



ANNUAL REPORT 2016

INNOVATION 4.0
CONNECTING KNOWLEDGE.
CREATING VALUE.

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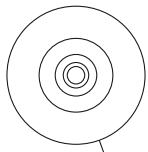
MASTHEAD

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WE ARE KÖRBER

KÖRBER — A NAME THAT STANDS
WORLDWIDE FOR POWERFUL INNOVATIONS,
TECHNOLOGICAL PROGRESS AND
UNIQUE EXPERTISE — ALL UNFAILINGLY
FOCUSED ON ACHIEVING SUCCESS
AND SATISFACTION FOR OUR CUSTOMERS.

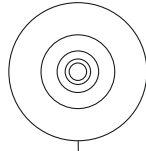
We are global market leaders in all of our Business Areas. Our broad knowledge and experience are our unique selling points in the market. We operate globally without losing sight of local requirements. This benefits our customers across the world. They value our reliability and our specially tailored solutions. The Körber Group is built on strong foundations — our joint Fundamentals and Corporate Values are the sound basis of our activities throughout the Group. They provide a touchstone as we continually update our strategy which is geared towards our target: long-term profitable growth.



Machine Tools

UNITED GRINDING

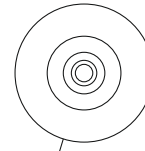
At the Ringier Technology Innovation Awards ceremony, United Grinding China received an award in the category "Machine Tools for Metal Processing" for its Walter Helitronic Vision 400 L high-performance tool-grinding machine.



Pharma Systems

WERUM IT SOLUTIONS

Werum IT Solutions was a winner in the Asian Manufacturing Awards competition in the category "Best Pharma Solutions Provider" for several reasons, including the advanced development of the PAS-X Manufacturing Execution System.



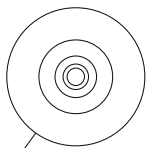
Pharma Systems

RONDO

Rondo and UCB Pharma were honored with the German Packaging Award in the category "Functionality and Convenience" for their innovative packaging of the medication Cimzia®.

AND THE WINNER IS...

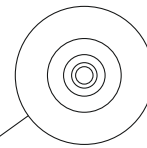
THE KÖRBER BUSINESS AREAS HAD MANY REASONS TO BE PROUD IN 2016.



Pharma Systems

MEDISEAL

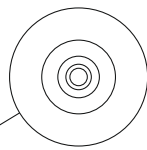
The consulting firm ID-Consult has honored the top three participants cited in the study "The Influence of Modular Product Systems on Corporate Success" with the Modularization Readiness Award. Mediseal was one of the winners.



Automation

LTI MOTION

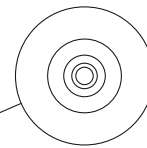
LTI Motion GmbH and Heinz Fiege GmbH received the Innovation Award of the sector magazine *MM Maschinenmarkt* in the "Milling" category for their joint development of the LeviSpin drilling spindle.



Logistics Systems

GEARL

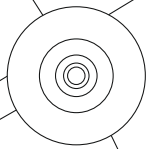
The joint venture Godrej Efacec Automation & Robotics, which now operates as Godrej Consoveyo Logistics Automation, based in Mumbai, India, received the Warehousing Excellence Award for the second time.



Machine tools

SCHAUDT

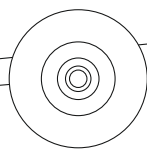
The Chinese *Automobile Manufacture Industry Magazine* presented the User's Commendation Award to Schaudt for its crankshaft grinding machine CrankGrind, which it praised for its stability, reliability, and user-friendliness.



Tobacco

HAUNI

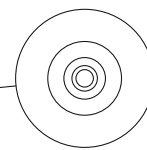
70 years of innovation: On July 14, 1946, Kurt A. Körber laid the foundation for today's Hauni Maschinenbau GmbH. All of the employees at the plant in Bergedorf celebrated the 70th anniversary of the company, which offers solutions for the tobacco industry.



Logistics Systems

INCONSO AG

SAP confirmed Inconso AG to have SAP Recognized Expertise in the area of Supply Chain Management/Extended Warehouse Management. This recognition makes Inconso AG a qualified service partner for implementing logistics solutions for the application of SAP EWM.



Tissue

FABIO PERINI

Fabio Perini celebrated its 50th anniversary with a gala dinner for customers in Shanghai, China; an in-house exhibition in Green Bay, USA; an Open House in Lucca, Italy; and colorful festivals for the employees and their families at all the company's locations.

“WE ARE DEVELOPING DIGITIZATION INTO ONE OF OUR CORE AREAS OF EXPERTISE”

Dear Ladies and Gentlemen,
Dear Business Partners,

Innovations and investments in new and future-oriented technologies and solutions for the benefit of our customers, as well as a high level of customer satisfaction, have always been key elements of our long-term operations, and thus of our corporate success.

Current developments related to the new technologies and innovations of the Fourth Industrial Revolution are transforming entire markets and industries. Today concepts such as the Smart Factory, Industry 4.0, the Internet of Things, and digitization in general are significantly impacting everything we do.

Business models are changing and expanding in fundamental ways; organizations and processes are being transformed at an ever faster pace. In order to shape this radical transformation successfully, we consistently think in terms of digital solutions and Industry 4.0 applications.

At Körber, we are convinced that digital and networked products and processes are the crucial factors behind our customers' future success. Already today we are providing first-class solutions and products that match our customers' needs or developing these together with our customers. To this end, we are continuously improving our know-how, our technologies, and their possible applications in the area of digitization into a further core area of expertise across our entire Group.

In this report you will find interesting examples of “Innovation 4.0 made by Körber” with which we are already supporting, delighting, and inspiring our customers. They include smart machine components, collaborative robotics solutions, intelligent packaging that makes it easier to communicate with patients, and service technicians who are linked into the action virtually and in real time.

“INNOVATION 4.0 MADE BY KÖRBER”

Innovation 4.0 made by Körber is clearly the logical consequence of our guiding principle “We are Körber – strong together for our customers' benefit.” All over the world, our companies and employees work together closely and act as partners of our customers in their respective markets. Our teams are continuously improving their performance in a process of exchange and sharing – always for the benefit of our customers. In parallel, through measures such as our group-wide IT infrastructure project Global IT@Körber, we are today creating the prerequisites that will enable us to offer new, innovative, and successful solutions, applications, and products to our customers and partners in the future as well. We are doing so in the areas of Industry 4.0 and digitization as well as in our traditional business operations.



Thanks to the positive results of all of our Business Areas in 2016 and our good development in the first months of the current fiscal year 2017 we are looking at the future with great confidence. In 2016 we received orders totaling €2,357 million. That represents a significant increase of more than 7 percent compared to the previous year. Our Group sales amounted to €2,215 million. The decrease in sales, amounting to approximately 4 percent compared to 2015, is due to changes in the portfolio that took place in the previous year. Our consolidated earnings (EBITA) increased by over 20 percent in 2016, to €171 million.

In addition, through our acquisitions in 2016 we further strengthened our focus on growth and technology as well as our global footprint. The Danish company Qubiqa Logistics expands our portfolio and is accelerating the internationalization process at our Business Area Logistics Systems. The US company Fargo Automation supplements our range of services as well as our market presence in the Business Area Pharma Systems. In 2016 we also concluded the sales of Baltic Elektronik and Baltic Metalltechnik in Grevesmühlen. Both of these companies were sold to new, more broadly based owners that offer them new opportunities for development and growth.

We would like to express our special thanks to our employees and managers, who in 2016 once again contributed to the success of our customers and our Group and advanced it with several innovations – all of this with tremendous commitment, responsibility, and their broad expertise. We will continue moving along this successful and future-focused course together in 2017.

I would like to sincerely thank our customers and business partners, both personally and on behalf of the entire Group Executive Board and all of our employees, for the trust you have placed in us and for your excellent and successful cooperation.

We look forward to actively and strongly supporting your business success in the future as well, with innovations, customized solutions, and the highest possible degree of customer orientation.

Hamburg, May 2017


STEPHAN SEIFERT CHAIRMAN OF THE
GROUP EXECUTIVE BOARD OF KÖRBER AG



TOWARDS THE FUTURE

BREAKING NEW GROUNDS TOGETHER:
THE GROUP EXECUTIVE BOARD OF KÖRBER AG

**HARALD
VOGELSANG**
MEMBER OF THE
GROUP EXECUTIVE
BOARD OF KÖRBER AG

**STEPHAN
SEIFERT**
CHAIRMAN OF THE
GROUP EXECUTIVE
BOARD OF KÖRBER AG



**CHRISTOPHER
SOMM**
MEMBER OF THE
GROUP EXECUTIVE
BOARD OF KÖRBER AG

**MICHAEL
HORN**
MEMBER OF THE
GROUP EXECUTIVE
BOARD OF KÖRBER AG

HOW WE CREATE THE FUTURE

TO ANTICIPATE TOMORROW'S TRENDS WITH TAILOR-MADE SOLUTIONS, YOU NEED PLENTY OF INNOVATIVE IDEAS AND THE DRIVE TO PUT THEM INTO PRACTICE. JUST LIKE KÖRBER.

AUTOMATION 4.0

Plug & Produce solutions from the automation specialists at LTI Motion cut machine setup times by up to 70 percent.



CONNECTED WORKING

By the end of 2018 around 11,500 employees throughout the Group will become users of a new, higher-performance IT infrastructure — and thus of new possibilities for mobile and connected working — as result of the Global IT@Körber project.

40

PERCENT SPACE SAVINGS

Langhammer from the Business Area Logistics Systems is presenting a highly flexible complete solution for palletizing different product groups in the form of a robot-supported layer-handling system. It offers a space saving of up to 40 percent compared with conventional layer palletizers.

80

YEARS OF EXPERTISE

The new BE series of blister machines from Mediseal was the first of the company's systems to be developed to be fully modular and has been honored with the "Modularization Readiness Award" as a result. This solution provider from the Business Area Pharma Systems has achieved a significant increase in machine availability — for even more productive time. 80 years of expertise in blister technology have paid off once more for the customers.



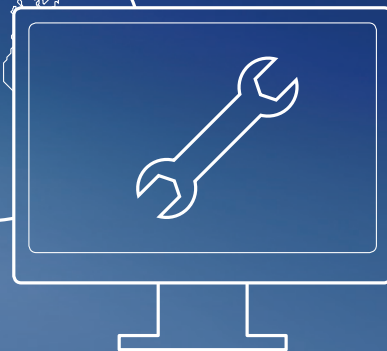
SMART SALES TOOLS

The Business Area Machine Tools has developed a sales app that contains several tens of thousands of digitized documents, presentations & films about the solutions and products offered by the individual brands. A virtual reality headset also enables customers to take a realistic trip into the Business Area's machines.



ONLINE SUPPORT

The Hauni Remote Service enables the tobacco-industry solution provider's customers to instantly resolve around 60 percent of all machine faults.



THE CONSTELLATION EFFECT

During the past year, Fabio Perini from the Business Area Tissue sold 50 production lines with integrated Constellation technology. This innovative winding system raises the quality of the end product and optimizes customers' production processes thanks to its consistent alignment with the requirements of Industry 4.0.

CONNECTING KNOWLEDGE. CREATING VALUE.

DIGITIZATION AND INDUSTRY 4.0
ARE REVOLUTIONIZING ALL ASPECTS
OF INDUSTRIAL PRODUCTION –
AND KÖRBER IS SUPPORTING TO
SHAPE THESE DEVELOPMENTS.

Refrigerators that send shopping lists to smartphones, heating systems that are remotely controlled with apps, and cars that park themselves – what sounded like science fiction just a few years ago has long since become reality. The foundation for this rapid development is a technological leap that revolves around the Internet, data analyses, sensors, and mobile terminals such as tablet computers and smartphones. This digitization of daily life will continue in the coming years. For example, according to estimates about 50 billion mobile devices will be in operation worldwide by 2020, accompanied by just as many communication and Internet-enabled “objects” – smart household appliances, apparel, and mobility solution components. The “Internet of Things” continues to expand and is set to change our lives more drastically than ever before.

INTERNET OF THINGS

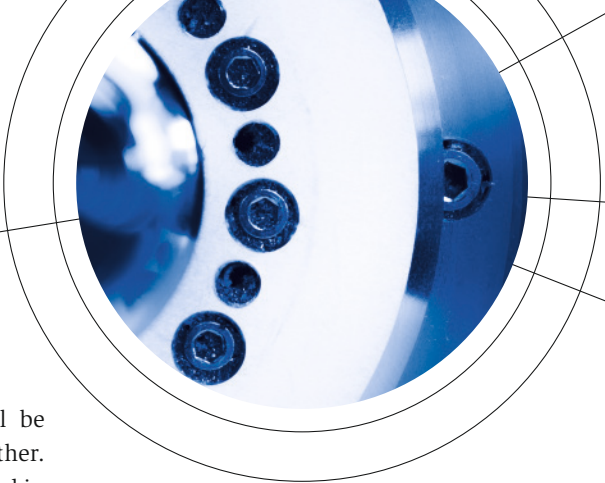
The Internet of Things refers to the sum of all objects that communicate autonomously via the Internet and carry out tasks or perform individual services for users.

INDUSTRY IN TRANSFORMATION

Industry is also undergoing a fundamental transformation – as both a basis and a conse-

quence of these developments. The catchword here is Industry 4.0, which refers to the growing link between conventional production systems and state-of-the-art information and communication technologies. Digitization is the primary driving force behind Industry 4.0, which stands for the Fourth Industrial Revolution: The First Industrial Revolution took place in the 18th century when the steam engine replaced muscle power; the Second Revolution saw assembly lines and electricity pave the way for mass production at the beginning of the 20th century. The Third Industrial Revolution transformed the nature of work with the advent of electronics, information technology, and automation starting in the 1970s, and the fourth revolution is establishing a new era by digitally networking the entire value chain.

Key components of this development are cyber-physical systems (CPS) – machines and facilities that are digitally networked and establish a connection between the physical world and the world of data. A CPS is a virtual object in the digital realm that is able to perceive its surroundings via sensors and can actively influence this environment using actuators, such as drive system elements that enable mechanical movements. In an Internet



of Things, cyber-physical systems will be linked to and communicate with one another. Once this occurs, any component involved in a production process will be able to collect information, for example on its own capabilities and current state, and then publish this data and share it with another CPS. Machines or entire facilities will then be able to coordinate with one another, control each other's operations, and move components through the manufacturing process with maximum efficiency. Data will thus become the essential factor in the design of industrial production.


FACTORIES BECOME SMART

This development will ultimately lead to the establishment of smart factories and thus a production system that largely organizes itself, utilizing data from procurement, logistics, and sales units, for example, and taking account of external factors such as energy prices in the process. This will lead to a significant increase in the efficiency of the value chain and also enable industrial companies to react to the requirements of markets and individual customers much more flexibly and quickly – for example by providing customized products and services.

In order to transform all of this into reality, experts around the world are working to develop solutions that will enable the compre-

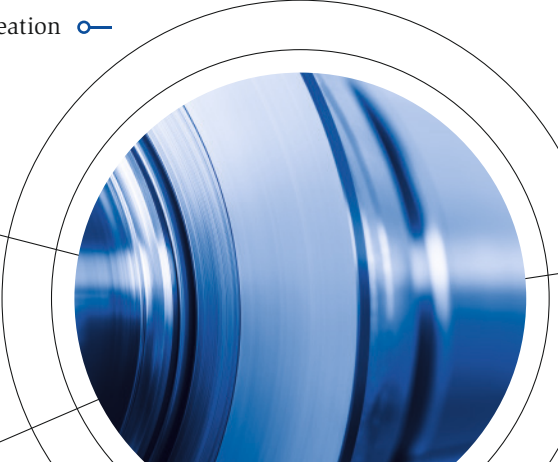
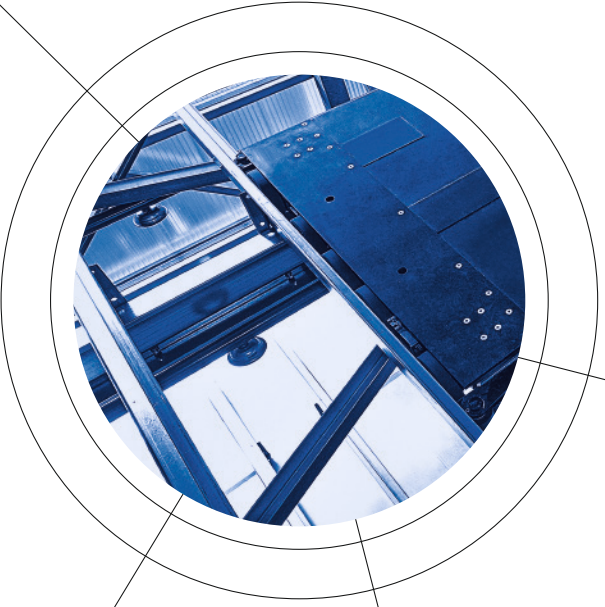
hensive networking of complex production processes and value chains. This includes the establishment of international manufacturer-independent standards for data storage and communication, as well as the development of big data analysis techniques that will make it possible to evaluate and intelligently utilize the huge amounts of data generated in production networks. Increasing digitization and networking offer tremendous opportunities. For example, a study commissioned by the Federation of German Industries (BDI) estimates that expanding digitization and networking could increase industrial gross value added by €1.25 trillion in Europe alone between now and 2025.

