BRINGING PASTA TO THE WORLD
Barilla expands into new markets

SORTING MAIZE TO SAVE LIVES
Solution launched to eliminate aflatoxin

ENERGIZING THE BATTERY INDUSTRY
New electrode slurry enhances performance
Creating tomorrow together.

From grain to baked products – competence from a single source. Whether wafer, biscuits, bread or other baked goods: at Bühler and Haas you are right – complete systems from A to Z tailored to your needs.

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Dear Readers,

Providing every person with enough healthy food – that is the goal to which we here at Bühler want to contribute. The challenges of doing justice to this task are enormous. But that is exactly what drives us, our customers, partners, researchers, regulators – and of course our employees – to develop solutions.

This edition of Diagram is full of innovation solutions that address exactly these challenges. My favorite is LumoVision: a new generation of optical sorter that, for the first time, is able to identify and sort out maize that has been contaminated with aflatoxin. Approximately 500 million people today are at risk of regular exposure to aflatoxin, one of the most toxic organic substances in the world. Aflatoxin causes stunting in millions of children and every year, over 150,000 people die of liver cancer as a result of long-term exposure. On page 30, you can learn more about how LumoVision works to eliminate this toxin.

I find two things fascinating in this story. First, the technology – for the first time we have connected an optical sorter to our new cloud platform that we developed with Microsoft. The evaluation of the optical data in the cloud is a prerequisite for reliable detection and independent learning for the machine. It is clear here how we use digitalization as a key technology to move closer to our vision. LumoVision is an ideal example of how we can combine digital and physical technologies.

Second, the innovativeness: the people who realized this innovation inspire me even more. The LumoVision idea was born of our Bühler Innovation Challenge; an in-house competition in which every employee was able to present new ideas and projects far from the established R&D process. Our team’s motivation is truly exceptional – to such an extent that the driving force behind the development, our colleague in London, Ben Deefholts, decided to postpone his retirement for a year. He does not want to leave until this job is done.

This is what gives us the hope that we can solve global challenges – technologies developed by individuals who dream of creating a better life for people everywhere. It’s all about passionate people who create innovations for a better world.

May your reading inspire you.

Stefan Scheiber
CEO Bühler Group
FOCUS

A universal love affair
From antiquity to the present, from young to old, from Parma to outer space – everyone loves pasta!

Entering new markets
The pasta giant Barilla is bringing a piece of Italian lifestyle to the world.

Pasta processing
Bühler has been writing pasta history for 115 years.

Feel the pulse
Pasta made from pulses is protein-rich and gluten free. Explore the trend.

Bühler’s dynamic path
Johannes Wick, Grains & Foods CEO, on quality, transparency, and digitalization.

Saving lives by sorting
LumoVision reliably reduces aflatoxin contamination in maize.

Fighting malnutrition
Africa Improved Foods in Rwanda produces fortified foods to improve the health of millions.

IN BRIEF

A conversation with the CEO
Stefan Scheiber on Bühler’s strong results in the past financial year, and the company’s strategy for the future.
CUSTOMER STORIES

A perfect fit
Car parts supplier, Çelikel, and Bühler enter a new realm of cooperation.

TECHNOLOGY & SOLUTIONS

Latest innovations

Recycle, reuse, ReNew!
Old Bühler machines get a new lease on life and a new home. Find out how.

INNOVATIONS

A revolution for car batteries
Our new continuous mixing process for battery slurry is a game changer.

Internet of Things
Our latest digital innovations.

Digital Services Portal
Production information at a glance.

GrainiGo
Grain analysis on the go!

Intelligent Roller Service
Insights from within your roller mill.

Silo Bin Monitoring
Safe storage for your grains.

Did you know?
• Sustainability at Bühler
• Imprint

Food for thought
Bühler’s Chief Technology Officer on our partnership with Microsoft.
From the simplest dishes to the finest dining, it’s the staple food option you can always rely on – comforting, satisfying, versatile, and nutritious. Pasta! Its historical roots are widely debated, its status in Italy is nearly sacred, and everyone has their particular preference. Undisputable, however, is that pasta and noodles are family favorites found in kitchens the world over.

TEXT: MICHÈLE BODMER & DAVID GILLIVER
Everything you see I owe to spaghetti.” Italian icon and Oscar-winning actor Sophia Loren is said to have uttered these words at the height of her fame in the 1960s. Today, at the age of 83, she retains her timeless beauty. One can argue whether this is due to pasta or good genes – but her quote has become legend. Her distinguished compatriot, the fabled Italian film director and screenwriter Federico Fellini also opined, “Life is a combination of magic and pasta.” Like these famous pasta lovers, we can all agree that a well-made pasta meal conjures images of family and friends enjoying “la dolce vita”.

“I also owe a lot to pasta,” Bühler’s Marco Loschi says with a smile. He joined the company three years ago as Product Manager Pasta. Loschi, who was raised in Parma, is passionate about this food, which is not only his job, but also a part of his culture. “I really do eat pasta every day. It’s not a stereotype in my case. My favorite is extruded through traditional bronze dies. It has a rougher surface so that the sauce really sticks to it.”

Loschi started his career in Parma at one of the world’s biggest Italian pasta manufacturers. It was there that he learned what it takes to produce great tasting pasta. Today, he supports Bühler customers around the world in their efforts to manufacture excellent pasta in its many shapes and forms.

Pasta dough is made from wheat flour mixed with water or eggs – Italian pasta makers use durum wheat semolina, while noodle production tends to involve common wheat, which is less coarse, more absorbent, and produces a softer texture. There are more than 600 different shapes of pasta worldwide – or 2,000 if you take into account all the different sizes, thicknesses, and lengths.

The Greeks have “orzo”, the Germans “spätzle”, and noodles are a staple of East and Southeast Asian cuisine. While the Italians may be fiercely protective of their pasta variations, this much-loved food has existed across the globe for centuries. Noodles had become a staple food for the Chinese as far back as the Han Dynasty more than 2,000 years ago, although they were thought to be making noodle-like dishes as early as 3,000 BC. The Japa-
Chinese are believed to have begun adapting Chinese recipes to make udon noodles as long ago as the 9th century, with ramen noodles becoming popular at the start of the 20th. Rice noodles are used in Thai and Vietnamese dishes, while some varieties of Korean noodles are made using acorn meal. The distinctive, see-through cellophane noodles used in Chinese, Vietnamese and many other cuisines, meanwhile, are usually made from mung bean starch, although some Korean varieties are created using the starch of sweet potatoes.

It’s believed that noodles were first made in Asia thousands of years ago, with European adoption coming about possibly thanks to nomadic traders. By whatever means it came to Europe, it soon became a staple of the Mediterranean diet. It has a low glycemic index – a good source of the slow-release complex carbohydrates that help to keep people feeling full longer and stop them snacking.

When it comes to per capita consumption, the Italians have the top seat at the table, followed – perhaps surprisingly – by Tunisia, Greece, and Chile. In fact, it would be possible to take the amount of spaghetti and linguine that Italians consume each year and wrap it around the earth 5,000 times! Italy is also the biggest exporter of the product, and little did Founding Father Thomas Jefferson know when he apparently served macaroni to his presidential dinner guests that the United States would go on to become the world’s biggest pasta importer. It was the industrial revolution that led to the mechanized production of pasta and its consequent adoption across the globe. The industrially produced product has gone a long way to making people’s lives easier. It’s an affordable, nutritious food that’s quick and easy to prepare, and can be stored for very long periods. It is universally loved by adults and kids alike, and can be made so quickly, it allows busy people to have more quality time.

Easy, hearty, and affordable
Flour milling and pasta making go hand in hand. Bühler built its first flourmill in 1890. It’s been providing innovative solutions to the pasta industry for almost as long – making its first pasta production equipment just 13 years later – and since then has manufactured entire pasta production lines, with components such as dryers, presses, coolers, along with control systems that enable customers to save on costs and energy without compromising quality. Today, 40 percent of global pasta production takes place on Bühler machines.

“I had been aware of Bühler’s pasta solutions for a long time,” says Loschi. “What I didn’t realize was that the company has been doing it for over a century! Many people ask me if it is difficult to convince customers about Swiss pasta solutions, but the industry is aware that Bühler is a leader. My job, therefore, is to listen to customers and ask hard questions to ensure that the products we create on our solutions always have the best quality, taste, and performance.”

As tastes change, some foods inevitably get left behind, but pasta’s longevity is down to its endless versatility and ability to evolve and adapt. One of today’s biggest trends is the ever-increasing popularity of “nutritional pasta”, which encompasses organic and wholegrain pasta, gluten-free varieties, or protein.

Around 11 percent of European pasta now has nutritional benefits, while in North America that figure rises to 15 percent as American consumers continue their shift towards more “natural” products. “This so-called better-for-you pasta is an interesting field for Bühler,” Loschi explains. “It adds new challenges for pasta production technologies but also new opportunities in terms of ingredients. Gluten-free products have been on the market for a while. Now, pasta with pulses is another advancement and we are working closely with customers to make tasty products. What I love about pasta is that there is so much potential to explore new variations.”

With more than 150 billion dishes consumed every year, one thing is certain – pasta won’t be disappearing from our dinner tables any time soon.
Barilla is feeding the world with its pasta. Its uncompromising quality, Mediterranean lifestyle, sustainable approach, and wholesome nutrition are the ingredients sustaining its growth. Bühler has supported Barilla’s production and internationalization efforts for decades – and Swiss values have played a key role in this.

TEXT: BURKHARD BÖNDEL / PHOTOS: THOMAS EUGSTER, JASON WALS Smith
Great brands are like powerful lighthouses that beam their light out into the turbulent seas of globalization. At a time when things are changing at breakneck speed and becoming more complex, their clear position makes it possible to navigate the seemingly infinite choices we have as consumers. What should I wear today? What should I brush my teeth with? What car should I drive? What perfume should I put on? What pen should I use? And, quite fundamentally: What should I eat? What tastes good, and what is good for my health?

In Parma, Italy, stands a lighthouse. Like no other, it fills the pasta universe with light: Barilla. The 140-year-old, family-owned, fourth-generation company is the undisputed global leader in the field of pasta.

Parma is home to the world’s largest pasta plant, which produces about 1,000 tons of pasta per day, and Barilla’s largest grain mill, which grinds around 1,000 tons of durum wheat into semolina, the raw material for making pasta. This is enough to feed 5 million people every day. If Bavaria stands for beer, Scotland for whisky, France for champagne, pasta has become synonymous with Parma. Uzwil, Switzerland, is not too far away.

Balmy breeze from the Mediterranean

“With our pasta, we carry a bit of the Italian lifestyle out into the world,” says Antonio Copercini, Chief Group Supply Chain Officer of Barilla in charge of global production. When you bite into Barilla fusilli spiced with pesto, you cannot help but feel the balmy breeze blowing in from the Mediterranean; you think of the gentle rolling hills of Tuscany, or hear excited voices shouting “Mamma Mia” and Vespa scooters clattering down alleyways – while all the time knowing: What I am
eating is delicious and healthy food. True, Barilla’s current portfolio includes much more than pasta. Sauces, bakery goods, and restaurants are also part of its business. Yet the pivotal products of this global food giant with over 8,000 employees, 28 production sites, and sales revenues of EUR 3.6 billion in over 100 countries remain spaghetti, penne, farfalle, fusilli, bucatini and others. Of the roughly 600 different pasta types that exist, Barilla carries about 200 in its product range.

Since the nineties, Guido, Luca, and Paolo Barilla members of the founding family’s fourth generation, have been the driving forces behind the globalization effort. “We had realized that quality pasta is unknown in key regions of the world,” says Copercini. In order to develop these markets, Barilla started building its own production sites there – grain mills and pasta lines. “We were aware of the fact that we had to be present locally.”

In 1998, production was launched in America. Starting at zero, the market share of Barilla now stands at 34 percent. Encouraged by this triumph, the company entered the Russian market in 2012, and growth of the Parma-based pasta producer has been even more pronounced in the East than in the West: Within just a few years, 12 percent of all quality pasta there was being made by Barilla. The success in both America and Russia has already called for the construction of additional factories and the expansion of existing ones.

**Partnership of 50 years**

This is where Bühler comes in: For over 50 years, Bühler has been one of the most important solution providers and equipment suppliers to Barilla. The first pasta line was ordered by Pietro Barilla in Uzwil, and the company’s mill in Parma is equipped completely with Bühler machinery. Today, Bühler is a trusted partner serving Barilla along the entire value chain. As the supplier of durum cleaning equipment, optical sorters, roller mills, sifters, and pasta lines, Bühler is part of the Barilla success story. “Bühler’s competence in providing solutions is a crucial factor for us,” Copercini says.

Barilla has chosen Bühler as its supplier for its new pasta factories and expansion projects. Seven of the 11 new production lines that it installed in the past six years were supplied by the Swiss Bühler Group: two pasta lines for entering the Russian market in 2013; the launching of gluten-free production with two lines in Ames, Iowa in the US in 2014; a large short-goods line for expanding the capacity in America in 2017; and in the same year the expansion of production in Russia by two additional lines. “Bühler has made a substantial contribution to our expansion efforts, and we are glad to have such a competent and dependable partner at our side during these ambitious projects,” says Copercini.

There are many reasons for the close partnership between Barilla and Bühler:

- **Technology and process expertise**

  Bühler possesses unique technology and process expertise, from grain handling and cleaning, optical sorting, and grinding to the actual pasta process with its mixing, shaping, and drying stages. This enables Barilla to implement complex turnkey projects with Bühler as a single source.

- **Innovation capabilities**

  The focus on sustainability and healthy food requires permanent adjustment and innovation capabilities both on the part of the pasta producer and the process technology supplier. Take gluten-free pasta as an example: Bühler
identified this trend at an early stage, responding to it by rolling out the appropriate extrusion technology based on the Polymatik pasta press. Because the raw material lacks gluten as a gelatinizing agent, the native, gluten-free raw material undergoes hydrothermal treatment in the Polymatik.

Or consider energy efficiency: In order to reduce energy costs and to increase the sustainability of production, Bühler has developed dryers that use up to 40 percent less energy. Another instance is digitalization, exemplified by PastaSense, which was launched at the Ipack-Ima trade show in Milan in May. It is equipped with sensors capable of continuously reading and saving the characteristic data of both the raw material and the finished pasta. The added value that this generates is complete production monitoring for quality management as well as automatic data capture.

