A SMART CITY IS A SUSTAINABLE CITY
THE FATHER OF URBAN DESIGN REVEALS HIS MASTER PLAN

A DIET THAT PROMISES TO SAVE LIVES
HOW TO EAT OUR WAY TO A HEALTHIER PLANET

SURFING THE WAVE OF MASS DATA
NETWORKS ARE GEARING UP FOR AN INFORMATION FLOOD

THE FUTURE IS NOW
The Intergovernmental Panel on Climate Change has concluded that we have 12 years to prevent the irreversible damage to temperature since preindustrial times.

We have had record temperatures in June 2019 in Europe. With striking courage and clarity, the extraordinary 16-year-old climate activist Greta Thunberg has reminded us of our responsibility to combat climate change.

The estimates for global population in 2050 have increased from 9 to 9.8 billion.

The urgency has increased, the magnitude of the challenge has increased, and our obligation to act is clear. We will increase the targets to 50 percent reduction of waste, of energy, and of water. We have added water to our targets, as every day, we consume at least 3,000 liters of water associated only with the food on our plates. We have not changed our targets because we have achieved 30 percent, but because on reviewing the challenge, we concluded that it is simply not enough. We will focus R&D spending and partnerships on achieving these targets, and we are convinced that there will be good business for us to leave a legacy for all future generations.

There is a simple answer to the question: Do we act or do we not? We must act now, we must collaborate across our entire ecosystem, and we must deliver a step change as an industry, as a company and as individuals.

At our inaugural Bühler Networking Days in 2016, we focused on the challenge we faced to feed 9 billion people sustainably by 2050. At that time, we described a food system where 24 percent of greenhouse gases resulted from agriculture, 69 percent of fresh water was used in agriculture, 30 percent of the global energy demand was used in food production, and 30 percent of food was lost or wasted, yet 800 million were hungry. We asked ourselves, "What is the action that we as a company and as an industry should take to provide safe, nutritious, affordable food for 9 billion people in 2050?"

We set the goal to reduce waste and energy consumption in our customer’s value chains by 30 percent. Possible alone? No chance. The achievement of these goals required collaboration on an unprecedented level and widespread embracing of transformative new technologies.

In 2018, we reiterated these goals at our Networking Days event in Changzhou, China with our commitment that the targets were applicable across our company and across industries. Since 2016, we have embarked on this journey, bringing new technologies to market, embracing digital capabilities and partnering in solutions that address these targets. However, as we approached our Networking Days 2019 we realized that we had not set our targets high enough to meet the challenge of feeding the world in 2050.

We are working towards the Digital Cell – aimed at delivering 0% scrap, 40% less cycle time, and 24/7 uptime to create a better, more efficient, and profitable future for the die-casting industry.
EVERY DAY, WE HEAR and read about the devastating effects of climate change that humankind has caused on our planet. Around the world, young people are protesting to tell us that we need to take better care of our environment. Only a few weeks ago, the United Nations warned that the extinction of species has accelerated dramatically.

We cannot wait any longer to focus our actions on the health of our planet. Specifically, this means minimizing CO2 emissions, consuming less energy, producing less waste, and ensuring that new settlements and cities are sustainable, and that people have access to safe and healthy food.

Industry has a special obligation here and is well-positioned to make a difference: We can make sure that our systems use less energy and less water, we can increase the efficiency of our value creation chains, and optimize our processes to produce less waste. We can invest in research and development to bring new low-emission solutions to the market.

In August, we have invited 800 of our customers and partners to the Networking Days 2019 in Switzerland. You, as decision makers and managers, will discuss with us how we can expand our impact together. “It is not too late to bring about change if we start now on all levels, from local to global,” write the authors in the UN report on species extinction. And, I am convinced that when we all make it our mission to leave a healthy world to our children, we can move mountains while also uncovering new and interesting business potential for all of us.

We call this edition of Diagram “The future is now” because we are convinced that together we can bring about positive change.

Sincerely,

Stefan Scheiber
CEO, Bühler Group
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ACT NOW TO BE FUTURE-READY

TEXT: STUART SPEAR
We face numerous challenges as the consequences of climate change and population growth take hold. Organizations like the United Nations are signposting the risks to a sustainable future and it is up to all of us to take action. Diagram explores these problems, and why we must unite to provide solutions.
There is a perfect storm brewing, and we need to prepare. Climate change, the protein gap, loss of bio-diversity, population growth, and urban migration—all will have an impact on where we source our food and what we eat. Extreme weather events such as the record-breaking temperatures experienced in Europe this summer are becoming more frequent. Warnings are getting starker as the scientific community tries to convey the urgency for action. The message is clear. We have to make ourselves ready for the future.

The greatest threat is our changing climate. In October last year, the United Nations Intergovernmental Panel on Climate Change (IPCC) came out with its starkest warning yet. The report explores the consequences of 1.5°C global warming above pre-industrial levels compared with a 2°C increase. The scientists warn that if we go beyond the 1.5°C threshold, even by half a degree, the risks of floods, extreme heat, and poverty for hundreds of millions of people will increase. These findings come as a shock.

If we can keep below the 1.5°C increase, then the proportion of the global population exposed to water stress will be half those at risk if we see a 2°C temperature rise. Food scarcity would also be less problematic with yields of corn, rice, wheat, and potentially other cereal crops less severely impacted, especially in sub-Saharan Africa, Southeast Asia, and Central and South America.

Dire consequences of a 2°C temperature rise
The warnings are equally stark when it comes to biodiversity. At a 2°C temperature increase compared to the 1.5°C maximum, insects would be twice as likely to lose half their habitats, putting at risk one of the foundations of our ecosystem. Insects act as both plant and crop pollinators and prey for other wildlife. Biodiversity is at the root of a sustainable and healthy food supply. In February 2019, the UN Food and Agriculture Organization (FAO) released its State of the World’s Biodiversity for Food and Agriculture report, looking at the role biodiversity
plays in food production. Again, the message was grim. It warns that over the past 20 years, an estimated 20 percent of the earth’s vegetated surface has become less productive as farms, cities and factories consume land and produce chemicals.

There has also been a debilitating loss of soil, biodiversity, forests, grasslands, coral reefs, mangroves, seagrass beds, and genetic diversity in crop and livestock species.

While 6,000 plant species are cultivated for food, only nine of them account for 66 percent of food production (sugarcane, corn, rice, wheat, potatoes, soybeans, oil palm fruit, sugar beet and cassava). Such heavy reliance on such a narrow food source is troubling. At its launch, the coordinator of the report, Julie Bélanger, warned: “The supermarkets are full of food, but it is mostly imports from other countries and there are not many varieties. The reliance on a small number of species means they are more susceptible to disease outbreaks and climate change. It renders food production less resilient.”

One does not have to go look far back in history to spot the risks. Overreliance on a narrow food source was a major factor in the potato blight in Ireland in the 1840s, cereal crop failures in America in the 20th century, and losses of taro production in Samoa in the 1990s. These threats are upon us just as the global population is expected to swell.

According to the UN World Population Prospects 2019, the current global population of 7.7 billion will grow to 9.8 billion in 2050 and 10.9 billion by 2100. Countries in sub-Saharan Africa will account for half this growth while India is expected to surpass China as the world’s most populated country by around 2027. The FAO estimates that we will need to produce 50 percent more food than in 2012 if we are to feed the global population in 2050.

Shifting eating habits
Then there are demographic shifts. Between 1961 and 2013, the average Chinese person went from eating 4 to 62 kilograms of meat a year. As people

“WE MUST UNITE BEHIND THE COMMON GOAL OF CREATING A FOOD SYSTEM CAPABLE OF FEEDING 9.8 BILLION PEOPLE WITHIN THE LIMITS OF THE PLANET IN 2050.”

IAN ROBERTS
Bühler Chief Technology Officer

migrate off the land into cities, their aspirations change and so does their diet. With global population growth and climate change, our cities are set to dramatically grow by an estimated 2.5 billion people by 2050. When people become wealthier, they also move to a more meat-based diet. If you count crop-land to feed animals and pasture, then almost four-fifths of all agricultural land is used to produce animal feed. Again, the FAO estimates that in order to meet population growth by 2050, the global number of ruminant livestock, that is cattle, buffalo, sheep and goats, will have to rise from 4.1 billion to 5.8 billion, unless we change the mix of our protein source. We need to find other ways of feeding ourselves (see article on pages 12–17).
Our food production system is struggling and risks becoming no longer fit for purpose. “We must unite behind the common goal of creating a food system capable of feeding 9.8 billion people within the limits of the planet by 2050,” says Ian Roberts, Chief Technology Officer at Bühler. “The reality of the food system today reflects a broken system with 25 percent of greenhouse gas emissions resulting from agriculture, 71 percent of our fresh water is used in agriculture, a third of energy utilized is in food production and a third of food is waste. It is time to take decisive action to bring about the sustainable turnaround that we so urgently need.”

These problems are too great for one sector to resolve. Government, business, academia, NGOs and civil society are having to come together in a spirit of collaboration to help tackle these issues. It is already happening, but much more needs to be done which is why in 2016 Bühler set out its sustainability target to cut food waste and energy consumption in its customer’s value chains by 30 percent by 2020. Since then the targets have been tightened to 50 percent (see page 95). Bühler food solutions feed around 2 billion people each day, which provides both the opportunity and responsibility to create change.

Collaboration is key
Bühler is working with customers, start-ups, and academia to develop technological solutions for cutting food waste and reducing energy usage. By working together, solutions can be found to address the issue of preparing to feed the projected population of 9.8 billion within the limits of the planet by 2050. “This cannot be accomplished without radical innovation,” Roberts explains. “Only through broadscale collaboration will we be able to create a significant impact on climate goals. We need to harness the energy, passion, and skills of our entire collaboration ecosystem and we believe that start-ups play a crucial part in this.”

One of the key drivers of Bühler’s ongoing innovation is its close working relationship with an extensive range of networks. Among the global academic networks Bühler collaborates with, are: ETH Zurich (Swiss Federal Institute of Technology), EPFL (École polytechnique fédérale de Lausanne), the University of St. Gallen (HSG), Kansas State University, the UNITECH International university network, and the World Food System Center. Its strategic partnerships include the EIT Food Accelerator Network, Partners in Food Solutions, and the leading start-up accelerator, MassChallenge. In 2017, Bühler began working with the Swiss Data Science Center, a joint venture between EPFL and ETH Zurich, which accelerates the adoption of data science and machine-learning techniques into the industrial sector (see article on pages 56–60). In the same year, Bühler partnered with MassChallenge Switzerland, a start-up accelerator that connects start-ups with established companies that can provide expertise as well as the marketing, sales and commercial leverage to scale up potential solutions.

“Disruption will come when technologies are combined with new business models,” says Roberts. “These start-ups frequently struggle when they need to scale, which is why corporates with global reach, sales platforms, and customer bases can provide perfect scaling partners.”

Bühler also partners with UNITECH International to support the Carbon Footprint Challenge, a collaboration that brings together nine top European universities with people in the business world to find solutions for how best to decrease the carbon footprint of manufacturing, of industrial processes,
“TO SOLVE THE SORT OF PROBLEMS WE ARE FACING, WE NEED TO HAVE A MULTI-STAKEHOLDER APPROACH.”

BEATRICE CONDE-PETIT
Group Expert Food Science & Technology at Bühler

as well as for products throughout the value chain. In early 2019, Bühler joined the World Business Council for Sustainable Development (WBCSD), a global network of 200 forward-thinking companies. By connecting with the WBCSD, Bühler can make a real impact on sustainability and on providing the growing world population with the nourishment and mobility solutions of the future. “Joining WBCSD’s network is an important step to furthering our sustainable businesses goals, and most importantly, in developing new means to feed the world,” explains Stefan Scheiber, Bühler Group CEO.

A multi-stakeholder approach
Africa is set to take the brunt of the population growth over the next 30 years as well as being one of the regions with the highest rate of urbanization. Bühler is working with other industry leaders to support the NGO Partners in Food Solutions, an organization designed to improve food security, nutrition, and economic development in Africa. The NGO facilitates the sharing of expertise between companies like Bühler and food processors along the whole food value chain in Africa.

“It is a great way of creating impact and supporting businesses that are coping with big challenges when it comes to feeding the planet,” says Béatrice Conde-Petit, Group Expert Food Science & Technology at Bühler. “To solve the problems we are facing, we need to have a multi-stakeholder approach. We need to get a combination of the right technology, the right business model, and the right players to leverage solutions.”

Another challenge we need to prepare for is urbanization. It is estimated that over the next 25 years around 24 million people in Africa will move from the countryside to cities each year, with a similar mass migration also concentrated in India, China, and Latin America. While technology will provide solutions for the management of new megacities we must still design our future cities with basic human needs in mind (see article on pages 18–25).

The future is now
To keep global temperatures from rising more than 1.5°C, will also require a drastic reduction of greenhouse gas emissions. According to the UN, CO2 emissions will have to be 55 percent lower in 2030 than today. Transportation is a major source of greenhouse gas emissions worldwide, and the electric vehicle is the greatest hope for providing sustainable transport, requiring new advances in battery technology. The battery made up 60 percent of the cost of an electric vehicle just four years ago, today that figure has dropped to 33 percent. But with the fall in price, problems with inconsistent and poor environmental performance during production increased.

New production technologies are being sought out to ensure more efficient battery production. The industry is moving towards scaled processing to reduce environmental contamination, greater automation to reduce errors, and constant quality monitoring to drive up consistency. New battery technologies are being explored around the world and there is a pressing need to bring together different expertise to develop batteries capable of providing sustainable future transport systems.

Today’s challenges are numerous, many of them getting more urgent. Never has the adage been truer that in the face of adversity we are stronger together.
Changing what you eat can lead to a healthier future for people and the planet, according to the authors of the EAT-Lancet report. The report is a road map to global nutrition, designed to optimize and respect natural resources, while limiting the impact of climate change. Diagram spoke with one of the report’s lead authors, Walter Willett, about the need to transform the food system.
IT’S NO SECRET that the world is facing immense challenges in terms of the environment and public health. The way our food system functions is central to both. The question is what we do about it. How our food is produced, what is eaten, and how much ends up being needlessly lost or wasted have all become critical issues.

Feeding a population of 9.8 billion people by 2050 with a healthy and sustainable diet will be impossible without changing our eating habits, improving food production, and reducing food waste. This is where the EAT-Lancet Commission on Food, Planet, Health comes in. The commission brought together leading scientists from across the globe to reach a scientific consensus that defines a healthy diet from a sustainable food system in alignment with the Paris Agreement and the Sustainable Development Goals. The EAT-Lancet report was the result.

It made headlines around the world when it was released in early 2019 with its vision of a “planetary health diet” that works for both our own health and that of the earth. The document collates three years of work from 37 leading scientists from across 16 countries, and a range of disciplines, including sustainability, human health, and agriculture.

Walter Willett is a lead author of the nearly 500-page report. He is a world-renowned Professor of Epidemiology and Nutrition at Harvard University and a Professor of Medicine at Harvard Medical School, Boston. Over the last 40 years, he has focused much of his work on the long-term consequences of food choices. He believes that without action, today’s children will inherit a severely degreaded planet where much of the population will increasingly suffer from malnutrition and preventable disease.

“Transformation to healthy diets by 2050 will require substantial dietary shifts. Global consumption of fruits, vegetables, nuts, and legumes (pulses) will have to double, and consumption of foods such as red meat and sugar will have to be reduced by more than 50 percent,” Willett explains. “A diet rich in plant-based foods and with fewer animal source foods confers both improved health and environmental benefits.”

This is not the final word – it’s a framework

The aim of the planetary health diet is not to prescribe exactly what everyone should eat across the globe. Instead it outlines a list of empirical food groups, along with recommended ranges of intake, so there’s a huge scope for adaptation and interpretation, depending on local cultures and geography. For example, the excessive consumption of foods with added sugars and red meat in wealthier countries should be reduced. However, some populations worldwide depend on animal protein from livestock, or face the burden of undernutrition, whereby gaining adequate micronutrients from plant source foods alone poses difficulty. Therefore, the role of animal source foods should be considered in context within local and regional realities.

When the report was released, it was met with both praise and criticism. “Of course we expected heavy criticism from the beef and dairy industries, and they didn’t let us down,” Willett says. “We have also had a lot of positive feedback. For some people it was new information, others knew that this was
the direction they needed to go, and very much wel-
comed having a strong scientific basis – a document – to support them in areas where they were already working. I need to emphasize that this is not the final word – hopefully it will be something we can update on a five-yearly basis.”

A diet that promises to save lives
The threat that current food production methods pose to climate stability and ecosystem resilience is such that they constitute “the single largest driver of environmental degradation and transgression of planetary boundaries,” the report says. However, this also means that food is now the “single strongest lever to optimize human health and sustainability on earth,” with food systems having environmental impacts along the entire supply chain from production to processing to retail.

All this makes food a defining issue of this century. The report’s vision is that feeding the global population a healthy diet by the year 2050 within safe planetary boundaries is not only essential, it’s also achievable. “To do so, there’s a vital need to move in a different direction,” Willett says. “Unfortunately, it’s like we’re on an expressway that is just about to go over the cliff in terms of climate change and other environmental impacts. We need to find an exit off this expressway quickly.”

Along with sustainability, the report states that a global shift toward healthier eating habits can save lives, citing that today, “unhealthy diets pose a greater risk to morbidity and mortality than unsafe sex, alcohol, drug, and tobacco use combined.”

The authors also found that moving to a healthy diet could prevent around 11 million deaths a year which represent between 19–24 percent of total deaths among adults by lowering diet-related conditions and diseases, such as obesity and diabetes.

As someone who has spent his professional career studying lifestyle risk factors for diseases, the professor believes that the public’s awareness of the dangers of an unhealthy diet is not where it should be.

“Awareness has grown, but we still have a long way to go, and this is strongly related to socioeconomic status,” explains Willett. “We’ve tracked diet quality in the US, for example, and it has gone up. Part of that was the removal of trans fat, which was something that happened really before consumers even saw it. In some ways that was an easy fix, but other things are going to be more difficult. What we see is that people with higher education and income levels are doing very well in terms of improving diet quality, and we see them living longer – we can connect all the dots. But low-income people are being left behind, and that gap is getting bigger and bigger.”
With excessive consumption of unhealthy foods having become an extremely serious problem in wealthy countries, Willett believes that regulation of marketing is necessary, particularly when aimed at children. “Aggressive marketing to children is really the exploitation of children – it’s for profit and it’s destroying their health and longevity. Unfortunately this practice is no longer limited to high-income countries – these industries are penetrating even the world’s remotest villages.”