KÖRBER AS A PIONEER

The grinding machine manufacturer Studer offers a good example of how Industry 4.0 works in practice. The Körber company from the Business Area Machine Tools is currently implementing its own smart factory. The project is part of a comprehensive digitization strategy that Körber is using as a basis for actively creating the future. Within the framework of this strategy, experts throughout the entire Group are extensively studying the key technology drivers behind Industry 4.0 – everything from smart sensors to 3D printing and holistic software systems for monitoring and controlling production and logistics processes. The goal here is to exploit the various new possibilities in order to create networked products, processes, services, and new business models that improve value creation 

BIG DATA

Big data refers to data whose huge volume and complexity make it impossible to process and evaluate it using conventional methods.

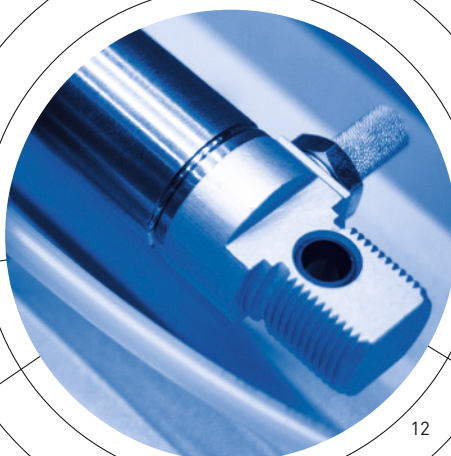




—○ for Körber customers, and thus offer measurable value added.

BROAD TECHNOLOGY BASE

Körber can rely on a broad technology base for its efforts here. With its six Business Areas – Automation, Logistics Systems, Machine Tools, Pharma Systems, Tissue, and Tobacco – the Group can fall back on extensive and detailed expertise in the areas of automation, sensor systems, software, and mechanical and plant engineering. The focus at Körber as the Group moves into the digital future is to develop and combine existing technologies in line with the requirements of Industry 4.0 so that a broad range of industrial applications can be covered. In addition, the Group continues to forge ahead with the development of

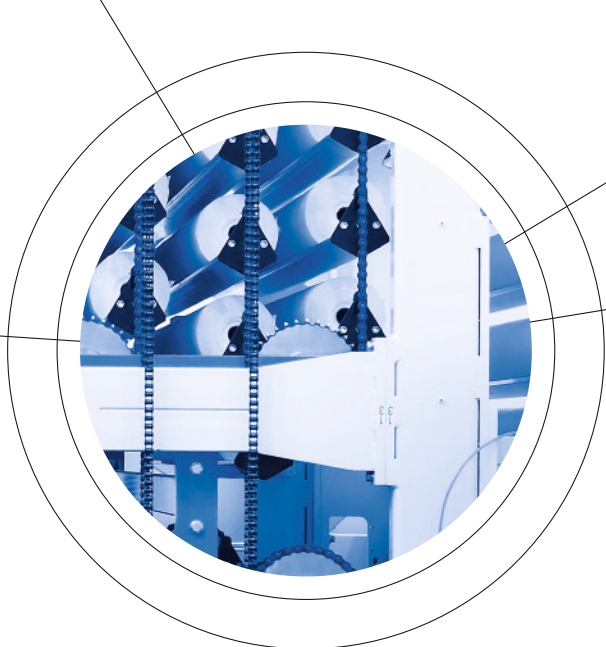


new and innovative solutions. To this end, Körber invests an above-average amount in research and development in order to accelerate the development of smart technologies and disruptive business models throughout the Group. Decisions about acquisitions will also be heavily based on digitization and Industry 4.0 considerations in the future. Of particular interest, therefore, are research spinoffs, startups, and other companies that can either contribute to the further development of the Körber technology base or else offer the Group access to new, pioneering business units. Here, internal and external growth go hand in hand within the framework of the digitization and growth strategy.

LEVERAGING SYNERGIES

A key factor of success here is the creativity of our employees. During the most recent fiscal year, Körber companies applied for 124 new patents, and 216 patents were granted after the normal examination procedures were completed. In order to further strengthen the innovative capability of our employees and exploit synergies in the process, the Group is, among other things, networking the knowledge of its technology experts across all Business Areas and locations worldwide. A good example of this approach is offered by Network Center Technology (NCT) – a competence network in which specialists from all Business Areas extensively discuss pioneering technologies, initiate joint projects, and exploit external expertise in a targeted manner. The ten specialist working groups that participate in NCT meetings focus on Industry 4.0 and digitization topics. In May 2016, the NCT “Sensor” Cluster, which consists of experts from the Business Areas Pharma Systems, Tobacco, Tissue, Machine Tools, and Automation, defined the new topics for its work in 2017. A key area of focus here involves smart sensors that support Industry 4.0 solutions.

Körber is also getting its own processes ready for the digital future. In its Global IT@Körber project, for example, the Group is providing all of its locations worldwide with a



high-performance, efficient, and secure IT infrastructure for all standard (and especially digitization) solutions. All employees at the Körber Group will begin to benefit from these by the end of 2018, as the new platform will also make mobile and networked working easier to implement.

INNOVATION 4.0

In parallel with the Group-wide initiatives, and in line with the common digitization strategy, the Business Areas are also continually and intensively developing their activities and adapting them to the requirements of their respective target markets. Cooperation with customers is playing an increasingly important role, as it enables the Business Areas to learn more about customer requirements and needs, while also making it possible to incorporate a broad range of information and data into the development of new solutions. One thing is clear: The use of a holistic approach is the only way to ensure that the various possibilities offered by Industry 4.0 and digitization can be exploited comprehensively for the benefit of customers.

The following sections describe how the Business Areas are using the intelligent networking of machines, processes, and data to help customers. Here, innovative products and services from Körber are presented in a manner that also offers a preview of the future of industrial production. Examples include a service app from Aberle – the system integrator from the Business Area Logistics Systems. This app uses augmented reality to support the company's customers with facility maintenance and repair operations. Two projects at the Business Areas Tobacco and Tissue have similar objectives. Hauni, the world's

leading supplier to the tobacco industry, has developed a digital service package with a corresponding tablet app that enables customers to obtain remote technical support and helps cut production downtime by as much as 30 percent. Fabio Perini, the leading company in the Business Area Tissue, also offers remote technical support in real time with its Wearable innovative high-tech helmet.

Whereas the latter two systems enable the rapid and efficient resolution of breakdowns, the machine tool manufacturer Schaudt Mikrosa is using a lifecycle monitoring system to find the causes of machine failures. The software-based machine-condition monitoring system offers a benefit in that users can plan for required maintenance intervals in advance and thus exclude the possibility of unwanted shutdowns. Schaudt Mikrosa is already taking things to the next level in the AMELI 4.0 joint project, which will enable even better machine-condition monitoring by more powerful sensors.

A project at Dividella focuses on the various opportunities offered by human-robot collaboration. This Swiss manufacturer of packaging machines is incorporating a collaborative robot into the process for a flexible packaging system in a way that enables the robot to package medications on its own. Another exciting project – this one from the Business Area Pharma Systems – is Smart Packaging, which the Swiss company Rondo AG is using to establish new interactive communication channels between patients, physicians, and pharmacies.

However, the starting point for the journey into the digital Körber world is LeviSpin – a magnetic-bearing drilling spindle from the Business Area Automation with high-resolution sensors that enable detailed process monitoring, and a 6D drilling system that has taken drilling technology a decisive step into the future. This innovation was developed in a close cooperation between LTI Motion and Heinz Fiege GmbH – in line with the motto: “Innovation 4.0: Networking knowledge. Creating value.”

HUMAN-ROBOT COLLABORATION

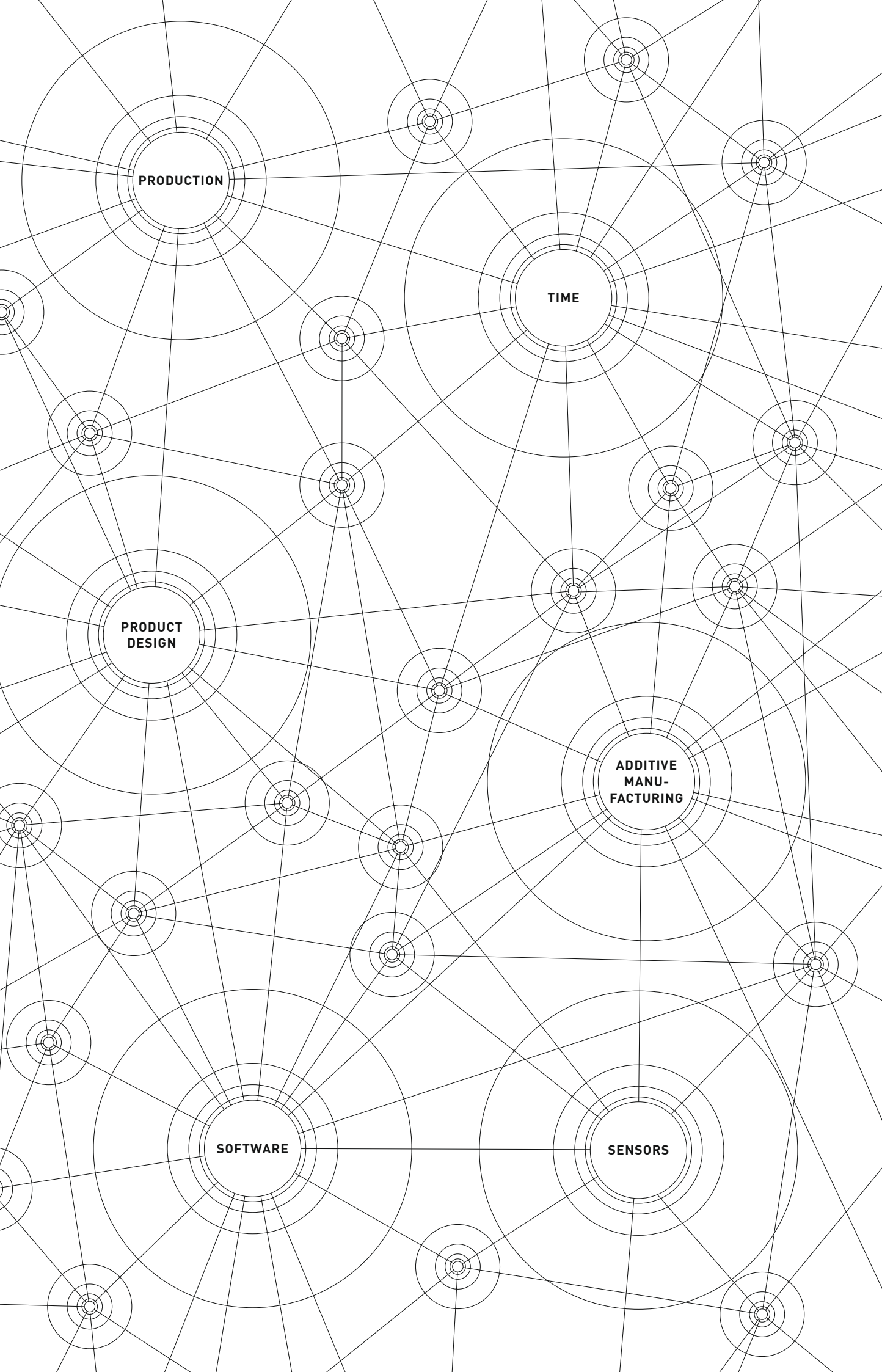
In human-robot collaboration, people and autonomous robots work together in the same area without protective barriers between them.

AUGMENTED REALITY

Augmented reality applications enrich visual depictions of reality with useful additional information.







LASER

MACHINE
SAFETY

CONNECTING IDEAS

THE NETWORK CENTER TECHNOLOGY
CONNECTS THE BEST MINDS AT
THE KÖRBER LOCATIONS WORLDWIDE.

Körber established the Network Center Technology (NCT) in 2009. The center's objective is to connect the Group's technology experts and so initiate an exchange of knowledge across the Business Areas and between the Körber locations throughout the world. Since

then, the members of the ten specialist working groups meet more than once a year to make new technologies useful for our customers. It's a fruitful exchange. Numerous joint projects have already been successfully driven forward by the NCT.

MATERIALS

AUTO-
MATION



EUROPE

GERMANY

- Bad Nauheim
- Eisenberg
- Freiberg
- Garbsen
- Göppingen
- Hamburg
- Hausach
- Lahnau
- Lahnau-Waldgirmes
- Leingarten
- Lüneburg
- Mainz
- Markt Schwaben
- Neuss
- Röllbach
- Sankt Augustin
- Schloß Holte-Stukenbrock
- Schwarzenbek
- Siegen
- Stuttgart
- Tübingen
- Unna
- Wasserburg/
Lake Constance

NORTH AMERICA

MEXICO

- Querétaro

USA

- Cary
- Clearwater
- Fargo
- Fredericksburg
- Green Bay
- Mechanicsburg
- Miamisburg

- Norristown
- Parsippany
- Richmond

- San Francisco

SOUTH AMERICA

BRAZIL

- Joinville
- São Paulo

ASIA

CHINA

- Beijing
- Chongqing
- Guangzhou
- Kunming
- Shanghai

HONG KONG

- Hong Kong

INDIA

- Bangalore
- Mumbai

INDONESIA

- Jakarta

JAPAN

- Anjo City
- Shizuoka
- Tokyo

MALAYSIA

- Shah Alam

SINGAPORE

- Singapore

SOUTH KOREA

- Seoul

TAIWAN

- Hsinchu

THAILAND

- Bangkok

TURKEY

- Izmir
- Van

UNITED ARAB EMIRATES

- Dubai

EUROPE

BELGIUM

- Brussels

DENMARK

- Arden

FRANCE

- Chilly-Mazarin
- Fleury-les-Aubrais
- Lyon
- Toulouse

UNITED KINGDOM

- Warwickshire
- Winchester

ITALY

- Bregnano
- Lucca
- Paese (Treviso)
- Settimo Milanese

AUSTRIA

- Wels

NETHERLANDS

- Amsterdam

PORTUGAL

- Moreira da Maia

RUSSIA

- Moscow
- St. Petersburg

SWITZERLAND

- Allschwil
- Bern
- Biel
- Etziken
- Fehraltorf
- Grabs
- Rütli
- St. Gallen
- Steffisburg
- Winterthur