- **Project management**

Managing complex projects such as the construction of a completely new factory, in which the deadline for completion and commissioning must be met to the day, is anything but straightforward. Today’s supply chains are globally organized and must be expertly managed. Reliable partners and careful project execution are then needed on site for installation. With Swiss precision, Bühler succeeded in meeting Barilla’s ambitious deadlines every time. For example, this allowed the Ames plant to package and deliver its gluten-free products without any problems from day one. “This was truly powerful performance that cannot be taken for granted,” explains production chief Copercini.

The steady growth and the outstanding reputation of Barilla are no coincidence. “We are uncompromising when it comes to quality,” says Copercini. This means that no matter where around the world you buy a pack of Barilla pasta, you can be sure to always get a product of a light yellow color without any discolorations or specks, an “al dente” bite with a fine wheat-like taste, and consistently high nutritional value – or in other words: protein content.

**Good for you, good for the planet**

Recently, the pasta-maker’s focus on sustainability and healthy food has also proved to be a valuable asset that customers appreciate. Barilla introduced gluten-free and whole-grain products a long time ago. Now it is launching an entirely new product category: pasta made from pulses. At the same time, the company has reduced the salt and sugar content of over 300 of its products and slashed the carbon emissions of its production plants by almost one-third. “Good for You, Good for the Planet” is Barilla’s purpose – and this is no mere advertising statement, but the company’s credible corporate philosophy.

Thus, the association between Barilla and Bühler is far more than a simple, matter-of-fact business relationship. “There are so many things that connect us,” says Copercini, referring to tradition as a family-owned companies, value-focused corporate cultures, quality orientation, sustainability – and passion. “These provide a sound basis for us to continue our shared success story far into the future,” says Copercini.
Ames, Iowa: A gluten-free spaghetti line was commissioned at the end of 2015.
“We do not judge consumer trends, instead we follow them worldwide.”

Antonio Copercini, Chief Supply Chain Officer, Barilla
The relationship between Barilla and Bühler is based on strong ties. The companies have striking similarities, common goals and values. It’s not surprising that these two giants of the food industry have combined their strengths to sustainably produce delicious pasta. Antonio Copercini, Barilla’s Chief Group Supply Chain Officer, explains why this cooperation is key to Barilla’s success.

INTERVIEW: BURKHARD BÖNDEL / PHOTOS: THOMAS EUGSTER

What does it take to make really good pasta?
Pasta is a very simple product. It’s wheat and water. To get good pasta, you start with the raw material. You need to have good durum wheat with a good protein content. Then you need to mill it properly to get the right semolina. Lastly comes the process, and that is decisive. It is all about mixing, forming, and drying.

You are responsible for production. What are the key elements to ensure the quality of this process and to make it highly efficient?
Machinery and devices are very important. The mill must run very reliably 24/7 with just a few people involved. In the pasta process you have to have full control of the key parameters such as drying, and the process must be very stable. So we need high levels of automation, reliability, control and stability.

How do you use digitalization to improve operations?
Digitalization offers a new dimension of transparency and traceability throughout the whole production process. The interaction between machinery and operational staff is becoming very limited. Operators mainly do supervision, everything else is done by the machinery itself. With this, we are increasing our capability to make good pasta and we will increase efficiency in the process.

Pasta has been around for thousands of years. However, it is still a very innovative area. What are the most important consumer trends and how do you respond to them?
One of these trends is to know exactly where your food is coming from. Consumers are very interested in knowing the origin of food. They associate the origin with the quality and purity of the product. They also expect consistent quality. Barilla stands for the Italian type of pasta which has the typical “al-dente” characteristic. We have set these same standards in the US and in Russia and the consumers have rewarded us.

What about health and lifestyle trends such as gluten-free pasta?
They are very important for our customers. For many years they have been interested in new formulations with proteins and whole content what we call “integral”. The gluten-free trend which started years ago and now is growing in double digits. The new trend is pasta not only from durum wheat but from vegetables. We do not judge consumer trends, instead we follow them worldwide.

«There’s no reason to interrupt good momentum»
Barilla has been growing for years – how do you explain this success?
We are a very consistent company. The most important asset is the trust of the consumers. And our mission is to give them what we would give our children. That makes us different. Our goal is simply to be number one in each market we are in. And, in fact, we are either at the top or number two.

You have captured the US and Russian markets. What triggered your decision to build factories there?
The US market launch and development is really a nice story. It is the biggest market in terms of value. But the quality we found was very poor. Furthermore, the Americans did not really know how to cook pasta. So after considerable investment, we built up our capabilities to produce Italian pasta there. Thanks to our extensive communications campaign, we were able to gain market share year after year.

We are now at 34 percent, and we are certain that the market will continue to grow. We are now doing the same thing in Russia. We have already become number one there.

Barilla has chosen Bühler as key partner for its recent expansion projects. Why?
The story of Barilla and Bühler started many years ago. There is a long cooperation between the companies, starting with the owners Pietro Barilla and Urs Bühler.

When I entered the company, I was very soon introduced to this historical relationship. There are strong commonalities between the two companies: They are both family owned, having dominant positions in their markets, they have respect for sustainability and for people. On top of that, the employees of both companies have passion for the jobs they are doing and have an outstanding capability in the markets they operate. We are very similar in terms of intent and mission. There is a top-to-top relationship in management which is based on trust and strong support. So, there is no reason to interrupt such good momentum.

Building new plants requires excellent project management. How have you experienced Bühler in this respect?
Bühler has a strong discipline in execution, a strong background in innovation. They know exactly
how to do it. This fits perfectly to our purpose to invest into new factories and bring them to operation quickly. Speed, agility, delivery attitude and reliability for results is a must. When you invest in a new plant, you must be ensured, that in 12 months you can start production and sell. This is something which distinguishes Bühler from others.

**Bühler not only offers pasta technology and equipment, but the whole value chain from raw material handling, cleaning, sorting, milling to the end products. How important is this for you?**

When you design a plant you don’t only design the production line, but you design the whole supply chain. To make a good product, you need to start from the field and go all the way to the cooked pasta on the table of the consumer. Barilla’s intent is to integrate all these processes, from selecting the raw material to storage, cleaning, grinding, mixing, forming, drying and packaging, to controlling the delivery to the end customer. Bühler has the capability to take ownership of most of these relevant steps which for us is definitely a benefit.

**Sustainability is part of Barilla’s DNA – how do you cover this topic?**

It is really a mantra for us at Barilla. It is not just a slogan. When you deal with sustainability you have to deal with every aspect of the entire value chain. We start from the field. Sustainable cultivation for us means supporting a sustainable agricultural system with field rotation. We are planning to support this in every part in the world, and we are making good progress here. We are a first mover in this regard.

On top of this, we control what happens between the field and storage so there are no preservatives or contaminants. When you then come into the factory you have three big drivers: less energy, less emissions, less water.

Over the last years, we have reduced energy and water consumption by more than 25 percent. By 2020, we want to reach 30 percent globally. After production, you also have to optimize packaging and transportation.

All our packaging is recyclable. This is just one example. When you put all this together, we can develop a sustainable company, and this is how Barilla operates.

**“When you deal with sustainability, you have to deal with every aspect of the value chain.”**

Antonio Copercini, Chief Supply Chain Officer, Barilla
Perfecting pasta since 1903

We’ve been fine-tuning our pasta production lines for 115 years. All of the know-how we’ve accumulated means top quality and improved profitability for our customers.

TEXT: BIANCA RICHE / INFOGRAPHIC: D. RÖTTELE & M. STÜNZI

Pasta production: From a variety of grains to more than 600 shapes

= Process steps in milling
= Process steps in pasta production

Raw materials

Pasta can be made with semolina and a variety of flours from wheat, and other grains or pulses. The choice of the raw material is based on several factors, ranging from traditional preference, nutritional benefits, and local availability of grains.

Wheat
- Durum, common wheat

Gluten free
- Rice, maize (corn), buckwheat, millet

Gluten free (plus fiber and protein)
- Lentils, quinoa, chickpeas, peas, amaranth, beans

Traditional pasta takes time. The Polymatik takes about 15 minutes to mix and perfectly hydrate the dough that is made from coarse semolina granules.

Meanwhile, Bühler’s Polymatik technology quickly processes a variety of materials, including pulses. This press technology, based on kneading-assisted hydration, takes only 30 seconds to mix the dough and is also ideal for gluten-free pasta production.

115 years: Bühler’s history in pasta from 1903 to 2018.

1860: Bühler is founded. Adolf Bühler establishes his cast-iron foundry with two employees.

1890: First flour mill completely built by Bühler is introduced. This lays the ground for expansion into pasta business.

1903: Bühler produces its first pasta machine.

1933: A continuous extrusion press is brought to market.

1940: Launch of the first continuous dryer.

1984: Origin of Turbomatik pasta dryers. The new air management coupled with high drying temperatures significantly improves cooking quality.

* Whole grain or additional fiber added
** Fortified by adding ingredients including pulses for protein, etc.

Sources: Bühler; Eurmonitor International; International
To dry one ton of pasta you need about 250 kilowatt-hours of thermal energy. With our Ecothermatik technology for long pasta, 40% of thermal energy can be recuperated in the process.

New diets change the market

Around the world, the market for “nutritional pasta” is growing. In the last five years, it rose by 37.5%, mainly driven by Europe with a growth rate of 88.2%.

2017 Nutritional pasta market

2003: The launch of Bühler’s C-Line (Century Line) pasta dryers, marks 100 years of Bühler in pasta.

2006: Release of the gluten-free pasta process, the only one-step solution in the market: The starch is gelatinized directly in the Polymatik Press.

2012: The Priomatik traditional press is launched. It is ideal for processing coarse semolina, as required by Italian tradition.

2014: Technologies for frying and air drying instant Asian noodles are unveiled.

2015: Launch of high-capacity Ecothermatik. It reaches capacities of more than 5,500 kg/h and saves space as it is 16% shorter than the original machine.

2016: Start-up of high-capacity Ecothermatik.


You guessed it: Italians love pasta!

Per capita consumption in kilograms in 2017

<table>
<thead>
<tr>
<th>Country</th>
<th>Consumption (kg)</th>
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<tbody>
<tr>
<td>Italy</td>
<td>396</td>
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<tr>
<td>Tunisia</td>
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<td>Greece</td>
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<td>Chile</td>
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<tr>
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<td>7.2</td>
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<tr>
<td>Czech Republic</td>
<td>5,000 x</td>
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The amount of spaghetti and linguine consumed by Italians every year is enough to wind around the earth almost 5,000 times!

If we add instant pot noodles to the mix, China accounts for approximately half of the world’s pasta consumption.

Around 40% of global pasta production takes place on Bühler machines.
The secret is in the dough

New food trends are going mainstream. Healthier, protein-rich, vegetarian or vegan products are in demand – along with alternatives to traditional cereals such as quinoa or amaranth. Pasta manufacturers are also experimenting with new products. In addition to corn and rice, which have long been used for the production of gluten-free pasta, pulses are the latest star ingredients.

At Bühler, specialists at the Pasta Application Center in Uzwil have been developing recipes for the production of pasta with alternative ingredients for over ten years. “The first requests for adding other ingredients in pasta production came from our customers. They primarily wanted to improve the nutritional properties of their products. We soon realized that this trend is one that will develop very quickly,” says Elena Fischer-Domacheva, Process Engineer Pasta & Noodles.

**Improve the nutrient content**
Initially, the new raw materials were mainly corn and rice, but from 2010 we started adding pulses. These are high in protein and rich in fiber, vitamins, and minerals. They are an integral part of a vegetarian diet; lentils, beans, etc., are becoming more and more prevalent as superfoods, also among health-conscious meat eaters. This is because they are not just full of vitamins and minerals, they also keep you fuller for longer than other foods and they are suitable as meals for people watching their weight.

“The first tests showed that it is possible to add up to 30 percent of pulses flour to conventional pasta dough without compromising taste and cooking properties,” says Fischer-Domacheva, who performs Bühler’s alternative ingredients trials.

Rigatoni, fettuccine, orecchiette, fusilli: The number of different types of pasta is well over 600. Each of them has its own shape: hollow, long, thick, thin, ribbed, flat, or round and each tastes particularly good with the appropriate sauce, which is usually thinner for long types of pasta and thicker for small variants. Precisely because there are so many varieties, it is essential for every producer that the pasta maintains its specific shape during the cooking process, and that the pasta does not fall apart.

So the biggest secret of pasta production has now been revealed – it’s all about the stability of the shape, and the right consistency of the dough. This should remain elastic enough after cooking to make the prepared pasta look good and retain its typical bite. The drying process is also an important contributor, but the dough is the basis. The dough has to be supple and stretchy and have the right moisture content.

With traditional pasta made from durum wheat semolina, the production process is well established. The proteins contained in durum wheat semolina act as glue. When these proteins are moistened, gluten develops, which has glue-like properties that are ideal for the dough, making it both stretchy and malleable.
FOCUS / Pulses pasta 23
To manufacture these new products, the experts hardly had to change the process parameters on the pasta press or in the dryer. “We tested chickpeas, red and green lentils, white, black and red beans and yellow peas. They are all excellent additions to the dough.”

**Gluten-free products are in demand**

However, the mix between wheat and pulses flour was not enough for some customers. As pulses naturally contain no gluten, they are particularly suitable for a gluten-free diet. So it quickly became clear that the market required products that could be entirely made without raw materials containing gluten, such as wheat and spelt.

This presented the Bühler food technologists with completely new challenges in terms of dough preparation. As it is not possible to produce doughs made from gluten-free flours because of the missing gluten. In this case, the dough formation is based on the gelatinization of the starch contained in the raw material. However, not all starches are equal. Pulses are less starchy than gluten-free cereals like corn or rice, and they contain a lot of resistant starch, which is not suitable for the dough-making process, because it only gelatinizes at high temperatures.

Therefore, a process was needed that would optimally gelatinize the starch from the gluten-free raw materials. The solution is to hydrothermically treat the raw materials. “We work with relatively high temperatures. We add hot rather than cold water and superheated steam during the mixing and kneading process. We also keep the housing temperature of the Polymatik pasta press high. This creates a dough that we can shape and then dry,” explains Fischer-Domacheva.

It turned out that the Polymatik pasta press from Bühler is perfectly suited for producing gluten-free pasta dough. “But we’ve also found that the result is even better if we mix the flours from pulses with flours from cereals like corn, rice, or pseudo-cereals like quinoa or amaranth. These pasta products are not only gluten-free; they also taste great. We therefore recommend that our customers use blended formulations,” says Fischer-Domacheva. Mixing different raw materials has another advantage. With the help of Bühler’s technologists, customers can create their own recipes to make their products unique on the market. “We test our customers’ ideas in the Application Center and work together to create their own customized recipe.”