Another critical problem is that many low-income people just don’t have enough money to buy healthy, sustainable foods at today’s prices. “Refined starch and sugar, unfortunately, are the cheapest form of calories, and so many people are getting a huge part of their calories from those sources,” he says. “The tide is turning in places such as the US, where consumption of sugar overall is coming down as a result of taxes and education.”

The planetary health diet is a win-win – it’s good for both us and the environment. But with unhealthy eating habits ingrained across much of the world, encouraging people to embrace it will prove challenging. “I think it will take time – it’s not going to happen overnight,” Willett acknowledges. “But it will take more than just persuading people. Many people are in situations where they don’t have the money or the access to have a healthy, sustainable diet, and it really requires a set of policies that go along with this. Humans tend to be wired for short-term emergencies rather than long-term strategic thinking, and that makes it inherently challenging. I hope we can rise to that. This is going to be a long struggle. But it is achievable.”

**A shift in policy is needed**

When it comes to larger agricultural systems, a big portion of resources are put into making beef and dairy inexpensive, however, things need to be rebalanced towards “making fruits, vegetables, pulses, nuts, and whole grains cheap,” according to Willett. “There are all kinds of policies that could be shifted. It’s not that we don’t know how to do it, because we’ve been doing it – just for the wrong foods.”

The report states that global consumption of fruits and vegetables will need to double and consumption of red meat and sugar will need to be at least halved. “Focused efforts will be needed to achieve these ambitious targets, but things today are happening at a very accelerated rate. Younger generations are very concerned about climate change and the future of the world they’ll inhabit.”

As a result, these generations are also increasingly embracing veganism and flexitarian eating. “There’s a lot of interest in shifting diets towards something more healthy and sustainable. It’s really important that these be delicious and attractive,” Willett says. “Healthy and sustainable foods can be more flavorful and interesting than some of the North American, Northern European or English foods that people
The co-author of the report calls for multi-sector, multilevel action to transform the food system – a three-way interaction between knowledge, engagement, and action across business, policy, and science. This includes shifting agricultural policies towards the production of healthier foods, restricting the expansion of crop-land while reducing water use, enhancing biodiversity, improving the management of the world’s oceans, using more climate-friendly farming practices, and developing national and international dietary commitments. A tall task. “One of the things that really needs emphasizing is that all the calculations and projections do assume that we get to green energy fast – by 2050,” Willett says. “The move to green energy is very urgent.”

It will also require improved education to help push the transformation towards the planetary diet. “There are many different areas where we need to act,” Willett says. “It’s important that healthy and sustainable eating habits become a core part of our educational system, not just in classroom teaching but also by setting best practice in terms of providing healthy, sustainable food in schools. It should be both educational, and directly beneficial to their health – from first grade to university. A lot is already changing in university systems because there’s a receptive audience. They’re learning about foods and eating patterns that they can take with them for the rest of their lives.”

More and more employers are also embracing this agenda, he states, because employers are realizing that having healthy sustainable food where people work is good for their bottom line – healthier workers mean better productivity. “The healthcare system has been almost completely missing in action, however,” he says. “There should be a lot of information available to patients to educate them that nutrition is at the core of health. That’s being ignored. The health system should be the leader, but it’s not.”

The role of business
Multilevel and multi-sector change is needed to make a difference. Where political will is lacking, businesses could also take up the slack. “There are many businesses that see the need for change as an opportunity. When I look at all of the restaurants sprouting up in Boston, a large part of them are vegan or vegetarian, so I think there are lots of opportunities – especially for start-ups.”

The authors of the report also stress the need for companies directly involved in the food system to “work to make food that’s consistent with health and sustainability as attractive and affordable as possible.” Ultimately, however, there are serious economic issues at play. “Nuts, for example, are very healthy, and having nuts instead of red meat is a huge shift that we can make in terms of health. Nuts don’t have to be expensive, however, we also have to look at this from the standpoint of farmers and producers. It’s critical that we make it possible for farmers to make a living producing healthy food. It’s a long-term investment, so government policies are needed to provide support for farmers to shift in that direction. We’re already doing that with other crops, but we need to do that with crops that are healthy and more sustainable.”

It’s clear that coordinated efforts are needed to transform the global health system, and the report offers a framework from which to start. The authors believe it is highly adaptable and scalable for all food cultures and production systems in the world. Achieving this transformation will require “rapid adoption of numerous changes and unprecedented global collaboration and commitment: nothing less than a great food transformation.”

INFO
Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems is available at www.thelancet.com/commissions/eat
Technology is considered by many as a panacea for future living, and yet, it is not the sole answer to the challenges of urban population growth. According to the world’s most experienced city planner, a truly “smart” city unites design with technology, and always puts the fundamental needs of its inhabitants first.
MACHINE FOR LIVING

TEXT: STUART SPEAR
Singapore’s new public housing focuses on greenery and comfortable living, like the award-winning Dawson SkyVille and Sky-Terrace projects.

The world’s cities have become social and commercial magnets. Like iron fillings, millions of us are attracted each year to city life as we leave the hinterlands and beyond in search of economic and cultural opportunities. The United Nations estimated in 2018 that 55 percent of the global population was living in urban settlements, by 2050 this is expected to rise to 68 percent. Factor in global population growth and that means an extra 2.5 billion people living in existing and new cities over the next 30 years.

According to the management consultant McKinsey, between 2015 and 2045 a staggering 24 million Africans will move each year from their rural homelands to cities. In India the figure is 11 million and in China 9 million. By 2050 an estimated 90 percent of Latin Americans will be living in cities and towns. Suddenly city planners across Asia, Africa, and Latin America are in big demand as politicians recognize the need to prepare for this future influx.

There are a number of drivers behind this global migration. Economic and educational aspirations are often not being properly met in rural communities, while political instability and failing rural infrastructures drive people off the land. Climate change is another factor as crop failures and food scarcity take their economic and social toll.

This unprecedented level of urbanization will strain the planet’s limited resources, as city living is linked to increased consumption habits. However, well-planned, sustainable cities have the potential to create a positive impact. Singapore is a prime example of how a sustainable future can be created for cities.

Technology as panacea
For those tasked with meeting the challenge of urban population growth it is very appealing to turn only to technology for solutions. Experts predict we will be surrounded by sensors collecting data that is fed into predictive algorithms through super fast interconnectivity to facilitate the livable city. It is the vision of a world where digital technology has the ability to decongest the city’s arteries and infrastructures, allowing us to accommodate the millions heading for our city gates.

There are other aspects to city planning that must go hand in hand with technology, says the world’s most experienced city planner – Dr. Liu Thai Ker. At 81 years old, he is still designing our future cities. To date, he has designed nearly 60 cities in China with populations ranging from 200,000 to 20 million. He is Chair of the global think tank, the Singapore-based Centre for Liveable Cities, and he has just set up Morrow Architects & Planners, also based in Singapore.
But it is as the “architect of Singapore” that he can claim his greatest success, a city long recognized as the global lead in the principles of successful urban design. Dr. Liu has been an urban planner for over 50 years. And while he acknowledges that technology will always be part of the future city landscape, he believes it is being seen as an all-too-easy solution to a profoundly complex question.

“The job of the planner is to understand basic human needs and build something that will last for a long time,” explains Dr. Liu. “The reason that such an ‘old-fashioned’ theory is not being expressed by anyone else is that it is extremely hard work to find out what the basic human needs are. So, people prefer to offer the easy option of buying technology, which they think can solve all urban problems, but planning comes first.”

Dr. Liu should know how tough it is. He started his career in planning in 1969, rising to become the CEO and Chief Planner of the Urban Development Authority responsible for transforming Singapore from its then developing world status to a futuristic metropolis that maintains greenery and a sense of community. He claims that every day since he has been studying and learning what it is that people need from the cities they live in.

“THE JOB OF THE PLANNER IS TO UNDERSTAND BASIC HUMAN NEEDS AND BUILD SOMETHING THAT WILL LAST.”

DR. LIU THAI KER
Urban planner and Chair of the Centre for Liveable Cities
Translating smart and ecological urban concepts into spatial arrangements in the form of a city plan is extremely challenging, he explains. “I am actually quite a dour person and I have spent my whole life burying my head down to find out what is going on. You really need to be a dour person to be a good urban planner and only a very few people have the patience to do it.”

The only way to truly understand a city is to see it as a giant machine for living, explains Dr. Liu. To design a machine you must first understand its purpose. Each component must relate to the next. Each part must be located in the right place and have the correct dimensions to work in harmony with the rest. If you want a city to be healthy, it has to be walkable. If you want a city to be livable, it has to facilitate community.

One way to achieve this is through the concept of neighborhood centers, with an area of no more than 50 hectares with walkable amenities within 500 meters. Familial relationships have to be built into the plans with equal sensitivity. According to Dr. Liu, grandparents need to be able to live close enough to their young grandchildren to be supportive, but not in the same apartment as their children to avoid being intrusive.

The same applies to infrastructure. When you place a gas or charging station shop, you need to understand every detail about its location. Is it in the right place? If it is too large, it will become a potential commercial competitor to community shops, if it is too small, it will not be fit for purpose. It is this level of granular detail that Dr. Liu believes an urban planner needs to be in command of if they are to create livable spaces fit for the sort of population growth being anticipated. These are the details that can be translated onto an urban plan and into developing new technologies.

Transport provides another illustration. While the technology behind public transport systems and vehicles of the future might change, the spatial arrangement between buildings will need to remain the same. Privately owned cars could be replaced with driverless public transport vehicles requiring less road lanes to accommodate them, but they will still need to get around and pass between buildings. Equally, emergency vehicles will need to traverse the city. Much like the way horses and carts are no longer our main form of transport, the tracks they traveled on are still with us today in the form of roads. Dr. Liu is concerned that these basic principles are being forgotten. “I listen very carefully to people

Gardens by the Bay brings to life the National Parks Board of Singapore’s vision of creating a city in a garden.
who champion the smart city and what they talk about is not the design of the city but the management of the city. Definitely technology can help by making the management of a city easier, but it cannot replace design.”

A humanist’s heart
Dr. Liu believes every urban planner should keep human emotions present in their vision. Each city must be created with the people and the land in mind. “You must have a humanist heart to give people a livable resilient quality of life and to give the land a functional and sustainable environment.”

He considers cities to be machines for living. To create such a machine requires the scientist’s head, he explains. And finally, to place the machine on the land you need an artist’s eye. “The machine must not come out of the land like a piece of hardware but it must caress the rivers and hills, the terrain and the historic buildings. What you put down on the land has to be environmentally beautiful as well as functionally beautiful.”

So how do these romantic principles survive harsh realities? With 60 cities to his name how has he managed to sustain these values that he says he applies to every project and that have remained with him since his early days in Singapore?

The answer lies in where he has chosen to leave his legacy. In 1978 the then Chinese leader Deng Xiaoping visited Singapore where as a fluent Mandarin speaker Dr. Liu offered to look after him. He took the opportunity to explain his vision for Singapore to Deng while standing on the roof of the Ministry of National Development. A few months later Deng announced that China could learn about urban planning from Singapore.

That meeting sealed Dr. Liu’s future as a city planner in China. To apply his principles to urban planning in China, the strong commitment of government was an advantage. Also when planning Singapore, the support of the then Prime Minister Lee Kuan Yew enabled Dr. Liu’s vision. Without strong government support, projects are often “bogged down with interparty arguments,” he says. It also helps to have a high degree of state land ownership to provide a canvas on which to work. Finally, it is vital to have a good plan in place. “I am accepting commissions anywhere in the world because it is better for them to have a good plan and later find ways to implement it, rather than not having a good plan at all.”

Planning big
Having a blank canvas to work with when designing a new city is one thing, but many of the world’s cities in places like Africa are going to have to be retrofitted to help deal with the coming population growths.
Dr. Liu believes in using the same principles when improving an existing city that he would when planning from scratch.

The secret, he says, is to plan long-term and on a big scale and then break it down into smaller scales for short-term plans. He typically starts with what the city should look like in 2070 to accommodate the projected population and then works back from there. He argues the failure to take a long-term approach is a fundamental mistake in urban planning. “Which is why a lot of cities look so disjointed and chaotic because they plan on a small scale and they plan short-term and they keep adding and adding and adding until there is no long-term holistic system,” explains Dr. Liu.

“One area where he thinks there will be a significant change is in the growth of urban farming, simply because many places do not have enough land to sustain their populations. China has four times the population of the United States and yet it has only 80 percent of the farm land. Similarly, the tiny republic of Singapore with a population of 5 million crammed onto a landmass of 715 square kilometers has been forced to experiment with roof gardens and vertical farming to feed its population. “Singapore is pushing harder than ever on vertical farming and we have gathered sufficient information so that now other cities are knocking at our door for advice,” explains Dr. Liu. An example of the kind of innovation coming out of Singapore is the world’s first “low-carbon, water-driven, rotating, vertical farm.” Aluminum towers, some 9-meters high, contain 38 troughs of tropical vegetables. The towers rotate slowly as plants travel to the top of the towers absorbing light and back down for watering.

One of Dr. Liu’s most comforting observations from his over 50 years of urban planning is that when you really study people’s experience of the city, no matter which country or culture there are certain basic human needs that have never changed. An example is the need to socialize. He recognizes that the Internet is threatening the sustainability of shops but struggles to believe we will one day do away with them. “I feel the shopping centers will still be there but that their contents will change because human beings are social animals. You cannot spend all day working from home and eating at home, you still need social contact and you need a place to meet boyfriends and girlfriends and so on,” says Dr. Liu.

“The machine must not come out of the land like a piece of hardware but it must caress the rivers and hills, the terrain and the historic buildings.”

Dr. Liu Thai Ker
Urban planner and Chair of the Centre for Liveable Cities
The Nanyang Technological University in Singapore combines nature with high tech.

"SINGAPORE IS PUSHING HARDER THAN EVER ON VERTICAL FARMING SO THAT OTHER CITIES ARE KNOCKING AT OUR DOOR FOR ADVICE."

DR. LIU THAI KER
Urban planner and Chair of the Centre for Liveable Cities

Above: The Parkroyal on Pickering hotel in Singapore features 161,459 square feet of sky gardens, waterfalls, and planter walls that constitute more than twice the size of the rest of the property. Left: Sky Greens is a low-carbon, hydraulic-driven vertical farm.
“At the heart of every global threat is a serious lack of management quality.” This conviction drives Kate Robertson, every waking moment. The co-founder of the One Young World global initiative has a clear vision: identify, promote, and connect young leaders to facilitate a more sustainable, fair, and livable world.

“I will be dead then, but the young generation will have to live with the burden of my generation. I cannot, and will not, permit this,” says the South African native. “It’s my life’s work to make all conceivable means and networks available to the leaders of tomorrow, so they can master the global challenges that we have passed on to them in gross negligence. We must drastically reduce CO2 emissions, reduce the divide between the poor and the rich, and push for equal opportunity – and this is just the start.”
“THE YOUNG GENERATION KNOWS ONLY THIS INTERCONNECTED WORLD AND WANTS TO SOLVE GLOBAL PROBLEMS ON A GLOBAL LEVEL.”

KATE ROBERTSON
Co-founder of One Young World
It is this mix of openness, iron will, and fundamental trust in young adults that makes Robertson the symbol of One Young World – and why she draws committed, ambitious young adults from all over the world to her like a magnet.

Go-getter with lofty goals
One Young World is committed to leading by example when it comes to working towards the United Nations Sustainable Goals (SDGs), which were adopted in 2015 to build a better world. Whether climate protection, the fight against hunger, or education for everyone, the participants of One Young World are leading the charge to drive change.

“We live in an age with the highest levels of education, the most transparent flow of information, and the best networking of people, yet we are losing the war against the most urgent challenges because we consider them to be isolated and want to deal with them individually,” says Kate Robertson. “The young generation – let’s say everyone under 30 – knows only this interconnected world and wants to solve global problems on a global level. Let’s finally clear a path for them to do so.”

First and foremost, Robertson wants to hold politicians to their promise of creating the basic conditions for this to happen. Instead of placing the blame on the politicians for their inactivity, unwillingness, and inability to enact change, she is actively taking matters into her own hands. She does this through One Young World, which provides young leaders with a network to bring about change, regardless of their level of education, position, or experience.

She is convinced that the participants of One Young World will be tomorrow’s leaders. “When the day comes that the presidents of the G20 summit and the managers of the largest hundred companies are ambassadors for One Young World, then we will have reached our goal.” The fact that this objective is more than just a Utopian ideal is aptly demonstrated at the annual summits, where some of the most motivated young professionals and students come together – and bring the spirit of the initiative back to their countries and organizations.

They do this quite efficiently: According to the One Young World Impact Report for 2018, the 10,000-plus ambassadors created a return on social investment (RSOI) of 13 dollars for every one dollar invested in social projects. These include access to education in Nepal, the establishment of a recycling system in West Africa, and the distribution of affordable solar energy packages in Pakistan. One of the 17 SDGs is assigned to every project, which enables a specific calculation of the social value created. When considering all of these initiatives, Robertson glows with enthusiasm. “Our ambassadors are all unbelievably good people with strong values. They are concerned about each other and our planet, and they want to help. It is my privilege to be able to inspire them every day to accomplish new things. It makes me that much more angry when these young people from my generation are sardonically dismissed as starry-eyed idealists. It is high time that we make room for them, and let them lead us.”

Driving change
In 2009, at the peak of her professional career at the well-known global communications agency, Havas Worldwide, she founded One Young World together with David Jones, who was the CEO of Havas at that time. A few years later, she left the business world behind to focus all of her energy on matters closer to her heart. “One Young World has developed from a

INFO

One Young World ambassadors in Uzwil

One Young World is a charitable organization headquartered in Great Britain. It brings together young, determined professionals from around the world in order to develop solutions for the most urgent problems. At its annual summits, young talent from every country and sector are counseled by influential leaders from business, politics and the humanitarian sector. In 2018, 1,850 participants from 196 countries met in The Hague – 13 of them were Bühler employees. Fourteen regional caucuses a year are organized by the One Young World ambassadors. On May 4, 2019, more than 200 participants from around the world participated in the first caucus in Switzerland, held at Bühler’s CUBIC innovation campus in Uzwil. With the motto “Responsible production and consumption in the future,” the participants took a closer look at trends in electric mobility and the future of food. The event was organized by the Bühler’s Generation B team, a global platform for employees actively working to shape the company.