SPAIN

- Sant Cugat del Vallès

CZECH REPUBLIC

- Ejovice
- Kuřim

HUNGARY

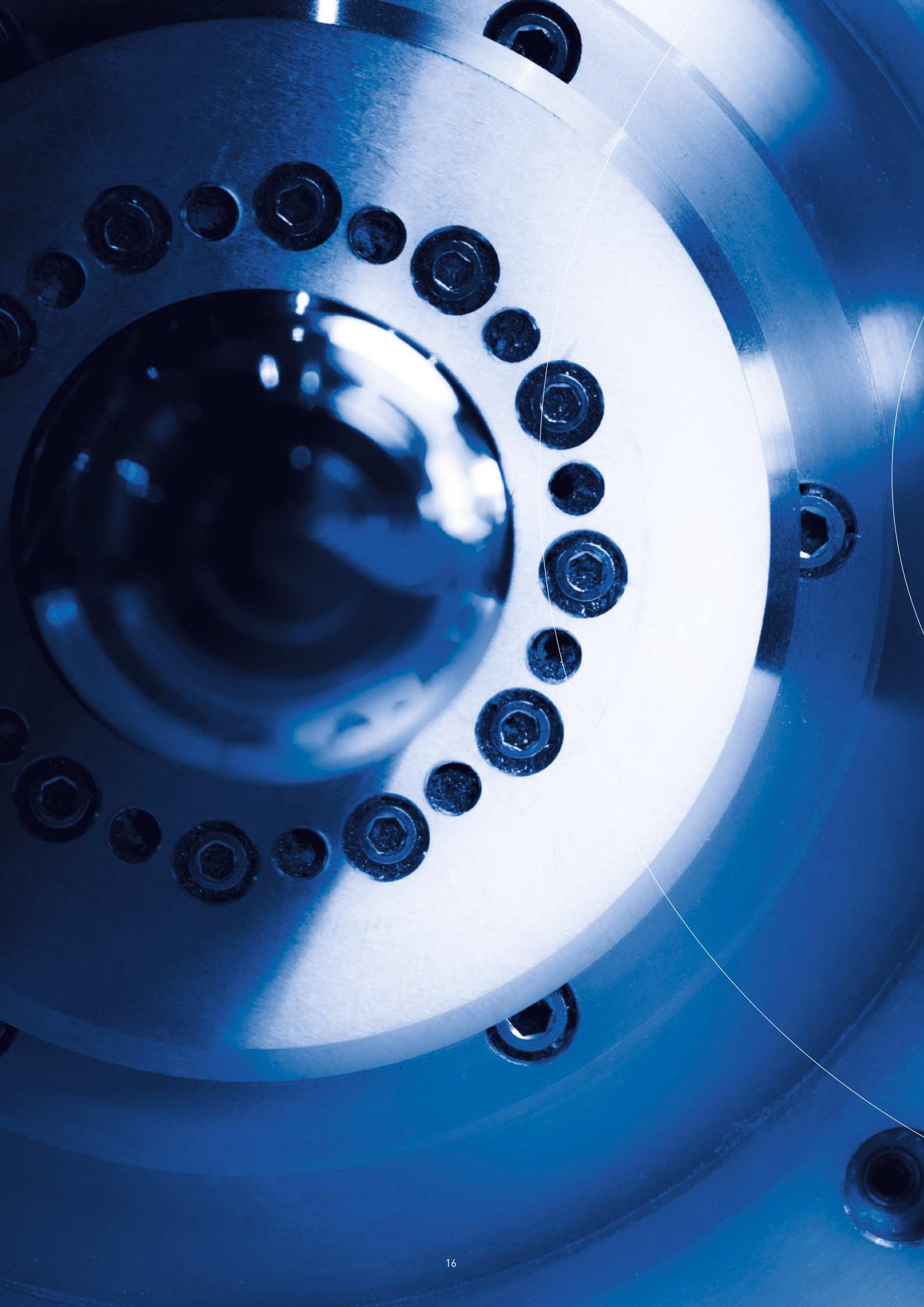
- Pécs

AFRICA

SOUTH AFRICA

- Cape Town





BUSINESS AREA

AUTOMATION

HOW COOPERATION BETWEEN TWO
AUTOMATION SPECIALISTS IS
REVOLUTIONIZING DRILLING TECHNOLOGY.

GOOD VIBRATIONS

LTI MOTION AND FIEGE, TWO SPECIALISTS IN THE BUSINESS UNIT MOTION TECHNOLOGY, HAVE JOINTLY DEVELOPED A FULLY AUTOMATED, VIBRATION-ASSISTED DRILLING SPINDLE THAT HAS TAKEN DRILLING TECHNOLOGY A DECISIVE STEP INTO THE FUTURE.

Good ideas tend to release creative forces – as was the case with the development of LeviSpin, an innovative drilling spindle from LTI Motion and Heinz Fiege. It all started with an unusual idea that was taken up by the two companies in the Business Area Automation, who worked closely together and combined their core expertise to create a new drilling technology that is now setting standards around the world. The key here is that LeviSpin reduces the size of drill chips, thus enabling a higher level of productivity with better drilling quality and lower costs. The project began in April 2015 with initial basic testing; the first prototype was completed just one year later. Extensive interest in the innovative technology was immediately expressed by numerous well-known companies from the aviation and automotive industries, as well as manufacturers of pneumatic and hydraulic valves. Field-test units are now being operated by customers.

LEVISPIN

The name of the innovative drilling spindle is derived from the words levitate and spin.

LIGHTWEIGHT DESIGN TREND


The new drilling technology is important because companies in the aviation and automotive industries are increasingly employing lightweight materials in order to conserve fuel and thus lower CO₂ emissions as well. Combinations of various materials are being used more and more often. For example, the new Airbus A350 contains combinations of titanium and carbon fiber-reinforced plastics (CFRPs). The increased application of these composite materials has changed the requirements for drilling processes. In the conventional drilling process with titanium, for ex-

ample, long metallic chips – known as flow chips – are formed and these generate substantial friction on the bore wall and can also damage sensitive materials such as CFRPs. “The friction also leads to a very high operating temperature, and drilling tools break down more quickly as a result,” says Markus Dirscherl, Head of Global Industry Management Machine Tools at LTI Motion. “This of course has a negative effect on efficiency and costs.”

SMALL DRILL CHIP SIZES

Flow chips have posed a problem in drilling processes for decades now. Back in the 1950s, experts at Bauman Moscow State Technical University began searching for a solution. Their research focused on vibration-assisted drilling, which works as follows: Along with the forward motion of the drill, there are also overlaid vibrations that are generated axially (i.e. in the drilling direction). These break the drill chips and thus keep chip sizes as small as possible.

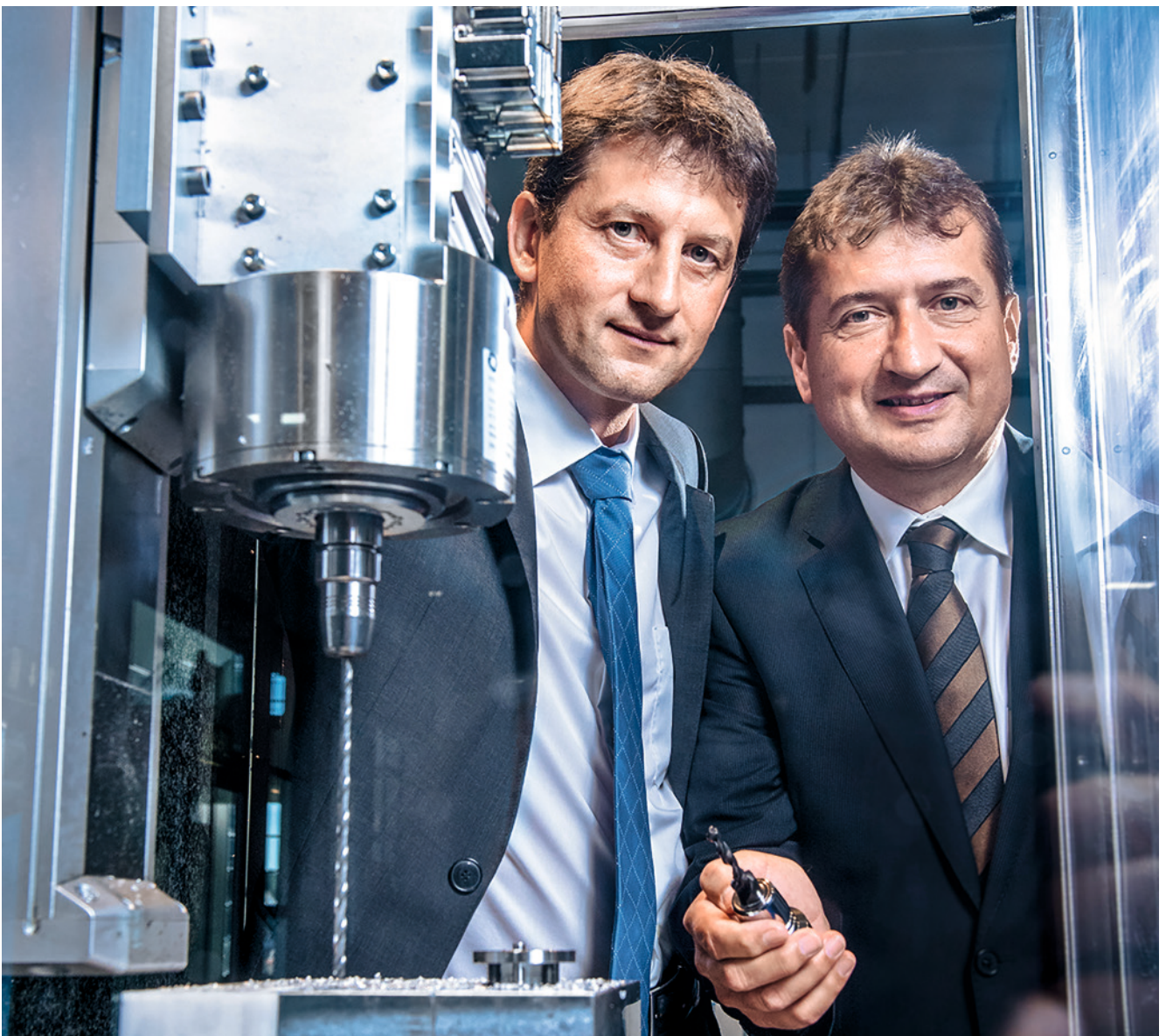
The automation specialist LTI Motion and the spindle technology company Heinz Fiege have now achieved a breakthrough with vibration-assisted drilling by building the world’s first vibration-assisted drilling spindle that can be used in fully automated processes. This innovation offers extensive market potential. For example, the drilling of rivet holes is one of the most important and demanding production steps in the aircraft manufacturing industry – several hundred million rivet holes are drilled every year in the Airbus Group alone.

The secret behind the success of LeviSpin has to do with magnetic bearing technology, which makes it possible to superimpose additional vibrations on the position of the spindle shaft, which is suspended in a magnetic field. As a result, LeviSpin only produces short chips that cannot do any damage to boreholes or materials. “The drill more or less strips out the bore,” Dirscherl explains. “The small chips produced as a result are blown out of the bore with air that is channeled to the cutting edge of the tool by 

“THE DRILL MORE OR LESS STRIPS OUT THE BORE; THE SMALL CHIPS PRODUCED AS A RESULT ARE BLOWN OUT OF THE BORE WITH AIR”

MARKUS DIRSCHERL, HEAD OF GLOBAL INDUSTRY MANAGEMENT MACHINE TOOLS AT LTI MOTION

Innovation team at the Business Area Automation:
Markus Dirscherl (left) and Mathias Fiege



6-D

DRILLING

LeviSpin can be programmed for drilling in six degrees of freedom, which means this spindle technology enables 6-D drilling for the first time.

—○ means of integrated cooling bores in the drill.” LeviSpin’s lower chip friction reduces operating temperatures as compared to conventional techniques and thus significantly improves bore quality and the service life of drills, especially when drilling deep holes.

LTI Motion and Heinz Fiege also developed the 6D drilling technique, which gives their drilling spindle great freedom of movement. Whereas conventional drilling spindles basically can only rotate, the LeviSpin drilling spindle shaft can be programmed via a machine control system and moved with five additional degrees of freedom. “It is therefore now possible to not only optimally adjust chip size, chip shape, entry speed, and angle of entry to a given drilling process but also achieve for the first time process optimizations such as automatic rear-side burr removal and compensation of drift when drilling deep holes,” says Dirscherl. “This offers significant value added and major potential in terms of production optimization.”

“WE COMPLEMENTED EACH OTHER PERFECTLY. THIS IS EXACTLY WHAT ENABLED SUCH RAPID AND SUCCESSFUL DEVELOPMENT WORK”

MATHIAS FIEGE, MANAGING DIRECTOR OF HEINZ FIEGE GMBH

But that’s not all – LeviSpin also makes a major contribution to Industry 4.0 in the form of multifunctional sensors mounted in the drilling spindle that provide machine operators with detailed process monitoring data and enable them to draw up preventive maintenance plans. For example, if the drill begins to get

blunt, the magnetic bearing will take in more electricity. The machine operator can define in advance whether a new tool (known as a sister tool) should automatically be used for the next bore in such a situation. In addition, the machine control system can automatically stop the drilling process if sensors register atypical readings and there is a danger that the component will have to be scrapped due to a damaged tool or a loose workpiece that leads to vibrations.

The sensors can also detect different material layers, which offers a decisive advantage when composite materials are drilled. “The required process parameters, such as forward motion, rotation speed, and vibrations vary tremendously among different materials in some cases,” says Dirscherl. “LeviSpin can be programmed in a way that ensures the parameters are automatically adjusted when the drill enters a new material layer.”

HOLISTIC SYSTEM

LeviSpin, with all of its functions, is not just a particularly innovative individual component. Instead, the drilling spindle is actually a holistic drilling system that has the potential to revolutionize manufacturing processes. In this sense, cooperation between LTI Motion and Heinz Fiege shows just what’s possible when specialists apply their expertise in a targeted manner that also consistently focuses on customer utility. “The Fiege experts contributed their knowledge of various spindle functions, while the specialists at LTI Motion took care of the magnetic bearing technology and the drive system,” Mathias Fiege explains. “We complemented each other perfectly. This is exactly what enabled such rapid and successful development work.”

It didn’t take long for the joint development to attract attention and praise either, as the industry magazine *MM Maschinen Markt* presented LeviSpin with the prestigious MM Award 2016 in the “Milling” category during the AMB International Exhibition for Metalworking in Stuttgart. ○

IMPROVED DRILLING

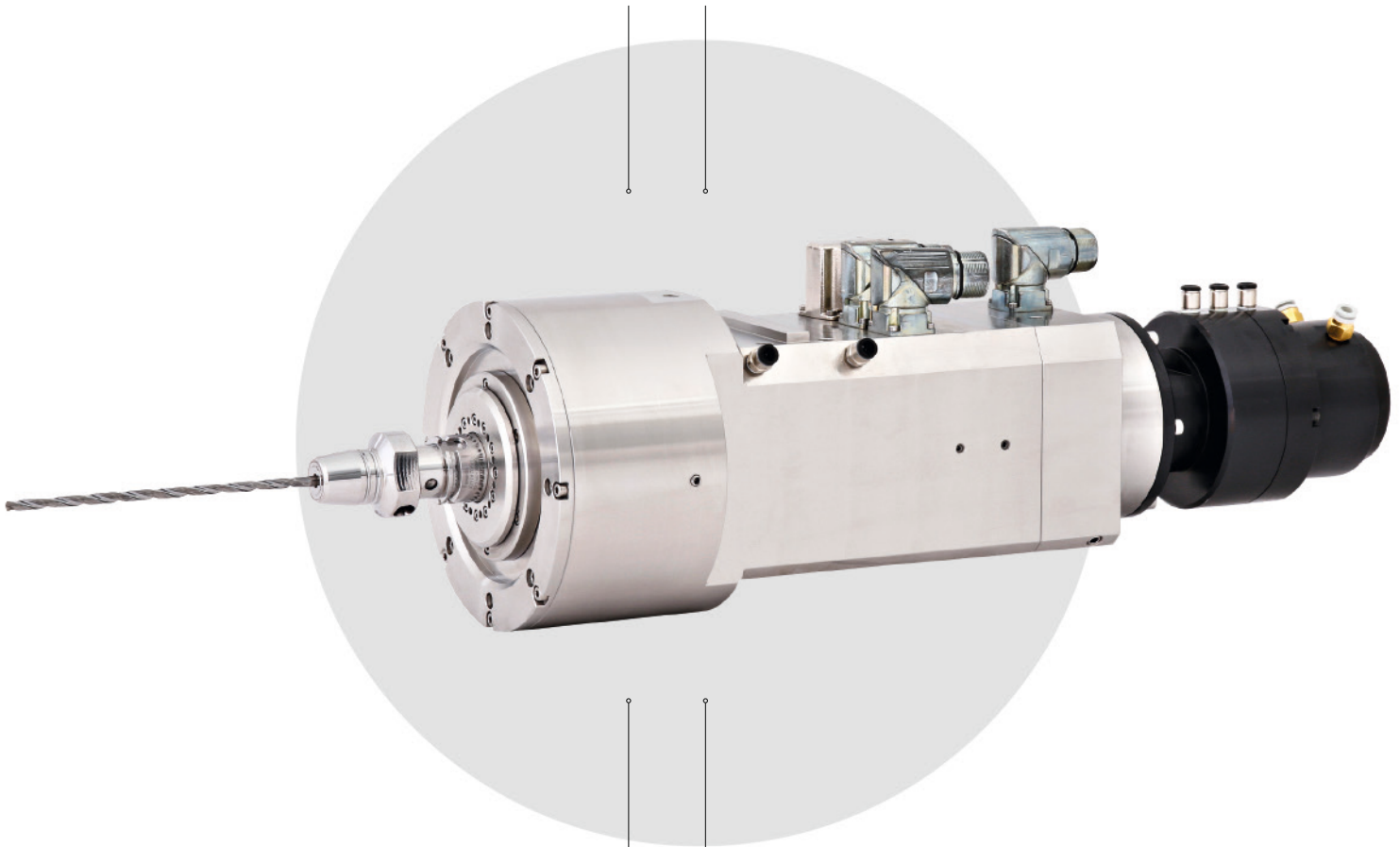
THE LEVISPIN MAGNETIC BEARING DRILLING SPINDLE GUARANTEES RELIABLE AND ECONOMICAL DRILLING PROCESSES

FAST

LeviSpin enables more rapid forward movement, higher cutting speed, and the use of PCD tools and drills with three cutting edges.