The sky seems to be the limit; you can mix corn and black beans, chickpeas and amaranth, or yellow peas and quinoa. But there are a few requirements for the raw materials: granulation of the flour is very important, the fat content should be low, and the amylose content high. Fischer-Domacheva measures these raw material properties in the laboratory and can draw an initial conclusion as to whether the production of a pasta dough is even possible using the chosen ingredients. “Customers often have certain ideas about the end product, for example, raising the protein content to a certain level. This helps us to find the right formula.”

**Getting the bite just right**

After that, they begin experimenting with the process parameters of the Polymatik pasta press, with different housing and water temperatures as well as the amount of water and superheated steam. The experts cook the different variants of the final product and test the pasta for taste and consistency, until
the desired goal has finally been achieved. The cooked pasta’s bite is hugely important and is right next to color, surface stickiness, smell, and taste in the series of “must-have” characteristics. “The selection of raw materials, their properties and the applied process parameters – everything has a huge influence on the texture and thus on the firmness of the cooked pasta,” explains Fischer-Domacheva.

When a recipe is ready and the product is successful in the market, the customers are happy. They have developed their own gluten-free pasta. “Of course, we keep the individual customers’ recipes a secret,” says Fischer-Domacheva.

**Endless varieties are possible**

Consumers can look forward to many new pasta products gradually coming onto the market in the near future. The excitement will continue for Fischer-Domacheva too, because new ideas are constantly being brought to them: “The choice of raw materials for gluten-free products is broad, especially because we can use the many different pulses and thus create an infinite number of different pasta products.”

However, something still stands in the way of endless variety. The raw materials would indeed be available, but there is a lack of producers who produce flour on an industrial scale, especially in pulses. “The technology would be there; at Bühler, for example, our Bühler colleagues from Special Grains & Pulses are experts in the production of pulses flours. But not enough producers have discovered this market,” says Fischer-Domacheva.

For once, the trendsetters in the industry are not from Italy, but from the US and Canada, partly because Canada is one of the world’s largest exporters of pulses and exports to over 130 countries. Europe has only recently rediscovered pulses. But here, too, more and more products are coming onto the market. “Pasta made from pulses flours is still a niche product, of course. Pasta made from durum wheat semolina is and remains the most common on the market,” says Fischer-Domacheva.

This is another reason why alternative products are always compared to pasta made from durum wheat semolina. Each experiment therefore has a clearly defined goal, she explains: “The more similar the texture and bite characteristics of the new products are to pasta made from durum wheat semolina, the better.”
We’ve only just begun

Ever-increasing consumer demand for transparency means that today’s food industry is more dynamic than ever. Johannes Wick, CEO Grains & Food, believes that while the journey to full transparency has only just begun, Bühler’s unique know-how along the entire value chain makes it ideally placed to take on the task.

**Going digital is at the core of Bühler’s strategy in 2018. What is the driver behind this?**

It’s very simple – it’s one of the main market needs today and in the future, and the push is coming primarily from the end consumers themselves. They are demanding more transparency and more quality, and they’re no longer accepting “black holes” along the value chain.

**How will Bühler deal with those “black holes”?**

As probably the biggest provider of food processing solutions, we are at the core of the value chain – we’re included in almost every step of food processing. We can implement traceability along the full value chain with our digital solutions.

**How does the development of digital services differ from developing a machine?**

Years ago, when we began exploring digital solutions, it was clear that this would be a very different business area in terms of R&D. When you develop a machine, you go through engineering, designing, and validation steps that can easily take two years. With digital services the market validation is equally important but you continue to make adjustments once the product has been tested in the market. This means we have to develop frequent updates every few months.

**Do you involve our customers this journey?**

Working together and sharing ideas is vital in the digital world. We have realized that the more we share ideas with our customers, the more those ideas will grow and new ones will develop. Ideas are screened and assessed and then it’s all about integrating customer feedback as quickly as possible to create a new offering for the market.

**Another benefit of digitalization is that it improves the nutritional value of food and feed. How is that accomplished?**

The new sensing technologies offer a range of possibilities for measuring the composition of materials – this includes not only the actual lab scale but also online measurements. Of course, the more you know of what you have as a raw material, the more you can adapt the processes and the more you can actually tailor a solution for the consumer, for example to make more protein-rich foods as an alternative to meat.

**Along with the focus on digital solutions, what are some other innovations in the pipeline?**

Embracing digitalization, of course, doesn’t mean that we neglect our core business, namely our technology and know-how in processing foodstuffs. At the Ipack-Ima fair in Milan in May, we presented two sets of innovations: our new digital products and our latest technologies in milling and pasta.

In milling, for example, we exhibited our latest version of a pearling machine, which is designed to the highest food safety standards to produce the cleanest pasta ever. Also, we’ve found a way to include our optical sorting experience into the pasta process to ensure a much more consistent quality in the end product. Our real “big bang” this year is that we’re working on a very new concept for how
“The more we share ideas with our customers, the more those ideas will grow and new ones will develop.”
to build mills – one that we’re sure will revolutionize the industry by using only half the space. We’ve already developed some front-runner projects together with our customers, and the solution should be ready for the market in 2019.

Another game-changing innovation to eliminate aflatoxins was presented at the Hannover Messe together with our cloud partner, Microsoft, in April 2018...

This was a real highlight for us – to have been invited by Microsoft to join them at their booth to display several innovations, including the LumoVision optical sorter. LumoVision is a revolution, not only in terms of the technology but also its potential impact on society. It can help improve the lives and livelihoods of millions of people affected by ingesting maize contaminated with aflatoxin.

The people at Bühler behind this innovation are very much driven by their wish to improve nutrition in developing countries – they developed this technology with the clear aim of solving the problem of people dying from the consequences of long-term exposure to aflatoxin-contaminated maize. LumoVision will help save the lives of the poorest individuals in countries most affected by aflatoxin.

What is your vision for this technology?
The dream is that all contaminated grains are separated from the crop directly at the source – right at the harvest – and from there that we could achieve full traceability and eliminate cross-contamination. We’re working toward this goal, and with this we will achieve our target of 30 percent waste and energy reduction, while improving the lives and livelihoods of many people.

This is quite a task when considering the number of smallholder farmers in the value chain, especially in Africa.

It is a huge challenge – one that can’t be addressed by a single company. We are seeing a trend of more products being processed locally, which is better in terms of sustainability and increased traceability. Even with local production, it’s still necessary to conserve the harvest properly, and drying, sorting, and cleaning processes have to be installed. In most cases, this isn’t happening yet. However, the earlier you treat the material, the more efficient the next steps will be. For example, with aflatoxin, if you separate right after the harvest you only need to separate about 3 percent of contaminated products. If you do it in the mill, you need to separate up to 30 percent because of cross-contamination.

How can Bühler impact this?
The biggest impact we can create stems from our know-how of the whole value chain. If you look at each of the process steps, whether in a mill or a pasta plant, each has been optimized over decades. But before each of these steps there’s quite a lot, and the more you go towards the beginning of the value chain – to the farm – the more impact you can have on improving safety and quality. The fact that Bühler is actually providing solutions from the conservation of the harvest up to the processing of the finished goods for the consumer enables us to develop a range of different solutions. This makes our position unique.

Bühler is also investing in new application centers. Why is this so important?
There are two reasons – one is we are dealing with natural products, which are obviously not always the same, due to different conditions in the fields and harvest. Consumers, however, always want the same product, which requires a lot of testing. On the other hand, there are new consumer requirements all the time – such as more healthy or more balanced food – that have to be developed, tested, and implemented into existing processes and technologies. Both are continuous tasks, so we really do need our application centers.

What is the benefit for our customers?
In our application centers we offer training and carry out experiments and product tests together with our customers. They can use the facilities for their own trials which are, of course, assisted by Bühler specialists. There are many ways in which customers can benefit.

In Uzwil we have extended and renewed the Bakery Innovation Center and the Pasta Application Lab. We are also building a food application center in North America, focusing on pulses and maize with the aim of finding new protein-based foods. In April we opened a completely new center in Changzhou in China, a testing center for the processing of animal feed.

What is Bühler’s recipe for such long-term success in the various industries in which it operates?
I think the main recipe is that we just continuously innovate. I mean, it’s a very dynamic industry. On one hand, of course, you have the traditional recipes, where you just need to provide more efficient solutions to produce the same type of product. But on the other hand, consumers really have new demands every day and the better we can serve them, the better our market position is.

For over 100 years, we have been investing 4 to 5 percent of our turnover in R&D. To develop new applications we work very closely with our customers, which is vital in terms of knowing what they need. And that is a big part of our success story.
Aflatoxin threatens the lives of millions

We can help protect them.

We’ve developed a breakthrough sorting technology that reduces aflatoxin contamination in maize and reduces yield losses to less than 5%. LumoVision will help save the lives of the poorest individuals in countries most affected by aflatoxin.

Would you like to learn more?
lumovision.support@buhlergroup.com
Toxic food: a global challenge

Aflatoxin is an invisible poison and a major threat to health and food security. Bühler has developed a system with the potential to change the lives of millions.

TEXT: MICHELLE BOMER/ INFOGRAPHIC: DANIEL RÖTTELE

What is aflatoxin?
Aflatoxin is a naturally occurring poison (mycotoxin) produced by a fungal mold (Aspergillus spp.). Along with malnutrition, it may contribute to 50% of the 4.5 million deaths of children under 5 in sub-Saharan Africa.

Climate change is making our food more poisonous
Previously more prevalent in tropical and sub-tropical regions, mycotoxin contamination is now on the rise in temperate areas – meaning it will increasingly become a food safety issue for Europe even if global temperatures can be limited to an increase of only 2 °C. There have already been documented cases in southern Europe.

Maximum limits
Maximum limits for aflatoxin B1 in the European Union in µg (micrograms) per kilogram.

<table>
<thead>
<tr>
<th>Category</th>
<th>Maximum limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baby food</td>
<td>0.1</td>
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<tr>
<td>Food for adults</td>
<td>2</td>
</tr>
<tr>
<td>Food raw material</td>
<td>5</td>
</tr>
<tr>
<td>Animal feed</td>
<td>20</td>
</tr>
<tr>
<td>By comparison in Kenya: food</td>
<td>10</td>
</tr>
</tbody>
</table>

Preventing aflatoxin contamination is a multi-player task

Today, no treatment destroys aflatoxin in contaminated food crops. Just two highly contaminated grains in 10,000 can render an entire batch unfit for food. As a result, many tons of good grain are lost, contributing to the one-third of all food that is wasted globally.

Good agricultural practices help prevent aflatoxin. This includes using the right seeds, proper crop rotation and pest management, and good irrigation.

Good post-harvest processing helps prevent aflatoxin. This includes properly drying and storing crops, and also protecting them from pests.

Eliminating contaminated grains by cleaning with classifiers, aspiration, and optical sorting can help prevent aflatoxin from reaching the food chain.

LumoVision optical sorters reduce aflatoxin contamination in maize. Yield loss with this system is less than 5% compared to 7–25% with conventional sorters.

A cloud-based solution enables real-time risk analysis for precision processing to maximize productivity and deliver an unprecedented level of accuracy.
500 million of the poorest people in developing countries, including sub-Saharan Africa, Latin America, and Asia, are at risk of chronic exposure to aflatoxins throughout their lifetimes. Many communities in these regions live on the crops they grow. Regulations for maximum aflatoxin limits in food are also less strict in these regions.

### A STUNTED GROWTH IN CHILDREN
Long-term exposure causes stunting, which includes impaired cognitive and organ development and growth.

<table>
<thead>
<tr>
<th>Country</th>
<th>Prevalence</th>
<th>Average Age</th>
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</thead>
<tbody>
<tr>
<td>Africa</td>
<td>40%</td>
<td>5 years</td>
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<tr>
<td>Southeast Asia</td>
<td>27%</td>
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<tr>
<td>Western Pacific</td>
<td>20%</td>
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<tr>
<td>Eastern Mediterranean</td>
<td>10%</td>
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</tr>
<tr>
<td>Latin America</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

### B FOOD AND HUMAN BREAST MILK CONTAMINATION
Children in countries that rely on a maize-based diet are exposed to aflatoxin through the food they eat or as infants through their mother’s milk.

### C SUPPRESSION OF THE IMMUNE SYSTEM
Chronic exposure to the poison weakens immune systems in humans and animals. It leads to nutrition-related chronic diseases in adulthood.

### D LIVER CANCER IN ADULTS
155,000 cases of liver cancer a year are attributed to aflatoxin. The rate of liver cancer in Africa is up to 60 times higher than that in the United States.

Distribution of hepatocellular carcinoma cases attributable to aflatoxin in different regions of the world

**LumoVision will help save lives and reduce food waste**

Special cameras and sensors enable LumoVision sorters to reduce aflatoxin contamination in maize by up to 90% with a yield loss of less than 5%**, while a Microsoft cloud solution helps the processor to estimate contamination risk of the raw material to maximize productivity.

**This result is based on using the SORTEX A LumoVision sorter alone, which is only one part of a cleaning workflow. Yield loss is likely to be even lower when part of a complete workflow.”

[Diagram](image-url)
Benedict Deefholts, Senior Research Engineer in Digital Technologies at Bühler, is the mind behind LumoVision.
Sorting maize to save lives

Aflatoxin, a natural carcinogen that affects maize, is hard to detect, yet its impact is devastating for millions of people. LumoVision, a breakthrough sorting technology from Bühler, improves significantly on previous systems and has the potential to transform lives and livelihoods around the world.

TEXT: JANET ANDERSON / PHOTOS: JUDITH AFFOLTER & THOMAS EUGSTER

Looking for aflatoxin contamination in maize is like looking for the proverbial needle in a haystack. Aflatoxin is a naturally occurring carcinogen that affects maize, one of the most important food and feed crops grown worldwide and a staple in the diets of many millions of people. The consequences of failing to find it are serious. “Eliminating aflatoxin contamination from maize represents one of the major food safety challenges faced today,” says Benedict Deefholts, Senior Research Engineer in Digital Technologies at Bühler.

Deefholts is one of the minds behind LumoVision, a revolutionary data-driven optical sorter developed by Bühler that finds and removes aflatoxin more effectively than any previous system. It represents a breakthrough in the search for a solution to a problem that has devastating effects on the lives and livelihoods of millions of people worldwide.

Aflatoxin is impossible to see with the naked eye and even today’s state-of-the-art sorting machines have trouble detecting it consistently. Yet just two highly contaminated kernels in 10,000 are sufficient to render an entire batch unfit for human consumption.