ONEYOUNGWORLD.COM
In 2018, 1,850 participants from 196 countries convened in The Hague to take part in the One Young World Summit.

One Young World has implemented the solution for this institutional problem for years: young people join together by means of the growing network, meet at regional or yearly global events and caucuses, and find a way for business and politics to circumvent the long-standing interdependencies.

In order to accelerate this slow process, the clever South African counts on the support of corporate partners. “Three years ago, when I presented the idea of One Young World to Stefan Scheiber and Ian Roberts from Bühler at Chocovision, a conference for chocolate and cocoa producers, I quickly realized that I could have saved myself the effort. Both of them were already fully aware of how important their young managers are, and that they simply need to make the tools and the network...”

vision to an intense passion that I want to be able to devote 100 percent of my attention to,” said Robertson in 2015 at the time of her departure from Havas.

This focused attention is needed now more than ever. “Let’s take industry as an example. With the right political conditions, such as legally binding targets or incentives like CO2 certificates in their pockets, the CEOs of the largest companies can convince their shareholders that effective immediately, 50 percent of their investments should go into the growth market of renewable energies. These firms thrive on competition and put all their efforts into staying at the top. Yet without precise requirements and rules from the politicians, industry as a whole moves a great deal slower than it wants to and, more importantly, can.”

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available to them. This requires clarity of vision and a commitment that I don’t often encounter in the business world.”

Where does the path lead?
However, Kate Robertson would not be the pragmatic figurehead if she didn’t chart a clear path in the midst of all the praise and success stories.

“Ten years after its establishment, the One Young World Summit is considered one of the best conferences in the world. We would not have been able to make this happen on our own. In order to have the best possible mix and really bring together the best young people, we are able to offer stipendiums thanks to the support of our corporate sponsors.”

At this year’s summit in London, about 22 percent of the participants were able to join because of the stipends. Robertson wants to increase this number by 50 percent and ensure that the young people are comprised of four equally represented groups. “Currently we are plenty of professional participants and a good percentage of social entrepreneurs – people who start companies with the goal of addressing social issues. However, we have plenty of room for young politicians and entrepreneurs. There is still a great deal to be done, although with the Politician of the Year award introduced last year, and the new Competition for Young Companies, we have been able to gain and will continue to gain many new talents from these sectors.”

Nevertheless, the concept of One Young World has arrived at the political level. From the European Commission to the First Lady of Colombia – whose network of First Ladies of Latin America is currently being developed – the level of political involvement is growing in many places. Robertson is confident this development will continue. “The ultimate goal is for future leaders to be One Young World ambassadors or kindred spirits. This is the only way for everyone to be certain that this CEO or this political leader shares the same values and that everyone is working to make our world more sustainable, more just, and more livable. This will be a long and difficult path, but I can no longer accept the status quo.”

“MY ULTIMATE GOAL IS FOR FUTURE LEADERS TO BE ONE YOUNG WORLD AMBASSADORS OR KINDRED SPIRITS.”

KATE ROBERTSON
Co-founder of One Young World
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Innovations for a better world.
What is the purpose of business? Until recently the answer seemed simple – to provide goods and services and create profit. But a change is underway. More businesses are talking about their purpose in wider terms, exploring how they can contribute towards solving the pressing challenges society faces today. What is driving this change and what does it mean for the long-term success of companies?

BlackRock is the world’s largest investor, managing assets worth trillions of dollars on behalf of its clients. Each year the company’s CEO, Larry Fink, writes a letter to the CEOs of the companies that BlackRock invests its clients’ money in and reminds them that, as a fiduciary, BlackRock is looking for sustainable, long-term growth and profitability.

In this year’s letter, he said that a long-term approach is “more important than ever.” In a world undergoing fundamental economic and political changes, Fink says that society is looking increasingly to companies, both public and private, to help address pressing social and economic issues and provide leadership.

Going further, Fink argues that given increasing uncertainty and frustration, and deteriorating confidence in markets, the only way for a company to navigate this difficult landscape is to have and embody a clear purpose.

What is “purpose” in business? Not so long ago, we all assumed that the purpose of business was simply to make money for its owners. As the US economist Milton Friedman famously put it in his 1962 book Capitalism and Freedom: “There is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud.”

The growth of purpose

Today, this idea is being increasingly augmented with a new focus on the long-term, broader social impact of business. It is not that people are questioning the idea that businesses are set up to make money, but rather that money alone is not a sustaining factor. Fink says that while profits are essential, only by understanding and expressing its purpose, can a
More and more people are looking for meaning in what they do – especially at work.

“INNOVATIONS FOR A BETTER WORLD. THIS IS OUR PURPOSE. BÜHLER HAS ALWAYS HAD A LONG-TERM ORIENTATION.”

STEFAN SCHEIBER
CEO, Bühler Group
company drive long-term profitability. A company’s purpose, he says, is its “reason for being” – the driving force for achieving profits.

Fink is by no means alone. A growing number of business leaders have expressed similar views. Back in 2006, Marc Benioff, CEO of Salesforce, said: “To be truly successful, companies need to have a corporate mission that is bigger than making a profit.”

But why go beyond making money? “Creating shareholder value worked when everything was stable, but it has its limitations,” explains Michael Chavez, CEO of Duke Corporate Education in the US. “If everything is changing, you need something else to help you decide what to do.”

With environmental pressure, social change, and population growth, the world is facing major challenges. At the same time, the rapid development of new digital technologies has connected the world as never before, bringing greater transparency and speed to everything we do.

This has brought huge benefits, but also changed the way we see things. Institutions of all kinds are being questioned about their role. As part of this, customers’, employees’ and society’s expectations of business are changing too.

“In the past, industry did not have to count the costs it created for society in terms of pollution, carbon, or welfare inequality. We had taxes to deal with these,” says Chavez. “Today we are reorientating our fundamental thinking around what business is. We see the firm in the context of society as whole.”

To survive in today’s competitive landscape, companies need a wider social purpose. It’s no longer an option. Having a wider social purpose is also good for the bottom line. In 2018, the consulting firm Accenture Strategy carried out a global survey of nearly 30,000 consumers. It found that 62 percent want companies to take a stand on issues such as sustainability, transparency, or fair employment practices. “Price, product quality, and customer experience are important and expected attributes that customers consider when making their purchase decisions. But they’re now table stakes. Expected, but no bonus points awarded.”

Companies that want to stand apart, the authors of the report found, need to provide something more. They need to show a commitment to principles like family connections, health, security, sustainability or respect for religious beliefs. These are the attributes that consumers today are willing to reward.

As a family-owned business, this notion is not new for Bühler, CEO Stefan Scheiber explains. “Bühler has always had a long-term orientation. Innovations for a better world, this is our purpose. We want to develop new solutions to contribute to a sustainable future.”

Money and meaning

Employees also increasingly seek companies that show they stand for a wider social purpose. “Making money is important,” says Chavez, “But it is difficult to excite people with money on the margin. What is more, if you work for a company whose purpose is only to create value for its owners, this does not help you answer the fundamental question ‘Why am I doing this?’”

There is a deep and complex connection between a company’s purpose and personal motivation. “People want to know that they can make a contribution,” says Chavez. “It doesn’t matter where you work –
whether you are a firefighter or an accountant in a large company –, you want to know that you have a role to play and that what you are doing fits with your overall life story.”

People are increasingly seeking a sense of meaning in the world of work. They want to know that by applying their skills and energy they are helping towards the success of a service or product, but, first and foremost, they want to feel that they are also helping other people. This is a fundamental human drive. “We are social beings, we want to be of service to others,” says Chavez. A company’s wider purpose must connect to each individual’s purpose in the organization.

This is a growing trend. Chavez says that those in the millennial generation and the generation following it are more fluent in the language of purpose than older employees. As these people move through the workforce, having a strong purpose will be increasingly important in attracting and retaining talent.

Not just that, as automation and artificial intelligence play an increasing part in business, people’s roles will change, focusing more on those things that only humans can do, such as applying creativity and ingenuity to solve problems.

How does a company go about defining its purpose? “It’s a deceptively simple question,” says Chavez. “You have to build a narrative. But there will be constraints.” He warns against overreaching, saying it will not work to claim you are creating a better world if this does not tally with the fundamental reason your customers choose your products. “You have to be clear about what your customers really care about in the context of using your products. You have to look at the overall context in which you operate. And you have to be clear where you can add value with what you do and what your core capability is,” he says.

The real thing
Nor is it wise to claim to have a purpose simply in order to attract talent. “People can smell when it’s inauthentic. It is better to be honest,” says Chavez. “You have to look at what your employees really care about. The individuals in your company must have a line of sight to the company’s overall purpose – they have to get why it matters and why they and their team matter to that purpose. It is not a monolithic statement, but a cascade of narratives.” Perhaps the most interesting advice Chavez gives is that a com-

“YOU NEED DISRUPTION TO MOVE FORWARD, BUT STABILITY TO KEEP YOU ON TRACK.”

ALEX HILL
Professor of Operations Management, Kingston University
Michael Chavez is CEO for Duke Corporate Education, US, where he teaches and advises in the areas of leadership and culture, organizational networks, team collaboration, strategy, and execution. Before joining Duke CE, Chavez worked for The Coca-Cola Company, the L.A. Times, and as a strategy consultant for Kurt Salmon. He holds an MBA in finance from the Wharton School of the University of Pennsylvania, an MA in International Studies from the University of Pennsylvania, and a BA in economics from UCLA. Together with co-author Sudhanshu Palsule, he has written Rehumanizing Leadership: Putting Purpose Back into Business, which will be published in January 2020.

Alex Hill is a professor of operations management at Kingston University, London. He is co-founder and director of The Centre for High Performance, which aims to become the leading authority on how to create and sustain high-performing organizations and use these insights to help develop a stronger and more robust UK economy, society, and environment. Together with Liz Mellon and Jules Goddard, he has conducted a study into how winning organizations last 100 years. Their findings are published here: www.radicallytraditional.org/our-research

A guide through turbulent times
Finding purpose is not a cost-free exercise. It involves effort and making difficult decisions. “It means saying, ‘We do this, but we do not do that, because that does not fit with our purpose,’” says Chavez. “There is an element of sacrifice. But if there is no cost, then it is not truly purpose.” The effort and sacrifice involved in taking difficult decisions pay off, however, particularly in turbulent times. “In a world in which everything is changing, finding your purpose should be seen as an investment, not as a cost.”

With digital technologies continuing to transform the way we work and live, many companies are grappling with the question of what their role is. It is a perilous time. The average life span of the biggest companies is declining; and some researchers predict that over the next decade or so, as many as half of S&P 500 companies will be replaced.

In times of rapid technological change, it is easy to focus on the technology itself. But technology alone is not a good guide. Just because something can be done, does not necessarily mean it should be done, as any business that has piled into the wrong technology will attest. In order to survive, businesses must rely on strong navigational skills.

Companies used to rely on strategy to weather the storm, but that is no longer enough, says Chavez. “Purpose creates clarity that is more enduring than strategy – it provides a decision-making framework that doesn’t expire just because the world keeps changing. It enables a company to innovate, to imagine different ways of doing things, or even disrupt itself and keep going,” he says.

Strategy is important but it needs to be linked to purpose to do the hard work. “Thinking about purpose forces you to look beyond what you create today. This is important, because what you produce today anchors you in a world that may be disappearing. Purpose helps you see beyond that. That is why it is so powerful,” says Chavez. “It sits above the standard strategic questions faced by functions within the company. The marketing function asks, ‘What do we make and how do we distribute it?’, finance asks, ‘How much does it cost?’, HR asks, ‘Who will make it and how?’. No one asks, ‘Why?’” In order to answer the question “Why?” a company must look well beyond itself and understand how it fits into society. “A sustainable business has to think of themselves as part of a functioning ecosystem.”

Standing the test of time
This is a view shared by Alex Hill, Professor of Operations Management at Kingston University, London. Together with his colleagues, Liz Mellon and Jules Goddard, Hill has studied what it takes for an organization to sustain success over the long term. “We were looking for organizations that have been around for 100 years doing the same core activities, and that have outperformed their peers for at least half of this time. These are organizations that are generally admired, and that people look to for ideas,”

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he says. “We wanted to discover what made them successful over such a long period.” The organizations they selected were not those from the commercial world, but from science, sports, art, and education. Their findings showed that each of these organizations combined both a stable core and a disruptive edge. “Both characteristics are equally important,” says Hill. “You need disruption to move forward but stability to keep you on track. Move too fast and you risk crashing. Without stability, you cannot know if you are changing the right things.”

The stable core at the heart of these organizations is its purpose – a purpose that, in each case, was defined broadly in terms of the organization’s role in society. As one of these centennials told them: “If you want to survive for 100 years, you cannot afford to focus narrowly on your current customers. You need to sustain support across society for what you do. You need to be thinking three or four generations ahead.” Hill and his colleagues believe long-lasting businesses see themselves as embedded in society and as having a profound impact. “With a strong sense of purpose, a business can change how we think and behave at a core level. These are businesses that we think of as great.” Believing that rather than concentrating on the current business mantras of growth, cost cutting, and customer focus, to achieve longevity, companies should look to the family business model. “The idea that business should shape our communities and societies is not radical. It’s what businesses used to do. It is reflected in the attitudes of the people who took over the running of the old, well-respected organizations we studied. They described their role as a form of stewardship, aiming to leave the world in a better place.”

Chavez sees this new perspective as a much-needed “rehumanizing” of business. “The paradigm of business we have worked with over the past decades is very mechanistic – we see companies as simply a means of answering straightforward needs and desires,” he says. “But the world has shifted. We have lifted millions of people out of poverty and now have gigantic middle classes, so we now have to ask higher-order questions about what kind of society we want. With climate change these questions will become louder. As some of the most important institutions in today’s world, businesses will have the biggest influence on our future.”
Why Bühler Group CEO Stefan Scheiber believes that a strong purpose and culture are key success factors for business.
How would you explain what Bühler does to younger
generations, such as your 14-year-old son?
To start, I explain to Max that we invent the tech-
nologies, machines, and solutions that our customers
use to make a variety of products. From the foods we
eat, to the feed we give to animals, to the smart
devices we use daily, and to the cars we drive, there
is a good chance that Bühler’s process technologies
were a part of an end product’s story.
And then I describe the big picture of what Bühler
does. I explain that our solutions help our customers
make the products that people and animals eat safe
for consumption, and that this is important because
so many around the world suffer consequences from
eating unsafe foods. I explain that we have a big
reach across the world, and that our solutions con-
tribute to the nourishment of 2 billion people every
day and the mobility of 1 billion people. I tell him that
Bühler is always working to improve the technolo-
gies it develops so that these machines consume less
energy and water, and produce less waste. And, I
explain that this is important because Bühler – and
I – want to do our part to make sure this planet
remains healthy for him and his future children. I
want industry to become part of the solution.

Is this Bühler’s purpose – its reason for being?
Yes, absolutely. Purpose is about deciding what
sort of future you want to build. Food production
and mobility systems significantly contribute to the
global challenges we face today, including climate
change. One-third of global energy is consumed by
the food sector, which also accounts for 20 percent
of all greenhouse gas emissions. On top of that,
one-third of the food we produce – and the energy
embedded in it – is lost or wasted.
These facts make it abundantly clear that there is
vast room for improvement and Bühler is in a unique
position to help effect change. It’s our ambition to
reduce energy use, water, and waste by 50 percent
with the next generation of our solutions. We have
raised the bar from 30 percent to 50 percent in 2019
because the need for sustainable change is becoming
more urgent.

How do you want to achieve this step change?
There are two starting points. First, we have to iden-
tify the opportunities and business cases in the chal-
lenes. I’ll give you one example. Together with a
start-up, we are currently developing a solution
which upcycles a by-product of the malting process.
It is sweet and also healthy because of its protein and
fiber content. Today this by-product is wasted or
fed to animals.

We found a way to refine this material so that it
can hopefully replace a good part of sugar in confec-
tionary products, such as cookies. If this becomes a
real business, it will create a tangible impact in
reducing sugar consumption and in upcycling by-
products. Second, it’s important to leverage the
potential of new technologies, especially digitalization and biotechnology. We will see many disruptions in these areas, and if we are clever, we can utilize them to achieve quantum leaps in efficiency and sustainability.

**Why is having purpose so important to you?**
It gives meaning to what we do. It is also what drives the ability to develop solutions that have an impact on the health and well-being of people and the planet. I connect with this purpose, and I believe that working for a company that has a deeper purpose is important for many people – especially younger generations. They want to know that the company they are working for is doing its part to contribute to a greater good.

Bühler is not alone in this. More and more corporations realize that generating profits is not an end in itself. Of course, profit is a prerequisite for sustainable business. However, purpose and profit have to be aligned. The way I see it, Bühler's purpose provides a framework for our culture, and a strong culture will help us drive our business with a consistency that will safeguard its long-term success.

As you said, purpose is long-term in nature. How does that work together with today's dynamics and the necessity for fast action?
To me this is just the other side of the coin. It is true that we live in a highly accelerated world. Just imagine what will happen when artificial intelligence really takes off. Today's world might be fast, but in two years from now, we will see that the engine was just warming up. In this context, purpose and meaning work as a lighthouse in stormy weather. Our purpose provides direction while we are running a series of sprints and also for the long-distance race we are running for our lasting relevance. I say “we” because the task of creating our future is not the exclusive responsibility of one person. It takes a culture of co-creation where everyone in the company works to visualize our future.

But isn’t Bühler too small on its own to create real impact?
No single company can manage the task of sustainable food production alone. This is exactly why we have built up an innovation ecosystem within our own company, with our customers, suppliers, industry partners, academia, and start-ups. Today's challenges are so complex and demanding, we need platforms where we cooperate with conscientious market participants, the economy, and politicians to implement and scale innovations in a purposeful way. Our credo therefore is: creating tomorrow together. That's why we developed the Networking Days platform in 2016 to bring together key players from our industries and beyond to discuss opportunities and create value.

For the Networking Days 2019, we decided to bring together nearly 800 of our customers and thought leaders from across the food value chain and the mobility sector. I am convinced that with innovative technologies, industry can become part of the solution for today's challenges.

“**YOUNGER GENERATIONS WANT TO KNOW THAT THE COMPANY THEY ARE WORKING FOR IS CONTRIBUTING TO A GREATER GOOD.**”

**Stefan Scheiber**
CEO, Bühler Group

What role does the CUBIC innovation campus play in this context?
The CUBIC represents our dedication to innovation, technology, collaboration and Switzerland as a location. It integrates research and development with engineering, rapid prototyping, application centers, factories, training and talent development, and communications. It embodies our innovation strength and our culture of working in partnership with a broad network to stay ahead of the curve.