ECONOMICAL

Customers benefit from a longer tool service life, maintenance-free storage, and less expenditure on coolants and chip removal operations.



PRECISE

The LeviSpin spindle ensures stable bore quality. Extra benefit: No burr formation at the drilling tool exit.

EFFICIENT

Process optimization with cutting parameters that reduce tool stress and integrated sensors that identify materials.



BUSINESS AREA

LOGISTICS SYSTEMS

HOW AUGMENTED REALITY AND
PROOF OF DELIVERY SOLUTIONS GENERATE
ADDED VALUE FOR CUSTOMERS.



DEEP INSIGHT THANKS TO MOBILE DATA

TWO EXAMPLES FROM ABERLE AND INCONSO ILLUSTRATE JUST HOW FAR INDUSTRY 4.0 HAS ALREADY ADVANCED IN TERMS OF THE INTELLIGENT NETWORKING OF MACHINES AND PEOPLE.

Humans have always dreamed of being able to see the invisible – and augmented reality is now making that dream come true. For example, digitally optimized logistics facilities, such as automated high bay warehouses, now make it possible to view technical processes that normally would not be apparent at first glance. Service technicians at the system integration company Aberle now only need a standard tablet, smartphone, or laptop to do this. Aberle’s innovative service app provides precise information on the operational state of machine and facility components while the technician’s on the move. And in the event of a breakdown the app guides technicians through all the steps that are needed to fix the problem.

ERP SYSTEM

Enterprise resource planning (ERP) systems help companies plan and manage the use of resources such as personnel and production materials.

DIGITAL SUPPORT

The secret behind this “x-ray vision” involves numerous markers placed on specific machine parts and components. For example, if technicians point their tablet at a particular spot, they will see on their display not only a real image of the machine part they’re pointing at but also context-related information that can help them with maintenance planning, servicing, and repair operations. The service app makes use of the principles of augmented reality here by delivering live images along with useful additional or background information such as operating hours to date, service intervals, and the latest error messages.

Depending on the specifics of the work order, the mobile device can also display digital

circuit diagrams, detailed images, or workflows from operating manuals. If desired, smart glasses can also be used to provide support in the form of an additional information channel. For example, the smart glasses worn by the service technician at the facility can send a live video stream to the support team in Aberle headquarters. The team then sees everything the onsite technician sees and can provide immediate support to help solve the problem.

All of this enables a mobility and time-optimized – and paperless – service. “The new service app makes it possible for our onsite technicians to quickly access all relevant documents on the hardware components and IT infrastructure for everything from ERP systems to programmable logic controllers,” Achim Aberle, Head of Development, explains. “This simplifies and accelerates processes, improves the quality of our services, and reduces machine downtime to a minimum.”

PRODUCT SOLUTION STARTING IN 2018

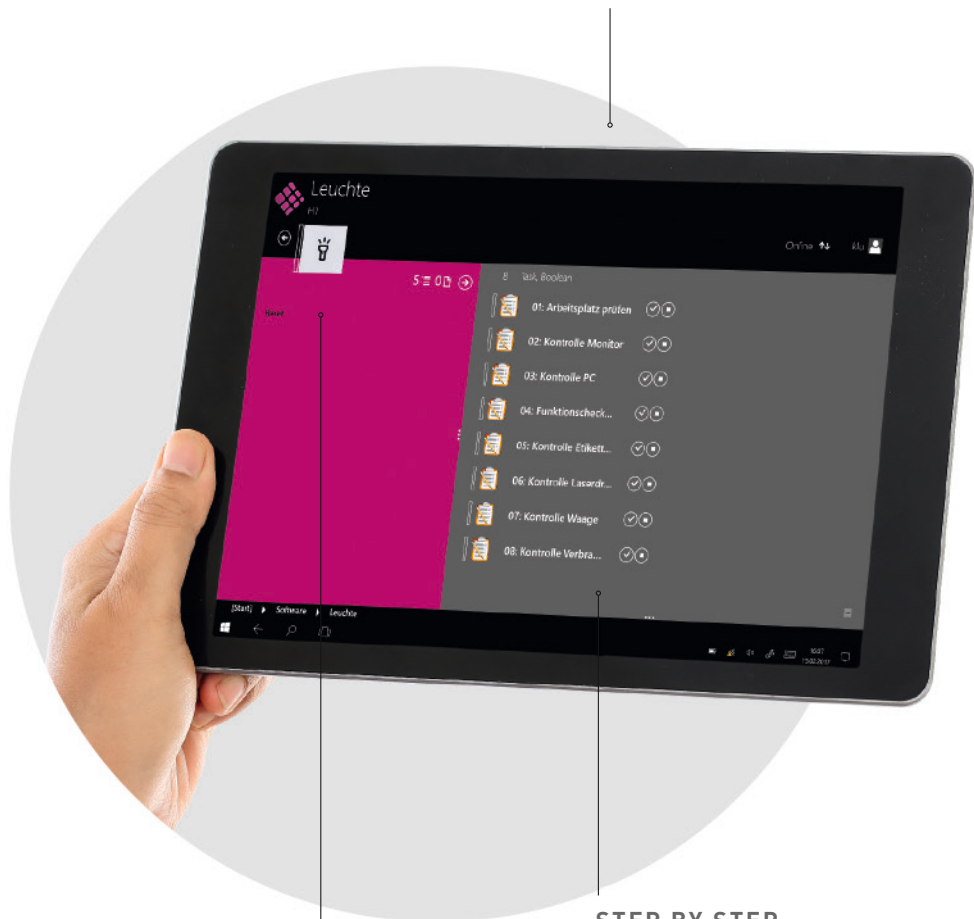
The innovative service app, which has comprehensively demonstrated its effectiveness internally at Aberle since the beginning of this year, will be rolled out as a product solution for the system integrator’s customers in 2018. “After the market launch, our customers will be able to acquire the app for use by their own service staff,” says Andreas Ebert, the Aberle Managing Director responsible for sales.

THE TABLET AS A PROBLEM SOLVER

ABERLE'S INNOVATIVE SERVICE APP
REDUCES MACHINE DOWNTIME TO A MINIMUM.

A LOOK INSIDE

When technicians point a tablet at a machine part, the service app provides them with detailed information on its current operational state.



PAPERLESS SERVICE

The Aberle service app allows users to access digital circuit diagrams, detailed images, or workflows from operating manuals as needed.

STEP BY STEP

The service app guides technicians through all the steps for fixing a problem. Among other things, live images of machine components can be displayed along with useful additional or background information.



Mobile assistants:
Tablets provide relevant
information in real time.

— A typical feature of this Industry 4.0 implementation project involves the use of modern and cost-effective features of tablet computers and smartphones in order to optimize business processes and project steps. In addition, digitization has been taken to its logical conclusion in that no paper whatsoever is required at any of the stages of the value and service chains. This isn't just good for the environment, as it also enables all relevant information to be accessed via the system in its most up-to-date version in real time. These two benefits are also offered by another system from the Business Area Logistics Systems – the InconsoPOD proof of delivery solution developed by the software company Inconso.

Electronic shipment tracking with digital documentation of all transfer points in the delivery chain is really nothing new. Indeed, anyone who has received a package by mail is familiar with the process of digitally signing for it on a mobile device. Even before the package is delivered, it is possible to track it on the

“WE ARE ABLE TO ENSURE
SEAMLESS DATA INTEGRATION FROM
THE CUSTOMER'S ERP SYSTEM
TO THE DRIVER'S MOBILE DEVICE”

WILFRIED PFUHL, MEMBER OF THE INCONSO BOARD OF DIRECTORS

Internet, locate its position in the delivery processing chain, and obtain an estimated time of arrival. However, the system that Europe's leading logistics software provider, Inconso AG, has developed can do a lot more.

The cloud-based app solution known as InconsoPOD particularly displays its strengths when it's used by industrial and retail companies that often operate with a complex mixture of their own vehicle fleets and external transport capacity purchased from shipping companies. One such Inconso customer, a provider of system solutions for roofs, has been using the app for a little over a year now. The customer sends the Inconso POD transport platform the latest information from its ERP system (enterprise resource planning) on all the day's delivery runs. All of the drivers have the associated app on their mobile devices – for example their smartphones.

PROCESS-RELEVANT INFORMATION

The app not only displays the delivery trip plan and the associated itemized delivery lists; it also provides information on whether empty pallets need to be collected at a delivery site, whether a delivery note needs to be issued or if an electronic signature is sufficient, and whether a photograph of the delivered cargo needs to be taken at the construction site in order to document its damage-free condition, for example. InconsoPOD transforms the mobile devices it's used on into multifunctional units that can display all the above mentioned information with just a few clicks.

The consignment data for the individual shipments is scanned with a smartphone camera when a delivery is made, and images and signatures are also digitized and forwarded to the consignment sender, which then has access to seamless documentation of all transports, including time stamps and GPS data. "We can even go a step further and use other smartphone functions such as Bluetooth to collect additional process-relevant information," says Wilfried Pfuhl, the In-

conso Board of Directors member responsible for Project and Product Development. "For example, a wide variety of sensors for measuring temperature or humidity in cargo areas or detecting doors that have been left open could be incorporated into the process."

GREATER TRANSPARENCY

InconsoPOD thus makes the delivery process more transparent and reduces the number of administrative tasks that have to be performed – tasks that offer very little added value. However, additional added value is generated by the provision and use of the collected data at the InconsoPOD portal, where customers can use portal dialogs to check the status of their delivery and download delivery notes containing all the latest data immediately after delivery if they need to have such documents in writing. Senders can also see whether a delivery is running late and then implement any required measures. The information collected at the portal can also be used to initiate follow-up processes or manage complaints.

The app is available for use with all three common smartphone operating systems (iOS, Android, and Windows). "It has an intuitive interface, so it can be used spontaneously at any time in tightly synchronized delivery operations," Pfuhl explains. "With InconsoPOD, we are able to implement seamless data integration from the customer's ERP system to the driver's mobile device, with the possibility of carrying out numerous real-time analyses along the way."

HIGH DEGREE OF DATA SECURITY

All of this data is stored in the cloud of a German data-management company certified in accordance with the country's exceptionally stringent and continually updated security standards. This is crucial, because in systems that form the foundation of Industry 4.0 – i.e. where devices exchange information with one another and with their human operators – it must be ensured that sensitive data never gets into the wrong hands. ○



BUSINESS AREA

MACHINE TOOLS

HOW SCHAUDT MIKROSA IS PREVENTING
UNPLANNED MACHINE FAILURES
BY MEANS OF PLANNED DOWNTIMES.



The maintenance intervals for the Kronos S 250 can also be planned in advance with the Life Cycle Monitoring system.

COMPREHENSIVE MONITORING


UNPLANNED MACHINE AND FACILITY DOWNTIMES ARE VERY EXPENSIVE.
SCHAUDT MIKROSA IS NOW PREVENTING THEM WITH A SYSTEM
FOR COMPREHENSIVE CONDITION MONITORING OF GRINDING MACHINES.

Companies can't make money with a machine that isn't working. This might sound like a simple idea, but for a long time it was quite difficult to prevent unplanned downtimes, or to plan and carry out required maintenance work in time. After all, it used to be generally accepted that technical systems were unable to provide information on their current state – and certainly not their future condition. Today, however, machines are capable of reporting problems and providing information on which components will need servicing in the near future. In order to do this, they need to be equipped with a condition monitoring system such as [Life Cycle Monitoring](#) from Schaudt Mikrosa. "Our customers expect their machines to be available at least 95 percent of the time," says Paul Kössl, Head of Customer Care at the United Grinding Group, and Vice President Sales & Marketing at Schaudt Mikrosa. "Our Life Cycle Monitoring system is an important component for ensuring that our grinding machines can continually meet this minimum requirement and thus maintain a consistently high level of productivity for our customers."

The Life Cycle Monitoring system from Schaudt Mikrosa is a software-based solution that enables transparent condition monitoring. The system will soon be displaying its strengths in the automotive and aviation industry, for example. The principle behind the system is very simple: Regardless of whether the filter for a hydrostatic unit or a wiper on a guideway needs to be replaced, or if oil simply needs to be changed – customers receive a message from the integrated software program and can then initiate the required maintenance or servicing operation. The software also documents, evaluates, and issues reports on wear and tear for quality-critical components such as axles and spindles. This condition monitoring allows customers to avoid sudden machine failures and also enables them to plan maintenance intervals in advance and integrate them into the production process. Or, as Kössl puts it, "Instead of unplanned machine failures, you have planned downtimes."

The system also helps Schaudt Mikrosa customers to diagnose and repair faults. If a disruption occurs, the machine operator's screen will immediately display an incident ticket that provides a detailed description of the cause of the defect. Various problems can thus be quickly eliminated in a targeted manner. The software also collects extensive data on key parameters such as hours of operation and workpieces produced. This information serves as a solid foundation for developing measures designed to increase overall facility effectiveness. The software also makes it possible for customers to determine which types of training measures are needed for machine operators.

An extensive amount of development work went into the various functions offered by the comprehensive Life Cycle Monitoring system. The project for the system was launched in 2002. Three years later, in March 2005, Schaudt Mikrosa signed a cooperation agreement with the Fraunhofer Institute for Production Systems and Design Technology (IPK). A team of scientists then began developing the monitoring software that would form the centerpiece of the Life Cycle Monitoring system. "We first had to find out which components could be used to actually enable reliable statements to be made on the current condition of a machine," Kössl explains. "To this end, we and the Fraunhofer IPK virtually disassembled the Mikrosa Kronos M precision grinding machine. That was fairly complicated when you consider the fact that a grinding machine has as many as 2,000 different components."

Once they had identified the parts they needed, the experts from Fraunhofer IPK began programming the monitoring software. After initial tests were conducted with the Kronos M, Schaudt Mikrosa launched a customer project. The results were presented to the German Mechanical Engineering Industry Association (VDMA) in 2008. Since then, the company has continually improved its Life Cycle Monitoring system. One of the biggest challenges here involved feeding the software program with data from live 

LIFE CYCLE MONITORING

Life Cycle Monitoring is an advanced form of condition monitoring that covers the entire service life of a product.

2,000

SINGLE PARTS
A Schaudt Mikrosa grinding machine has as many as 2,000 different components.

30

PERCENT

The goal of the AMELI 4.0 joint project is to reduce machine maintenance, inspection, and servicing costs by as much as 30 percent.