In the developed world, consumers are largely shielded from the effects of aflatoxin contamination and cases of aflatoxin poisoning are rare. Farmers, grain handlers, and food processors are alert to the dangers and apply a combination of sophisticated and costly prevention and reduction measures to rid it from the food value chain. Regulations are in place to ensure these measures are applied strictly and consistently. When cases arise, swift action is taken to alert the public and minimize the risk.

In the developing world, where many communities consume the produce they grow themselves, such protection is low or non-existent. It is these many millions of individuals who are most exposed to aflatoxin contamination.

An urgent challenge

Chronic, long-term exposure to aflatoxin is estimated to cause 155,000 cases of liver cancer a year worldwide, with the highest incidence in Africa, where the rate is as much as 60 times higher than that of the US, according to International Agency for Research on Cancer. Mothers who eat contaminated maize can pass aflatoxin to their unborn babies. This has been associated with stunting, where children’s physical and cognitive development is impaired. It can also be passed to humans through milk from cattle that have been fed on contaminated feed.
Acute exposure to high doses of aflatoxin are fatal – in Kenya in 2004, 125 people died in an outbreak.

According to the International Agency for Research on Cancer, 500 million people in developing countries are at risk of chronic exposure to aflatoxins throughout their lifetimes. The scale of the problem is such that aflatoxin is recognized by the Food and Agriculture Organization, the World Health Organization, and other public health bodies as a major food security challenge.

“It is one of the biggest global pains, but also a complex problem that is difficult to tackle,” says Béatrice Condé-Petit, Food Safety Officer at Bühler. Aflatoxin is caused by a common fungal mold called aspergillus, which grows on the maize plants when they are stressed by extreme weather, such as drought, and on maize kernels when they are not dried sufficiently before storage or when they are stored in a high-moisture environment. The mold produces a range of toxins known as mycotoxins, of which aflatoxin is the most toxic. It is colorless, odorless, and cannot be destroyed through cooking or other thermal processes. “Contamination can occur at any time, from when the plant is growing to post-harvest storage. It can get into the food chain through contaminated grain fed to animals and affect products like milk, meat, and eggs. It is a complex problem that no one player can tackle alone,” says Condé-Petit. The only way to be certain of contamination is to send a sample to a lab for testing, but this is a time-consuming process and, since the contamination occurs in hotspots, very hit-or-miss.

As a leader in food processing systems, Bühler’s sorting systems play a key role at the milling and cleaning stage, when harvested maize is passed through its sorting machines to detect and remove contaminated kernels. The current solution relies on looking for signs that contamination may be present, such as discolored, brittle or shrunken kernels, as well as dust from broken kernels. However, these signs are not direct proof of contamination; some contaminated kernels display none of these signs, while some with these signs are not contaminated. To be on the safe side and meet the required safety standards, between 5 and 25 percent of the maize is rejected.

A breakthrough technology

This is where LumoVision comes in. Unlike conventional optical sorters it is able to detect direct indicators of aflatoxin contamination in grain and to assess risk in real time using the power of latest digital technologies. The result is that LumoVision eliminates 85 to 90 percent of contaminated grain with a yield loss of just 5 percent.

One key to the breakthrough was the observation that contaminated maize fluoresced a bright green color under ultraviolet (UV) light, whereas clean grain fluoresced blue. The fluorescence is thought to be caused by kojic acid, which, like aflatoxin, is produced by the aspergillus fungus when it grows on maize. This color difference could only
The LumoVision sorts up to 15 tons of maize per hour. Ultraviolet light is the key for detecting contaminated grains.

be detected by cameras using a long exposure. “The challenge was to design a camera and lighting setup that would pick up the difference within milliseconds – the rate at which cameras scan in sorting conditions,” says Deefholts.

The team at Bühler’s Research Lab & Center of Excellence in London, UK, designed a hyper-spectral camera and powerful LED-based UV lighting system for the sorting machine. With these, each maize kernel is analyzed as it passes the machine’s sensors. Contaminated grains are blown out of the product stream by air nozzles that deploy within milliseconds of detection.

By connecting the machine to a cloud platform provided by Microsoft, the team at Bühler were able to go one stage further and provide real-time risk assessment of the grains as they are processed. The data collected is transmitted to the cloud where it is compared with other data such as the weather conditions under which the maize grew. This data is then combined to calculate the risk of contamination for each grain. When the risk falls to a minimal level, sorting halts while monitoring continues. If the risk rises, the machine automatically restarts sorting.

“This is a great example of technology finally catching up with potential,” says Matthew Kelly, Managing Director of Digital Technologies at Bühler. “We have worked on the problem of aflatoxin contamination for many years, but only now is the technology available to produce a commercially viable solution that takes a real step forward.”

The combination of processing know-how, specialized cameras, and lighting, together with cloud technology, data science, and Internet of Things, delivers an unprecedented level of accuracy at industrial grade throughputs of up to 15 tons an hour. “To put that into perspective, if you cut the bottom out of a 1 kg packet of rice, this machine can successfully sort the bad grains from the good ones before it hits the floor,” says Kelly.

Reducing aflatoxin contamination is not only a huge contribution to food safety, it also reduces the economic impact of yield loss for farmers and food processors and helps to reduce food waste globally. “I believe LumoVision has the possibility of transforming millions of people’s lives, particularly in the developing world,” says Deefholts. “It also meets one of Bühler’s main aims: to provide safe food sustainably.”
A toddler dances. She wears one shoe, holding the other as she happily sways to imaginary music. Her mother glances at the 1.5-year-old now and again, but her attention – along with that of the other mothers gathered in a little room at the Centre de Santé health facility in the Rulindo district of Rwanda – is on the nurse explaining the importance of proper nourishment for their babies and themselves while pregnant or nursing. The mothers and children in this room are recipients of the fortified porridge made by Africa Improved Foods and distributed by the Government of Rwanda to scale up nutrition efforts and combat stunting in the country.

TEXT: MICHÈLE BODMER / PHOTOS: EHRIN MACKSEY
The mothers have brought their babies to be weighed and measured to assess their development progress. When they come for a check-up, they take part in a lesson and then get more of the fortified cereal, which they have also learned to prepare in similar classes. The mothers receive the fortified cereal for free as part of the Rwandan Ministry of Health’s Thousand Days program to address the effects of malnutrition, particularly in the critical first 1,000 days of development from conception to age two.

Finding lasting solutions
The young women keenly listen as a nurse describes how to prevent malnutrition in their babies and themselves. Nourish your own body properly during pregnancy, breastfeed for at least two years, and when your infant is six months old, begin to supplement with the fortified porridge provided by the government. It is made by Africa Improved Foods (AIF). The majority of the women here are among the poorest 20 percent in the country and lack education, making them especially vulnerable to malnutrition. Added to that is food insecurity, a significant threat in Rwanda. The government has partnered with AIF to find a lasting solution to both issues. Despite ongoing efforts, nearly 37 percent of children under five in Rwanda are affected by stunting, according to the government’s 2015 Comprehensive Food Security and Vulnerability Analysis report.

Stunting is one consequence of under-nutrition, and simply put, it means a child’s height is significantly less than the average for their age. However, the complexities of stunting extend far beyond impaired growth to include poor cognitive and organ development, weakened immune systems,

“The world needs smallholder farmers. AIF can do its part by making rural livelihoods more sustainable.”

Amar Ali, CEO of Africa Improved Foods
AIF produces its commercial Nootri range cereals for mothers and infants.

and nutrition-related chronic diseases in adulthood. Though the numbers have improved from 43 percent in 2012 when the last study was made, there is still much to be done, primarily in rural areas, such as Rulindo, where the average is still 40 percent compared to 27 percent in urban areas.

**Taking action in the first 1,000 days**

While the statistics are daunting, stunting can be prevented if the right steps are taken in those first 1,000 days. “We’ve placed 46 children in the government program at the Centre de Santé. All of them have stunting problems where their height did not match their age,” says Jacqueline Urures, head of the health center and a nurse for 15 years. “It will take some time to accurately evaluate, but we can already say that three of them are now in the correct height-age range. We also see that well-nourished children have more energy.”

AIF’s mission is curbing malnutrition not only in Rwanda but across sub-Saharan Africa, which has been heavily impacted by famine in recent years.

The famine is fueled by the worst El Niño event on record. While achieving its mission, AIF is also working to develop a truly sustainable food value chain in Rwanda that it hopes to extend to other countries, including Uganda, eastern Congo, Kenya, Tanzania, and Ethiopia, in the next five years. “We are happy to be providing relief foods and foods to address malnutrition, but more needs to be done. Our premise is to support African countries so they reach a level where they no longer need international support and can be economically self-sustaining using local capacities,” explains AIF CEO, Amar Ali.

AIF directly employs 300 people – among them mill operators, who required training to learn to effectively and safely operate the high-end Bühler-built factory, located in the Kigali Special Economic Zone. The factory has a production capacity of 45,000 metric tons annually. “The need in Africa for the products we produce is extremely high considering the famine in East Africa,” Ali explains. “We can’t afford downtime. We chose Bühler because we wanted a reputable company that knows
Engineering Customer Success

Bühler’s involvement in what would become AIF began in 2009, when Peter Boehni, Head of the Bühler Innovation Satellite at the Swiss Federal Institute of Technology in Lausanne, heard about a DSM project that would address malnutrition in Africa with a factory in Africa. “I knew this was the perfect project for us because we share DSM’s goals of wanting to create a more sustainable food industry to feed the growing global population and address malnutrition,” says Boehni. The project was aptly named “Life.” Though technical discussions with the Bühler team, DSM, and consortium initiator CHAI (Clinton Health Access Initiative) began in 2013, Project Life only really began to take form in 2015 when the AIF consortium was established and the decision was made to build a plant in Kigali, Rwanda. “Things happened fast after we signed the contract in July 2015,” says Bühler’s Theodor Sutter, Key Account Manager for the project. By December 2016, the plant was fully productive.

how to build in Africa and in challenging environments without compromising quality and that will be with us through all the challenges. There have been many challenges, and Bühler has been there as a partner throughout. One of the challenges was finding people to operate the mill. Bühler did that as well, training our people on their equipment in Nairobi.”

AIF officially inaugurated its CHF 60 million plant in May 2017, but already in late 2016 had begun manufacturing fortified cereals for its biggest customers – the World Food Programme (WFP) and the Government of Rwanda. From the start of production to the end of 2017, the company had produced 4 million kilograms of fortified cereal for the Rwandan government, and 17 million bags – 26 million kilograms – of relief foods for the WFP.

The WFP and the Government of Rwanda are not only customers. They are also members of the AIF public-private joint venture, along with Royal DSM (the project initiator), the International Finance Corporation, Dutch development bank FMO, and the UK-based CDC Group. “We could not achieve our mission without the support of the Rwandan government, which is a shareholder, cus-
Bühler Service Engineer Alex Ndachi is often on-site to train AIF technicians in the maintenance of machinery.

On a hazy, warm morning in September 2017, almost 20 cooperative members have gathered to help Akmanizanye sow maize. “I could not manage it on my own,” she explains in Kinyarwanda, the country’s national language. Cooperative manager, Thacien Hakizimana, interprets her words into English. “People in the cooperative work together. We work in harmony to help one another,” she says.

Each family tends between 100 and 1,500 square meters of land. The majority of them lack access to modern methods of harvesting, processing, and storage. This is where AIF comes in. The consortium collects the maize shortly after harvest and transports it directly to its facilities, where the moisture content is maintained to acceptable levels. “With AIF picking up maize harvests immediately, we have seen a significant reduction of post-harvest loss due to aflatoxin,” explains Yassim Iyamuremye, Director General of Corporate Services for the country’s Ministry of Agriculture and Animal Resources.

The farmers in the AIF cooperatives are paid at the moment of pickup, an unusual but effective practice. Raising the income of local farmers by sourcing crops directly improves their livelihoods and creates financial inclusion. “I’m grateful to be in the cooperative and have access to good seeds and fertilizer. Without the middlemen, I get a good price for my crop,” says Akmanizanye.
“AIF’s partnerships with the cooperatives create financial inclusion. This is a big achievement.”

Yassin Iyamuremye, Director General of Corporate Services for the Rwandan Ministry of Agriculture and Animal Resources
Just three years ago the government was struggling to find a market for the maize and soy crops produced by smallholder farmers, but it now faces a new issue, explains the Director General, as AIF is currently consuming about 30,000 metric tons of maize a year. “Our next issue is developing a strategy to ensure the raw materials continue to remain available to them. We need to put a system in place to mitigate drought impact and resilience against climate change, and irrigation systems are a big part of this.”

**It pays to invest in cooperatives**

Cooperatives play a vital role in drought preparedness, says Iyamuremye. “Well-managed cooperatives can make a difference, not only in the lives of individual farmers. They also help the government reach its goal of increasing agricultural GDP with their successful ‘teach my neighbor’ approach.”

Elia Habimana, Cooperative Chairman of the Rulindo district, applied for this voluntary position to help fellow farmers actively exchange knowledge. He is respected and viewed as a role model by his peers, explains Cooperative Manager Hakizimana.

“It is a lot of work to be the Chairman, but I want to support my government with the sustainable development of farming,” Habimana says. “We farmers have learned from the challenge of drought, we are elevating the quality of our harvests, and we are improving our yields. We have benefited 100 percent from our partnership with AIF.”

The investment into the cooperatives has a greater purpose than meeting AIF’s production goals, the company’s CEO explains. “Worldwide, 80 percent of farmers are smallholders, and they produce over 80 percent of the food consumed in the developing world. They have an essential role to play in food security, and with this in mind, we are facing a big problem. Young people today don’t want to take over the smallholder farms of their parents,” says Ali. “This has a lot to do with the fact that these farms haven’t paid off in the past. We are trying to solve this because it is part of a bigger picture. Africa’s population is projected to grow at about 100,000 people a day between now and 2050. They need food and jobs, and the world needs smallholder farmers to meet its nutrition needs. AIF can do its part by making rural livelihoods more sustainable.”

“I am grateful to be in the cooperative and have access to good seeds and fertilizer. Without the middle-men, I get a good price for my crop.”

Vestine Akmanizanye, Smallholder farmer and cooperative member
The El Dorado of the thin-film coating industry is in operation

Bühler reopened its revamped and expanded application center in Alzenau, Germany on December 1, 2017. Bühler Leybold Optics and its customers in the thin-film coating industry want to develop tailor-made and revolutionary product innovations in this collaborative space.

Bühler’s global network of application centers promises “Engineering Customer Success.” One means of achieving this is by working side by side with customers in these application centers to develop tailor-made, state-of-the-art products that help customers succeed. This global network has now been expanded: On December 1, 2017, the doors of the revamped application center for thin-film coatings officially opened in Alzenau, Germany.