What is required to continuously drive innovation?
Frankly, one key prerequisite is a sufficient cash flow. We have to be able to invest in our future. Bühler invests as much as 5 percent of its turnover in research and development each year. An equally vital element of innovation is attracting and retaining talented individuals who are creative, passionate,
professional, and have strong leadership skills. It is our job to create a supportive environment – a culture that embraces inclusion, collaboration, courage, and ownership so that they can thrive, and in turn, Bühler can as well.

Can you elaborate on why culture is so important?
Even the best strategy is just a paper tiger – something that creates an illusion of strength, but crumples when deployed in an environment that does not have a strong foundation. Peter Drucker, author and well-known management consultant, once said: “Culture eats strategy for breakfast.” I fully agree with this sentiment. That isn’t to say that a strategy is unimportant, but it has no traction if it is not aligned with an empowering culture. Our corporate values are trust, ownership, and passion. These values, along with our strategy of “playing to win” are key elements of a culture that encourages entrepreneurial thinking. There is so much untapped potential in the markets that can be harnessed when we all play to win, rather than not to lose.

How do you play to win?
Addressing realities, whatever they may be, is the first step. That is why we have established a broad network to comprehend the significance of today’s realities. And, we work with our customers to fully understand the challenges they face. The next step is to define a winning approach. What are the opportunities in the situation? This is followed by promoting intelligent failure.

As children grow into adulthood, they learn to avoid failure at all costs. That is a hard lesson to shake, but it is clear that winning companies take a very different approach to failure. Amazon’s Jeff Bezos, for example, believes that an openness to failure leads to innovation. It’s about reframing failure into “empowered experimentation.” This requires leadership imperatives that enable employees to take entrepreneurial risks, to have a voice and take ownership. We strive for a culture where failures are accepted and used as a learning opportunity. I believe in the philosophy that it is better to have tried and failed than never to have tried at all.
What are the biggest hurdles to playing to win?

Today, we are bombarded by negative headlines and scenarios. Playing to win in this environment takes a positive outlook and focus. Many of the risks of climate change also offer opportunities to rethink the status quo and develop technologies that benefit the environment and society. With a shared purpose, the potential for change is limitless.

Here again, the culture in which we operate is decisive. Along with establishing where we will play and how we will win, we also need to have the capabilities and talent to get the win. That requires the best available talents with varied perspectives and experience.

We are a diverse company operating in 140 countries, and we are working to further strengthen our culture of inclusion to help us continue to attract and retain top talent. We are doing this by asking employees and managers to get involved and drive the topics that are important in their locations. We want everyone at Bühler to feel able to be themselves and fully utilize their different experiences and ways of doing things. This will not only ensure a positive working atmosphere, but this diversity of thought also leads to creative solutions and innovation.

Where do you stand in terms of diversity and how do you want to proceed?

I want Bühler to be known not only for innovation but also for having a nondiscriminatory, inclusive work environment. I would like us to be recognized for having a culture of bringing different perspectives into the arena. Going forward, we have committed to increasing the share of women we employ by 1 percent year-over-year. In 2018, women made up just 16 percent of our global workforce of over 13,000 employees.

Thinking about the long term, how do you want to hand over Bühler to your successor?

It is my goal to hand over a robust company with a reputation for working towards a higher purpose. Keep in mind that Bühler will celebrate its 160-year anniversary in 2020. This longevity comes from a family business model of positively shaping community and society. This is deeply ingrained in our culture, as is our appetite for innovation. I feel privileged to be a part of Bühler’s story.

I am very aware of my responsibility – together with the Bühler family, the Board of Directors, and the management team – to move this company forward during challenging times while keeping it stable for future generations. It is tempting to think that the people who come next will create the future, but it’s our job now to make this company future-ready.

“It is tempting to think that the people who come next will create the future, but it’s our job now to make this company future-ready.”

Stefan Scheiber
CEO, Bühler Group
When in 2017 Microsoft’s head of the Internet of Things first heard that Bühler was developing the technology to detect aflatoxins in corn, he could not believe what he was hearing. Trained as a chemist, Egbert Schröer, Microsoft Principal Program Manager Azure IoT, immediately understood the public health benefits of the technology.

He knew how serious a risk aflatoxin poses to those living in the world’s poorest regions. It is estimated to cause up to 155,000 cases of liver cancer every year and is responsible for stunting the growth of millions of children. Bühler was developing LumoVision, the sorter technology capable of detecting fungal mold that produce mycotoxins, the most poisonous of which is aflatoxin. Bühler had approached Microsoft to develop the digital part of the service and Schröer was keen for the tech giant to be involved. LumoVision was big-picture stuff, addressing a number of issues that Microsoft was already interested in, including food waste, food safety, and sustainability. “When I am speaking at a conference and I talk about LumoVision, it immediately gets the attention of the audience,” explains Schröer. “The reason is that it is mind-blowing. No one believes you can sort corn at 15 tons an hour, kernel by kernel, to detect aflatoxin.”

LumoVision was the beginning of an alliance between Bühler and Microsoft that today aims to make food production more sustainable and safer. Having started with LumoVision, the relationship would soon move on to the development of the Bühler Insights IoT platform and Laatu and is now evolving into blockchain processing solutions.

When the world’s biggest grain processing technology company joins forces with the world’s biggest IT company, exceptional things can happen. Bühler’s new alliance with Microsoft was born out of common goals and the two companies are now on a journey together to tackle food safety and address sustainability.
It was quickly clear that there was a comfortable synergy between the two companies. “The benefit of us coming together was that there was an ideal fit,” explains Schröer. “We agreed on the technology, but it is not just technology that drives digital transformation; culture change is a super important part of the process and without the change management within the company, you won’t be able to achieve your goals.”

**A perfect match**

Having the same goals was an important starting point. Microsoft had just launched AI for Earth, an artificial intelligence and cloud tool capable of collecting and analyzing data to develop solutions that address climate change, biodiversity and sustainable food supplies. In 2016, Bühler had announced its sustainability targets. Currently, around a third of all food produced is wasted. It is estimated that Bühler’s customers produce food for around 2 billion people each day. This provides a lot of leverage to make a real and lasting impact on food waste. It was decided that the digital strategy would aim to address sustainability in the food processing industry by helping cut energy consumption, CO₂ emissions, and waste by 30 percent by 2020. Since then these targets have been tightened to 50 percent. The two companies were clearly on the same page.

“We had found this company with exactly the same things in mind, so for us it was a fantastic proof point for developing technology. We were both looking to a more sustainable future, so the first project quickly led to the next one,” says Schröer.

Through its sustainability targets Bühler had laid out its direction of travel, now it had to decide how it was going to achieve its goals. The Board of Directors recognized that the two biggest assets it could offer its clients were generations of experience in the food processing industry and a strong relationship forged from working together for years. “We
can offer deep process understanding and trust,” explains Ian Roberts, Chief Technology Officer at Bühler. “If we have been working together to build your business for generations with you and your family, then we have been doing something right. It is important to remember that when you are asking your clients to make a big technological jump, trust has to be part of the process.”

Bühler also offers its clients a third key benefit, points out Roberts: “We have a hundred service stations around the world. What is the point of offering a beautiful digital solution if the physical responses are not aligned to go with the digital experience? When knowledge is located locally it becomes a fantastic match with the digital platform.”

**Internet of Things unlocks potential**

It was the arrival of the Internet of Things, thanks to an explosion in computer processing power, data storage, and interconnectivity, that would make that digital platform possible. Powerful algorithms can now do things with data not even dreamt of a decade ago. The arrival of this powerful technology was the key that Bühler needed to unlock a new generation of functionality for its clients.

The development of sensor technology had already created a data source by enabling Bühler machines to be set to ever more sophisticated processing parameters. Why not take this data and apply years of accumulated food processing experience to analyze it in the cloud? The result would be the ability to calculate the optimal processing parameters to both drive up client profitability and help meet those sustainability targets.

The idea for Bühler Insights had been born, the platform that enables clients to assess their production parameters on a Bühler processing machine. Sensors feed data into algorithms that can predict the yield and then calculate how those parameters could be adjusted to increase yield and quality. “We were focused on where we wanted to go with digital data. We needed a digital partner to help us build the platform that would enable us to connect all our devices and build a service offering on our platform that allows us to run analytics on the data to increase yield, decrease unplanned downtime, and decrease energy usage,” says Roberts.

The decision was made to use the Microsoft Azure IoT hub to drive the new platform. Bühler software engineers started to work closely with Microsoft engineering on IoT advances. Today 85 percent of Bühler machines have the potential to be linked to the Bühler Insights platform.

While Microsoft and Bühler were working on Bühler Insights, the two companies discovered they shared another vision. Schröer explains: “The
Microsoft strategy was that in an industry like food processing, it is important for companies to operate together in an ecosystem rather than everyone being in silos. The more you drive digital information, the more important it is to run the business as part of an ecosystem, especially in the food and beverage sector where the processes are so interconnected from farm to fork. When we discussed it for the first time, we realized this was an idea that resonated with Bühler too."

This was a huge shift. Companies are historically protective of their data and distrustful of working with other companies in such a highly competitive market as the food sector. The idea of working with other companies as part of an ecosystem, or a community of businesses that interact and share knowledge to drive up quality and yield, was a radical one.

But according to Roberts it was not as hard a sell as it first appeared: “The industry is much more forward-looking than we first realized. As soon as you can identify and then demonstrate a benefit there is a high level of interest from customers. Once we get into a discussion with clients about sharing data and we can demonstrate that there is a really significant benefit to them, then it is okay.”

Bühler Insights was able to collect processing data to drive the algorithms that have the power to calculate how to make food processing more sustainable and profitable. The next move would be into blockchain, which has opened up a whole new vista of opportunity. “The aim of blockchain for us is very simple – we can help a customer answer the question: Is what it says on the packet in the packet?” explains Roberts. “In the end as a consumer that is what you want to know. The second aim is to make sure food has been processed in the way that it is safe and nutritious. We are talking about, where does the product come from, is it grown in the way it is supposed to be grown, was it harvested in the right conditions, was it processed correctly, and was there any chance of adulteration? We are talking about a transparent and secure food chain.”

Blockchain technology in the spotlight
At this year’s Hannover Messe conference, Bühler and Microsoft once again shared a stand, this time it was to showcase Laatu, the low-level electron food safety process (see also page 84). By linking Laatu to Microsoft blockchain technology there is now the potential to turn the food safety technology into a food safety certification tool capable of generating a fast, accurate, and secure audit trail for food producers globally.

One of the early challenges faced by Bühler when launching its digital strategy was the rate of technical development that had taken place within the food processing industry. “It is not as advanced as the semiconductor or automotive industries,” explains Stuart Bashford, Bühler Digital Officer. “To digitize some of these processes is a little like going..."
through an industrial revolution. However, in industries that are advanced you have to work much harder to get added value, whereas in the food industry we only have to apply a small amount of technology and we realize large amounts of benefit to our customers.”

By linking up with Microsoft, Bühler has been able to bring significant benefits to its clients and make big inroads into those original sustainability targets. TotalSense is a digital solution targeted at the rice industry, and the evidence points to companies that have adopted it being able to increase their yield by 2 percent. With the same raw material coming into the plant and 2 percent more coming out that has a direct impact on food waste.

“As an example, if you use the pet food drying application MoisturePro over a year it can reduce your energy costs for drying by USD 20,000 a year,” explains Bashford. “Additionally, it can gain you USD 300,000 per line because your yield has increased which is effectively both the waste and energy metric. It’s clear that digitalization can deliver on those sustainability goals.”

**Revolution across different industries**

The arrival of blockchain is also set to have a significant impact. Being able to trace and track products as they flow across the supply chain through the use of blockchain will improve food safety and so cut the risk of waste from product recalls and spoilage.

Bühler is currently working with the UK flour millers Whitworth Bros. Ltd. to use blockchain to introduce a new level of transparency to the milling process (see also page 72). Clients will be able to see the parameters being used to mill their wheat in real time, providing another level of assurance that their raw material will be of the optimum quality for their specific purpose. With the knowledge of your raw materials optimized, with the help of blockchain, and the food processing optimized through IoT, quality and yield will rise and wastage will fall. There is no doubt that the food industry is now on the frontline when it comes to tackling big issues such as food waste and sustainable future food supplies. But the need for greater efficiencies leading to energy and waste reduction apply in other Bühler sectors.

Digital technology is providing solutions in these industries too. Half of all new cars manufactured worldwide have die-cast components produced with Bühler technology, while around a thousand die-casting foundries rely on Bühler solutions every day. IoT is creating the same opportunities to reform production in this sector as in the food sector.

An example is how cloud-based algorithms are driving AI and machine learning capable of predicting machine failings before they occur. Predictive Analytics, a cloud-based digital solution, can cut unscheduled downtime by 80 percent by providing advanced diagnostic predictions of potential problems, so they can be fixed with planned maintenance (see also page 86). IoT solutions have also been developed to streamline the die-casting production process with the objective of cutting energy cost and creating zero waste.

Schröer confirms that this revolution in IoT is happening across many different industries. At the Hannover Messe this year Microsoft announced the launch of the Open Manufacturing Platform (OMP) with the car manufacturer BMW. Similar to the way Bühler is introducing smart solutions into its different sectors, OMP participants will use IoT to produce an open data model to address common industrial challenges.

“This is a huge shift,” says Schröer. “I have been with Microsoft for 16 years, and I can tell you this is the most exciting time that I have had here because of this enormous change that is taking place, it is cool, it is hip, and you help others.”
Food safety alerts.
Get the news first.

Bühler’s digital food safety platform

Detect emerging risks and minimize potential harm with global data available in real time and 24/7.

safefood.ai extracts and delivers insights on food safety threats. Customize the platform to stay ahead in your market.

Find out more:

digital.buhlergroup.com/safefoodai
The quantity of data we produce is growing exponentially. There are many reasons for this, including the increasing global population, the need to be digitally networked, and the machines, buildings, and cars that are communicating with each other with increased frequency. This presents network providers and energy suppliers with great challenges. Bühler is ready for this flood of data thanks to innovations that make a significant contribution to sustainable solutions for the future.
READY FOR THE DATA TSUNAMI?

TEXT: CARMEN PÜNTER
Invisible networks run through populated areas like nerves, under the earth, through municipal buildings, and even through the air. Pulsing, whirring, and glimmering, they forward messages, phone calls, images, videos, and codes from point A to point B and back again, in all directions and to all regions of the world. Fiber optic and 4G cable have elevated the digital transfer to a level previously unimaginable.

On almost every mobile device, it is long since possible to receive Internet and GPS signals, stream videos, and send or download megabytes and gigabytes of data at the click of a button.

According to a study by the International Data Corporation (IDC) and the American hard drive manufacturer Seagate, 33 zettabytes of data is generated around the world in just one year. A zettabyte comes after an exabyte, which comes after the petabyte, terabyte, gigabyte, and megabyte, and is a figure with 21 zeros. In other words, almost 12 gigabytes of fresh data per person per day streams across the Internet. According to the IDC, this volume will increase fivefold by 2025. This presents huge challenges for the operators of mobile phone and fiber glass networks. “When more and more people are consuming more and more data in an ever denser space, then we are talking about enormous requirements for bandwidth in the networks of the future,” explains Samuel Schär, CEO of Bühler Advanced Materials.

It is crystal clear that this will be the case when you consider the growth of the world’s population and its digital needs: mobile Internet, online shopping, e-banking, GPS navigation systems, smartphones, fitness trackers, as well as personalized marketing, security cameras, networked machines in industry, smart buildings, and self-driving vehicles.

People communicate not only with each other, but also by means of data flowing between clouds and computers, traffic control systems, airplanes, buildings and machines, and everyday objects. The invisible network continues to expand its reach. “Initially, people had smoke signals, then they had messengers, mail carriers, and carrier pigeons, later they started to transmit electronic signals, and today the network providers work primarily with pulses of light,” says Schär. What makes the light so
“WHEN MORE PEOPLE ARE CONSUMING MORE DATA IN AN EVER DENSER SPACE, THEN WE ARE TALKING ABOUT ENORMOUS REQUIREMENTS FOR BANDWIDTH IN THE NETWORKS OF THE FUTURE.”

SAMUEL SCHÄR
CEO of Bühler Advanced Materials

Big data / FOCUS

efficient is its high performance bandwidth. “The frequencies of light are very high and the wavelengths are extremely small as a result. For this reason, an enormous number of channels are running next to each other in the thinnest of fibers.”

One single glass fiber can be divided into many separate information channels. The key to this is the different colors that can create light. Every color has its own wavelength which forms a separate transport channel. Bühler technologies are an essential part of such optical data networks. A system is needed to decrypt the information that is bundled in individual channels for transmission. “The optical coating solutions from Bühler Leybold Optics play a key role in this. They can filter out individual flows of information from the multitudes,” says Schär.

The systems from Bühler apply nanometer-thin coatings to optical sensors. “When you skillfully adjust the process parameters and the composition of the materials, you can decide exactly which light frequencies to strengthen and which to extinguish. The more precise the filter, the more channels can be used simultaneously in one data line,” he says.

Wireless service providers used to work with lower frequencies. Nevertheless, there is also a tendency to use shorter wavelengths in order to achieve a higher bandwidth. The 5G network is waiting in the wings for this. Bühler is a contributor on the international production stage as well. 5G antennas are placed inside an aluminum housing which is manufactured using a die-casting process. Bühler happens to be the global leader in this process.

“When the increasing frequencies and obstacles in the densely populated areas, such as in megacities, the range of the antennas drops. This means that a much higher density of such antennas is needed than even with 4G,” said Schär. “Per industry forecasts, in the future, 12 million 5G antennas will be needed..."
around the world. One antenna typically consists of six transmitting units, each with five to six housing parts, thus a total of 30 to 36 housing parts, and our die-casting process is simply unbeatable in terms of efficiency when manufacturing in such large quantities.”

There is a question of how long it will take until this 5G network reaches the limits of its capacity. Schär is convinced that the demands on wireless networks cannot increase endlessly.

“I currently see no reason why the capacity of 5G should not be sufficient. It is much more likely that new technologies will arrive locally,” says Schär. “For example, there have already been tests with what are called Li-Fi networks, which, as the first syllable in the name indicates, work with light waves – in particular, with light from an LED lamp inside a room. This technology is still in its infancy, but once it has matured enough to be brought to the market, it could replace our current Wi-Fi and make enormous bandwidth available, especially in very dense centers.”