—○ machines in order to enable a comparison between ideal component conditions and actual conditions, as well as the generation of statistically reliable statements regarding future maintenance requirements, for example. “Our software has been running in test operations at selected customers for years now,” says Kössl. “We also have additional operational data from the test runs we regularly conduct with our own machines inhouse.” All of this has led to the gradual collection of a huge amount of data that has enabled Schaudt Mikrosa to continually refine its condition monitoring system and adapt it to customers’ actual production processes.

The system was also employed with more and more machines as development work proceeded. Today, the Life Cycle Monitoring system is so far advanced that it can easily be used with any grinding machine built by Schaudt Mikrosa. “We’re currently developing a marketing strategy for our product,” says Kössl, “and we’ve already been approached by customers who want to use our comprehensive Life Cycle Monitoring system.” Other companies from the Business Area Machine Tools – Mägerle and Blohm Jung, for example – are also planning to use the software after adapting it to their machines.

In the meantime, Schaudt Mikrosa is getting the Life Cycle Monitoring system up to speed for Industry 4.0. Together with six partners, the company is working on the condition

monitoring systems of the future within the framework of the AMELI 4.0 project. The goal of the research project is to improve the market position of German companies in terms of Industry 4.0. That’s why Germany’s Federal Ministry of Education and Research is subsidizing it with nearly €4 million in funding. “In Life Cycle Monitoring we draw conclusions from the data we receive from the CNC system on the mechanical condition of individual components,” Kössl explains. “In AMELI 4.0 we are attempting to take condition monitoring to a new level with the help of a sensor system.”

Here, the partners rely on MEMS (micro-electromechanical system) sensors that have already proved their worth in automobiles and the consumer electronics sector. Such sensors are considered more intelligent and energy-efficient than conventional industrial sensors – and also less expensive. However, they are still not powerful and robust enough to be used in complex industrial environments. Researchers in the AMELI 4.0 project therefore want to improve the MEMS sensors. If they succeed, the new sensor system they create will be able to measure oscillations, vibrations, and sounds inside a machine in real time and compare the data it collects with stored profiles. This type of sensor-assisted machine monitoring will reduce maintenance, inspection, and servicing costs by as much as 30 percent. ○

“AS PART OF OUR JOINT PROJECT AMELI 4.0, WE ARE ATTEMPTING TO TAKE CONDITION MONITORING TO A NEW LEVEL WITH THE HELP OF A SENSOR SYSTEM”

PAUL KÖSSL, HEAD OF CUSTOMER CARE AT UNITED GRINDING GROUP, AND VICE PRESIDENT SALES & MARKETING AT SCHAUDT MIKROSA

EVERYTHING IN SIGHT

VERSATILE, INTELLIGENT, EFFECTIVE: THE SOFTWARE-BASED
CONDITION MONITORING SYSTEM BY SCHAUDT MIKROSA

DATA ANALYSIS

The software collects business-relevant process data, as well as other data.

TECHNICAL SUPPORT

Incident tickets displayed on the screen provide a detailed description of the causes of defects.



PROCESS CONTROL

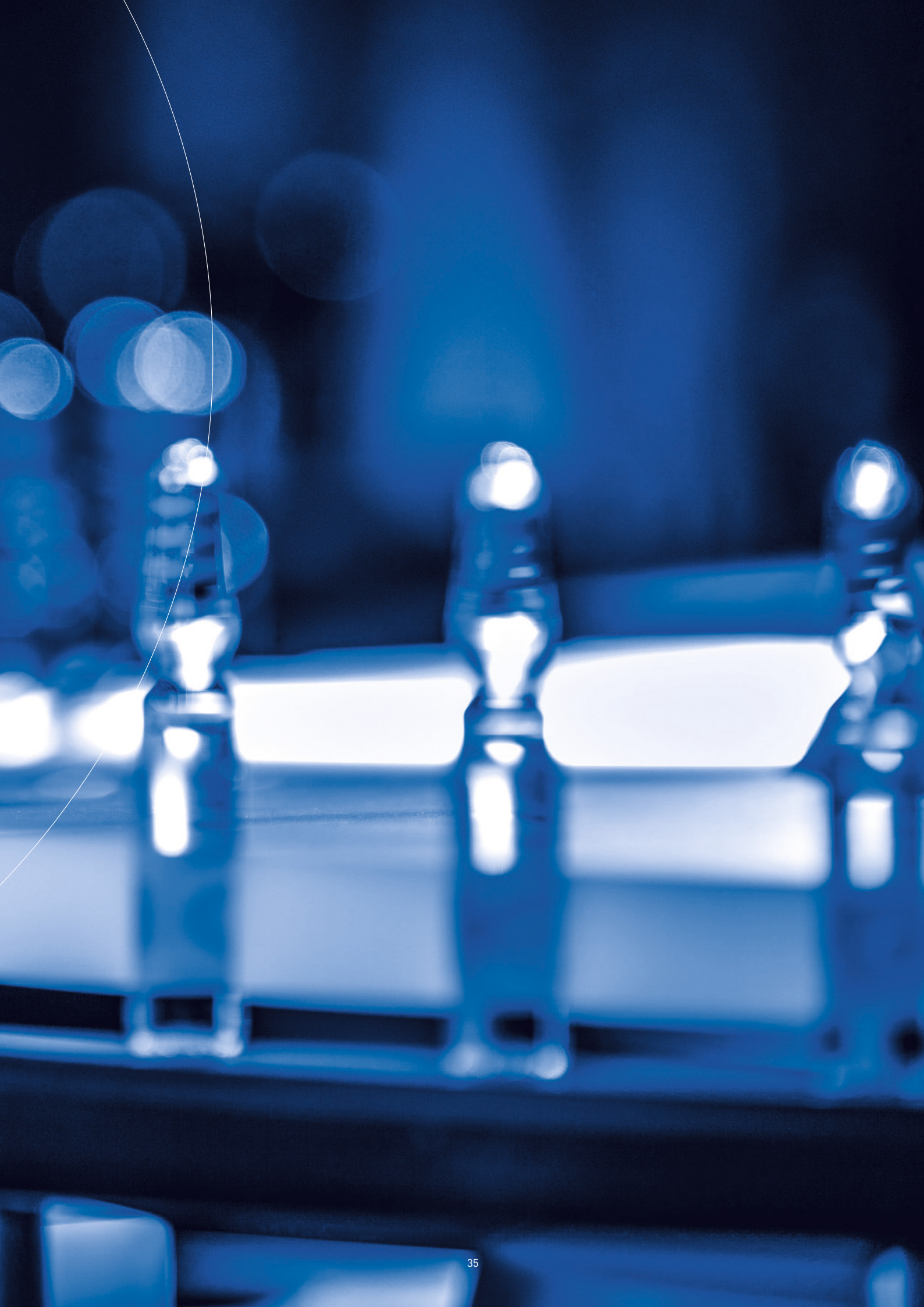
The machine control system sends the machine operator detailed information on wear and tear on axles and spindles, for example. The data can be used to initiate necessary maintenance activities.



BUSINESS AREA

PHARMA SYSTEMS

HOW TWO KÖRBER COMPANIES
ARE MAKING THE PHARMACEUTICAL
INDUSTRY FIT FOR THE FUTURE.



SMART PACKAGING

A COLLABORATIVE ROBOT AND A FOLDING BOX THAT COMMUNICATES WITH DOCTORS, PATIENTS, AND PACKAGING MACHINES: THIS IS HOW DIVIDELLA AND RONDO ARE SUPPORTING THE PHARMACEUTICAL INDUSTRY AS IT MOVES INTO THE FUTURE.

A factory hall, a Rubik's cube, and a robot form the scenery of a video that can be watched on the Internet platform YouTube. Things start to get exciting at second 32: The robot picks up the Rubik's cube, looks at it from every angle, and starts to turn the movable elements of the cube, using both of its gripper hands. The robot's movements are careful and seem highly focused. Starting at minute 1:08, the speed of the video increases eightfold. Finally, at minute 1:30 the robot has finished its task. The Rubik's cube is once again in its original state, with every side of the cube displaying of a single color.

Generations of human players have failed to reconfigure Rubik's cubes since the 1970s. YuMi has turned out to be much smarter – so smart that the pharmaceutical industry is now paying attention. YuMi is a “collaborative” two-armed robot (known as a cobot) built by the Swiss industrial group ABB. Together with a major customer from the pharmaceutical industry, the Group company Dividella has worked out a way to integrate the cobot YuMi into the processes of a flexible packaging system. After YuMi has completed its qualification process, it is expected to be “permanently employed” by Dividella's customer. One of its jobs will be to fill medicine packaging units. “The trend in the pharmaceutical industry is clearly going in the direction of small batch sizes and even personalized medicine packaging,” says Jürg Messmer, Head of Engineering Automation at Dividella. “The use of a collaborative robot such as YuMi in an automated packaging system is the ideal

supplement that will allow us to have the kind of flexibility and efficiency that the market is demanding and to maintain our traditional high product quality even with small batches.”

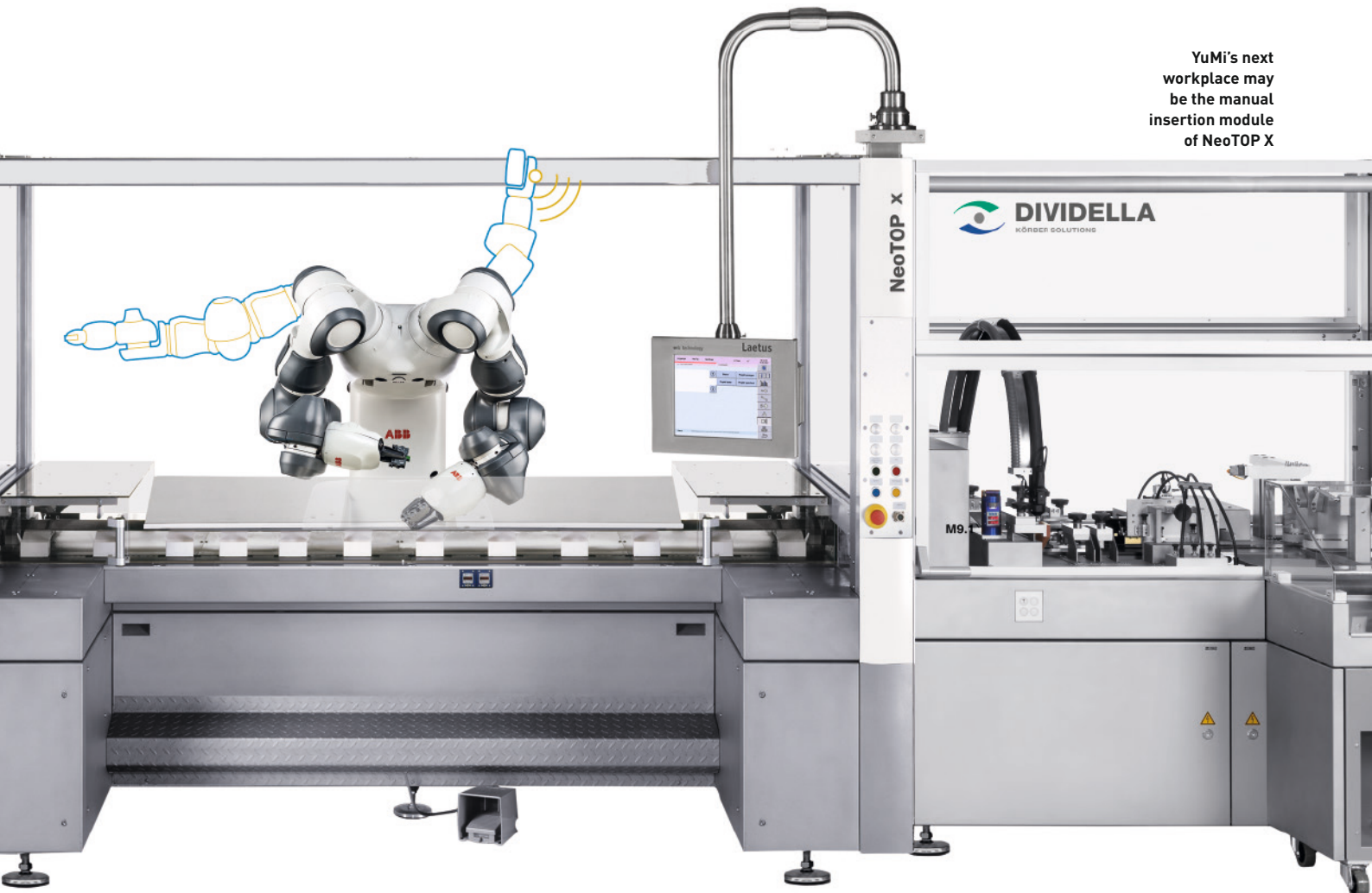
In many industrial sectors, human-robot collaboration (HRC) is already part of the daily routine. However, this solution has not been used so far for the packaging processes of a pharmaceutical company. Dividella now changed that. YuMi's first new workplace will be the manual insertion module NeoTOP x. NeoTOP x is a packaging system used at Dividella which has been directly adapted to increasing product segmentation and decreasing batch sizes. In the system, robots work in the same environment as their human colleagues, directly next to them and in cooperation with them. There's no need for a protective separation wall such as those that are used to screen off welding robots in the automotive industry. “Collaborative robots feature an integrated safety solution – and besides, from a safety point of view they are incorporated into an existing machine concept in a completely different way than traditional robots,” Messmer emphasizes. “We are currently working to clarify these safety-related technical issues related to YuMi and NeoTOP x.”

EFFICIENT AND ACCURATE

After this step, YuMi will be ready to take on its new job from a technological perspective. Using YuMi has numerous advantages for the Dividella customer. Thanks to its staying power, YuMi further enhances the efficiency of the packaging system. In addition, its work

COBOTS

Collaborative robots are industrial robots that work together with human beings without any protective separating walls.



YuMi's next workplace may be the manual insertion module of NeoTOP X

is reliable and accurate. These capabilities are in great demand in the pharmaceutical sector. “If medicine packages are filled manually, there’s a risk that the activities may not be carried out as they should be – for example, with regard to the product alignment or the amount of force applied. If deviations like these are not detected in the quality control process, they could well have critical consequences for patients,” Messmer explains. By contrast, if YuMi is responsible for filling the packaging, many typically human sources of error are eliminated.

Another huge advantage is the robot’s flexibility. Whether it’s blister packs, ampoules, syringes or injectors, YuMi can

“THE USE OF A COLLABORATIVE ROBOT SUCH AS YUMI IS THE IDEAL SUPPLEMENT THAT GIVES US THE FLEXIBILITY AND EFFICIENCY THE MARKET IS DEMANDING, EVEN WITH SMALL BATCHES.”