On November 30, the opening ceremony of Bühler Leybold Optics was attended by 150 key representatives from the thin-film coating industry. In order to give the invited guests the broadest possible insight into the application center, booth tours were carried out and various machines were shown in action. The entire portfolio of Bühler Leybold Optics could be seen with 12 coating machines on display, including DynaJet, a vacuum sputtering system for metalization applications, Leybold Optics FLC for flexible layers, Helios, and Leybold Optics IBS for high-precision coating of high-quality products.

Covering an area of more than 1,200 square meters, customers have access to a test area, a high-tech laboratory, and a state-of-the-art research and development area.

Testing limits in a safe haven
“This application center is a safe haven where customers can conduct tests on our machines. The insights gained can be used in real production,” explains Samuel Schär, CEO of Advanced Materials, in his speech at the opening event. Customers can...
create production qualification samples, enhance their range of applications through coating applications, and test how reliable and robust new system components are. There are unimagined possibilities for further development. “A big advantage of this center is that we can work together on new concepts and test the limits of what is technically feasible,” says Giulia Smonker, R&D Department, Luxottica.

Apart from the added value for its customers, the application center is also key to the further development of Bühler itself. Solutions begin with the product, and only those who truly understand the end product and its associated challenges can develop good solutions, which is why a collaborative approach pays off.

“Thanks to this application center and the latest technology in the field of optical vacuum coating, we can expand our range of applications and our product qualification services. This gives us high-quality, reliable and robust machines and processes for our customers,” says Antonio Requena, CEO and Managing Director of Bühler Leybold Optics.

Saving energy with innovative coating

Thanks to its many innovative solutions, Bühler Leybold Optics has grown considerably in recent years. With vacuum evaporation systems, Bühler Leybold Optics is contributing considerably to better food preservation, to greater comfort and to greater energy efficiency. For example, buildings with coated facade glass from Bühler Leybold Optics consume up to 30 percent less energy for heating and cooling.

Thin-film solutions from Bühler, in turn, cover very broad areas of application – from functional optical coatings for window glass and car headlight reflectors to flexible packaging. Coatings for ophthalmic and precision optics products, such as lenses and laser optics round out the product range of Leybold Optics.

“The application center is a safe haven where customers can conduct tests on our machines.”

Samuel Schär, CEO of Advanced Materials
Bühler opened a new battery laboratory in Wuxi in March 2018, further developing its leading position in the production of high-performance electrode slurry. With this new lab, Bühler can meet customers’ expectations for concept trials, formulation, and process optimization. “This new battery lab features the latest applications and will allow us to strengthen our cooperation with our customers,” says Cornél Mendler, Managing Director Grinding & Dispersing. The lab, covering 400 square meters, is installed in a large dry room, making it possible to process and study battery raw materials which are susceptible to moisture. The heart of the lab is a continuous twin-screw mixer with multiple powder and liquid feeders. “We are using this technology to produce battery samples on a much better performance and consistency level than with conventional methods,” says Adrian Spillmann, Director Market Segment Battery Solutions. Three process engineers and a service engineer work in the battery lab in Wuxi. The first trials with Chinese and European customers are already scheduled.

The cocoa test center at Bühler Indonesia is now open

Bühler has invested over CHF 500,000 in a new laboratory where various cocoa applications can be tested. Customers can try out the complete processing of cocoa, from handling of the raw product to production of the cocoa mass and quality control for the end product. Fifty-five representatives from well-known cocoa and chocolate manufacturers inspected the laboratory technology when the lab opened in mid-March 2018. “We showed our customers what our laboratory and our specialists can do – both in terms of research and new product development,” says Joachim Essig, Head of Market Segment Cocoa.

Customers were enthusiastic about the possibilities, according to Ajay Nair, Production Manager at Olam Cocoa Asia Pacific: “This is just what we’ve been waiting for. Bühler provides support and also presents innovative solutions. That is why we cultivate close relationships.” A number of customers have already made bookings for laboratory tests.
Bühler’s Innovation Challenge 2018 culminated in April when the winning idea was chosen. The company-wide competition gives employees the opportunity to submit ideas that have the potential to make a real impact for our customers and our business. This year, nearly 350 teams submitted ideas – that’s twice as many as in 2016. In a next step, employees, along with an independent jury, voted for their favorites, selecting just eight teams with particularly promising ideas. On April 30, a deciding jury had a difficult task of selecting a winning team from the eight. They chose a project that has the potential to help ease the protein gap expected as the world population grows. The winning team from left to right: Béatrice Condé-Petit, Food Safety Officer; Georgios Akepsimaidis, Food Safety Project Manager, Nicholas Trounce, Head of Product Management Wheat & Rye, Frank Cordesmeyer, intern, and Jay O’Nien, intern. The challenge has taken place every two years since 2012. The innovations from past winners have all been brought to market, including LumoVision, a sorting technology that will minimize toxic contamination in maize (see article on page 32).

With Oslo’s ambition to become carbon-neutral by 2030 and Norwegians being among the world’s biggest per capita drinkers of coffee, it seems natural that Bühler should team up with the country’s largest coffee manufacturer to build the world’s first carbon-neutral coffee plant. Joh. Johannson produces high-quality roasted beans and ground coffee. The challenge is how to produce carbon-neutral coffee without compromising on flavor or quality. Extensive flavor-matching trials took place at our Application Center in Uzwil until cupping experts gave their seal of approval. The new greenfield plant in Vestby will be using two Bühler InfinityRoast 2000 roasters with green bean preheating units along with sophisticated energy recovery systems and emission control technologies that cut energy consumption and greenhouse gases. Bühler is providing all the processing equipment apart from packaging. Hundreds of photo-voltaic panels will be used to mitigate energy consumption and ensure the plant is carbon-neutral. The future plant is a landmark change that will allow Joh. Johannson’s customers to enjoy carbon-neutral coffee.

**A strong partnership: Bühler and Microsoft**

Bühler and Microsoft committed to an alliance that will increase the availability of safe food at the Hannover Messe in April 2018. The partnership will also enhance food integrity and traceability with the roll out of cloud-based solutions and the evaluation of blockchain applications.

Food safety and availability are global challenges that demand solutions. The application of digital technologies, such as offered by Microsoft’s Azure cloud, artificial intelligence, and blockchain technologies, combined with the inspection and processing technologies of Bühler and partners, will provide transparency and greater efficiency in food value chains.

Block-chain applications in particular have immense potential. They can enable full traceability across food value chains and could be key to ensuring food integrity and winning the fight against food fraud. “We live in exciting times. Digitalization has now reached the global food system,” says Bühler Chief Technology Officer Ian Roberts. Microsoft and Bühler to explore the technological and business opportunities together.
We are moving even closer together

CEOs Stefan Scheiber, in an interview with Head of Communications, Burkhard Böndel, explains how Bühler combines customer success and sustainability, the role of digitalization – and why a strong corporate culture fuels growth.

TEXT: BURKHARD BÖNDEL / PHOTOS: RALPH RICHTER
Mr. Scheiber, a lot is happening at Bühler: You acquired the Austrian wafer, waffle, and biscuit specialist Haas, you are building an innovation center in Uzwil, and you have successfully entered the electric vehicle battery market.

That isn’t everything by a long shot. The list goes on; we’ve launched the first digital service for the quality assessment of rice; we’ve opened a new factory in Changzhou, China; we are equipping our production with Industry 4.0 methods; and we have aligned our Grains & Food operations more closely with market needs.

Transformations like you’ve described don’t happen overnight.
The foundations for it were laid years ago, and in many cases we are now reaping the benefits. Take batteries, for example. Five years ago, we began developing a completely unique continuous mixing process to produce battery slurry with our customers. The pilot line was launched in 2016, and in 2017 Lishen opened its new gigafactory in Suzhou using our new process.

How did you bring this change about?
It’s due to our innovation culture, which is bearing fruit. Bühler reached a leading position in many areas over the past few decades. But that can quickly lead to a situation where people suppose that no further progress is possible. People then automatically adopt a defensive attitude, and they fight defensive battles. We’ve definitely broken through this way of thinking. Of course, you can’t just change your market share as and when you like. But even where we’re already number one, there is so much untapped potential in the markets. We’ve now so deeply ingrained a motto into our conscious-

ness that we’re making huge progress. We call that motto “play-to-win” – for our customers, the world, and also for ourselves.

In what direction is Bühler moving with this impressive dynamism?
We have transformed ourselves into a solution provider for the sustainable production of food and feed as well as for applications for mobility and optics. We integrate value chains and processes with one point of contact between us and the customers. This way, we stand out from all the other providers in the market.

What are some examples of full solutions?
Take the processing of grain, for example. We come in after the combine harvester with silos, conveying systems, loading and unloading systems. Then the raw materials go through the cleaning process, optical sorting to ensure food safety, processing with grinding and milling – through to packaging. We can supply our milling customers with plants for producing dough or pasta, and also waffles and biscuits.

In the Advanced Materials business, solutions consist of highly integrated die-casting cells, including all the peripheries, such as robotics. On top of that are our services, training courses, and the opportunity to work together on solutions, such as new recipes, in our application centers. This comprehensiveness is one of Bühler’s unique selling points. We are extending it in a calculated way with new technologies, application centers, and the innovation campus – the CUBIC – which is currently under construction. We no longer think in terms of organizational business areas, but from the customer’s perspective. We think in terms of process solutions, for example: from grains to pasta, or from aluminum to the finished structural element.

“In 2017, we established our first team of data analytics experts. Our goal is to help advance digital transformation in our industries.”
What do customers gain from this comprehensive approach?
With our solutions, we can help our customers assure food safety, increase the quality and nutritional value of their products, reduce their energy consumption and waste, and increase their efficiency. Our sustainability objective is to enable our customers to use 30 percent less energy and produce 30 percent less waste.

Such value is not created purely at the machine level, but rather by integrating value chains across entire systems. This becomes visible with major projects, such as the ones we are completing in Bangladesh. Here we are helping to fundamentally improve food supply throughout the region. For us, sustainability isn’t an afterthought; it’s the starting point for our actions, especially when developing new technologies.

What are other benefits of this setup?
They are very practical: our customers don’t have to deal with 20 different people, just with one contact. That makes it easier to develop and implement complex projects. As we develop products further, we can synthesize and standardize individual elements strategically, with automation, for example. Of course, it’s only possible to offer these kinds of integrated solutions with qualified employees. This is why we run excellent training programs for our employees, and our customers also benefit from our offering. After all, top-range equipment needs to be operated properly to reap the most benefits. This training takes place in our global application centers, or the milling schools that we run on every continent.

Which new opportunities does digitalization open up for the industry?
We urgently need new technologies and solutions to make our world more sustainable. Approximately 30 percent of all food still goes to waste, too many antibiotics are being used in animal feed, and our transport systems are coming close to their limits. How can we better understand, manage, and control such complex systems and value chains? This is where data-based applications will help us in the future.

Can you give us an example?
We have now launched a quality check for rice made up of a light box, an app, and a cloud solution. The rice processor prepares a rice sample, slides it into the light box, opens the app, and scans the grains with a mobile phone. The app sends the image to our cloud, where it is analyzed and a precise result is produced in minutes. The processor can then use this information to optimize their plant and negotiate prices with retailers with the documented quality data. This is a significant leap relative to existing practice. Currently, rice producers manually take samples once a day by placing them on a grooved board and sorting the grains of rice by hand according to their quality. This is not only inconvenient, time consuming, and inaccurate; it doesn’t produce structured, traceable data.

How is Bühler adapting to these changes?
We are doing this by setting up our new Digital Technologies business area, accelerating the development of such services from our site in London, and investing extensively in technical platforms and specialists. In 2017, we also established our first team of data analytics experts. Our goal is to help advance digital transformation in our industries.

How is this changing the relationship with our customers and other partners?
We are moving even closer together. The enormous potential of connectivity lies not only in technology, but also in people with their specific knowledge, experience, and skills. A few years ago, we completely opened up the innovation process at Bühler. Meanwhile, collaborative innovation with customers, our employees, scientific institutions, start-ups, nongovernmental organizations, and technology partners has become an established practice for us. No individual can answer the question of how to sustainably nourish 9 billion people in 2050. This requires networks where various experts come together to develop and implement new solutions. The fact that we at Bühler have contributed to establishing such networks, not least through our Networking Days, makes us proud, and we regard it as a duty. As a relevant market player in the areas of nutrition and mobility, we have a responsibility to our customers and society. We strive to live up to that calling.

“For us, sustainability isn’t an afterthought; it’s the starting point of our actions.”
INTERVIEW / CEO Stefan Scheiber

Burkhard Bönkel, Head of Corporate Communications.

Stefan Scheiber, Chief Executive Officer.
Growing together
A special history connects Bühler with the Turkish car parts supplier Çelikel. Having grown together over a period of 20 years, a new era of cooperation has begun. The goal of this long-term partnership is securing a strong position for Çelikel in the European automotive supply sector.

TEXT: CARMEN PÜNTENER / PHOTOS: ANDREAS ZUBER, CARMEN PÜNTENER
Approaching Çelikel, one is greeted by the sight of an orchard with over 60 fledgling olive trees stretching their branches skywards. They grow on the roof of the Çelikel die-casting building in the city of Sekerpınar about 50 kilometers outside Istanbul. The building is just two years old and encompasses the production halls, a floor for the back offices, meeting rooms, an inner courtyard with garden, and a cafeteria for around 500 employees. Everything is ultra-modern, wood and glass predominate.

With their young, smooth, greenish-grey branches and tender leaves, the trees on the roof complement the prevailing urban style of the complex. The greenery is a welcome sight in this industrial area. It also serves another purpose. “In three to four years, we expect to harvest approximately 40 kilograms of olives per tree,” says Oguzhan Deniz, Commercial President at Çelikel. “This is approximately 300 liters of olive oil. We will use it as gifts for our customers.”

Oguzhan Deniz shares management responsibility with his brother Okan, who is three years younger and has the last word in all technical matters. Çelikel is growing just like the olive trees. New orders from the automotive industry facilitated the construction of the new production site.