Energy must be more sustainable
Despite many sustainable solutions for matters of transmission, the data explosion still presents us with another big challenge. Together, all the networks, storage solutions, and end devices will still require even greater amounts of energy in the future.

“When we use a fiber-optic network to watch a movie at home, we need about two kilowatt hours of energy when you consider the energy consumption of all of the infrastructure. This corresponds roughly to the energy used by a dishwasher to wash a full load of dishes. “But if we stream a movie using the mobile network, we need about twice the amount, or four kilowatt hours,” says Schär. “If you look at today’s computer technology and the technology at data centers, along with the anticipated increase in data volumes, then by 2030 about 40 percent of the world’s energy needs will be used in this area. This is appalling, and of course, in no way sustainable.”

For this reason, Bühler is very intent on using more efficient energy solutions, not only by setting a goal to reduce the energy consumption in the value chain of its customers by 50 percent, but also by searching for new innovative ways to use the technologies from Bühler to contribute to sustainability. Already today, 75 percent of the silver inks that are used for the front contact on solar cells are processed with Bühler three-roll mills.

Bühler has also developed a new method for manufacturing electrode slurries for lithium-ion batteries which is already in use in large-scale production in China. The slurry is manufactured using Bühler’s fully continuous mixing process for both the positive and negative terminals on the batteries, and it significantly improves the manufacturing efficiency and the quality of the batteries. In the manufacturing efficiency of car batteries in particular, this is a significant advance because it enables the manufacturers to utilize the maximum possible performance in their battery technology.

Bühler is also a trailblazer in the coating of architectural glass, which makes buildings more energy-efficient. “The thin-film coatings that our systems apply to glass determine how much of the infrared radiation, or the heat, stays either inside or outside. Depending on the glass, this will be beneficial for either cooling or heating the spaces,” says Schär. “The next step, and already a reality, is electrochromic glass. This is a development that I am following closely. Electrochromic means that you can influence the transparency of a piece of glass with the help of electrical voltage.”

If one compares the solutions, it is already possible to save about 50 percent of energy consumption by using coated glass. And with electrochromic glass, you could save half of that again, meaning a total of about 75 percent.

“There’s no doubt this technology will have an impact in the future, and we assume that we will continue to see new buildings with a great deal of electrochromic glass – especially skyscrapers. With our new CUBIC innovation campus in Uzwil, we are already making full use of this technology,” explains

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**“THERE’S NO DOUBT GLASS COATING TECHNOLOGY WILL HAVE AN IMPACT IN THE FUTURE, AND WE WILL CONTINUE TO SEE NEW BUILDINGS WITH A GREAT DEAL OF ELECTROCHROMIC GLASS.”**

_SAMUEL SCHÄR_  
CEO of Bühler Advanced Materials
more conscious of the energy available. Of course, there are things that have not yet been invented, that will be needed in future networks or by mankind in general. But Schär emphasizes the clearly observable acceleration in development, as it is outlined by Ray Kurzweil, Director of Engineering at Google. How do we deal with all of the new possibilities, ranging from utopian to dystopian? Should we really use the CRISPR/Cas genotech method to change people's DNA? Do we want to be surrounded by machines that are perhaps able to develop their own self-awareness?

For Schär, one thing is clear: forerunners in industry and technology, such as Bühler, also need to be involved in the ethical discussions that affect their sector.

Schär. He believes that glass will also play a bigger role in the vehicles of the future. “The air conditioning system in the car, or the heater if there is no available source of heat like a hot engine, consumes enormous amounts of energy. Automotive manufacturers are now starting to coat the glass used in vehicles so that the heat either stays in or stays out. When used in combination with electric mobility, this can significantly influence energy efficiency.”

Responsive housekeeping
Battery technology from Bühler is used in the energy network as well, especially in places where a lot of renewable energy is produced, like where wind or solar parks are located. In these networks, there is the challenge that the energy is not always accumulated when it is needed. This means that it must be temporarily stored somewhere – like in batteries. “What is interesting here, in terms of sustainability, is that batteries which are no longer usable in cars because they are unable to provide the necessary cycle behavior performance, are still well suited for use as stationary intermediate storage,” Schär says.

The CEO of the Advanced Materials business unit at Bühler is certain that technology alone cannot solve all problems. Consumers must also learn to be more conscious of the energy available. Of course, there are things that have not yet been invented, that will be needed in future networks or by mankind in general. But Schär emphasizes the clearly observable acceleration in development, as it is outlined by Ray Kurzweil, Director of Engineering at Google.

How do we deal with all of the new possibilities, ranging from utopian to dystopian? Should we really use the CRISPR/Cas genotech method to change people’s DNA? Do we want to be surrounded by machines that are perhaps able to develop their own self-awareness?

For Schär, one thing is clear: forerunners in industry and technology, such as Bühler, also need to be involved in the ethical discussions that affect their sector.

“I truly hope that we humans draw ethical boundaries and give much consideration to which technologies we want to apply in the future and which we don’t.”

SAMUEL SCHÄR
CEO of Bühler Advanced Materials
Digitalization and the growing options for interlinking machines can unleash substantial gains within industrial production, including higher efficiency, improved quality, and increased sustainability. Bühler’s team of data scientists combines artificial intelligence algorithms with the company’s nearly 160 years of process expertise to harness this potential.
TURNING DATA INTO PROFIT

TEXT: ANJA METZGER
A B U Z Z O F E N E R G Y can be felt as soon as you enter the Innovation Park of the Swiss Federal Institute of Technology in Lausanne (EPFL). In Bühler's Innovation Satellite, thinkers – PhD candidates, students, and analysts – are concentrating on the figures and diagrams visible on their computer monitors. Though the team is fully immersed in their work, when visitors arrive, the office transforms into a break room where everyone is ready for some chit-chat. “Our close relationship with the EPFL really helps us maintain a relaxed atmosphere,” states Dr. Matthias Gräber, Head of Data Science at Bühler. “And the drive of the students gives us a fresh perspective, allowing us to continue moving innovations forward.”

Since 2017, the Innovation Satellite in Lausanne has also been home to the multicultural data science team, headed by Gräber. Data scientists extract meaning from large volumes of data. His team members come from Canada, India, China, Brazil, and Switzerland, and work in Lausanne, Uzwil, and London. Supported by two employees from the Swiss Data Science Center (SDSC) the specialists work on developing digital solutions for Bühler customers across all its industries.

Data is the new gold
According to IBM, 90 percent of all data ever generated worldwide was produced within the past two years. A study by the International Data Corporation (IDC) and the hard disk manufacturer Seagate, indicates that data volume is set to quintuple by 2025: from 33 zettabytes (33 billion terabytes, or 33 with 21 zeros) in 2018 to 175 zettabytes in 2025.

The study also predicts that it will be possible to process 30 percent of this data in real time by 2025, meaning companies risk falling behind if they don’t learn to handle it now.

Data is the new gold, that reaches far beyond the marketing industry. “Data is powerful. Those who have it can better understand processes and make crucial optimizations to production in industrial applications especially,” says Gräber.

Many producers are already taking advantage: The Internet of Things, Industry 4.0, predictive maintenance and machine learning are familiar concepts. Smart controls and sensors are already collecting immense volumes of data today, flowing through node points on production systems in a fraction of a second – from megabytes, to gigabytes to terabytes.

But no matter how large these data streams are, they alone do not improve the end product, reject rate, or profit margin. They’re just the start. What we really need is a system that sorts, interprets and prepares this flood in a way that makes sense. Visualization on a user interface (also known as a dashboard) helps users draw their own conclusions from the gathered information. This is where artificial intelligence comes into play. For example, algorithms can learn the typical behavior of machines and processes. Collected data becomes even more powerful when analysts feed their systems with human process expertise, enabling them to even better recognize dependencies and issue concrete recommendations for action.

Developing services with added value
The data science team at Bühler develops digital services which offer precisely this advantage. How can we interpret the generated data volumes to harness new insights? How can we define rules for automatic actions that anticipate the operations of a system while responding faster to fluctuations and environmental effects in production processes? And how can we incorporate Bühler’s nearly 160 years of technological expertise into the smart machines?

The data scientists from Bühler all have a technical or scientific background with additional training in the area of data science. They analyze the data that gives our customers an edge.

“Bühler’s global network of technology suppliers in the food and automotive industries, is extremely exciting for us,” explains Bühler Data Scientist Alison Michan, who feels very strongly about the sustainable use of natural resources. She is convinced that Bühler can play an important role here as well: “Even with the smallest of optimizations, digital services can make a positive contribution to areas such as food waste and energy usage for many of our customers.”

The Swiss Data Science Center
The Swiss Data Science Center is a joint venture between EPFL and ETH Zurich. Its mission is to accelerate the adoption of data science and machine-learning techniques within academic disciplines of the ETH Domain, the Swiss academic community at large, and the industrial sector. In particular, it addresses the gap between those who create data, those who develop data analytics and systems, and those who could potentially extract value from it. The center is composed of a large multidisciplinary team of data and computer scientists, and experts in select domains, with offices in Lausanne and Zurich.
To develop digital products, the data analysts and their colleagues from the SDSC combine the experience of system operators, process engineers, service technicians, scientists, and other experts. In regular meetings, they get together with engineers from the specialist departments at Bühler and discuss what services are suited for the data-driven process optimization. Bühler’s experience is incorporated into the development of new digital products each and every day, with collaboration beyond company boundaries playing a key role. “Working with the SDSC and other external partners ensures that we can take advantage of the latest technological developments and the ideas of many bright minds,” explains Gräber.

**Faster and more consistent**

Never before have the production data of control systems, machines, sensors, the devices for quality analysis and environmental conditions been looked at so profoundly. “The beginning of every product is a journey to the unknown,” says Michan. “As soon as we become acquainted with the data, we often have more questions than answers at first.” This makes cooperation with customers and process experts essential. The data analysts take an agile approach, regularly gathering feedback from those looking to simplify their day-to-day work with digital services. This allows them to continually improve products and keep pace with the industry in terms of innovation: “Transforming a concept into a physical product ready for market launch can take years – with digital products, this process usually just takes a few months,” says Gräber.

In many industries, efficiency and quality optimizations were long only possible in small steps, and relied on the expertise of the system operator especially. The output and quality of a mill was only as good as the head miller operating it. The processes, wear, and dependencies between individual events...
within a casting cell were often so intransparent that searching for the cause of a poorly cast part was extremely difficult.

Digitalization has yielded entirely new opportunities extending beyond mechanical and training-related improvements. “As soon as we go beyond simply visualizing data, and start integrating artificial intelligence into processes, we have one major advantage: continuous optimization and detection of fault conditions,” says Gräber. In markets where it’s important to identify malfunctions or possible food safety risks, this makes a crucial difference.

Real-time analyses intervene in processes before humans could have even drawn a conclusion based on a visual inspection or spot testing. Imagine, an employee takes a sample from a pet food dryer to determine its water content. The employee tests it in a lab, and based on the results, adjusts the drying temperature. This employee is only capable of optimizing a single part of the process at a specific time. In contrast, artificial intelligence uses online sensors to continually adjust the drying temperature, making the process much faster and more efficient. This has an immediate impact on the quality of the product.

Secure in the Microsoft cloud
The over 50 digital services Bühler is now working on for customer systems run on the Bühler Insights platform, based on the Microsoft Azure cloud. This system guarantees that highly sensitive production data is transferred and stored fully encrypted at all times. Bühler Insights is currently being certified in terms of data security and management. “By certifying our development processes for Bühler Insights to industry standard ISO 27001, we can ensure that we provide all control mechanisms to protect our customers’ data,” explains Robert Cuny, Program Manager IoT at Bühler. Not all digital services were initiated by the Data Analyst Team in Lausanne; the data analysts are also involved in many Bühler projects around data and digitalization in the role as consultants.

Some of these digital products appear quite simple. For example, GrainiGo and TotalSense reliably perform quality analyses of corn and rice reducing subjectivity and cutting the time required. Both solutions are run only using a small box; data is then transferred to the smart image processing system in the cloud via smartphone. The new Replay Service systems allows customers to rewind their process data as in a video. In the event of quality issues or system malfunctions, each individual process step can be traced back in detail and the underlying cause can quickly be found.

Sometimes high-tech help in risk management plays more of a role than optimizing one’s own processes. Customizable alarms on Safefood.ai help customers to quickly respond in the event of food contamination. Digital services can also make achieving Bühler’s ambitious sustainability goals of reducing waste and energy consumption in the food value chain of its customers by 50 percent a reality. “The better and faster settings for a visual sorting machine can be optimized using machine learning, the more food waste we can avoid,” says Michan.

Gräber believes this is just the beginning. “Once our customers realize the enormous potential analyzing process data brings for the area of profit maximization, they won’t want to live without it.”
Two billion people each day enjoy foods produced on Bühler equipment. We are focused on developing new ways of sustainably nourishing the world’s population as it grows to 9.8 billion by 2050.

Traceability and food safety along the value chain are the challenges we are addressing with our customers to ensure the supply of healthy, nutritious food for the planet.

Discover some of the solutions which help you to achieve your goals:

digital.buhlergroup.com

Innovations for a better world.
In 2008 a paper appeared, authored by the mysterious Nakamoto, that is credited with helping launch us into this new phase of our industrial evolution. Diagram explores how the food industry hopes to benefit in the coming years.

In past decade, blockchain has emerged from an obscure reference in an academic paper to become the foundation of the fourth industrial revolution. To this day no one knows the true identity of Satoshi Nakamoto, yet he is credited with one of the most significant advances in what is now being called the fourth industrial revolution. The first industrial revolution used water and steam to power mechanized production. The second harnessed electricity for mass production, then in the second half of the last century the third saw electricity and information technology combined to facilitate automation.

In the past few years unprecedented levels of computer processing power, data storage, and interconnectivity have been created. It is the speed with which these new capacities are heralding novel ways of working, in both the digital and physical sphere, that is being described as the fourth industrial revolution.

In 2008 a paper appeared, authored by the mysterious Nakamoto, that is credited with helping launch us into this new phase of our industrial evolution. It was the first time that the phrase blockchain had appeared in print, described in relation to a new peer-to-peer electronic cash system known as Bitcoin. It is impossible to know if the anonymous author, or authors, writing under an assumed pseudonym, had any idea how blockchain was about to grip the corporate imagination.

**Future business**

Today, business leaders treat blockchain as one of the building blocks of the fourth industrial revolution. While many still only associate it with cryptocurrencies, blockchain has in reality become an
integral part of the commercial horizon. Along with the Internet of Things, artificial intelligence, 3-D printing, and materials science, blockchain is about to radically change the way future business is done.

Companies, Bühler included, are always assessing future technologies for their potential commercial benefits. This is why in recent years Bühler machines have been transitioning to Bühler Insights, the conduit that enables clients to take advantage of all the new opportunities provided by the Internet of Things. Today, 85 percent of Bühler machines have the potential to be connected. Blockchain has the potential to provide clients with equally radical new ways of working.

Bühler Blockchain Analyst Camilla Cavaliere has been tasked with recognizing the new business opportunities offered by blockchain and turning those ideas into reality. “We are at the proof-of-concept stage where we are talking with clients and exploring possibilities,” says Cavaliere. “Any type of data that reaches Bühler Insights can be published on the blockchain, so we need to know what sort of data clients would like to share with external partners and when it makes commercial sense.”

What exactly is blockchain, and why does Bühler believe it offers such exciting new client opportunities? Put simply, blockchain is a decentralized ledger that permanently and digitally records a transaction or event without the need for third-party authentication. What makes it unique is the fact that once logged an entry can never be tampered with or changed.
Rather than information being held centrally it is stored digitally on a network of computers in many different locations. When a transaction is recorded it is verified by each of the computers on the blockchain, with the new information forming a block. This is then linked to the last block of information. It is this process that gives the new technology its name. It forms an unchangeable chain of information blocks. The technology has a number of characteristics that Cavaliere believes will form the basis for a new generation of Bühler functionality in the food processing industry.

A true record of events
Firstly, blockchain offers security. Every event or transaction that happens on the blockchain is recorded in date-stamped blocks and then stored in multiple locations. It makes it possible to record every chosen parameter that occurs during a food manufacturing process. Ultimately, it will be possible to digitally record every event that happens in the value chain from farming parameters to transport, storage, milling, and food processing. Because the record cannot be changed everyone in the value chain is secure that they have a true record of events.

Then there is transparency. The data is shared across a network of computers and therefore is always available. Because the blockchain is self-perpetuating by all those on it, no one has control of it. So no one can turn it off.

Finally, the data can be shared by multiple users who are invited to join the blockchain across the supply chain. Cavaliere uses the example of a flour mill to illustrate how blockchain could work in future. Using Bühler Insights, a miller can continually monitor, record, and assess milling parameters on any particular flour batch in a digital format.

Today, the flour leaves the mill and has to be tested by the food processor to make sure it is of the required quality before entering their factory. “With blockchain, instead of testing the flour at a single point, data can be collected by each of the machine sensors throughout the milling process and then put on the blockchain so that clients buying the flour can then see exactly how the quality is changing as it gets processed,” explains Cavaliere.

The beauty of blockchain
Once customers have indisputable evidence that the flour has been produced to the required standards, there is no need to test it before entering the food processing plant. Every date-stamped batch that arrives will be of a guaranteed quality because customers have been seamlessly monitoring the whole milling process on the blockchain. The beauty of blockchain is that the miller only shares the real-time processing data it wants the client to see.

“Blockchain represents a part of a centralized data set, enabling the customer to publish the processing parameters that they want to share with external parties, while keeping their commercially sensitive data secure,” explains Cavaliere.

Bühler is currently working with Whitworth Bros. Ltd., one of the UK’s largest flour millers, to see how blockchain could work in their supply chain. Cavaliere agrees that blockchain may not work for every supplier, but larger firms that want to provide their clients greater transparency are showing a keen interest.

Smart contracts
Once you can provide immutable evidence that a product has undergone a prescribed process to produce the desired quality, it is a short step to then make those prescribed parameters a contractual requirement.

The smart contract is the next stage in the evolution of blockchain. Take transportation as an example. A processor may want their raw material to be transported at a specific temperature and humidity to optimize quality. If that is built into a smart contract with the carrier, then the moment sensors detect that the truck refrigeration unit is operating outside the agreed temperature range, the batch can be rejected. Again, because blockchain provides the data seamlessly and both the supplier and client know it is impossible to tamper with the data, there is little room for dispute. The batch could be automatically rejected without human intervention. In the case of a flour mill, the smart contract could ensure that specified parameters are met at each stage of the milling process to guarantee the client gets the optimum flour for their specific needs.