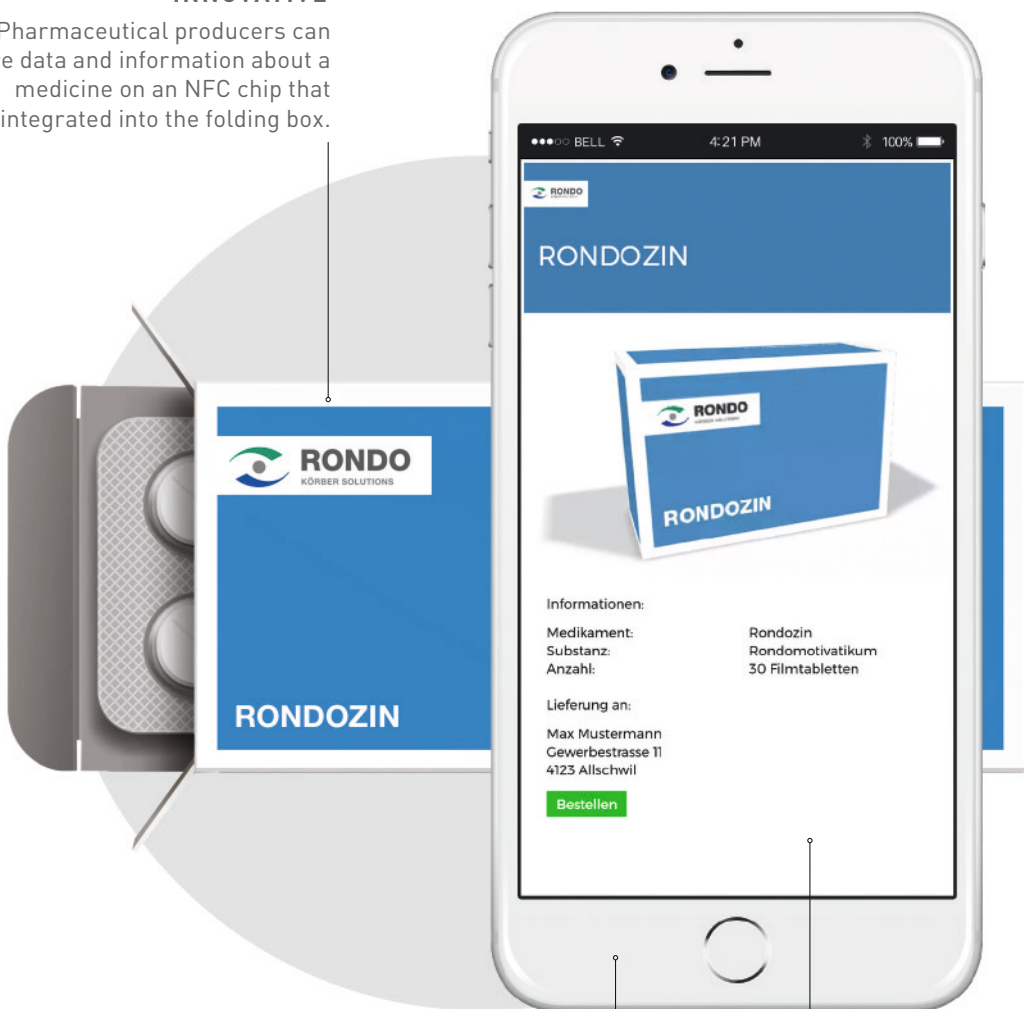
JÜRGE MESSMER, HEAD OF ENGINEERING AUTOMATION AT DIVIDELLA

NEW COMMUNICATION CHANNELS

RONDO BRINGS NFC TECHNOLOGY INTO THE PHARMACEUTICAL INDUSTRY VIA ITS TALKING FOLDING BOX.

INNOVATIVE

Pharmaceutical producers can store data and information about a medicine on an NFC chip that is integrated into the folding box.



SECURE

The chip transmits the stored data to a terminal with reading capability — but only when it is in the immediate vicinity of the packaging.

CONVENIENT

The end user can use the transmitted data to have the information on the instruction leaflet read aloud or to order a repeat prescription via a smartphone.

— place a wide variety of products, intact and in the desired amounts, into their packaging. Dividella therefore aims to go a step further by using the robots for additional tasks in the medium term. One category of these tasks is the Plug & Produce process. As Messmer explains, “We have a lot of discussions with our customers about the topic of communication and integration. The question is: How can we provide robots with data so that they can also work with a different machine without requiring long changeover times? This possibility offers entirely new opportunities in terms of flexibility and efficiency.”

Communication is also the focus of the Smart Packaging project of the Swiss folding box producer Rondo AG. In this project, Rondo takes advantage of the opportunities offered by the Internet of Things and uses a technology that has already proven to be successful in the keyless opening of cars as well as cash-free payment: Near Field Communication (NFC). Thanks to this international transmission standard, data can be shared over short distances by means of radio technology. All that’s needed is an NFC chip and an appropriate terminal device such as a smartphone. By contrast to comparable solutions such as RFID codes, data transmission via NFC technology functions only over short distances. That makes it impossible for third parties to read personal or sensitive data unnoticed from afar.

With its Smart Packaging solution, Rondo demonstrates that Near Field Communication is also suitable for use in the pharmaceutical industry. The solution: Data is stored on an NFC chip, and the chip is subsequently integrated into the folding box. Users only need to lay their smartphone or another terminal with reading capability on the packaging in order to receive the data that has been stored on the chip. “Our folding boxes thus enable direct communication between the patient and the package. They also open up new opportunities for dialogue between the patient, the doctor, and the pharmacist,” says Marc Helfenstein, Head of Packaging Development at Rondo. “The feedback we’re getting from

the pharmaceutical industry shows that the topic of Smart Packaging is a very important one.” There are many possible applications for this type of communication via a product’s folding box. For example, patients can have the instruction leaflet read aloud to them or take a look at more detailed information about the right way to take their medicine, for example. In addition, the system can be used to automatically order repeat prescriptions or refills of the medicine.

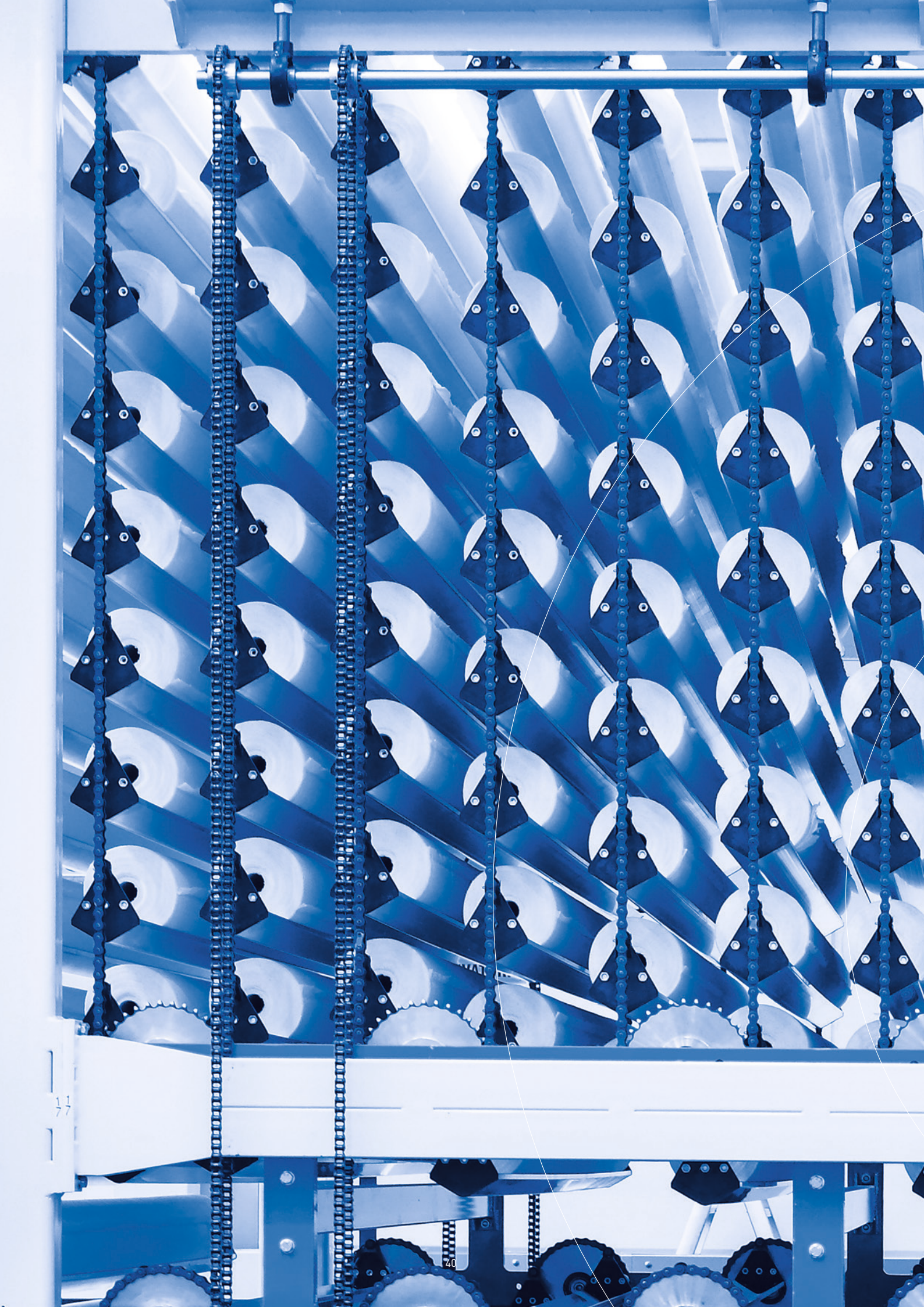
Rondo is continuing its development of Smart Packaging. It is currently working on a solution that can automatically remind patients to take their medicine at the right time or help them to participate in surveys that are part of clinical studies. An exploration of the topic of augmented reality is also part of the project. In parallel, the experts at Rondo are tinkering with the interaction between the folding box and the packaging machine. There are numerous promising application possibilities for this NFC application as well. For example, information about the desired packaging processes can be saved on the chip and transmitted to the machine. As Helfenstein explains, “These projects are still new for the pharmaceutical industry, but it’s becoming clear that there is a need for this technology, so we’re rapidly forging ahead with Smart Packaging for our customers. We’re being helped by the close cooperation between the colleagues in mechanical engineering and in IT — for example, people from Werum within the Business Area Pharma Systems.”

PLUG & PRODUCE

With Plug & Produce, machines and devices can autonomously configure themselves and form networks with one another. The process is inspired by Plug & Play, which ensures that a printer, for example, is ready to use directly after it is connected to a computer.

“OUR FOLDING BOXES ENABLE DIRECT COMMUNICATION BETWEEN THE PATIENT AND THE PACKAGE”

MARC HELFENSTEIN, HEAD OF PACKAGING DEVELOPMENT AT RONDO





BUSINESS AREA

TISSUE

HOW FABIO PERINI IS INCREASING
THE PRODUCTIVITY OF TISSUE
PAPER MANUFACTURING AND
REDUCING COSTS AT THE SAME TIME.

CREATIVE AND CUSTOMER CENTERED

WITH ALL-IN-ONE AND WEAREABLE,
FABIO PERINI IS CREATING IDEAL CONDITIONS
FOR TISSUE PRODUCTION 4.0.

Rolls of tissues such as paper towels and toilet paper have a long way to go before they appear fully packaged on supermarket shelves. Soft tissue paper goes through a variety of production stations during manufacturing. From the press roll and the winder to the packaging unit, a wide variety of machines in the plant ensure that the right rolls of paper reach the customers at the right time. One of the main preconditions for this is the existence of an efficient and fault-free production process.

For manufacturers this means that all of the machines in the plant have to be precisely coordinated with one another and the workflow has to be optimized to make interruptions in production almost impossible. The technicians at the Körber company Fabio Perini are working continually to ensure this is the case. Their latest innovation is called All-In-One. This software lives up to its name because it coordinates all of the production steps and optimally matches the capacities of the individual machines for the processing and packaging of tissue paper.

Previously, many work steps had to be performed manually whenever a facility was switched to manufacturing another product. Whether the switch, for example, from thin to thick tissue paper is successful depends, in part, on how efficient the coordination processes between the plant managers and the plant operators are and how well the corresponding machine requirements are met in practice. As a result, a big drawback of the previous approach was that switches in produc-

tion cost considerable amounts of time during which the facility was shut down.

The All-In-One software, by contrast, enables such switches in production to be automatically triggered by the push of a button. The software system is centrally connected to all the stations of the plant and sends them information to adjust them for the new product. If a problem occurs in one part of the facility, the system will immediately display it on the screen so that it can be quickly rectified. This enables the customers of Fabio Perini to save valuable time, ensure that machine downtimes are kept to a minimum, and deliver products to their recipients on time. "Our customers benefit from All-In-One because it simplifies changes of product so that the effectiveness of the facility as a whole increases sustainably," explains Luca Frasnetti, Chief Technology Officer of Fabio Perini.

ALWAYS PRODUCTIVE

In addition, All-In-One controls the individual production steps by holistically monitoring them. In order to optimize the facility's output, the software flexibly adjusts the speed of the individual machines whenever there is a disruption or loads are too high. Under the watchful eye of All-In-One, a roll of tissue passes through all of the stations of the plant under unvarying conditions. Frasnetti sees this as a big step forward. "In conventional tissue production, the effectiveness of the overall facility used to always depend on the skills of the people involved. These skills often vary greatly, and production fluctuated as

ALL-IN-ONE

This software comprehensively coordinates and monitors all of the production steps for tissue paper. As a result, it reduces the number and duration of interruptions in the production process.

a result,” he says. “Our new IT system, on the other hand, guarantees the sustained optimization of the production cycle as well as a consistently high level of productivity.”

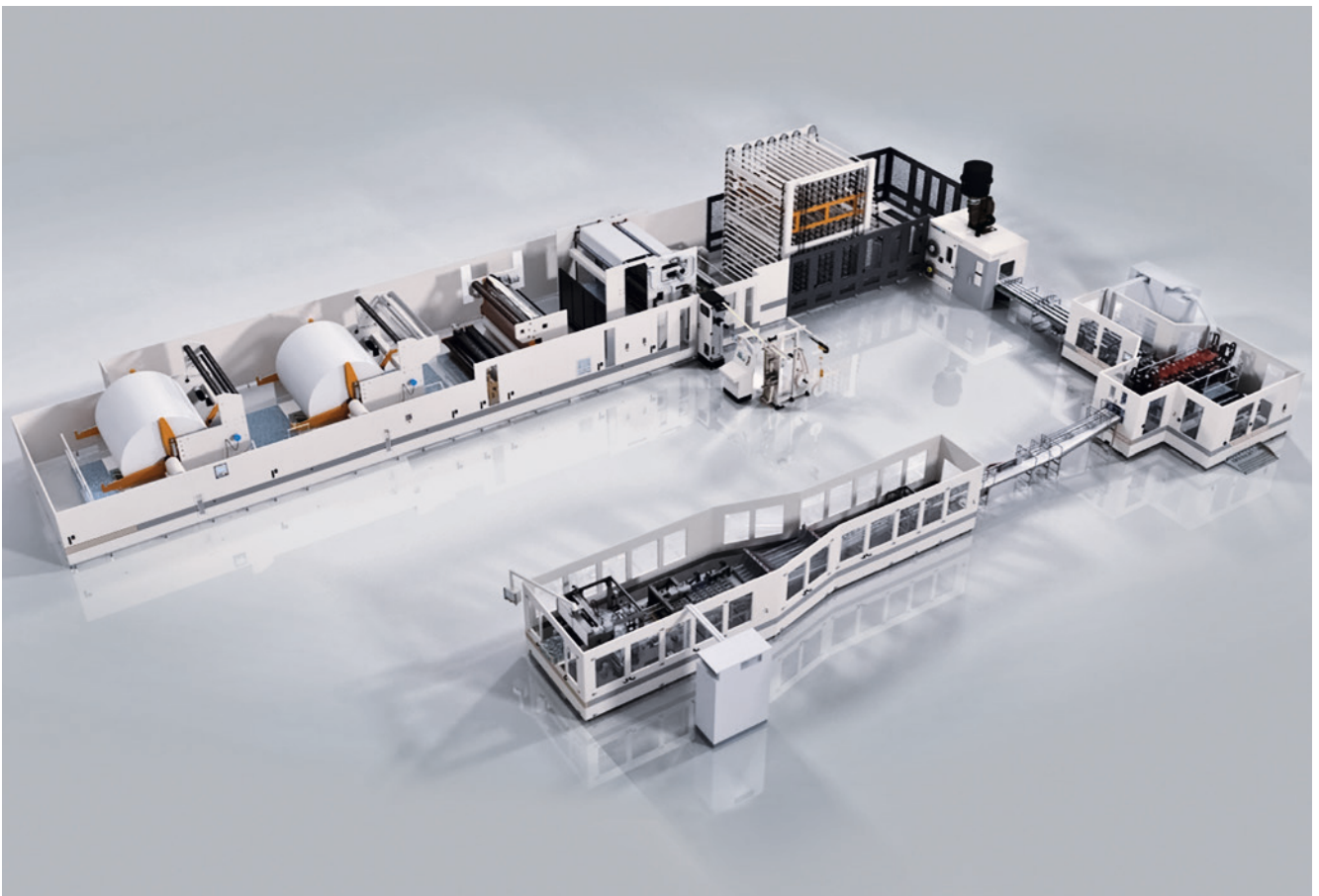
Moreover, the monitoring process collects valuable data concerning, for example, the length of interruptions to production when cutting surfaces or rollers are replaced. The software logically groups possible stops, depending on when the components have to be replaced and how long this will take. On the basis of these forecasts, the system automatically stops the facility at a time when several components can be replaced simultaneously. This reduces the number of interruptions so that production can run unimpeded for a longer period of time. According to Frasnetti, this innovation has great development potential. “All-In-One has enabled us to create the

“OUR CUSTOMERS BENEFIT FROM ALL-IN-ONE BECAUSE IT SIMPLIFIES PRODUCT CHANGES SO THAT THE EFFECTIVENESS OF THE FACILITY AS A WHOLE INCREASES SUSTAINABLY”

LUCA FRASNETTI, TECHNICAL DIRECTOR AT FABIO PERINI

world’s first integrated tissue paper production line that extends along the entire manufacturing process, from the raw material to the final product,” he says. This feat has enabled the developers at Fabio Perini to take a big step on the way to achieving Industry 4.0. —

Fabio Perini stands for innovative processing and packaging solutions.