The legacy continues
Çelikel has a 50-year history and the brothers have been part of it for over 20 years. “We are proud of what we’ve accomplished,” says Oguzhan. “Our late father Osman started the business with a warehouse measuring just 16 square meters. Back then, they still used sand casting. My brother and I joined in 1995.” The company produced mainly white goods back then, and parts for irons and washing machines. Competition was fierce, with similar white goods products coming in from Asia. “We decided to switch our production focus and manufacture more complex aluminum parts for the automotive industry. We wanted to stay in shape for the
future,” says Oguzhan. His brother Okan adds: “To do this, we needed new, high-quality equipment.” Çelikel has continuously restructured its business over the past years, says Paolo Zanone. As a former salesman and Managing Director at Bühler Brescia, he cultivated this customer relationship, even after he switched to the Feed division at Bühler as Global Feed Sales Director in 2018. “To my mind, their strategy of switching from white goods to the automotive supply industry was a wise one.”

Quality equals safety
The automotive industry enjoys the top spot in the die-casting sector. Aluminum components for cars account for 90 percent of worldwide production. Of this 90 percent, 40 to 50 percent is manufactured with Bühler die-casting machines. “Bühler sets high standards and it is a clear point of reference in the market when it comes to quality,” says Zanone. Quality, which equates to safety, is the essence of the car industry. It would be a disaster to have a shock absorber break on impact due to porosity. The same principle applies to an unstable front axle or material defects in another car component. “Our machines produce top quality items and also enable us to manufacture with less waste,” says Zanone. Okan confirms this. “We’ve tested it – one of our 10-year-old machines with the same stamping block had a reject rate of 3.5 percent, while Bühler’s new Evolution 66 was less than 1 percent.”

The reliability of Bühler’s die-casting machines persuaded the Deniz brothers to go for this model in the future. The actual injection unit ensures consistency in the die-casting cell, the heart of the die-casting machine. Peter Schneider, Sales Support Specialist at Bühler, explains: “Our machines use parameters for production which are repeated with every casting cycle once they have been defined and programmed in the control system. These parameters generate a reference curve which is reproduced cycle after cycle in the injection process for the liquid metal. Bühler machines
"When production runs as reliably as it does here, we are free to concentrate on other things."

Oguzhan Deniz
Commercial President of Çelikel

are also able to react to influences such as temperature fluctuations and can regulate speed and pressure values automatically."

**Sharing the same values**
The cooperation between the client and Bühler is not a matter of chance. The companies had already been in contact for decades. The former Managing Director of Bühler Istanbul, Detlef Tremer, regularly visited the company and developed a cordial relationship with the Deniz family. Moreover, the philosophies of Çelikel and Bühler were highly compatible, Zanone says. “Bühler is a family business. This is why many other family businesses feel an affinity with us. The owners of Çelikel see their values reflected in Bühler.”

As far as the Deniz brothers were concerned, it had long been clear that Bühler would be the best partner for them as soon as the time was right. “The change in strategy brought an upturn and we bought four new machines in two years,” says Okan, visibly proud of his new acquisitions.

The company’s actual move to the automotive industry started with the first Bühler Carat 105 over a year ago. From then on, the technical teams at Çelikel and Bühler worked hand in hand until the first serial production emerged from the production halls. According to Peter Schneider, Bühler Sales Support Specialist, it was a textbook example of cooperation: “Everything worked smoothly from the start. We really got on well with the Çelikel engineers and project managers straight away. The relationship was open and respectful.”

**Working at full steam**
Now there are two Carat 105s in the production hall. They are working at full capacity. The air is heavy with the steam rising from the aluminum cooling process in the casting cell. Two rows further along is the Evolution 66, the latest acquisition in the Çelikel machine park. Okan can hardly contain his joy.

“The Bühler machines are extremely reliable,” he explains. “They run day after day, week after week, month after month. We are very pleased with the output.” Last year Çelikel was able to increase this from 12,000 to 13,000 metric tons. The figure indicates how much aluminum was processed per year. “Our target is 20,000 metric tons per year – with the same production area and number of employees,” says Oguzhan, the strategist. “And something else is very important for us: When production runs as reliably as it does here, we are free to concentrate on other things.”
The Deniz brothers complement one another perfectly. Okan, who worked in production for 10 years at the behest of his father to acquire knowledge about all technical matters, now monitors quality and is driving forward development of new products. Oguzhan, who manages the sales side, knows about all the recent trends in the industry.

**The latest technology for success**
The production hall is 24,000 square meters and resembles a small Legoland. Every minute, the forklift trucks place the manufactured aluminum parts into large wooden crates. The melting plant sounds a warning signal when the crane drives into the hall with one of the giant concrete pots.

Inside is the glowing aluminum, 700 °C hot. Flashing lights warn of the danger, one drop of the viscous liquid would go right through clothing in a fraction of a second and could cause serious burns. Which explains why such great attention is paid to safety in production. “Safety first” – this is the motto printed on the back of the shirts of every employee at Çelikel.

The fourth Bühler machine, another Evolution 66, is due to be installed this year. The Deniz brothers have already cleared a space for it. There is a prominent gap next to the existing Evolution where the new casting cell will be installed. The most important thing for Okan is that the cooperation with Bühler goes beyond merely installing new machines: “Bühler is a solution provider. In addition to the machines, we are acquiring technology and know-how.”

Okan and Oguzhan have plans. The first step was constructing the new site. Now they want to try to consolidate their position in the European market, even if Istanbul is not the ideal location for it owing to the relatively high transport costs incurred in delivering goods to car manufacturers. However, when choosing the new site, the tried-and-tested team was the key factor for the Deniz brothers:

“Our employees are highly qualified in their respective fields. When we moved, it was important that we could take the entire workforce with us. So we chose a location close to the old one. This industrial zone in the east of Istanbul is also home to many other suppliers to the automotive industry. And this is an advantage,” says Oguzhan.

The Deniz brothers’ enthusiasm and long-term approach impressed Zanone: “Çelikel is a customer for whom I would drop everything. Like Bühler, working sustainably is important to them. They share the same long-term mindset.” The mutual hymns of praise ring true; here are two ideal partners who have found one another.

“Çelikel will definitely be buying more Bühler machines,” says Okan Deniz. “Our plan is to increase our capacities and buy even bigger machines for the foundry.”

Every piece produced is inspected to certify quality.
MTPA Osiris vertical pearler

Bühler’s new vertical pearler MTPA Osiris is setting new standards for grinding various types of grains and pulses. In contrast to conventional grinding machines with stone grinding disks, Osiris uses a synthetic diamond-coated rotor. This makes it possible to eliminate the potential risk of product contamination from stone particles. The innovative coating also optimizes the URWDWLRQVSHHGZKLFKLQFUHDVHVWKHJULQGLQJHijHFW7KHJULQGLQJURWRULVGULYHQ directly by the main motor, which eliminates the cost and maintenance of drive belts, which are also a source of possible contamination. The ingenious design makes the vertical grinder more efficient than conventional grinding machines.

- Maximum food safety
- Higher throughput rate – grinds up to 12 tons of grain per hour
- Reduced operating and maintenance costs

Diorit MDDY mill

The roller mill Diorit MDDY scores high with our customers thanks to its reliable grinding and exemplary hygiene. The new roll diameter of 300mm is especially suitable for the production of fine, low-ash flours with little starch damage. These flour characteristics are particularly desirable for Asian noodles as they provide the basis for outstanding product quality.

- Low-maintenance and energy-saving grinding
- Uniform grinding results over the entire roll length
- Available as four-roller mill 1000/300 and 1250/300

MMUN neodymium magnet separator

The magnet separator MMUN with its efficient neodymium magnets provides fully reliable separation of magnetic metal parts from flour, semolina, or flocks. The optimal selection is achieved by the enormous field strength of 10,000 to 12,000 gauss. At the same time, the magnet rods are located at the center of the product flow. This means that the product always passes at very closely to one or more magnets. The magnetic separator MMUN achieves the best results in the combination of gauss value (flow density) and section depth. The MMUN is also very impressive with its versatile application. As a pipe magnet it is suitable for the selection of magnetic metal parts in the downpipe. As a drawer magnet it is impressive with a low installation height and easy accessibility, which facilitates regular monitoring.

- Reliable selection of magnetic metal parts
- Hygienic design
- Easy to clean
OLCC cracking mill

The OLCC represents a new generation of highest-capacity cracking mills for the oil and feed industry. The machine is an unprecedented solution because it guarantees the lowest waiting times, the highest throughputs, and the best possible flexibility. The novel roll exchange mechanism expands the machine availability to an unrivalled maximum: In the roll exchange process the roller shaft remains in the machine – only the roll shell is detached. The sophisticated sensors and the full remote control options allow full integration of the OLCC into your personal process landscape.

- Comprehensive automation options
- Permanent magnet in the feeder

Carat die-casting solution

Carat, the bestseller amongst die casting machines, is being launched in a revised version in 2018. It is suitable for production of large and complex parts and is impressive with a number of innovations: It is more reliable, has optimized service intervals, and allows substantial energy savings. Alongside higher productivity and easy handling, it combines the latest technology with the best automation solutions. The Carat solution has impressed our customers around the world for 10 years: It is in use on five continents with approximately 450 applications.

- Automated first phase for shorter cycle times
- Ready for the digital age with the DataView control system
- Available in 13 different sizes

Uses up to 25% less energy
HEIP, for intelligent buffering

HEIP, the new high efficiency inline buffer for wafers by Haas, handles up to 30 wafer books per minute in stacking and up to 36 wafer books/min in unstacking. At this speed the cause of most inefficiencies in a production line can be avoided. “Micro-interruptions” such as foil rupture or small malfunctions which mostly result in piled up wafer books, manual removal and re-inserting as well as manual stacking and unstacking. The system acts dynamically and avoids the loss of valuable production resources by keeping them in the process, while avoiding humidity absorption or overheating. It then returns them to the process without any damage.

- Increased productivity
- Higher efficiency

HESZ cutting and infeeding system

HESZ, the new high efficiency cutting and infeeding system for wafers by Haas, combines gentle handling and efficient infeeding in the adjacent process. The space-saving system handles cutting and infeeding in one combined unit and has a remarkably high cutting and handling performance of up to 300 end products per minute. As it uses no conveyor belts for product acceleration or gap forming, the HESZ system can operate on a dramatically reduced footprint compared to other conventional systems. The HESZ system constantly controls the end products by continuously guiding or embracing them until they are fed into the packaging machine. This allows the entire process to take place reliably and at high speeds, even with end products containing less stable creams or when the system is operating at higher ambient temperatures.

- Eliminates product damage
- Modular construction for individual needs
- Needs less space
TUBO conveyor system

TUBO is a revolutionary conveyor system for transporting materials. Specifically designed for use in the food industry with its stringent hygiene requirements, it transports the bulk material without a tension cord in a closed pipe via TUBIT sliding elements. In comparison to conventional conveyor systems, TUBO reduces energy consumption substantially and transports the bulk material much more gently.

- Flexible system planning
- Takes up less room

PSM MYTA measuring system

PSM MYTA, the mobile measuring system, is suitable for determining particle size distribution between 10 – 5,000 microns. PSM MYTA combines laser diffraction and image processing in one system and in this way determines the granulation in grist, semolina, dust, and flour, for all common types of grain. The advantage of the new mobile version lies in its mobility and integrated operation. The system can be moved freely towards the different measurement points in the plant and can run off of an external power and air supply.

- Easy operation
- Quick and flexible measurement of particle size distribution
- Analysis and presentation of results directly on site
Bühler ReNew –
machine recycling
made easy

Why dispose of a trusted machine that has been used in production for years just because it’s reached a certain age? Instead, customers can find new homes for old machines by selling them via a recently launched Bühler Internet platform. Bühler acts as a hub, overhauling the machines and bringing them up to date.

TEXT: CARMEN PÜNTENER / INFOGRAPHIC: DANIEL RÖTTELE

Bühler has committed to sustainability. One aspect of this is waste reduction, and its ReNew platform is a great stride in this area. From mid-May 2018, customers registered on the ReNew website will be able to sell used Bühler machines, for example, when they are planning to replace their production lines with new ones. Existing or new customers who are not in a position to invest in the newest and most expensive plants benefit twice from this: You can buy a used machine that has also been overhauled by Bühler.

The ReNew service was developed by a project group from the Master of Bühler Management course. “Bühler machines enjoy an excellent reputation for their longevity,” says Hemanth Nagaraja, Project Manager at ReNew. “So we asked ourselves why the topic of recycling should not also receive special attention in our own company. We have built the resulting platform around the values underlying the Bühler brand – quality and trust.”

Customer-friendly user interface
This service is very easy to use. Customers can register and offer their used machines for sale. If another producer wishes to learn more about a product, they can contact Bühler. Depending on the needs and individual wishes, Bühler brings the system up to scratch in one of its refurbishment plants. This means the machines are up to date and can still continue producing for years.

All offers include a photo. Detailed information about the product is just one click away. Bühler experts are on hand to lend support at any time throughout the process, and Bühler even organizes the logistics and all the necessary export and import formalities as soon as a sale is completed. Another feature is the Refurbish section. Here, customers who wish to continue using one of their existing machines can obtain a quote for an overhaul. This is also of benefit to producers looking to renew their systems, but who are not yet considering a major investment.

Learn more about how the ReNew platform works by watching this explanatory video.

Ready to sell an old machine or buy a refurbished one? Visit: renew.buhlergroup.com

Text: Carmen Püntener / Infographic: Daniel Rötele
The idea of offering second-hand equipment is not new at Bühler. It has been involved in this area in Alzenau, Germany for a long time. The Minneapolis site has also overhauled and resold many of Bühler’s used machines, as well as Bühler Brescia, Die Casting’s refurbishment plant in Italy. However, the customer service staff negotiated the cases individually and verbally with the customers. “The projects were mainly in the minds of the sales staff. The business was driven by people and each business area did it a bit differently,” says Nagaraja. “We wanted a central solution for everyone.”

To ensure Bühler’s high level of quality and transparency, the company is involved in all transactions and approves all entries on the website. Up to now, the main users of the platform have been the Grinding & Dispersing and the Die Casting business areas, but other business units will follow.

The ReNew range also includes Bühler’s own refurbished machines, which are currently stored in the warehouses. All equipment that is resold – even machines offered by Bühler’s customers – will go to the new owner with a full warranty and the European CE certificate.

**First-rate second-hand trade**

“The portal guarantees that only ‘good’ second-hand machines will be on offer, which Bühler will restore to a highly-productive condition at an attractive price. This means the machines do not remain an impossible problem and do not turn out to be non-economically revisable – for example, scrap metal,” says Samuel Schär, CEO of Advanced Materials. “Personally, I prefer to buy a good used car at a reputable garage. That’s why I’m convinced that our customers will use the platform.”
Yi Liu, Director Process Technology Department, Lishen.
Breakthrough in the 6th attempt

It’s 2014: Jesse Wang wipes a bead of sweat from his face and readjusts his breathing mask. He knows that now is not the time to make mistakes. He joined Bühler three years ago, in July. He didn’t know much about batteries when he started, and he never thought that he would become an expert working tirelessly to develop a new electrode slurry. A process that would be so unique that his customer, Yi Liu, would later say: “This solution from Bühler will completely change the battery industry. It is a historic moment, a revolution.”