“A smart contract can contain anything that can be translated into code, which then provides an immutable update to the blockchain,” Cavaliere says. “It is a little like a piece of software on which a smart contract sits that has been preprogrammed.
with a set of parameters. Both the carrier and the client are registered on the blockchain with the software waiting for the data to arrive."

Data is secure
Data security is a natural concern for potential blockchain users. A miller may be happy for clients to see some processing parameters, but not so keen for their competitors to know all about them. It is critical that each player has total control over what data is shared, how it can be used, and what data remains discreet. When it comes to someone unwanted accessing data on the blockchain it is no different from any other secure database.

“When it comes to security from outside, blockchain technology behaves like any other centralized computer or the cloud,” explains Cavaliere. “You install antivirus and security software and you trust the technology provider, which in this case is Microsoft. All the data that is safe in the cloud is equally as safe on the blockchain.”

Speed of response
Another food industry application is to use blockchain for food safety auditing, food fraud prevention, and to improve traceability. The advantage of blockchain is the speed of response it facilitates to a particular incident. Today, physical records often have to be found, all of which are vulnerable to human error and even fraud. Blockchain provides an almost instantaneous and reliable record of events. This means a product can be traced back with greater certainty and speed, enabling a food producer to more effectively mitigate the risks and therefore costs associated with a food safety incident.

The food industry in some respects is still on a steep learning curve when it comes to blockchain. In the field of food safety, for example, public health officials and food safety auditors have yet to be convinced that a digital representation of an event is more reliable than a paper-based record. “These are some of the most important people that we need to bring on board,” says Cavaliere. “We need recognition from government agencies that the digital certificates are as reliable as paper-based records although some food safety auditing companies are already embracing this new technology and even thinking of setting up their own blockchains.”

Consumers also hope to benefit from blockchain. Not only does it have the potential to improve food safety and cut fraud, but in an age of ever-increasing ethical consumption blockchain can provide the consumer with the assurance that a product is genuinely fair trade or has been produced sustainably. When does Bühler think the food industry will start to see blockchain functionality appear? “We have already looked at supply chain monitoring and at the moment we are looking at interfaces between suppliers and clients in the process and trying to understand what our customers have difficulty sharing with external parties,” explains Cavaliere. “Once we have established what the data sensitivities are, we will be in a good position to further develop the practical applications.”
Total traceability thanks to blockchain

In this digital age where food incidents can quickly become food safety scandals, traceability, transparency, and data intelligence are the most trusted allies of the food industry and consumers. Digital technologies, including blockchain, will unlock a new degree of food safety assurance.

TEXT: MICHÈLE BODMER

Blockchain is transforming big industries

A range of industries are using blockchain to drive greater transparency, including banking, health care, charity organizations, the luxury goods sector, and food. Bühler and Microsoft are working together on the development of a blockchain solution that will increase food safety and transparency across the food value chain. Here are some examples of how blockchain will help the food industry and consumers.

Verify authenticity / anti-tamper

Food fraud costs the global food industry USD 30-40 million a year, according to Price-waterhouseCoopers. Food fraud includes mislabelling, adulterating, and counterfeiting food products. For example, olive oil can be diluted with lower quality oils; wood pulp is added to Parmesan cheese; and seafood is often wrongly declared. With blockchain, product authenticity is verified at each step of the production process.

Blockchain is, like any ledger, a record of transactions. What distinguishes it from other ledgers is that it is virtually impossible to tamper with. This is because the information is stored digitally in a network of computers around the world. There is no central location holding all of the records. If a new transaction is added or a change is made, it has to be verified by each of the computers before it is recorded. Each “block” of information is linked to the previous block to create an unchangeable record of events.

The need for traceability is regulated, but the systems used to be compliant are not. Many players still rely on manual records, which are vulnerable to human error. In the event of a food safety incident, manual systems limit the speed of response. With blockchain, each event is verified to quickly pinpoint the source of the incident and mitigate risks.

A third of food is lost or wasted

One third of the food we produce is lost or wasted along the value chain, according to the Food and Agricultural Organization of the United Nations. Digital technologies, such as blockchain, and the Bühler Insights digital platform will significantly help to curb loss in production.

Where food loss and waste occurs:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>22%</td>
</tr>
<tr>
<td>Distribution and market</td>
<td>11%</td>
</tr>
<tr>
<td>Processing and packaging</td>
<td>11%</td>
</tr>
<tr>
<td>Agricultural production</td>
<td>32%</td>
</tr>
<tr>
<td>Handling and storage</td>
<td>23%</td>
</tr>
</tbody>
</table>

Rice, corn (maize), and wheat are food staples that account for 60% of the world’s caloric intake — and Bühler provides solutions for the processing of all of them. It is also involved in the agricultural value chain from post-harvest through to the packaged product. This puts Bühler in a unique position to support its customers in reducing food loss.

A transaction is recorded

The network verifies the transaction

Each block of information is linked to the previous

Security

Every event is recorded in time-stamped blocks and stored in multiple locations.

Transparency

Data is accurate, distributed across a network of computers, and always accessible.

Accounting (ledger)

There is an unchangeable, verified record of every transaction.

The benefits:

What is blockchain?

65% of grain is processed on Bühler equipment

Rice, corn (maize), and wheat are food staples that account for 60% of the world’s caloric intake — and Bühler provides solutions for the processing of all of them. It is also involved in the agricultural value chain from post-harvest through to the packaged product. This puts Bühler in a unique position to support its customers in reducing food loss.

Empowerment for farmers and consumers

Trust and ethics are important to today’s consumers, and blockchain allows them to get the transparency they are looking for when it comes to the foods they buy. For example, consumers can trust that a fair trade label really means that the farmer was treated ethically and was paid a fair price for his products. The consumer can even track a product back to the source and learn more about the farmer.

Source: Food and Agricultural Organization of the United Nations, PwC, Bühler Group
Every “block” in the food chain* is tracked

With blockchain, every stage of a physical product’s journey from farm to fork is recorded and verified. This is an example of how blockchain can be used in the food industry.

*This food supply chain has been simplified for illustrative purposes

Farmer: A farmer produces wheat under specified conditions to earn organic and fair trade certifications.

Transport: Authenticity is verified and the wheat is transported under high-quality assurance regulations.

Processor: The containers of wheat are again verified and the wheat is processed in the mill.

Distributor: The finished product is now moved by a distributor under high-quality assurance regulations.

Retailer: The product reaches the retailer having been accounted for and verified at each step of the journey.

Consumer: The consumer purchases the organic and fair trade certified flour that has been quality assured.
It should come as no surprise that Industry 4.0, artificial intelligence, and increased automation will bring along changes for workers of all ages and hierarchies. But, it’s not only digital skills that will play a bigger role for companies and the workforce of tomorrow. Soft skills are equally important in making companies fit for the future.

Throughout history, technology has changed the way we work. The advent of steam and water power, electricity, computerization, and digitalization, has done more than streamline processes and improve productivity – these developments changed society.

We are now in an era where digital technologies increasingly interact with the physical and biological worlds. This age, dubbed the “Fourth Industrial Revolution” by Klaus Schwab, Founder and Executive Chairman of the World Economic Forum (WEF), is expected to “fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before,” according to Schwab.

Such unprecedented change presents both challenges and opportunities. In fact, according to the WEF’s 2018 Future of Jobs report, advances in robotics and artificial intelligence won’t lead to robots taking over the workplace. Instead, these developments have increased the potential to create more work – not take it away.
The report predicts that about half of today’s core jobs will remain stable in the next five years. It also states that a loss of 0.98 million jobs will be balanced by a gain of 1.74 million jobs. It is clear that new hard skills such as cloud computing, artificial intelligence, and analytical reasoning are needed in this age of transformation. However, soft skills such as creativity, critical thinking, persuasion, and negotiation will also become increasingly essential in the new, digital workplace.

“It is critical that businesses take an active role in supporting their existing workforces through reskilling and upskilling, that individuals take a proactive approach to their own lifelong learning, and that governments create an enabling environment, rapidly and creatively, to assist in these efforts,” according to the WEF report.

Bühler’s Head of Corporate Personnel Development, Irene Mark-Eisenring, explains that training and upskilling are deeply ingrained in Bühler’s culture, and aid the company in staying relevant and competitive in a rapidly changing environment. She and her team, who work in the CUBIC innovation campus in Uzwil, develop the company’s training and talent development strategy. She explains that Bühler’s current business planning is based on three pillars – digital technology, collaboration, and talent.

A learning culture

“Continuous learning and development have always been important to Bühler,” says Mark-Eisenring. “Like a lot of other companies, we do need more people with specific skills, such as data scientists who can handle all of the technologies we are introducing. However, more important than ever will be the nurturing of soft skills – such as good verbal communication, the ability to listen to others, and empathy for team members. They are particularly important so people can learn from failures and cooperate effectively, and especially to drive creativity and innovation. Individuals and organizations must become more agile and encourage ownership in order to inspire other people. I’m convinced that the more technical we become, the more human we will need to be.”

According to the human resources expert, training has to be more impactful, efficient, and accessible than ever. In a classroom situation, learning needs to be more experiential and interactive. “We foster a learning culture at Bühler, independent of where our employees are in their careers,” explains Mark-Eisenring. “We also have a strong tradition of experiential learning. Our vocational training program is over 100 years old, and a high percentage of our managers began their careers as apprentices.”

Apprenticeships have a long history in Switzerland, where two-thirds of young people go down this route. Stefanie Bärlocher, Leader of Vocational Training at Bühler, says that the company recruits up to 85 apprentices a year in Switzerland and has a total of 600 enrolled worldwide each year. Sites offering vocational training include those located in Switzerland, Germany, Austria, China, India, Brazil, the US, and South Africa. Under the Swiss model apprentices receive a mix of practical and academic training. One example is the academy in Minneapolis, US, which offers apprentices practical, hands-on training at the Bühler plant, along with three months of class-based training at a local vocational school. All training, classes, tools, books, computers, and uniforms are paid for by Bühler, along with each apprentice receiving a salary and social benefits. Bühler invests around USD 30,000 per apprentice per year for training and education. The Swiss vocational training model is seen as a global benchmark and is being adopted by other countries.

When their training is finished, 66 percent of apprentices will normally stay with the company. “At the age of 19, they already have a good experience
opportunity, achieving buy-in from key decision makers, and producing a realistic assessment of the potential return on investment from their idea. “Last year, we further developed the program around the theme of ‘leading to win,’ with emphasis on the skills needed for future success, such as entrepreneurial agility, collaborative leadership, communication, and innovation,” says Mark-Eisenring. To achieve this, the MBM program has gone into partnership with a leading business school near London, where tailored programs place a strong emphasis on ensuring that learning translates into behavioral change.

Bühler is exploring various ways to drive knowledge exchange in the company, either through mentoring programs, where employees can share experience, or through Generation B, a global platform, that was designed to facilitate collaboration aimed at Bühler employees who are eager to embrace change. Mark-Eisenring explains: “Its goal is to provide a platform that bridges gaps within the company.”

Flexible learning
Bühler is committed to making training more accessible, while also moving from structured learning to more flexible and customized training. In 2018, Bühler launched B-Learning, a new learning management system that is delivered through a range of different training mediums.

At its center is a state-of-the-art, globally accessible virtual learning library, offering a broad spectrum of courses on subjects ranging from business to leadership. Employees can use the training medium best suited for them and their unique circumstances, whether it be videos, e-learnings, classroom trainings, or webinars. B-Learning provides staff with the opportunity to expand and deepen their knowledge anytime and anywhere, through an entirely new and flexible learning environment that is also accessible to users via mobile apps. The global availability of the system means there are no longer geographical barriers to learning, which ideally supports an individual’s further development.

Bühler is striving to make sure that entrepreneurship, along with creativity and decision thinking, runs deep within the company. In 2014, our international Master of Bühler Management (MBM) program was developed to ensure that the right skills are in the perfect places to harness commercial opportunities when they arise. Each year around 30 middle managers are selected from different countries, business areas, and backgrounds to participate in a 12-month training program that is designed to ingrain entrepreneurial skills throughout the company. Each module is held in one of three different countries. Along with the program each participant is tasked with identifying a potential business opportunity, achieving buy-in from key decision makers, and producing a realistic assessment of the potential return on investment from their idea. “Last year, we further developed the program around the theme of ‘leading to win,’ with emphasis on the skills needed for future success, such as entrepreneurial agility, collaborative leadership, communication, and innovation,” says Mark-Eisenring. To achieve this, the MBM program has gone into partnership with a leading business school near London, where tailored programs place a strong emphasis on ensuring that learning translates into behavioral change.

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Developing leadership strength
Bühler also has a number of different initiatives designed to nurture the best talents within individuals who are already part of the company and those joining the company as tomorrow’s leaders. One such pipeline, now in its third year, is the Excelerator program, an initiative that tailors career development to the specific needs of an individual.

With such a wide geographical spread, Bühler has access to some of the best talents the world has to offer. The aim of Excelerator is to ensure that these talents are first recognized and then enabled to mature and develop into leadership roles. The initia-
Talent involves employees being nominated for a two-day assessment program from which 20 candidates are selected. An individual development and coaching plan is then drawn up for each successful candidate to build on their leadership abilities.

The Bühler International Management Trainee program offers another pipeline into senior management and leadership. Designed to attract the best talents leaving universities and business schools, the three-year program takes seven trainees every year and fast-tracks them through the Bühler corporate experience. These lucky seven get the chance to work with Bühler’s top management at the Executive Board-member or regional-head level, where they get to understand the top-to-bottom workings of the company.

Candidates take responsibility for a major Bühler project, as well as experience all the entrepreneurial challenges that go with a new business venture such as a start-up. Trainees also have the chance to work abroad for one year as part of the program.

Global innovation and production network
To make sure Bühler is positioned to attract the best talent, the company has also been building up the strength of its employer brand by expanding its global innovation network. “We want to sustainably increase the innovative strength and market leadership position of Bühler for the long-term,” explains Dipak Mane, Chief Human Resources Officer. “For this reason, we are not only investing in the talent we already have in the company, but also in our global training offering for customers and local talents across our 29 training and application centers around the world.”

Bühler operates five milling schools to train the next generation of millers. The schools are in Switzerland, China, the US, India, and Africa. They equip these future millers with the knowledge to process grain into high-value products. A good miller significantly influences the output of a mill, increases the quality of the flour, and ensures that there is high availability in the plant and that things are carried out safely. In a two-year dual training course, for example, the African Milling School teaches the necessary skills and trains young people to become a miller or head miller. Stefan Birrer, Managing Director of Milling Solutions, says that the company has a policy of investing in local talent to strengthen regional food production. “We explain the processes, how the machines work, and the key performance indicators and give the trainees a practical experience of milling,” Birrer says. Since 2014, 82 local millers have graduated from Bühler’s African Milling School in Nairobi, Kenya.

Bühler will also open a chocolate training hub in the capital city of Abidjan, Ivory Coast in the second half of 2019. Participants will learn about operations and maintenance of Bühler’s cocoa bean processing machinery with hands-on training. The training center will contribute to the development of local competencies, and help local operators of Bühler chocolate lines to improve quality and increase yields.

“Our long history as a training company, and our elaborate developmental landscape are wonderful assets, which helps us attract and retain talent,” says Mane. “Trainings for customers, executed globally, are our unique differentiator and illustrate that we take our responsibility seriously.”

“WE ARE NOT ONLY INVESTING IN THE TALENT WE ALREADY HAVE IN THE COMPANY, BUT ALSO IN OUR GLOBAL TRAINING OFFERING FOR CUSTOMERS.”

DIPAK MANE
Chief Human Resources Officer
The global milling industry is about to be disrupted. Mill E3 is a new approach to the plant, processes, and machinery of a flour mill. Compact in design, faster to build, and more efficient to run, it brings together Bühler’s know-how in mill construction to help millers achieve lower costs and improve in quality, transparency, and food safety.

MILLING IS A CORNERSTONE OF FOOD PRODUCTION. Many of the foods people enjoy every day are made from flour provided by millers – a role they have played in our societies over centuries. Modern milling uses many advanced technologies but, at its core, it relies on the fundamental process of grinding cereal grains between two hard surfaces to produce flour.

With the world today facing the challenge of feeding a growing global population while dealing with the impacts of climate change, and with consumers demanding ever more transparency in the food value chain, millers are facing new pressures. To meet the demands of our era, millers need to find new ways to increase efficiency and yield, reduce waste, and improve quality, and food safety.

One mill owner at the forefront is Whitworth Bros. Ltd. in the United Kingdom. A traditional family-owned business that has been involved in flour milling since 1935, Whitworth has grown its share of the market over the past two decades to become the largest miller in the UK and now operates 17 flour mills on nine sites. They attribute their success to the fact that they have always sought ways to improve their operations. “As a company, we have always embraced new ways of thinking,” explains Mike Peters, Managing Director of Whitworth Bros. Ltd. “Today we have some of the most technically advanced mills in the world.”

Bühler has played a key role in this success. In the late 1990s, Whitworth began a program of investing in new mills and new technology. That was the beginning of the company’s association with Bühler. Over the past two decades, as Whitworth has expanded, Bühler has built all of the company’s new mills, and has helped it to refine its processes while acting as a sparring partner for the development of innovative new ideas. “With each new mill we’ve
The mill of the future has just three floors.

looked to improve on the technology in terms of how to construct flour mills. That is where the partnership has been really good,” says Peters. Now, the two companies are embarking on the next chapter together with Mill E3.

Into the future with the three E’s
Mill E3 represents the state of the art for flour mills, combining Bühler’s latest concepts and designs with cutting-edge digital technology to drive further improvements in efficiency and quality. “We know that Whitworth is looking at ways to further develop and optimize milling technology. Mill E3 is our answer to this challenge,” says Stefan Birrer, Head of Milling Solutions at Bühler.

E3 stands for three efficiency levels: space, time, and energy. In the optimal case it can be just three stories high, instead of the usual four to seven, making the Mill E3 building almost a third smaller in volume than a standard mill. This significantly reduces infrastructure cost, while its compact design and energy-saving system components mean significant energy savings. With many of its parts pre-assembled, installation time is also reduced.

“It is basically a plug-and-play mill,” says Birrer. The new Bühler grinding system, Arrius, for example, is fully integrated into the mill. Meanwhile, TUBO, the tubular push conveyor, replaces pneumatic transport at break passages to save space and energy. Mill E3 is packed with new ideas that demonstrate Bühler’s mechanical, process, and automation know-how and its ability to bring dramatic innovation to areas that have changed slowly over the centuries.

