With more OEMs stepping in, the momentum is unmistakable. "Megacasting has grown from a niche idea adopted by EV start-ups into a global movement embraced by North America, Japan, and increasingly Europe. This has been made possible as the technology itself has matured along with the adjacent peripherals. The growth in megacasting has been continuous as more OEMs implement it. It is in the cars on the road today," says Martin Lagler, Director Global Application Technology Die Casting at Bühler. "We're now closely monitoring what lies ahead and looking at the next chapter in this transformation. With our global setup, know-how, and close relationships with our customers, I'm confident we will continue to empower the new manufacturing play."



A megacasting machine is as big as a house. In production, peripherals like robots, melting furnace, and sprayer are added to complete the megacasting cell.

FOOD FOR THOUGHT

The future we feed



by Mike Häfeli, CEO of Grains & Food at Bühler

Every time I visit one of our customers, I am reminded how important and interconnected our food system is, and how quickly it is changing. Processors face growing demand, tighter margins, and increased expectations around food safety and sustainability. At the same time, they are dealing with shortages of resources and price pressures, from energy and raw materials to skilled labor. Despite these pressures, our customers around the world succeed in delivering food that is safe, delicious, and nutritious every day. This should never be taken for granted.

To continue doing this in future for a growing global population, we have to tackle a fundamental challenge: how to produce more while using less energy, less water, fewer raw materials, and fewer resources. Every tonne of grain saved from spoilage, every percentage point increase in yield, and every opportunity to recover value from side streams contributes to a stronger food system.

In many cases, the most sustainable food is food that is never lost in the first place. We also need to get more nutrition, more functionality, and more value out of the available resources. That means recovering nutrients and fiber from side streams and optimizing food quality and nutrition.

Technology plays a central role – and this is where Bühler contributes. Our solutions based on data and AI are helping companies optimize operations, increase yields, improve quality, and make better decisions. We also develop process technologies for new protein sources, as well as advanced ingredient processing, fermentation technologies, and digital solutions that expand the possibilities for food and feed production.

To achieve the full potential requires thinking beyond individual processing steps. One of Bühler's strengths is that we work across value chains, from post-harvest storage, transport, processing, and ingredient production to finished food manufacturing. This provides insight into where nutrients can be saved, waste prevented, and where technology can help create more value. Sustainable progress depends on how effectively we combine innovation with collaboration across the food system – among farmers, processors, food manufacturers, researchers, policymakers, and technology providers.

Collaboration is at the heart of our approach. Working with customers around the world, I have seen remarkable entrepreneurs investing in local food systems, supporting farmers, creating jobs, and strengthening regional supply chains. Helping such businesses succeed is one of the most powerful ways we can contribute to food security and resilience.

Feeding the future is one of the defining responsibilities of our generation, but also one of our greatest opportunities. I am optimistic that by bringing together innovation, expertise, and strong partnerships, we can turn this ambition into reality and ensure future generations have access to more safe, nutritious, and delicious food while preserving the resources on which we all depend.

Always up to date

Would you like to stay informed about the latest trends, innovations, and inspiring stories from Bühler's customers, partners, and experts? Then follow us on social media. We look forward to connecting with you.

THE BÜHLER INSPIRATION HUB

Industry-relevant trends, fresh perspectives, and customer projects – you'll find all this and much more on our website. The Bühler Inspiration Hub brings together insights from customers, partners, and our own experts around the world.

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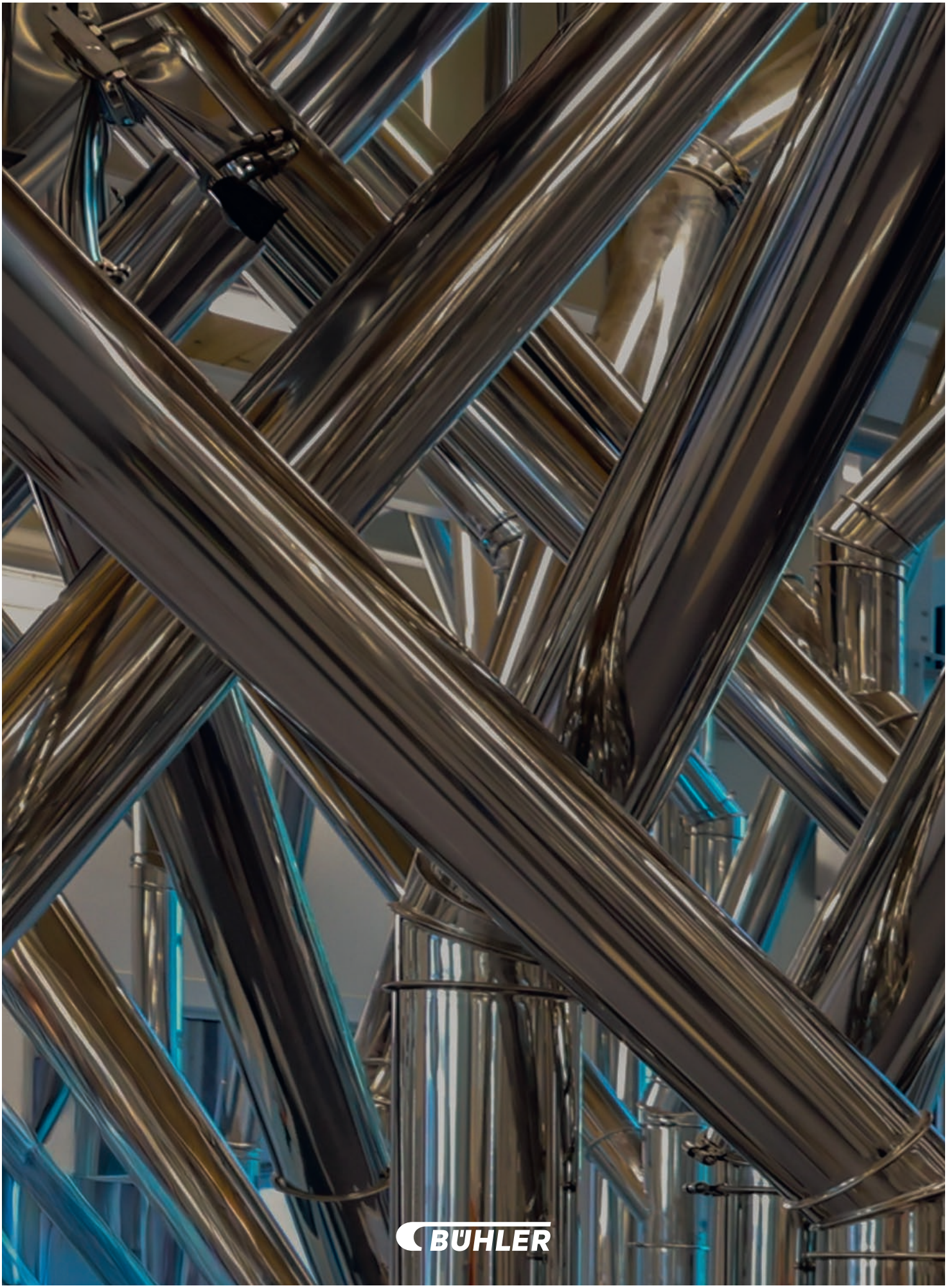
We want to make our magazine even more relevant for you. Let us know what you like and what you're missing. Write to us: **media.relations@buhlergroup.com**

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