TEXT: SAMUEL ECKSTEIN / PHOTOS: EHRIN MACKSEY
Just after starting in this position, Wang received the order to expand the battery laboratory at the Bühler site in Wuxi. The talks with the first customer were so promising that Bühler quickly decided to make this preliminary investment. Wang was responsible for the battery industry in China, supported by his colleagues at the Swiss headquarters who had originally developed the idea for the new process.

But now he is alone in the battery lab, already working on the sixth trial to make the electrode slurry. So far, the tests have not produced the sought-after results. Would he meet the high requirements his customer Lishen was looking for this time?

**Batteries are the guiding factor**

Batteries keep our world turning. They are the small energy stores that drive our lives and make them easier. More and more cars are being entirely powered by batteries – particularly in China. In 2017, around 800,000 electric cars were sold in the country; that's nearly half the total global production.

E-mobility is heavily supported and subsidized by the Chinese government. It is an effective measure against air pollution and crucial to China's strategy of becoming a high-tech country. Financial support is expected to run out by the end of 2020 though. By that point at the latest, car batteries will have to be powerful enough to be able to survive in the free market. Reason enough for battery manufacturers, including Lishen to invest significantly in research and development of new processes to produce batteries.

Founded in 1997, Lishen today employs over 9,000 people. Its list of customers reads like a “who's who” of the electronics and entertainment industry: Apple, Samsung, Dell, HP, Huawei, and Lenovo are just some of the illustrious names. The Chinese battery manufacturer has production plants in Beijing, Qingdao, Suzhou, Wuhan, Shenzhen, and Mianyang and is one of the top-five battery producers in China. Lishen is planning to increase yearly output from around 10 GWh currently to 40 GWh by 2021 – which is equivalent to an output of around 800,000 car batteries.

It's all about the slurry

Wang applies the electrode slurry carefully onto a carrier film. It is black and slightly viscous in consistency. He is using a film applicator to apply the layer as thinly as possible on the film – this should be no thicker than 100 micrometers. Afterward, the dried electrode goes to Lishen and to his main contact, Liu, the engineer who is responsible on the customer side.

The cooperation with Lishen is extremely close. The two companies work well together: as the client, Lishen brings its expertise and knowledge of batteries to the table. In return, Bühler brings knowledge of processes and years of experience in continuous mixing: a unique mixing process never used in the battery industry before until now.

The electrode slurry is essential for the power density and energy density of a battery, that is to say, for the output and energy per battery volume. Traditionally, slurries are produced in batches in large vessels. These conventional plants are huge and expensive. The process is also very inflexible: if a batch does not

“This order has allowed us to send a clear signal to the industry: the new mixing process is ready for industrial use.”

Jesse Wang, Manager Battery Application Center, Bühler China
The viscosity of the electrode slurry took six years to perfect.

meet the requirements, it is either disposed of or used for inferior products. While the production of large batches takes several hours, the production in the new process developed by Bühler takes only a few minutes.

Using a rotating twin-shaft mixer, the necessary process steps – such as mixing, homogenizing, dispersing, and degassing – are combined in a single, continuously running unit.

Thanks to this continuous mixing process, the manufacturer is able to intervene at any given moment should the results not meet the requirements. Ultimately, what counts is that the improved mixing process significantly increases battery performance. It also reduces the investment costs, and the energy costs are much lower using this new process in comparison to using conventional production methods. Lastly, the space requirements of the new process are considerably lower, and fewer rejects are produced. Something that has also impressed Lishen. Abandoning the classic batch processing of electrode slurry in favor of a new continuous process benefits the customer. But will Bühler be successful in developing the industrial-scale process soon enough for Lishen’s new plant?

Each trial takes several months. First, the Bühler engineers develop and validate the optimum slurry composition based on Lishen specifications. Once the Bühler team is satisfied with the test results, they produce 50 liters using the new formula, which is then sent to Lishen. Liu, a leading engineer from the process department at Lishen, then takes over. The Lishen team uses the new electrode slurry to create battery prototypes and conducts extensive tests. Because this is no ordinary electrode slurry. Bühler has revolutionized the battery-making process.

Will the sixth attempt pay off?
Wang is in the analysis laboratory. In addition to the many other parameters, for this sixth test he has further adjusted the concentration of the bonding agent. The test results are in. He checks the
The rotating twin-shaft mixer is the heart of Bühler’s continuous process to produce electrode slurry.

viscosity and the distribution of particles in the electrode slurry as well as the electrical conductivity of the electrode; together these determine the power density and energy density of the battery. The viscosity of the slurry was particularly problematic in the last series of tests. New raw materials and new parameter settings led to the slurry being too thick, so that it could not be optimally used. “Thick and viscous like toothpaste,” Wang recollects.

The latest values convince the engineer. The test results meet Liu’s requirements. But it will be several months before Lishen confirms the results. It’s a long wait before Wang knows whether the client will want to perform more trials. But time is of the essence, because Lishen’s competitors are also working on innovations, and the Bühler process is the first in a series of steps in the complicated process of developing batteries. Should the Bühler engineers miss their goal, it endangers the whole manufacturing process and the new plants Lishen is planning in Suzhou.

The production of batteries takes place in several phases. It begins with preparing the various raw materials that the battery manufacturers usually buy from chemical companies. These are then processed into anode and cathode slurries in a mixing process.

This is where Bühler’s innovative continuous mixing process comes in; however, Bühler solutions are also used in the upstream process to ensure correct dosing of raw materials. After the mixing process, the slurries are applied to films. These are then cut to size and rolled up into battery cells. In the next step, the manufacturers charge and discharge the cells to ensure the best possible battery performance. Finally, the cells are packaged in battery packs, which are then used in cars. A single electric car battery consists of several hundred to several thousand battery cells.

“Everything hinges on this one call

Months later, Wang’s mobile phone rings. He takes the call. Liu is on the other end of the line. The Lishen project manager, who is usually rather restrained, is delighted: the results of the sixth trial are impressive. The viscosity problem has been solved, and the power density and energy density of the batteries have significantly increased during the test series.

Wang can hardly believe it. He only trusts the results after conducting the tests again. But in fact, Wang and his team have done it. The electrode slurry was indeed of the required quality. Things now start picking up pace, and Lishen signs a contract for the delivery of a pilot plant to their factory in Tianjin. It is August 2014, three years after Wang started working for Bühler.

The successful trials that eventually led to ordering the first pilot plant were the beginning of a mutual success story for Lishen and Bühler. Both partners agreed the delivery of 10 production lines on an industrial scale. Four will be opened in the new Suzhou factory, two in

“This solution from Bühler will completely change the battery industry. It is a historic moment, a revolution.”

Yi Liu, Director Process Technology Department, Lishen
Tianjin, where the pilot plant is located, and four more at the Qingdao location.

Altogether, the lines have a yearly output of up to 10 GW/h. Enough to produce more than 200,000 car batteries per year. “This order allowed us to send a clear signal to the industry: the new mixing process is ready for industrial use; the benefits can be seen directly in an industrial context. So it did not take long for additional orders to roll in. Another customer has already ordered four production lines, and we are in talks with further customers,” Wang explains.

A milestone for the battery industry

Wang ties his tie. It is July 20, 2017. Today is a historic moment, the grand opening of the Lishen plant in Suzhou in front of hundreds of spectators. He has already visited the plant and knows just how impressive it is: stretching over 600 by 50 meters, the plant contains all the processing steps for car batteries, from the raw materials and the electrode slurry right up to the finished electric car battery. Everyone from the battery industry will get together tonight. Representatives of the local and regional government will show up. A great success after six years of work in the lab.

It has grown dark in Suzhou. The audience listens with bated breath to the statements made by Qin Xingcai, the President of Lishen. The company plans to be at the forefront of the Chinese battery market with the new plant.

“This new factory of ours is producing a new generation of batteries. This 30 percent increase in energy density means we have achieved a quantum leap,” Liu and Wang nod to each other with appreciation. Lishen Suzhou honors Bühler with the Best Equipment Supplier award.

“Six years of joint research and development have paid off. Six years of strong cooperation between Lishen and Bühler colleagues in China and Switzerland. This award and 10 production lines at Lishen are visible proof of this,” Wang says with pride. And Liu adds: “Bühler kept the promise they made. Bühler is our long-term partner; we tackle new projects together.” Since then, Liu has been appointed Director Process Technology Department at Lishen. Not least because of the successful project with Bühler, and a milestone for the battery industry.
Internet of Things (IoT) technology is evolving across the food production process. Bühler’s Digital Services Portal offers a generational leap in IoT technology by combining powerful analytical tools with years of experience and data on how to maximize production yields.

TEXT: STUART SPEAR

Combine over 150 years of experience in the milling industry with technology that can analyze every aspect of your production process. Put all that information in one place and you can start to understand the potential behind Bühler’s Digital Services Portal (DSP) and Internet of Things (IoT) Platform.

Put simply, it is like having the combined experience of generations of experts permanently overseeing each of your machines, telling you how to fine-tune temperatures, best maximize yield from a specific raw material, or how to avoid downtime later by making adjustments now.

Instead of an army of ever-present and omnipotent technicians, all this knowledge can now be created through a network of sensors attached to machines, each transmitting information into the cloud where algorithms work their magic.

As dynamic data flows into the cloud, it is cross-referenced and compared with current and historic data sets. By looking at past production rates, a real-time assessment is made on how best to maximize current yield. It’s not just about the right information, but how to interpret the data generated by each machine, so the right action is taken when needed.

**Actionable data**

Once digested, the data is fed into a range of IoT applications, showing process optimization, key performance indicators, customer tolerance levels, predictive maintenance, or information unique to your production process on a customized dashboard. All this data is analyzed and presented in one place numerically and graphically, so it can be simply understood and then acted on.

The Digital Services Portal starts with the physical machine on the production line. Whether you have multiple sites involved in different processes across many countries or you have a single plant with more than one machine, the principle is the same.

At critical points, smart sensors are fitted to the machinery to provide the raw data. Existing feeds from machine and plant control systems are also fed into the cloud. Even smart phones can be used to photograph raw materials to help assess product quality as part of the IoT image processing analysis. Bühler has developed two image processing IoT solutions, one for corn (GrainiGo) and one for rice (TotalSense).

At all times, the client can see which machine is producing what real-time data. Trends can be assessed, performances compared or data stored for future analysis. Once converted into common protocols, the raw data can be transmitted into the cloud where it is channeled to different processing platforms.

**A wealth of experience**

This is where Bühler’s years of food processing experience across numerous product ranges feed into the IoT process. It means a wealth of data is stored for individual clients and across industry sectors to help inform product efficiency. Different platforms store historic data on different processes, such as yield parameters or machine health and output perfor-
mance. They combine this knowledge with the real-time data feeds to interpret what is happening right now and then provide actionable information if needed.

“We may have an IoT application looking at predictive maintenance, but we also store long-term historic data on a machine’s performance history,” explains Robert Cuny, Bühler’s Program Manager for IoT. “By making that data available to the analytics model, it can recognize certain performance patterns and run checks, maybe every half hour. If it spots the pattern and senses something may go wrong in the future, it sends the data to the app and raises the alarm.”

With data from all your machines now being analyzed on a single IoT platform, the result is a much more sophisticated and powerful analytical tool. In a food production line each process is inter-connected. Equally, the Digital Services Portal is able to analyze how each machine relates to the next.

Knowing that the number of grains being rejected by your sorter could be reduced by adjusting another machine setting earlier in the production process could give a valuable boost to yield.

Bühler understands that clients do not want to go to different systems or data sources to collect information on their overall production process. The goal is one portal with one log on to provide streamlined simplicity. Bühler plans to achieve this by integrating the Digital Services Portal with the existing myBühler Customer Portal, thus creating a digital world for the customer in one place. The myBühler Customer Portal then becomes the ultimate gateway for all services and products.

myBühler already knows about your plant and your equipment. Soon it will also be the interface through which you access all the data provided by the Digital Service Portal.

“In myBühler our customers can already order spare and wear parts for their machines. They can get an overview of all past and current orders and they can get product information, such as technical documentation and manuals,” explains Cuny.

“With the step-by-step integration of the Digital Services Portal and the IoT Platform into myBühler, static information from machines will be enriched with real-time information, such as KPI values or a machine’s health indicators, thus bringing an entire new dimension of production transparency.”

**ADDED VALUE**

- Customized dashboard displays customer-specific information
- IoT image analysis by Smartphone
- Overview of past and current orders

Would you like more information?

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Assessing the quality of maize has always been a tough judgement. It can lead to some costly surprises when quality fails to meet the mark. Which is why Bühler has created a technology capable of assessing milling yield from a sample of kernels that is about to revolutionize an age-old trade.

TEXT: STUART SPEAR

For generations maize merchants have used their experience and bargaining skills to negotiate the value of the crop they are trading. They can examine a kernel’s tell-tale signs to calculate a fair price. Equally, farmers have been looking for those same characteristics as their crop matures in the field, to help predict what they hope to get at market. But the challenge for buyer and seller alike is that their opinion is always subjective and open to dispute. Which, in an industry where 70 to 80 percent of corn-milling costs are tied up in raw material, can spell risk for everyone in the production chain.

What if you took the subjectivity out of the trading process? What if you could take the observations of the seasoned corn merchant and replace them with an objective crop analysis? If the technology were available to calculate milling yield, prices could be set with confidence and risk could be mitigated. That is exactly what Bühler has achieved with the new image analysis tool GrainiGo. Part of Bühler’s Internet of Things product range, GrainiGo is light and portable and designed to be used at any point in the production chain to provide an almost instant yield analysis.

This means farmers can send their crop analysis to potential buyers as proof of quality and value. Merchants will be able to firm up prices at either end of their trade while food manufacturers will have a guarantee of the quality of their raw material before it enters their mills.

Quality control
Today, when a lorry arrives at a food production plant, the operator has to rely on staff visually assessing hundreds of kernels, which is time-consuming, imprecise, and subjective. In order to assess the milling yield, lab-scale degeneration, milling, and sifting is needed. This cumbersome process may take up to two hours to provide a reliable result. The alternative is to ship the samples to a specialized laboratory which could then take days to get the results. Either method of quality control risks discovering you have a poor crop after it is too late and the maize is already in the production process.