“We knew that Whitworth wanted to be sure that this investment would be another step in competitiveness. So, the new site has to operate at a much lower cost than any other site in the UK. That’s why they are working with us for E3,” says Birrer.

The improvements are significant. For the entire mill, the energy savings amount to 7 to 10 percent – without compromising on yield or quality. The E3 concept also helped Whitworth to get the permitting for the new site much faster. The mill’s overall carbon emissions are lower thanks to its compact size – a smaller building means fewer trucks, less concrete, and less steel. It also uses less energy in operation. “In all these phases we were able to show that the plant will be better than anything other mill builders have on the market,” says Birrer.
“LIKE US, BÜHLER IS IN IT FOR THE LONG TERM. WE WANT TO KEEP MOVING WITH THEM ON THIS WORLD-CLASS JOURNEY TOWARD IMPROVING EFFICIENCIES, SAFETY, CONSISTENCY, AND QUALITY.”

MIKE PETERS
Managing Director of Whitworth Bros. Ltd.

However, it is the digital technologies that open up the most interesting opportunities for Whitworth. “Besides the obvious mechanical benefits E3 offers, we were also convinced of the digitalization approach. Bühler is definitely on the forefront in this respect,” says Peters.

Together with Mill E3, Bühler has also proposed introducing sensors, IoT, and blockchain to help guarantee the end product quality as well as increasing transparency along the value chain.

Field to flour traceability
Whitworth is best placed to take advantage of these opportunities thanks to the way they already work with their wheat suppliers. “We procure over 90 percent of our grain from cooperatives and larger merchants. This gives us the opportunity to accept vendor-assured grain where the initial testing is completed at source and the wheat quality is already known before it is delivered to us,” says Peters. This means that there is already a high level of traceability. “With systems in place to trace the grain back to farms, Whitworth was in a good position to do a blockchain project,” says Birrer. “What we have done is transform paper-based tracking into blockchain tracking,” (see also pages 62–67).

“We want to be the leaders in this area because we believe that blockchain is a powerful tool that can help us stay ahead of our competition,” says Peters. “But more than that, we believe that if you don’t embrace these new digital technologies and embed them within your business now, in the longer term that could be a bar to entry into certain markets as pressure comes from the end consumer and eventually from regulatory for increased transparency.”

Taking transparency beyond the mill to the consumer is the next step. “The intention is that when you buy a sandwich, a barcode on the package lets you see where it has come from. It gives the consumer more detailed transparency about the supply chain,” says Peters. “We are doing a pilot in this area with our partners downstream, but there is some way to go. However, there is no question that this technology is coming. Consumers want to know where their food comes from. Together with Bühler, we want to explore joining up the different sections of the product pipeline.”

A relationship founded on trust
The new mill is due to be completed by the end of 2020. After that begins the monitoring. Data from the mill will be uploaded to Bühler Insights, a secure cloud service that works on the Microsoft Azure platform. Whitworth of course already monitors energy consumption, yield, and analytical data of products. Mill E3 will take monitoring to the next level. “We will be able to put probes in to measure temperatures and pressures in machinery, so that we can operate our machines as efficiently as possible.
We will also be able to measure product characteristics that will enable closed-loop process control. It’s very aspirational,” Peters explains.

The team at Bühler are so confident of their new mill, that they have proposed to Whitworth to collect and compare data from E3 and compare it with another plant over a period of two years. In another first, Bühler will also show an intelligent 3-D model of Whitworth’s mill at the CUBIC innovation campus in Uzwil, Switzerland this summer. “It’s like a digital twin. You will be able to walk through the virtual plant, see the process data live, and do dynamic simulations,” says Peters.

The degree of trust between the two companies that has been built up through this collaboration is clear. “We are very happy to showcase our facilities in this cutting-edge way with Bühler. Like us, Bühler is a family-owned business, so we share similar values,” says Peters. “We treat each other with dignity and respect. That enables us to have an open and honest dialogue, and that’s how you get the best out of any project. Most importantly, like us, Bühler is in it for the long term. We want to keep moving with them on this world-class journey toward improving efficiencies, safety, consistency, and quality.”

Watch the video where Mike Peters shares his views on the Mill E3 and the relationship between Whitworth Bros. Ltd. and Bühler.
driving a car has entailed a person maneuvering a steering wheel while peering over it to decide where the machine should go. Of course, more cognitive skills and strategies come into play to handle the many eventualities that one encounters in traffic and which require intelligent decisions. Events such as when a chicken crosses the road, a motorcycle rider passes from the right in heavy traffic, or an oncoming vehicle cuts a turn too sharply. All of these events are perceived by the driver and a decision is made based on past experience.

For some time now, the automotive industry has the various participants, can be made safer. Emergency braking assistance, improved rearview mirrors, and intelligent headlights have been developed for this purpose. These are functions that assist people during driving and help them to better anticipate and overcome dangers.

“Today, the industry is facing another revolution. The car, more and more, is expected to be able to not only assist the driver, but also to make decisions for them,” explains Dr. Steffen Runkel, Head of Optics at Bühler Leybold Optics. “Adaptive cruise control slows down when the car comes too close to the vehicle in front of it, the blind spot assistant warns of vehicles approaching from the side, the lane assistant notifies the driver when the car unintentionally drifts to the edge of the lane.”

The technology that makes it possible for the car to be equipped with additional optical nerves comes from the semiconductor industry. Sensors scan the environment and estimate distances or perceive objects – the vehicle learns through them to perceive the environment itself.

**Sensors are only as good as their coating**

Sensors are placed in various locations in a vehicle depending on their area of application. A laser beam is sent out to illuminate the sensor’s field of vision. The light reflected back by the surroundings is captured and evaluated by a detector. This is how the sensor detects the size and distance of the object. One challenge for this technology is that the sensor detects the reflected light waves that are important for the use of the detector. All other distracting light
waves, such as sunlight, need to be kept away from the detector. The selection of light waves is done with the help of what is called a band-pass filter, which consists of a certain sequence of nanometer-thin optical layers.

**A technology that sorts light waves**

Bühler Leybold Optics, in Alzenau, Germany, specializes in this area. Nearly 20 years ago, its HELIOS technology was developed and is used to manufacture exactly this type of filter. “The technology is based on the sputtering method. To do so, a material like silicon or tantalum is used for the coating and is referred to as the target. It is placed as a block in the sputter cathode,” explains Dr. Runkel. “With the help of an energetic plasma, individual ions are created which bombard the target material. This ejects individual silicon or tantalum atoms out of the target material which in turn condense on the filter. By adding oxygen gas, these layers oxidize and become transparent. This results in several nano-meter-thin layers of various materials. Depending on the composition, they filter different wavelengths.”

The HELIOS technology has advanced so far today that the filters produced can sort out the light waves with great differentiation.

They work in the light spectrum from ultraviolet to infrared by applying up to 800 layers of various optical materials to a filter. Another decisive factor is that a HELIOS system can coat several work pieces simultaneously, thus increasing production volumes. This makes the production of filters much more cost-effective.

“When we think about the future, our technology is very well suited for manufacturing optical sensors in autonomous vehicles,” says Dr. Runkel. “It is clear that a car can only drive by itself if it completely detects its environment.”

Of course, it takes more than just optical sensors. A self-driving vehicle must evaluate all the information generated by the sensor in real time and convert it into an appropriate action.

“Therefore, a self-driving car needs additional intelligent software programs based on artificial intelligence that can make the correct decisions,” explains Dr. Runkel.
The euphoria of the industry that both public and private vehicles can be completely self-driven in the future is still somewhat contained.

Despite extensive research, the conversion to self-driving traffic will probably take a bit longer than originally planned as objects are still being mis-identified. “If a truck coming from the left is not recognized as a truck but as a bridge, then the system is still incorrect. Even street signs can currently be detected by the camera system with only about 90 percent accuracy. So far, there is no system that can reliably see all eventualities,” explains Klaus Herbig, Head of Product Management Optics at Bühler.

This hardly stops the automotive industry from continuing to believe in the vision. Not least thanks to the technical feasibility of LiDAR technology, which is now within easy reach. LiDAR (short for light detection and ranging) is a method related to radar that works with light rays instead of radio waves. “LiDAR emits a laser beam that is reflected by the object and captured again. One of the challenges here is that the laser beam must scan the entire environment. In comparison to conventional sensors, LiDAR not only detects objects, it also classifies them and determines the distance and movement relative to the vehicle. An additional difficulty is the reliable coverage of distances of up to 250 meters in any weather conditions,” says Dr. Runkel.

Industry working in high gear

The first prototypes of LiDAR systems have already been installed on the roofs of cars. They are arranged in boxes at various angles so that they can capture all of the surroundings. However, such systems could only reach market maturity when the components are smaller and can be integrated into existing car components, such as headlights. “Currently the entire industry is working in high gear on this, both established companies as well as many start-ups. There are about 100 start-ups around the world that have their own ideas of how LiDAR technology could work in cars in the future,” says Dr. Runkel.

LiDAR itself is not new. The technology is already used in satellites and various military applications. “In these areas, a system could cost several thousand euros,” explains Herbig. “In the automotive industry, we are talking about much higher quantities. In the premium class, such a device could cost even a bit more, but once we approach the mid-size or compact class, then we are talking about the 100-euro range.” Within the Optics department Herbig is responsible for recognizing trends in the market in a timely manner. “This is crucial for us so that we can further develop our solutions according to the needs of our customers. For example, in order to reduce the costs in production, high volumes and a high level of automation are the critical factors that differentiate ourselves from the competition,” he explains.

However, the Bühler Leybold Optics team in Alzenau will only be able to tackle these further developments once it is clear how such a technology will be used in large numbers. “Many of our customers are currently researching in this area. For us, it is therefore crucial that we maintain our contacts and cooperate with our customers to provide them with the coatings needed in this area. We are the experts. Leybold Optics is well connected within the industry and is in regular contact with research institutions in Germany, France, and Belgium. “We are also in contact with several automotive manufacturers and their suppliers,” Herbig explains. “We offer them the opportunity to test their creative ideas and developments in our application center in Alzenau.”
The application center was established a year and a half ago, and includes a 1,200-square-meter test area, a high-tech lab, and a highly modern research and development area. Due to the high demand, Bühler just set up two HELIOS systems from the latest generation there. There is also a DLC machine right next to them (DLC stands for diamond-like carbon) which is used for manufacturing items such as cameras for night vision. These support the driver to detect potential risks earlier in darkness and in difficult light conditions. The forward-facing cameras need to withstand enormous loads, like stormy weather and use in heavy traffic.

The DLC can coat the outer camera window to make them very resilient. For customers of Bühler, the application center is a huge added value, especially for those who do not yet have a lot of experience with optical thin-film coating technology.

“Many of these ideas are still in the early stages, but they will soon be implemented in one way or another,” explains Dr. Runkel. “We are talking about the car of the future that learns to see through a variety of smart sensors based on optical technologies.”
A DIE-CASTING MACHINE FOR THE DIGITAL AGE

LIKE MANY INDUSTRIES, die casting is under pressure from numerous sides. Customers such as automotive manufacturers are demanding higher quality at reduced prices. At the same time, more sustainable production with reduced energy consumption is a key target. “We wanted to reinvent and rethink the die-casting machine,” explains Marco Tobler, Product Manager Die Casting at Bühler. “We wanted to create a modular system which is more productive, more user-friendly, and more attractive.”

And in an industry where the foundry suffers from the three D’s – dangerous, dirty, and demanding work – there is a hunger to move die casting from a predominantly manual operation into a more automated environment. The Fusion die-casting machine is designed to help foundries overcome these challenges, while also paving the way for a fully digital future. “Die casting is at a crossroads,” says Jonathan Abbis, Managing Director Die Casting at Bühler.

“On the one hand, we need technology to improve existing processes. On the other, we need to push forward with digital services that can enhance automation and bring smarter operations. Fusion was designed with both in mind, offering a step change in traditional performance and a gateway to the digital future.”

Faster cycle times and higher quality
A die-casting machine is a huge piece of equipment with various peripherals such as robots and sprayers arranged around the die-casting cell to suit the specific process. A typical cell with many peripherals might have a footprint as big as half a basketball court. Using closing units that create huge amounts of pressure to force liquid aluminum or magnesium...
into a mold, die-casting machines are able to stamp out products such as car engine blocks. The Fusion uses an innovative three-platen closing unit with an optimized toggle system. This gives customers faster, more precise closing, whilst using less energy. Combined with a new, smoother servo drive, energy savings can be as high as 40 percent.

Using less energy to create each part is great, but only if high quality is repeatedly achieved. In die casting, quality is governed by many factors, but a key process is the injection of the liquid metal. Just the right amount of liquid metal at exactly the right moment is needed to create the perfect shape in the die. Fusion uses an enhanced version of Bühler’s unique real-time closed-loop shot control to ensure higher reliability and accuracy at this critical point.

“FUSION OFFERS A STEP CHANGE IN TRADITIONAL PERFORMANCE AND A GATEWAY TO THE DIGITAL FUTURE.”

JONATHAN ABBIS
Managing Director Die Casting at Bühler

Here you can watch the video about the development and creation of the Fusion and its first deployment in the industry.
Fusion certainly looks sleeker and smarter than typical die-casting machines – but it’s not just for show. Fusion has been designed to keep operators safer by keeping the electrical and mechanical parts behind safety gates. A unique energy frame system, which contains all the interfaces to connect the die-casting tool with the machine, also makes it quicker and safer for engineers to make production changes.

Each Fusion machine comes with a Bühler DataView user interface, making it easier for operators to adjust the die-casting machine. “With DataView, operators can manage adjustments directly from the touch screen. Simple graphical interfaces show what is happening at any moment, and recipe management makes programming easier,” Tobler says.

Ready for digital services
Fusion is also digital-ready (like TVs were HD-ready a few years ago). As Bühler introduces more and more digital services on the journey towards the Digital Cell (see page 88), Fusion is primed and ready to accept them.

One of the available options is SmartCMS, which brings control of all the processes in the cell – across the machine and its peripherals – into one digital management system. This provides at-a-glance visibility across the entire process, giving operators, maintenance engineers, and managers the information they need in real time. It enables them to identify problems, make adjustments, and reset peripherals, without having to walk around the machine. And although foundries have been relatively slow to adopt Industry 4.0 and Internet of Things (IoT) technology, Tobler thinks that may be about to change. “There haven’t been digital services created by dedicated die-casting professionals who really understand our industry and the complex casting process. Our SmartCMS, Digital Dashboard, Predictive Analytics, and downtime analysis are based on years of industry experience,” says Tobler. “In customer trials we are seeing these services make a really positive difference to quality, efficiency, and bottom line. You don’t need to include them with Fusion, but it’s an option we expect more and more customers will take up over the next few years.”

Modularity for today – and for the future
Die casting has to adapt to changing demands from customers. New mobility concepts, including electric cars, are searching for lighter structural parts to extend their range. Fusion’s modular system enables customers to choose from a wide range of options to suit different processes and to reconfigure them as production requirements change. “It’s a tailor-made solution for every customer based on standardized modules they can configure,” says Tobler.

Repurposing a Fusion machine or introducing upgrades for future digital services is therefore relatively simple, ensuring that an investment into a Fusion machine is an investment for the future. As Tobler describes it, “Fusion can make an immediate impact, helping customers achieve higher quality, easier operation, and greener performance. Whenever they want to take it further, our new digital services can be plugged in, now or at any time in the future.”
Integrate pulse processing solutions.

Technology for utmost quality and yield

Produce flour, extruded snacks, or pasta with pulse processing technology from Bühler. Each process stage is customized to your plant and commodity. This results in top-quality pulse products with high yields.

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Intake, cleaning, and drying
Hulling, grading, and splitting
Optical sorting
Milling and extruding

Innovations for a better world.
NEARLY 600 MILLION people fall ill every year after eating contaminated food, impacting human health, life expectancy, and economic development, according to a 2015 World Health Organization report.

“As more than 2 billion people a day enjoy food produced on our machines, Bühler is well positioned to make a difference in global food safety,” explains Stuart Bashford, Bühler’s Digital Officer. “Our goal is to enable our customers to produce safe food while reducing waste and energy in the process.”

Unsafe food is costly for low- and middle-income economies, which lose an estimated USD 95 billion in productivity a year as a result of employees who are too ill to work. Product recalls are also extremely costly for food producers. “Time is critical when dealing with a food safety issue with the average direct cost of a product recall being around USD 10 million,” explains Bashford. This number does not include costs from brand damage and lost sales.

Harmful bacteria can linger in dry foods
Dry foods, such as spices, cereals, cocoa, nuts, seeds, and grains can also carry foodborne pathogens. Microorganisms can survive the drying process. When contaminated dry foods are added into food products with a higher water content, such as meats, dressings, and soups, the amount of harmful microorganisms can rapidly increase. Bühler’s Laatu solution significantly reduces harmful bacteria that can cause illness or even death, such as salmonella, E. coli, and spores.

To date, conventional microbial reduction techniques for dry foods have been associated with several drawbacks, such as quality damage, high costs, space constraints, and risks for the environment. A more sustainable technology was needed, and therefore Bühler developed Laatu which was introduced in April this year.

Improving food safety and efficiency
Solutions such as Laatu can significantly reduce the human and financial burden of food poisoning worldwide. “Laatu provides significant and efficient microbial reduction,” says Heidi Kotilainen, Food Quality Manager at Bühler. “It is a nonthermal solution that is able to destroy more than 99.999 percent of salmonella in milliseconds while maintaining the quality, nutritional value, taste, smell, and appearance of the dry foods that have been treated.”

Laatu does this without introducing heat, water, chemicals, or radioactive sources, so it not only makes these foods safe, it reduces food waste and drives down the use of energy and other natural resources. “Connected to the Bühler Insights IoT platform, Laatu becomes a potent food safety tool. It is capable of providing food processors with an unparalleled level of transparency of their process,” Bashford explains. “It can record and visualize important parameters and makes them available for customer’s use. Ultimately, this improves their efficiency and productivity while reducing food safety incidents.”
Global population 7.6 billion

EFFECTS OF FOOD CONTAMINATION ON PUBLIC HEALTH AND THE ECONOMY

Public health
It is estimated that, each year, after eating contaminated food:
- 600 million people fall ill
- 420,000 die
- 125,000 children under 5 die

Food loss and waste
One-third of food produced globally every year is lost or wasted. A quarter of this is attributed to spoilage caused by microorganisms.