—○ “However, our long-term goal is to offer our customers a comprehensive set of intelligent solutions from which they can select exactly the combination of measures that meets their requirements,” Frasnetti points out.

TARGETED ASSISTANCE

The company also pursues a customer-centric approach in its handling of technical problems. Offering support by phone is often too complicated and ineffective when individual machines in the plant fail or the entire plant comes to a standstill. That’s because the technicians have to know which error message is being displayed and if it’s possible to see which part is defective. Moreover, it’s often hard to clearly describe complex technical processes or the positions of machine parts on the phone. As a result, it helps if the assisting technician on the other end of the line can get an impression of the actual situation at the plant.

WEAREABLE

The product name combines the words “wearable” and “we are able.”

Weareable makes all of this possible. Although it might look like a futuristic pilot’s helmet at first glance, Weareable makes it much easier for customer support staff to provide remote assistance when technical problems occur. Weareable is equipped with a mobile display, a camera with a memory function, an audio system, and a data link. As soon as a customer dons the helmet and switches it on, Weareable transmits a real-time video im-

age of what the customer sees to the technician at the other end of the line. Instead of having to laboriously describe the problem to the contact person at Perini’s technical customer service department, the customer can now simply show it with Weareable’s built-in camera.

Moreover, Weareable is convenient because it only needs to be put on and can be taken along wherever one goes. Its further benefit is expressed by the product’s name: “We-are-able.” Specifically, this means that customers are provided with targeted assistance through the headset so that they can solve problems on their own, no matter where in the world they may be. The only thing the user needs is a good Internet connection. Weareable enables Fabio Perini to provide remote assistance in real time. The company’s technical assistance team is reachable around the clock and adapts itself flexibly to the customers’ wishes and suggestions.

As a result, faults can be diagnosed much more quickly and precisely than would otherwise be the case. Weareable ensures that defects are rectified in a targeted manner. In addition to reducing stress, it saves valuable time that can, for example, be used instead to further improve the production process. The efficient and permanent elimination of faults also reduces costs because the facility can be quickly put back into operation again. ○

For Fabio Perini, Weareable and All-In-One are important elements in the continuous optimization of customer service through innovative solutions. “We are devoted to the continual further development of maintenance programs, the creation of training courses, and the improvement of the spare parts service,” explains Roberto Ferrari, Customer Service Sales & Marketing Director at Fabio Perini. The concept aims to provide a comprehensive range of services extending from the sale of a product to its regular maintenance. Customer orientation and creativity are the forces that motivate the company’s technicians to continuously develop new solutions for their customers’ Industry 4.0 requirements. ○

“OUR APPROACH FOCUSES ON THE CONTINUOUS FURTHER DEVELOPMENT OF MAINTENANCE PROGRAMS”

ROBERTO FERRARI, CUSTOMER SERVICE SALES & AND MARKETING DIRECTOR AT FABIO PERINI

HIGH-TECH PERCEPTION

WEAREABLE PROVIDES A PERFECT VIEW OF THE SITUATION, ENABLING REMOTE SUPPORT IN REAL TIME.

WEBCAM

The customer uses a built-in camera to film the defective facility, providing service technicians with real-time video images.

HEADSET

The built-in ear-phones enable the customer to receive the instructions needed to quickly eliminate the defect.



DATA GOGGLES

The technician's instructions are projected into the customer's field of vision here.

MICROPHONE

No matter where the facility in question is located, the customer can use the microphone to contact a service technician at any time.



BUSINESS AREA

TOBACCO

HOW A CIGARETTE MANUFACTURING
MACHINE IS BEING TRANSFORMED INTO
A NETWORKED INDUSTRY 4.0 FACILITY.



THE VIRTUAL TWIN

WITH ITS SMART MOBILE OPERATOR SUPPORT, HAUNI HAS DEVELOPED AN INTELLIGENT SERVICE SOLUTION THAT CAN SIGNIFICANTLY REDUCE PRODUCTION DOWNTIMES.

Sometimes reality surpasses fiction. For example, the latest innovation from the Business Area Tobacco brings back memories of the classic science fiction film “2001: A Space Odyssey,” which was directed by Stanley Kubrick in 1968, and it follows a voyage to Jupiter. In that movie, the talking onboard computer known as HAL informs two astronauts on a spaceship that their communication antenna will soon fail because of a defective circuit. HAL’s service-oriented electronic brain also shows the two astronauts the digital

circuit diagram of the affected “Unit AE-35” in large magnifications and different views.

SELF-ANALYSIS ENABLED

Nearly 16 years after that visionary film was set, a very similar process has become reality – not in space but instead in the world of industry. With Smart Mobile Operator Support (SMOS), Hauni has developed a digital service package that transforms cigarette manufacturing machines into a networked Industry 4.0 facility that continually analyzes itself



Hauni's SMOS solution can be used with all cigarette manufacturing machines built from 2005 on — e.g. with the PROTOS-M4.

and carries out intelligent communication with its human operators. For example, if a breakdown in operation occurs, it is immediately digitally identified. The system's tablet app then notifies the service technician, guides him or her directly to the affected machine, and even describes reasons for the fault using keywords. Once the technician has arrived at the machine, he or she is guided through the steps required to eliminate the problem with the help of a "twin" machine that is displayed in real time on the tablet screen. SMOS can also do something that HAL couldn't: initiate an online order process for any required spare parts that are not directly available.

FOCUSING ON PARAMETERS

A simulation demonstrates more clearly just what the system is capable of. The app shows a schematic diagram of a cigarette production hall with a large number of machines, one of

is not behaving normally. The designation of the PROTOS-M4 is highlighted in red, which means that the machine has stopped operating. An explanatory message in the red field on the display says, "Stop: Tube wheel too high." In other words, the service technician knows at a glance which machine has a problem and which component in the machine is causing it.

Using the virtual twin, the technician can see all of the current parameters of the machine and immediately determine which functions are affected and which ones continue to work properly. But what does "Tube wheel too high" actually mean? To find out, the technician can click on "Cause / Corrective Action," after which a schematic drawing of the module in question appears under the "Diagnosis" tab. SMOS also suggests three possible causes of the fault in this case, e.g.: "Tube wheel height set incorrectly." However, a look inside the real machine reveals that this is not the case. Second suggestion: "Incorrect tube wheel in use." A look inside shows that the right version is installed. Third suggestion: "Photo sensor B207S not correctly aligned." Bingo! As the technician discovers, it was the tiny light-sensitive sensor that caused the problem. The app then instructs the technician to consult the PROTOS-M4 operating manual for information on how to correctly handle the sensitive component.

PAPERLESS LIBRARY

"This is actually already standard procedure for us up to that point," says Andreas Eckroth, who is the Group Manager responsible for the basic development of automation technology at Hauni. "Now we get to the real innovation." More specifically, until recently thick tomes of paper had to be located on their shelves, carried to the machine, and consulted — and perhaps turn out to be outdated. This doesn't happen with SMOS, which has three additional buttons for choosing between "Circuit diagram," "Manual," and "Spare parts catalogue," all of which are stored digitally in the system and can be accessed in their most recent versions at any time. —

“AN ORDER OF SPARE PARTS CAN BE PLACED DIRECTLY WITH THE APP”

ANDREAS ECKROTH, GROUP MANAGER
AUTOMATION & DRIVES AT HAUNI

30

PERCENT

SMOS can reduce output loss by as much as 30 percent.

— The service technician can thus first examine the circuit diagram and zoom in on the wiring schematics or select another excerpt from the documentation as required. The defective B207S sensor is immediately marked in red by the system. A click on “Manual” then takes the service technician to the corresponding digital documentation – on the right page and in the right section for the sensor. The latter is already marked in the digital spare parts catalogue, along with a message that there are two such sensors in the machine in question. If a replacement sensor is not immediately available, a B207S unit will have to be ordered from the spare parts warehouse, which is no problem at all. “The order can be placed using the app,” Eckroth explains. The technician can review the installation procedure explained in the manual while waiting for the photo-sensor to be delivered. All of this is done without having to use a single sheet of paper.

REMOTE ASSISTANCE

However, what happens if the customer’s technician is unable to resolve a complex problem alone at some stage of the repair process? In that case, he or she will be given assistance remotely. Here, the technician uses the Remote Service (RS) module in the tablet to launch an “RS Session” with a Hauni expert. A chat window that enables a live dialogue then opens – or alternatively the technician can talk to the expert using a headset. The technician can use the tablet’s webcam

to send the Hauni expert live images of the defective machine. There’s also a whiteboard that both the technician and the Hauni expert can use to draw sketches and provide graphic support for possible solutions. “And the best thing is that both parties remain completely mobile with their tablets,” says Eckroth. In other words, the technician can walk around the machine and send detailed images of exactly the perspectives or details of the machine that are needed to show where the problem originates. All of this saves customers a lot in terms of downtime, as Eckroth explains: “We believe the system can reduce output loss by as much as 30 percent.” That would mean around one third less downtime due to machine failure.

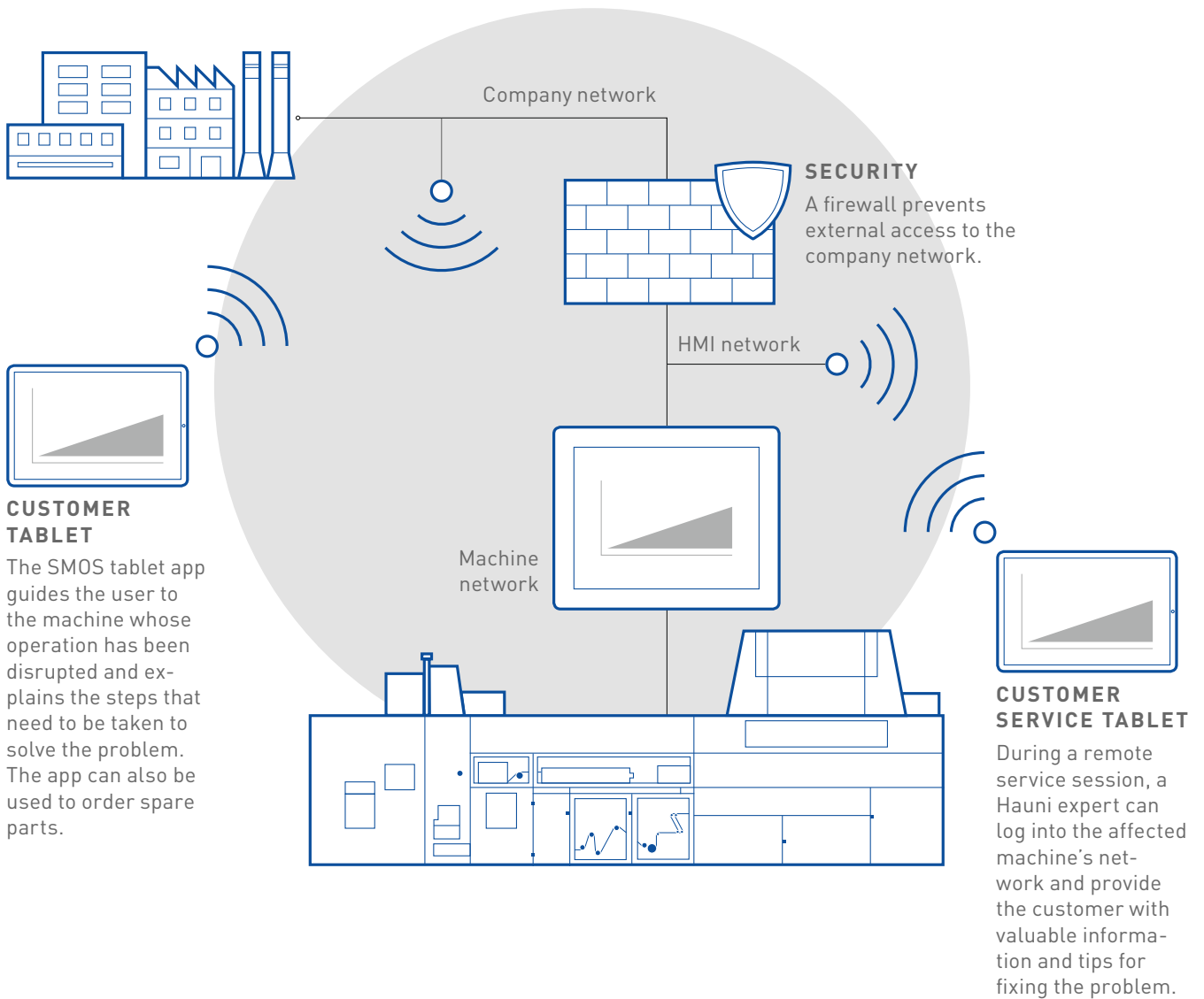
FIREWALL SEPARATION

The app runs on a Windows tablet that uses WiFi to log into one of two possible networks. Either the customer’s service technician uses the company’s own network or a Hauni expert directly logs into the system of the machine in question after receiving authorization from the customer in the form of a password. The machine’s system is separated from the rest of the customer’s network by a firewall. All modern cigarette manufacturing machines built from 2005 on can be retrofitted with the SMOS program package.

Extensive interest has been expressed in the app solution by potential users, whose suggestions have also been incorporated into SMOS – a system that would make even HAL from “2001” jealous. ○

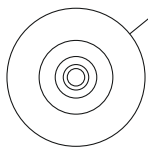
SOLUTION VIA LIVESTREAM

SMART MOBILE OPERATOR SUPPORT MAKES IT POSSIBLE TO SOLVE PROBLEMS EFFECTIVELY. IN MORE COMPLEX CASES, A HAUNI EXPERT CAN BE CALLED IN TO PROVIDE REMOTE SUPPORT IN REAL TIME.



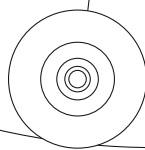
OUR BUSINESS AREAS

IN ITS BUSINESS AREAS THE KÖRBER GROUP UNITES THE TECHNOLOGICALLY LEADING COMPANIES WITH MORE THAN 130 PRODUCTION, SERVICE, AND SALES COMPANIES.



AUTOMATION

The Business Area Automation develops, produces, and markets high-quality, innovative products and services for international markets in the fields of motion technology, sensor technology, and energy technology. Its three Business Units — Motion Technology, Sensor Technology, and Energy Technology — are renowned for their technologically leading products and set new standards to guarantee their customers long-term competitive advantages.



LOGISTICS SYSTEMS

The Business Area Logistics Systems offers its customers high-quality, intelligent, and efficient logistics solutions along the entire value chain. These range from project planning and consulting services through software, materials handling, palletizing and warehousing technology, down to comprehensive systems integration for production, distribution, and transport logistics. Thanks to their expertise, experience, and top standards of quality and service the Business Area's six companies — Aberle, Aberle Software, Consoveyo S.A., Inconso, Langhammer, and Riantics — offer customized logistics solutions that boost their customers' sustained success.



MACHINE TOOLS

The Business Area Machine Tools unites leading global suppliers of precision machines for grinding, eroding, laser finishing, combined finishing, and gauging. With its eight brands — Studer, Schaudt, Mikrosa, Walter, Ewag, Mägerle, Blohm, and Jung — the Business Area has the broadest application know-how, the largest product portfolios, and the most comprehensive range of services in the international market.