But with the fast and accurate analytical powers of GrainiGo, the food producer will be able to assess quality before the maize is unloaded and so prevent further contamination or a costly low yield production run. With empirical evidence of the quality of their raw material, food manufacturers will also better know how to set their machine parameters to maximize yield for the raw material they are using.

“We saw how critical time was to making sure poor quality maize does not enter their mills.”
Janine Wegmann, Product Manager, Special Grains & Pulses
The way GrainiGo works is not so different from those timeless methods used by corn traders. By taking samples of maize kernels and assessing their length, color, and internal structure along with the number that are broken or blemished with specks, it is possible (using state of the art techniques such as deep machine learning) to judge crop quality and so product yield.

These are the exact parameters that GrainiGo measures. By using the photograph function on either an android or an IOS mobile phone and a foldable light box into which you place your samples, GrainiGo is able to create the ideal conditions to capture the unique characteristics of the kernel and send the information into the cloud for further analysis.

Once the maize sample has been placed in the mobile light box, two photographs are taken with a mobile phone and the analysis can begin. The first photograph is taken while light is projected from the bottom of the light box through the kernels to reveal their internal structures. The second is taken when light is projected from above to reveal their exterior qualities.

**Results in minutes**

With the photographs now in the cloud, the advanced Bühler algorithms can get to work calculating, analyzing, and comparing each photograph with historical data banks to assess what kind of yield can be expected. Within minutes, no matter where you are, the report is ready and available on your mobile phone.

In both graphic and numerical form, the user will see average kernel size, the numbers that fall below a minimum size threshold, how many are broken, hollow, or damaged, along with the percentage of the kernels that will need to be removed as germ or hull. Using these criteria, GrainiGo will then provide, within a 2 percent margin of error, a yield calculation. For example, a food producer or farmer will instantly see that this batch of maize will produce a certain yield in grits by weight or yield in flour with an estimated germ-flour yield.

Nothing short of revolutionary, this new technology is expected to boost productivity whether you are part of a farmer’s cooperative or a multinational milling operation. “When we were doing our research we visited milling companies receiving up to 20 truck deliveries an hour and we saw how critical time was to making sure poor quality maize does not enter their mills,” explains Product Manager Janine Wegmann. “Or you may be part of a farmer’s cooperative in Africa negotiating maize prices in a field. Your pricing will rely on a quick assessment of yield, which is what this tool will give you, just by objectively analyzing kernel quality.”

**ADDED VALUE**

- Harvest analysis can serve farmers as proof of quality
- Millers may assess quality before the maize is unloaded
- Light-weight, portable, and deployable everywhere

**Would you like more information?**

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Would you like more information?
The mechanics of milling revealed

It is a mill’s rollers that carry out the critical work when it comes to sorting and grinding the raw material. But what really goes on inside your roller mill and how is it impacting yield? The answer is provided by Bühler’s new Intelligent Roller Service.

TEXT: STUART SPEAR

What really goes on during the milling phase when grain is being processed? Until now it has been a bit of a mystery. The rollers are the heart of every mill. It is the rollers that separate wheat into germ, bran, and endosperm, the part of the wheat that is used to produce white flour. Depending on the type of flour, whole wheat or white, germ, and bran are totally or partially sifted.

But mysterious things happen to rollers while out of sight and inside their machine casings. Just the mechanics of the milling process can create extreme vibration and temperature. Material passing at speed can stick to the roller surfaces causing “winding” or additional vibration that leads to uneven processing. When raw material is absent, the rollers can overheat causing “dry running”.

Yield, efficiency, and product quality all depend on the performance of the roller mill, which is why the grain processor needs to know exactly what is going on. When you are in an industry where 60 to 80 percent of your costs are spent on raw material, increasing yield by just a fraction goes straight to the bottom line.

Which is why Bühler has launched its Intelligent Roller Service. From 2019, every Bühler roller mill will be prepared for or fitted with sensors inside the rollers capable of transmitting real-time data, alerting operators to conditions inside their roller mill. It means that adjustments can be made and preventative action taken to avoid costly, unexpected downtimes.

It is by using new Bosch sensor technology that Bühler plans to help its customers increase operation efficiency and reliability. This also opens the door to existing and new services that will use the power of the Internet of Things (IoT) to create data analytics that inform the real-time running of the plant.

The sensors will monitor temperature and vibration, detect uneven roller gaps, sense material sticking to the rollers (winding), and alert operators when the feed is uneven. All new Antares and Diorit Bühler roller mills will be “IoT ready” with the sensors able to transmit raw data into powerful future IoT services.

Retrofit service
But it’s not just new machines that will be able to access the Intelligent Roller Service and gain from the IoT analytics. Bühler is launching a retrofit package, so that existing machines will be able to benefit from the new sensor technology, even if a mill is operating a competitor’s roller mill. Customers will have the option of fitting different

“This is only the beginning of the journey when it comes to how Bühler plans to add additional value for its customers”
Nicholas Trounce, Head of Product Management Wheat & Rye
solutions. Plug Sensors can be fitted at either end of the roller, measuring temperature and vibration at opposing points and thereby provide key data to the operator.

“Working on the principle of monitoring the roller condition during operation will make it possible to inform the operations team in case of any critical event. The new service will also be able to detect temperature differences and tell the team where there is an uneven roll gap. The mill’s operational reliability can be improved with these new services,” says Nicholas Trounce, Head of Product Management Wheat & Rye at Bühler.

It is simple to install the plug sensors with holes drilled at each end of the roller. The sensor retrofit for existing rollers will be implemented by one of 100 Bühler Service Stations worldwide. It means operators will for the first time be receiving key information enabling them to make critical adjustments and increase the efficiency of their roller mills.

Full-length sensor
The second solution is to fit a new roller with a Roll Sensor running from end to end over the entire roller length. This will provide a more comprehensive data feed able to detect acceleration force or vibration and temperature variation from any point on the roller. Uneven product feed has always been a challenge for grain processors. With data from the full length of the roller being analyzed, a faulty feed can quickly be adjusted to maximize milling efficiency.

Both solutions are designed to provide the raw data for IoT analytics. Data fed into the cloud is analyzed to produce actionable information for the operator. “We transfer the data for analysis into the cloud so we can alert the operator, either through a dashboard in the control room or remotely on a mobile phone, that there is an uneven feed on roller three or there is winding on roller five,” explains Trounce.

The Intelligent Roller Service will complement other Bühler services such as myAssist, which gathers information from different parts of the mill for analysis. These live data feeds can be compared to historic data showing yield rates under different machine settings and parameters.

With the Intelligent Roller Service now joining the existing suite of Bühler’s IoT services, grain processors now have the tools to monitor the total running of their plant. “This is only the beginning of the journey when it comes to how we plan to add additional value for our customers,” says Trounce.

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**ADDED VALUE**

+ Existing machines can be retrofitted worldwide
+ Immediate information on critical operating conditions
+ Incorrect or irregular feed rate can be quickly adjusted and grinding efficiency maximized

**Would you like more information?**

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Safe oversight: the grain spoilage solution

Grain stored in silos is always at risk of spoiling. It is a risk that can be mitigated if you spot the right signs early enough. The Bühler Internet of Things (IoT) solution to safe grain storage gives you the oversight you need to store your raw material safely and use the equipment required to run a modern grain silo.

TEXT: STUART SPEAR

Whether you are a wheat farmer, a grain trader, or a mill operator, the risk of grain spoilage during storage is the sort of thing that can keep you up at night. Once the crop has left the field it has to be cleaned and then stored, either on farms, at regional reception depots, or at the mills themselves.

All food processes rely on safe storage of the raw material. Silo operators and managers are concerned about the integrity of their crop and the most efficient running of the machines that make up a modern grain storage depot. When everything runs efficiently yield is maximized and maintenance costs are minimized. But when something goes wrong the consequences can be very costly for a business.

Launched at the Agri Technica agricultural fair in Hanover in November 2017, Bühler Machine Condition and Silo Bin Monitoring is the latest IoT innovation to help reduce risk for managers and operators at the storage stage of the food production process. The solution monitors the four machine types that make up a silo plant: the cleaning machines, filters, elevators, and chain conveyors. The Bühler solution then monitors temperature at each point in the grain silos so potential spoilage can be prevented. Silos are fitted with vertical temperature monitors so the operator can see exactly where crop damage may potentially take place.

Bühler research with customer focus groups has revealed that silo operators and managers need the flexibility to step away from their control rooms or to monitor plants in other locations or even in a different country where there are multiple sites. This IoT solution has been designed so that the health status of each of the machines and the raw material can be accessed on a mobile phone, anywhere and at anytime. The phone app gives you an overview of the operation of the whole plant and allows you to drill down into each machine to see its health status. The app gives a countdown to the next maintenance interval and allows you to set alarms.

Flexible processes

Sensors are at the heart of this IoT solution. Multiple sensors are attached to each machine, feeding critical data into the cloud where it is analyzed against historic performance and maintenance data and real-time analytics. The sensors are designed to be retrofitted to existing machinery. Recommendations are made about what maintenance is needed when to prevent a later malfunction or yield reduction. It means the overall working of the plant can be visualized while alerts can be set when defined parameters are reached.

It is through this constant monitoring that unplanned downtimes can be cut to a minimum while the lifetime wear of a part can be optimized, reducing the need for spare parts. Operation costs can be cut by only carrying out maintenance when it is needed and reducing time-consuming physical
checks on machinery that may not require them. The app provides the data you need to optimize operations rather than always being reliant on the knowledge of an experienced machine operator.

Multiple sensors
All the parts of the process are inter-reliant. The grain arrives at the depot and is first moved to the elevator on the chain conveyor. The elevator takes the grain to the cleaning and filtering machines before it is ready for storage. The multiple sensors are feeding data from the conveyor’s chain tension and the belt tension and the drum status of the elevator. It monitors trends in pressure difference at the filtering stage to ensure reduced energy costs and the wear of filter bags.

At the cleaning stage the oscillating circuit is monitored to check the optimum movement of the sieving box. All this data is fed through the cloud and onto the operator’s mobile phone. Designed to be intuitive to use, the visualization of the data alerts the operator when action is needed.

The same intuitive visualization is used to describe what is happening inside the grain silo. The operator can get an overview of each silo and a temperature read out at each layer of the grain bin. Trend visualization shows temperatures rising and whether parts of the silo need to be cooled or aerated. The app assesses temperature rises to indicate if it could be a mold developing or insect damage.

Prevent grain spoilage
“If you suddenly have hot spots you know there is something wrong. With the information on the app you can start to aerate your silo to bring your raw material down to the recommended temperature for the grain you have,” explains Cornelia Koller, General Support for Machine Condition and Silo Operators by preventing grain spoilage and degradation of raw materials. It also allows them to run their plants optimally by monitoring their machines wherever and whenever it’s needed.”

ADDED VALUE

- Minimized downtimes
- The plant components have a longer service life and require fewer spare parts
- Less wear and tear, lower energy and operating costs

Would you like more information?

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Did you know ...

...that we are continuously improving our solutions for the production of safe foods. In 2017, 34% of our R&D projects focused on the topic, and we launched a digital food safety alert system.

...that in 2017 we exceeded our 2020 target of ensuring that 20% of our food-relevant R&D projects would focus on improving nutrition by 3%. This is just the beginning.

...that our goal is to reduce energy and water consumption, carbon emissions, and waste by 30% by the year 2020. In 2017, we introduced 50 new products and technologies that do just that.

...that in 2017 we exceeded our 2020 target of ensuring that 20% of our food-relevant R&D projects would focus on improving nutrition by 3%. This is just the beginning.

...that digital solutions will help us – and our customers – improve quality, reduce waste, energy, and downtime. We currently have over 50 digital services in development.

...that we contribute to making cars lighter with our die-casting systems, and electric vehicles more energy efficient with our new electrode slurry solution.
Our digital transformation continues to gather pace. We are convinced that digital technologies are key for us to deliver on our promise of achieving a 30 percent reduction of waste and energy consumption in the value chains of our customers. One of our digital initiatives that is essential to realizing these targets is the capability to connect our solutions to the cloud and analyze data. In the past 18 months, we have developed our Internet of Things (IoT) platform and now have the capability to connect more than 85 percent of our solutions to the cloud. With multiple services on our platform, we are learning to accelerate our digital service development. We have established several partnerships to achieve this.

A highlight on our digital journey was the invitation from Microsoft, our cloud partner, to join them at their booth at the Hannover Messe, the leading trade fair for industrial technology. To be alongside such prestigious industry leaders at the booth of this premiere software company was a humbling recognition of our progress.

We launched LumoVision, a new fluorescence-based optical sorting technology to reduce aflatoxin contamination in maize. Aflatoxin is a naturally occurring toxin produced by a fungal mold that grows on maize and other grains. It belongs to the group of natural poisons known as mycotoxins. The Food and Agriculture Organization of the United Nations estimates that 25 percent of crops worldwide are affected by mycotoxins.

More than one third of the world relies on maize as a staple food. Small quantities of aflatoxin are sufficient to make a batch unsafe to eat. In Europe and the United States quantities above 5 parts per billion (ppb) are considered as unfit for human consumption. In Kenya, by contrast, it’s 10 ppb. Long-term exposure has been found to cause cancer and is estimated to be responsible for up to 155,000 cases of liver cancer a year. The rate of liver cancer in Africa is up to 60 times higher than that of the US. Long-term aflatoxin exposure is also linked to stunting in children. Generally affecting some of the poorest and most vulnerable, stunting results in physical and cognitive impairment and is directly linked to inadequate nutrition and repeated infections.

The challenge has always been to effectively detect and eliminate those contaminated grains. LumoVision is the first industrial-scale solution to do just that by inspecting each and every grain. The contaminated grains are sorted out. Industrial testing has delivered a 90 percent reduction of aflatoxin while rejecting only 5 percent of the product.

We also invited Gamaya – one of our partners in precision farming – to showcase its solutions for improving farm efficiencies using satellite, drone, and farm data at the Hannover Messe. We also showcased two of our newest digital products: TotalSense, an easy-to-use, phone-based app for rice quality control, and FoodSafe.ai, a food safety alert tool using machine learning for early detection of food safety outbreaks.

All these solutions utilize the Microsoft Azure Cloud and are available globally.

This was a fantastic event, demonstrating the potential of our fledgling partnership with Microsoft and emphasizing the huge benefits that digital technologies bring to create a safer and more efficient food value chain. A big question does remain. Now that we have a working solution in LumoVision, how can we be sure that it will reach those most in need, typically in sub-Saharan Africa? To achieve this we will need new business models and new partners. We are open to both.