Economic losses
The average direct cost of a recall to a food company is USD 10 million. The majority of recalls worldwide is due to microbial contamination.

Source: 2015 World Health Organization estimates of the global burden of foodborne diseases; United Nations (UN)

One-third of food produced globally every year is lost or wasted. A quarter of this is attributed to spoilage caused by microorganisms.

Harmful bacteria in dry foods, or foodborne pathogens, can make you ill. Examples include salmonella, E. coli, and spores. Contamination of food can occur during handling of raw materials and during and/or after processing.

LAATU AND ITS BENEFITS

The Laatu solution is designed to deliver safe food, reduce food waste, and drive down the use of energy and other natural resources—supporting the United Nations Sustainable Development Goals.

Environmentally and economically sustainable
The Laatu process does not introduce heat, water, chemicals, or radioactive sources. In comparison to solutions using steam, it is able to reduce energy consumption by up to 80%.

Inactivating microorganisms in milliseconds
Laatu enables a significant reduction of microorganisms such as salmonella, E. coli, and spores. This takes place in milliseconds. Salmonella, for example, is reduced by 5-log or more (>99.999%).

Preserving nutrients and taste
Laatu is a nonthermal solution with a gentle surface decontamination technique that has minimal or no impact on the nutrients, taste, smell, and appearance of the dry products that have been treated.

Small footprint and easy to use
Laatu is easily integrated into existing plants. Its processing runs continuously, and it features a recipe-based interface. Cleaning takes just 30 minutes compared to eight hours for steam solutions.

Increasing traceability via digitalization
With a potential link to the Bühler Insights platform, Laatu is a powerful tool in food safety auditing. It is capable of delivering accurate records of process parameters, as well as dates, times, and product batches.
The extreme heat, force, and pressure in the die-casting process can cause part failures and breakdowns with serious consequences. Bühler’s new Predictive Analytics can help eliminate up to 80 percent of unscheduled downtime in die-casting machines, improving reliability and cutting production costs.

**Cutting interruptions from 30 hours to 3 hours**

Bühler’s data analysis shows that upon one instance of unexpected downtime, including initial failure and shutdown, investigating the cause, and fitting a new part, causes an average of 30 hours of lost production. That’s 30 hours that the foundry is not making gearbox casings. That’s also 30 hours of skilled operators who are unable to work. An idle production line also has knock-on effects in terms of raw material storage, logistics, finishing, and shipping. Predictive Analytics gives the foundry advan-
Predictive Analytics in action

Predictive Analytics identifies that a specific measure is changing – the speed of a cylinder movement for example – while the oil pressure and volume are staying the same. This can point to cylinder wear. Based on data analysis and computation, the remaining useful life (RUL) of the cylinder is calculated and the risk of breakdown is shown.

Ordering a new cylinder, and scheduling convenient maintenance while production continues, means that the cylinder can be replaced efficiently. Over time, Predictive Analytics can predict the end of life for critical components based on live data for the specific machine more accurately. By adding data from other worldwide operating die-casting cells to the system, it can also learn from the performance of other die-casting machines, and make even more accurate forecasts.

Added Value

- Predictive Analytics can target the root causes of up to 80 percent of unplanned stoppages in die-casting machines.
- Avoiding breakdowns with planned maintenance could save hours of lost production every month.
- Predictive Analytics uses data science and Bühler domain knowledge to provide valuable foresights tailored to the specific machine.

Would you like to know more?

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Fleet-based learning

An automated, fleet-based learning process formed on anonymized data from die-casting machines around the globe, enhances the strength of prognostics and extends the horizon of availability forecasts. Using this data, Predictive Analytics can also benchmark a machine’s performance against industry averages, and learn from the performance of other models. This helps the overall system evolve.

Zhao says it’s actually a virtuous circle. “Thanks to the machine-learning process, the more machines using Predictive Analytics, and the longer they are in the system, the more accurate the forecasting becomes.”

ced diagnostic predictions of potential problems, so they can be fixed with planned maintenance. This can typically reduce downtime for any incident from 30 hours to just 2 or 3 hours. Die-casting foundries have unique setups and tailored processes to create specific parts. Therefore, this cannot be a one-size-fits-all solution. Instead, Predictive Analytics uses machine learning from sensors in the specific die-casting cell to build up a picture of machine performance over a period of three to six months.

Using advanced algorithms, based on experience across thousands of installations around the world, Predictive Analytics can then detect deteriorating or substandard performance.

Making decision-making easy

Predictive Analytics is linked with Bühler Insights. Its results are displayed in easy-to-read graphical representations that depict malfunction prognosis, downtime risk, and historical data. Custom KPIs can be programmed to give operators, maintenance engineers, and managers at-a-glance metrics and historic performance data. “Customers can see the risk profile and decide when they want to replace certain parts,” Zhao explains. “Planned maintenance can then work around their order book and production commitments, ensuring the machine is kept in optimum condition and output is a lot more predictable.”
Bühler’s Digital Cell, like a concept car at the Geneva Motor Show, is a vision for the future. Using advanced technologies, the goal is to produce with 0 percent scrap, 40 percent faster cycle times, and 24/7 uptime. And Smart-CMS, launched in June, is an exciting first step towards making it reality.

COMPARED TO MANY OTHER industries like automotive or food production, die casting has been slow to fully adopt automation and advanced Industry 4.0 technologies. But Bühler now has a vision that it believes could help the industry embrace the digital future.

“To achieve a step change in die casting, it’s not enough to focus on digital control of the machine. To significantly boost productivity, we realized that we have to tackle the system as a whole. That’s where the vision for the Digital Cell was born,” explains Jonathan Abbis, Managing Director, Bühler Die Casting.

Bühler makes world-class die-casting machines that use huge forces with incredible precision to cast parts like engine blocks or shock towers from liquid aluminum or magnesium. Sophisticated digital technology controls the process, keeps operators informed, and collects historic data on performance.

But that’s only part of the picture. Machines need peripherals for cooling, spraying, marking, and handling. A die-casting cell may have as many as 20 peripherals and external processes, all coming from lots of different manufacturers. If digital technology is only controlling the machine, or everything is run by separate systems, keeping production running smoothly is almost impossible. As soon as a sprayer gets out of sync, or a part is not removed...
cleanly by the robot arm, the whole process in the cell is affected. Abbis explains that this a constant problem. “Even the most sophisticated foundries can suffer with unplanned interruptions every hour. Imagine the lost productivity.”

How will the Digital Cell work?
The Digital Cell is built on Industry 4.0 and Internet of Things (IoT) technologies to monitor, control, and manage the complete cell. Using artificial intelligence (AI) and machine learning (ML), it will grow to understand the process for each part being produced. It will learn from past performance, anticipate problems before they happen, and suggest fixes before failure occurs.

Using cloud-based technology with algorithms based on Bühler’s unique industry knowledge and anonymized data from foundries around the world, it will also benchmark performance. Historic patterns will be analyzed, enabling foundries to constantly tweak operations for better performance and plan for step changes in efficiency. This approach could deliver benefits in foundries around the world and transform competitiveness against alternative processes and materials.

Improved efficiency
By analyzing key processes in real time, the Digital Cell will ultimately recognize quality issues and immediately optimize itself to correct the problem. “Zero scrap would be a game-changer for the economics and sustainability of our industry,” Abbis says. At the moment, about a third of average cycle time may be taken up with different elements of the thermal management processes. Bühler calculates that using digital technology to harmonize this process could reduce cycle time by as much as 40 percent, transforming the costs and energy required to make each part.

Today, when there is a problem in a process, the cell may detect it, but it cannot proactively do much more than halt the process until it is fixed. Using AI and ML, the Digital Cell will use algorithms with other advanced technologies to make smart decisions, without the need for intervention. “A smoother, more reliable operation like this would make 24/7 operation easier,” Abbis explains. “It could also shift operators away from the noise and heat of the foundry to quiet air-conditioned control rooms.”

While the complete Digital Cell may be some time away, Bühler has just launched SmartCMS as an important first step towards the overall concept.

If we think of a die-casting cell like a human body, with lots of different tasks carried out by different parts, then SmartCMS is the brain, ready to coordinate all of that activity in the most effective way (see also page 90).

Using interfaces with a standardized protocol called BühlerFlex, SmartCMS is designed to accept inputs from virtually any intelligent device, sensor, or component, old or new.

With SmartCMS, real-time alarms and diagnostics can immediately identify a problem across the entire cell, saving diagnostic time and effort. Operators can set up a cell automatically, from a recipe. After a shutdown, a ‘home button’ can reset all components back to their default position. Once a foundry installs SmartCMS, it can access Bühler digital services, which include downtime analysis and Predictive Analytics (see page 86). In addition, its Industry 4.0 infrastructure can communicate with wider Smart Factory solutions. Abbis says that SmartCMS is the first step to making the Digital Cell concept a reality. “If the Digital Cell is the future for die casting, the exciting news is that with SmartCMS, the core capability has already arrived.”

**ADDED VALUE**

+ With 0% scrap, a 40% reduction in cycle times, and 24/7 uptime, the Digital Cell will revolutionize the competitiveness of the die-casting industry.

+ SmartCMS, available now, is the first step, integrating every part of the cell in a single digital system.

+ SmartCMS can connect with Industry 4.0, IoT, and Smart Factory functionality to connect die casting with wider automation systems.

**Would you like to know more?**

Marcello Fabbroni
Global Director Product Management and Marketing
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Why is a good part good and a bad part bad? Jens Hunke is focused on improving the understanding and monitoring processes of die-casting cells. His foundry, FIASA in Northern Spain, has become a pioneer in the area of Industry 4.0, equipping a cell with SmartCMS (Smart Cell Management System) together with Bühler.

“The automotive industry is a cost-driven market. Success mainly hinges on low process costs,” says Jens Hunke. The CEO of Fundiciones Inyectadas Alavesas, S.A. (FIASA) knows just how important it is to keep processes and costs under control at the foundry. For over 46 years, his company, located in the green hills of the Basque country, has directly and indirectly supplied virtually all European car brands with drivetrain components. In the current situation especially, with the automotive industry in a state of upheaval, it is essential for suppliers to offer a wide range of services and prepare for the future.

“The challenge is figuring out what direction the market is going to take,” says Hunke. After all: Fewer cars with pure combustion engines mean fewer cast parts for the drivetrain. In times like these, FIASA will invest in a new die-casting cell. But not just any die-casting cell – the new one should set benchmarks in terms of overall equipment effectiveness (OEE), that is, availability, performance and quality. “We can gain market shares by optimizing our OEE,” explains Hunke. There are two reasons why the OEE isn’t simply 100 percent: malfunctions and scrap, both due to the fact that not all processes are transparent to date.

To open this black box, FIASA decided to partner up with Bühler in 2018. Together, the two companies are developing a Smart Cell Management System (SmartCMS) that brings information from all peripherals together in a single system.

SmartCMS is more than just a cell control. It lays the foundation for intelligent management of entire die-casting cells, including connectivity to Internet services. “Bühler’s request for our involvement in the project as a beta test customer presented the perfect opportunity,” says Hunke. Of course, IT special-
ists could develop a cell control. The crucial difference is that at Bühler, it's the application engineers, and not the IT specialists, who define the functions. “What stands out about Bühler is that the company is both a machine manufacturer and a technology leader in application engineering,” Hunke says.

**Complex cell**
Both project partners had the same goal in mind right from the start: higher availability and lower scrap rates in FIASA production. Together, they aimed to gather insights in order to optimize SmartCMS. “It was important for Bühler and FIASA to have the same focus – that is driving the Industry 4.0 initiative forward,” underscores Oliver Walter, Project Manager at Bühler. Both sides were ready to gradually work towards an ideal solution in two-week development cycles while remaining in close communication. Thanks to the geographical proximity between Spain and Switzerland, the team held monthly meetings to regularly update the road map based on the needs of FIASA.

FIASA had very strict requirements for the new cell. To ensure end-to-end traceability of the entire process down to individual cast parts, FIASA integrated a blasting machine into the cell for surface finishing. As there is no manual transport path be-

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**VIDEO**
Have a look at the video about the FIASA and Bühler SmartCMS project here.
tween the cell and the blasting process, it is impossible for data from other cast parts to get mixed up. Final marking within the cell with the data matrix code – similar to a bar code at the supermarket – now relinked to its production process data. “Our goal was an isolated production solution enabling us to cast, stamp, blast, and verify the part as well as identify it via data matrix,” says Hunke. This allows FIASA to ensure transparency regarding the origin and production of parts for customers.

Identifying causes for scrap
However, the gained traceability provides the greatest benefit for FIASA internally. “We want to understand what data is crucial for a good cast part,” explains Hunke. Combining this complex casting cell with SmartCMS is where things get interesting: from the time of the shot, to adjusting the casting machine, to the temperature of the cooling basin – each process parameter can be recalled to any time specified. “SmartCMS collects and saves data from all peripherals within the cell, providing us with insight on the die program for concrete components,” states Hunke.

This means that the system can better identify the causes for scrap parts and possibly prevent them altogether. If employees from quality control detect a bad part in the X-ray machine, the system operators can check the data matrix to see whether a process parameter has gone off course, enabling them to keep better control over the parameter in the future. After all, the later a bad part surfaces in the production chain, the more costs it generates in follow-up processes.

The goal is to discover bad parts far before quality control. “SmartCMS helps our customers collect quality data and define windows for parameters that ensure high-quality parts,” says Walter.

Starting the cell from a central location
Since the spring of 2019, the cell has been up and running in the halls of FIASA, providing initial insights. SmartCMS is a plain touch panel that acts as a control center, or the brain of the cell, so to say. Much of the process data from the individual peripherals is visible to system operators at a central location for the first time ever.

“Access to this data requires close collaboration with all partners that supplied a part of the peripherals,” says Walter. To harness insights from collected data, the engineering team at Bühler installed even more sensors into the cell. And the result is a ton of data: each day, 1.42 gigabytes are collected and provided on the Bühler Insights IoT platform.

For the die caster, this mass of data means more training. After learning the ropes of the system, employees can work applying a more targeted and efficient approach. Manual testing is no longer required, and they can start or stop the entire cell from a central location, in addition to confirming messages or changing parameters. The variety of data not only makes processes more transparent – it also helps understand wear. The worst enemy to availability is unplanned malfunctions forcing cell
downtime. “By contrast, if the cell says ‘imminent malfunction’ thanks to SmartCMS, we can complete the required maintenance or troubleshooting during a planned break,” Hunke explains. “This increases our availability, while reducing costs for individual cast parts.”

**Investment into the digital future**

By pooling all data, SmartCMS is the perfect platform for launching digital services with data analytics. “In the future, we will be able to apply algorithms to integrate artificial intelligence into the system,” says Walter. Ultimately, the cell should be able to optimize itself and identify the best production parameters for each product on its own. The first specific services, such as a digital service for predictive maintenance (see also page 86), are already on the market.

With the new die-casting cell and its capacity for connectivity, FIASA has made a major investment towards Industry 4.0. Jens Hunke is convinced that he can only win by using SmartCMS.

“As most suppliers in the automotive industry, we are looking for alternative selling markets,” he says. “When it comes to process and material competition in drivetrain electrification, companies producing the most lightweight components in the most cost-effective way will come out on top. I believe that in the future, SmartCMS users will also be able to replace other technologies, such as forged parts or sheet metals.”

“IN THE FUTURE, WE WILL BE ABLE TO APPLY ALGORITHMS TO INTEGRATE ARTIFICIAL INTELLIGENCE INTO THE SYSTEM.”

OLIVER WALTER
Project Manager at Bühler
DID YOU KNOW...?

... that according to the United Nations, in 2050, about two-thirds of the world’s population will live in urban regions?

These mass movements of people bring challenges with them, in the areas of garbage and sewage disposal, traffic, energy, and infrastructure.

... that New York was the first megacity?

In 1930, the city cracked the 10-million resident mark. Tokyo soon followed, and surpassed New York in 1954. Today, Tokyo has 38 million residents.

... that cities with more than 10 million residents are known as megacities?

Today, there are more than 30 megacities around the world.

... that about 70% of CO₂ emissions around the world come from urban regions?

These are being reduced in what are called “smart cities.” The goal of the “smart cities” is to use digital technologies to help large cities save resources, be greener, and more livable.

... that as a result of rapid growth in cities in China, so-called overflow cities have been built around the megacities?

These overflow cities provide space for millions of people. In the future, Beijing will consist of several large cities that will all be part of the large region of Jing-Jin-Ji and have more than 1 billion residents.

... that a large tree can remove up to 30 tons of CO₂ from the air during the course of its life span?

Trees work like air filters and contribute to improving the climate of the inner city.

... that trees are used in cities as nature's air conditioners?

A fully grown deciduous tree can evaporate up to 400 liters of water on a hot summer day. The water consumes heat during evaporation, which in turn cools the surroundings.

... that according to the UN, every seventh person is living in a slum?

That is about 1 billion people. Problems in these parts of the cities include poor water and energy supply, as well as a lack of sewage and garbage disposal.

... that cities are growing primarily in developing and emerging countries?

Of the world’s largest megacities, most are in the Asian region. In China and India the economy is booming, which brings the population from the country into the city, in hopes of finding employment and better opportunities in urban areas.
We have had record temperatures in June 2019 in Europe. With striking courage and clarity, the extraordinary 16-year-old climate activist Greta Thunberg has reminded us of our responsibility to combat climate change.

The estimates for global population in 2050 have increased from 9 to 9.8 billion.

The urgency has increased, the magnitude of the challenge has increased, and our obligation to act is clear. We will increase the targets to 50 percent reduction of waste, of energy, and of water. We have added water to our targets, as every day, we consume at least 3,000 liters of water associated only with the food on our plates. We have not changed our targets because we have achieved 30 percent, but because on reviewing the challenge, we concluded that it is simply not enough. We will focus R&D spending and partnerships on achieving these targets, and we are convinced that there will be good business solutions that address these targets. However, as we approached our Networking Days 2019 we realized that the world had changed. The Intergovernmental Panel on Climate Change has concluded that we have 12 years to prevent the irreversible damage that will result from a 1.5°C increase of global temperature since preindustrial times.

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REVEALS HIS MASTER PLAN

A DIET THAT PROMISES TO SAVE LIVES
HOW TO EAT OUR WAY TO A HEALTHIER PLANET

SURFING THE WAVE OF MASS DATA
NETWORKS ARE GEARING UP FOR AN INFORMATION FLOOD

IS NOW
THE