PHARMA SYSTEMS

The Business Area Pharma Systems offers solutions for safe, efficient processes in the manufacturing, inspection, and packaging of pharmaceutical products and pharmaceutical traceability. This Business Area's unique combination of process know-how and cutting-edge technology makes it one of the leading systems providers to the pharmaceutical and biotech industries. It brings together leading international companies — Dividella, Fargo Automation, Mediseal, Rondo, Seidenader, and Werum IT Solutions.

TISSUE

The Business Area Tissue is synonymous with innovation, state-of-the-art technologies, and end-to-end solutions for processing and packaging machinery and equipment for toilet paper and paper towels. Outstanding innovations and a systematic customer orientation make Fabio Perini a technology and market leader in the sector.

TOBACCO

The Business Area Tobacco, comprising the Hauni, Borgwaldt, Borgwaldt Flavor, Decouflé, Garbuio Dickinson, and Sodim brands, is the leading supplier to the international tobacco industry, thanks to its comprehensive product range and global presence. At locations around the world, the companies in this Business Area support customers in the fields of tobacco processing, filter and cigarette manufacture, and measuring and analysis equipment, as well as flavorings.

CORPORATE VENTURES

The Körber Group plans to continue its growth in the years ahead. That includes expanding its strategic investments. The group is therefore focusing on key future technologies and markets. The Business Area Corporate Ventures offers the ideal framework for those companies that represent new territory for the Group.

COMPANIES OF THE BUSINESS AREAS

KÖRBER UNITES TECHNOLOGICALLY LEADING COMPANIES AROUND THE WORLD
WITH MORE THAN 130 PRODUCTION, SERVICE, AND SALES COMPANIES.

BUSINESS AREA AUTOMATION

- Dressel GmbH, Unna/Germany
- Heinz Fiege GmbH, Röllbach/Germany
- Körber Automation GmbH, Lahnau/Germany
- LTI AUSTRiA GmbH, Wels/Austria
- LTI Motion Deutschland GmbH, Lahnau/Germany
- LTI Motion GmbH, Lahnau/Germany
- LTI Motion GmbH, Wasserburg/Lake Constance/Germany
- LTI Motion Italia S.r.l., Settimo Milanese/Italy
- LTI Motion Schweiz GmbH, Rüti/Switzerland
- LTI Motion (Shanghai) Co., Ltd., Shanghai/China
- LTI REEnergy A.S., Van/Turkey
- LTI REEnergy Co., Ltd., Hsinchu City/Taiwan
- LTI ReEnergy GmbH, Unna/Germany
- LTI USA Ltd., Mechanicsburg/USA
- Sensitec GmbH, Lahnau-Waldgirmes/Germany
- Sensitec GmbH, Mainz/Germany

BUSINESS AREA LOGISTICS SYSTEMS

- Aberle GmbH, Leingarten/Germany
- Aberle Logistics GmbH, Siegen/Germany
- Aberle Software GmbH, Stuttgart/Germany
- Consoveyo S.A., Moreira da Maia/Portugal
- Consoveyo Singapore Pte. Ltd., Singapore/Singapore
- Godrej Consoveyo Logistics Automation Ltd., Mumbai/India
- inonso Aktiengesellschaft, Bad Nauheim/Germany
- inonso Beteiligungs GmbH, Bad Nauheim/Germany
- inonso SASU, Lyon/France
- inonso Software, S.L., Sant Cugat del Vallès/Spain
- Körber Logistics Systems GmbH, Bad Nauheim/Germany
- Langhammer GmbH, Eisenberg/Germany
- Langhammer GmbH, Freiberg/Germany
- Riantics, Arden/Denmark

BUSINESS AREA MACHINE TOOLS

- Blohm Jung GmbH, Hamburg/Germany
- Blohm Jung GmbH, Göppingen/Germany
- Ewag AG, Etziken/Switzerland
- Fritz Studer AG, Steffisburg/Switzerland
- Fritz Studer AG, Biel/Switzerland
- Irpd AG, St. Gallen/Switzerland
- Mägerle AG Maschinenfabrik, Fehraltorf/Switzerland
- Schaudt Mikrosa GmbH, Leipzig/Germany
- StuderTEC K.K., Tokyo/Japan
- United Grinding GmbH, Moscow/Russia
- United Grinding GmbH, India Branch Office, Bangalore/India
- United Grinding Group AG, Bern/Switzerland
- United Grinding México Sociedad Anónima de Capital Variable, Querétaro/Mexico
- United Grinding North America, Inc., Miamisburg/USA
- United Grinding North America, Inc., Fredericksburg/USA
- United Grinding (Shanghai) Ltd., Shanghai/China
- United Grinding (Shanghai) Ltd., Branch Office Beijing, Beijing/China
- United Grinding (Shanghai) Ltd., Branch Office Chongqing, Chongqing/China
- Walter Ewag Asia-Pacific Pte. Ltd., Singapore/Singapore
- Walter Ewag do Brasil – Importação e Exportação de Máquinas Ltda., São Paulo/Brazil
- Walter Ewag Italia S.r.l., Bregnano/Italy
- Walter Ewag Japan K.K., Anjo City/Japan
- Walter Ewag UK Limited, Warwickshire/United Kingdom
- Walter Maschinenbau GmbH, Tübingen/Germany
- Walter Maschinenbau GmbH, Garbsen/Germany
- Walter s.r.o., Kuřim/Czech Republic

BUSINESS AREA PHARMA SYSTEMS

- **Dividella AG**, Grabs/Switzerland
- **Fargo Automation Inc.**, Fargo/USA
- **Körber Medipak América Latina Soluções Farmacêuticas Ltda.**, São Paulo/Brazil
- **Körber Medipak Systems AG**, Winterthur/Switzerland
- **Körber Medipak Systems GmbH**, Hamburg/Germany
- **Körber Medipak Systems Machinery s.r.o.**, Kuřim/Czech Republic
- **Körber Medipak Systems NA Inc.**, Clearwater/USA
- **Mediseal GmbH**, Schloß Holte-Stukenbrock/Germany
- **Mediseal GmbH**, Shanghai Representative Office, Shanghai/China
- **Rondo AG**, Allschwil/Switzerland
- **Rondo obaly s.r.o.**, Ejpvovice/Czech Republic
- **Rondo-Pak, LLC**, Camden/USA
- **Rondo-Pak Inc.**, Norristown/USA
- **Seidenader Maschinenbau GmbH**, Markt Schwaben/Germany
- **Werum IT Solutions America Inc.**, Parsippany/USA
- **Werum IT Solutions America Inc.**, Cary/USA
- **Werum IT Solutions America Inc.**, San Francisco/USA
- **Werum IT Solutions GmbH**, Lüneburg/Germany
- **Werum IT Solutions GmbH**, Hausach/Germany
- **Werum IT Solutions GmbH**, Sankt Augustin/Germany
- **Werum IT Solutions GmbH**, Allschwil Branch Office, Allschwil/Switzerland
- **Werum IT Solutions K.K.**, Tokyo/Japan
- **Werum IT Solutions Pte. Ltd.**, Singapore/Singapore
- **Werum IT Solutions SARL**, Toulouse/France
- **Werum IT Solutions Ltd.**, Bangkok/Thailand
- **WPG Pharma GmbH**, Heidelberg/Germany

BUSINESS AREA TISSUE

- **Engraving Solutions S.r.l.**, Lucca/Italy
- **Fabio Perini Germany GmbH**, Neuss/Germany
- **Fabio Perini Indústria e Comércio de Máquinas Ltda.**, Joinville/Brazil
- **Fabio Perini Japan Co. Ltd.**, Shizuoka/Japan
- **Fabio Perini North America, Inc.**, Green Bay/USA
- **Fabio Perini (Shanghai) Co., Ltd.**, Shanghai/China
- **Fabio Perini S.p.A.**, Lucca/Italy
- **Körber Engineering (Shanghai) Co. Ltd.**, Shanghai/China

BUSINESS AREA TOBACCO

- **ASL Analytic Service Laboratory GmbH**, Hamburg/Germany
- **Baltic Metalltechnik GmbH**, Hamburg/Germany
- **Borgwaldt Flavor GmbH**, Hamburg/Germany
- **Borgwaldt KC GmbH**, Hamburg/Germany
- **Borgwaldt KC, Inc.**, Richmond/USA
- **Decouflé s.à.r.l.**, Chilly-Mazarin/France
- **Dickinson Legg, Inc.**, Richmond/USA
- **Dickinson Legg Limited**, Winchester/United Kingdom
- **Garbuio Dickinson Group Holding S.r.l.**, Paese (Treviso)/Italy
- **Garbuio (Shanghai) Trading Company Limited**, Shanghai/China
- **Garbuio S.p.A.**, Paese (Treviso)/Italy
- **Hauni do Brasil Máquinas e Equipamentos Para Tabaco Ltda.**, São Paulo/Brazil
- **Hauni do Brasil Máquinas e Equipamentos Para Tabaco Ltda.**, Uberlandia/Brazil
- **Hauni Far East Limited**, Hong Kong/Hong Kong
- **Hauni Far East Ltd.**, Kunming Representative Office, Kunming/China
- **Hauni Hungaria Gépgyártó Korlátolt Felelősségű Társaság**, Pécs/Hungary
- **Hauni Japan Co., Ltd.**, Tokyo/Japan
- **Hauni (Malaysia) Sdn. Bhd.**, Shah Alam/Malaysia
- **Hauni Maschinenbau GmbH**, Hamburg/Germany
- **Hauni Maschinenbau GmbH**, Dubai Branch, Dubai/United Arab Emirates
- **Hauni Primary GmbH**, Schwarzenbek/Germany
- **Hauni Richmond, Inc.**, Richmond/USA
- **Hauni Singapore Pte. Ltd.**, Singapore/Singapore
- **Hauni South Africa (Pty.) Ltd.**, Cape Town/South Africa
- **Hauni St. Petersburg Ltd.**, St. Petersburg/Russia
- **Hauni Teknik Hizmetler ve Ticaret Limited Sirketi**, Izmir/Turkey
- **Hauni Trading (Shanghai) Co. Ltd.**, Shanghai/China
- **ISIS S.r.l.**, Paese (Treviso)/Italy
- **PT. Garbuio Dickinson Indonesia**, Jakarta/Indonesia
- **Sodim S.A.S.**, Fleury-les-Aubrais/France
- **UNIVERSELLE Engineering U.N.I. GmbH**, Schwarzenbek/Germany

OUR STRATEGIC LONG-TERM GROWTH TARGET

Our clearly defined long-term growth target for the period until 2025 is an ambitious one. We will achieve this growth by continuing to impress our customers on a permanent basis. We intend to more than double our total earnings by comparison with 2013 through organic growth and strategic acquisitions.

OUR KÖRBER VISION

The future is ours to create! We are technology leaders, strong together, and inspire our customers and partners as sector experts in all business areas.

OUR KÖRBER MISSION

As an international technology Group with a strong regional presence, we create measurable benefits and added value for our customers. As a reliable, solid partner, we develop and supply pioneering, innovative solutions and perfectly tailored services worldwide with and for our customers.

OUR GROUP-WIDE CORPORATE VALUES

Our group-wide uniform Corporate Values form the foundation of everything we do. They make clear what strengthens and connects us across all the companies and functions in the Group and what we pledge to uphold in all our dealings with one another and third parties.

CUSTOMER SATISFACTION

We are Körber and we add value for our customers by inspiring our customers and partners as industry experts. As a solid, reliable partner, we develop and supply pioneering, innovative solutions and perfectly tailored services worldwide with and for our customers.

INNOVATION

We are Körber and we create innovations by putting our experience, expertise, and creativity to work for our customers. We defend our technological leadership through tireless innovation and the improvement of our products, services, and business processes.

CONNECTING PEOPLE AND KNOWLEDGE

We are Körber and we connect people and ideas by recognizing and leveraging the full breadth of our know-how and experience. We encourage and require everyone within our international Group to share ideas and experiences in order to apply all our knowledge to developing efficient, best-practice solutions.

RESPONSIBILITY

We are Körber and we take responsibility by putting our corporate values at the heart of everything we do. We keep our promises and act reliably toward employees, partners, and customers. Our success depends on close, long-term relationships with our employees and business partners.

FOCUS ON THE FUTURE

We are Körber and we strive for sustained and profitable growth by viewing long-term success and financial independence as a motivating challenge. Together, we develop profitable, sustainable solutions. We count on our employees worldwide and support everything they do with modern, attractive work conditions.

CONSOLIDATED INCOME STATEMENT

From January 1 to December 31, 2016

In thousands of euros	2016	2015
Sales	2,214,577	2,317,277
Increase in finished goods and services and work in progress	48,159	5,576
Other own work capitalized	3,890	2,573
Total operating performance	2,266,626	2,325,426
Other operating income	129,734	180,397
Cost of materials		
Cost of raw materials, consumables, and supplies, and of purchased merchandise	731,458	765,954
Cost of purchased services	136,586	128,816
Personnel expenses		
Wages and salaries	697,520	741,500
Social security, post-employment, and other employee benefit costs	139,206	159,953
of which in respect of old age pensions	26,014	38,972
Depreciation, amortization, and writedowns of intangible assets and tangible assets	104,750	108,274
Other operating expenses	466,267	515,639
Income from long-term equity investments	116	2,422
of which from affiliated companies	116	2,422
Income from other securities and long-term loans among the fixed assets	33	33
Other interest and similar income	7,156	21,585
of which from affiliated companies	496	782
Writedowns of long-term financial assets	100	1,389
Interest and similar expenses	26,425	21,920
of which to affiliated companies	4	8
Consolidated earnings before taxes on income	101,353	86,418
Taxes on income	41,650	52,679
Consolidated earnings after taxes on income	59,703	33,739
Share of non-controlling interests in consolidated earnings	-1,386	-912
Consolidated retained net profits	58,317	32,827

CONSOLIDATED BALANCE SHEET

As of December 31, 2016

In thousands of euros	2016	2015
Assets		
Fixed assets		
Intangible fixed assets	248,937	268,976
Tangible fixed assets	337,035	351,510
Long-term financial assets		
Shares in affiliated companies	17,937	18,101
Other long-term equity investments	9,577	4,920
Other loans	10,396	8,888
	37,910	31,909
	623,882	652,395
Current assets		
Inventories	676,347	604,393
Receivables and other assets	549,748	516,282
Securities	813,967	511,015
Checks, cash on hand, and bank balances	658,074	877,276
	2,698,136	2,508,966
Prepaid expenses	6,833	6,197
Deferred taxes	96,097	65,060
Goodwill arising from asset offsetting	8,916	8,775
Balance sheet total	3,433,864	3,241,393
Equity and liabilities		
Equity	1,814,776	1,769,121
Accruals	329,535	332,908
Liabilities	1,286,505	1,138,488
Prepaid expenses	3,048	876
Balance sheet total	3,433,864	3,241,393

KÖRBER GROUP KEY FIGURES

In millions of euros	2012	2013	2014	2015	2016
Operating business					
Incoming orders	1,965	2,252	2,320	2,191	2,357
Sales	2,004	2,194	2,342	2,317	2,215
EBITA ¹	229	222	258	141	171
Return on sales (EBITA) ¹	11.4%	10.1%	11.0%	6.1%	7.7%
Net income after taxes ²	151	137	150	34	60
Cash flows from operating activities ³	138	218	167	244	181
Capital expenditure on tangible fixed assets	48	54	58	65	46
Research and development expenses	99	120	129	145	127
Research and development ratio	4.9%	5.4%	5.5%	6.2%	5.7%
Balance sheet indicators as of December 31 reporting date					
Equity	1,470	1,578	1,727	1,769	1,815
Balance sheet total	2,194	2,352	2,535	3,241	3,434
Equity ratio ⁴	67.0%	67.1%	68.1%	54.6%	52.8%
Employees as of December 31 reporting date					
Employees ⁵	9,553	11,190	11,950	11,578	11,246

¹ Earnings before interest, taxes, and amortization of intangible fixed assets (EBITA) from acquisitions

² Includes scheduled amortization of goodwill in accordance with the HGB

³ Since 2014 according to DRS 21

⁴ Equity as a percentage of total equity and liabilities

⁵ Including unconsolidated companies



