CABLEWORLD
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INDUSTRY 4.0

REVOLUTIONISING PRODUCTION PLANTS

CLEVERNESS AS A COMPETITIVE ADVANTAGE

Dear readers,

One look at our immediate environment is enough to realise that plenty of visions are now very much a reality. Our mobile phones are little multimedia machines, our cars are computers on wheels and we live in smart homes. The logical next step for these intelligent technologies is for them to be used in a smart factory.

At Lapp, we welcome anything smart, or clever. Because cleverness is something we know all about. With our origins in Stuttgart and Swabia, you could say it's in our genes and has been part of the Lapp Group from its inception.

And cleverness is also what is needed to take technologies from our everyday lives and use them in industrial processes. In other words, to build the intelligent factory of the future. If production is going to become cleverer, it needs sophisticated and intuitive components. It needs intelligent networks and they, in turn, need intelligent connection solutions. In simple terms, smart solutions like those that we at Lapp have always been developing for our customers.

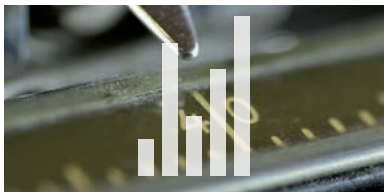
Against this backdrop, I am looking forward to the challenge of Industry 4.0, and I hope you enjoy reading this issue.

With best regards,

Andreas Lapp

COVER STORY

IN FOCUS



THE 4TH REVOLUTION: IT CONQUERS INDUSTRY.

FACTORIES WHERE THE ENTIRE PRODUCTION PROCESS IS INTELLIGENTLY NETWORKED. ADAPTABLE PRODUCTION LINES THAT CAN PRODUCE ONE PRODUCT TODAY AND ANOTHER TOMORROW, ADJUSTING TO RESPOND TO CHANGING CONSUMER NEEDS. HEAVILY CUSTOMISED PRODUCTS THAT STORE THEIR OWN PRODUCTION SCHEDULE. IT SOUNDS LIKE A DISTANT VISION, BUT THIS IS THE NEXT INDUSTRIAL REVOLUTION. AND IT'S CLOSER THAN YOU MAY THINK.

How real this revolution is can be seen by the groups of people who are driving it forward. The people behind Industry 4.0 are not underground agitators, they are established industrial giants like the Lapp Group, working alongside new start-ups and acting hand-in-hand with the worlds of research and politics.

Greater flexibility and the ability to produce unique products manufactured to customer specifications – these are the main aims of Industry 4.0. Overall, it is a principle that will enable companies to produce with greater resource efficiency and more ergonomically, while customers and business partners will be integrated into the value chain much more dynamically.

Greater flexibility means that the old assignment of products to particular production facilities will be eliminated. This means that in the future, plants will not necessarily be built for specific products. Instead, production technologies will be developed so that they can quickly be reconfigured for different products.

AN INTELLIGENT FUTURE

From a technical perspective, the key to making it a reality will be autonomous production facilities and intelligent workpieces. They will store their own production schedule and bill of materials, for example in the form of an RFID tag. In a way, they will know how they have to be built and will autonomously find their way through the production process.

Intelligent materials, clever products and smart machinery – this combination of innovative technologies will shape the future. The result will be intelligent networking of the entire production process. In the not too distant future, it will be possible to manufacture individual product variants in very small quantities, simultaneously creating a much more variable production process.

There is no doubt that this will bring major changes to our current world of factory automation, which is based largely on the hierarchical structures of electrical engineering. There will need to be a shift towards smart factory networks with production facilities that communicate with one another.

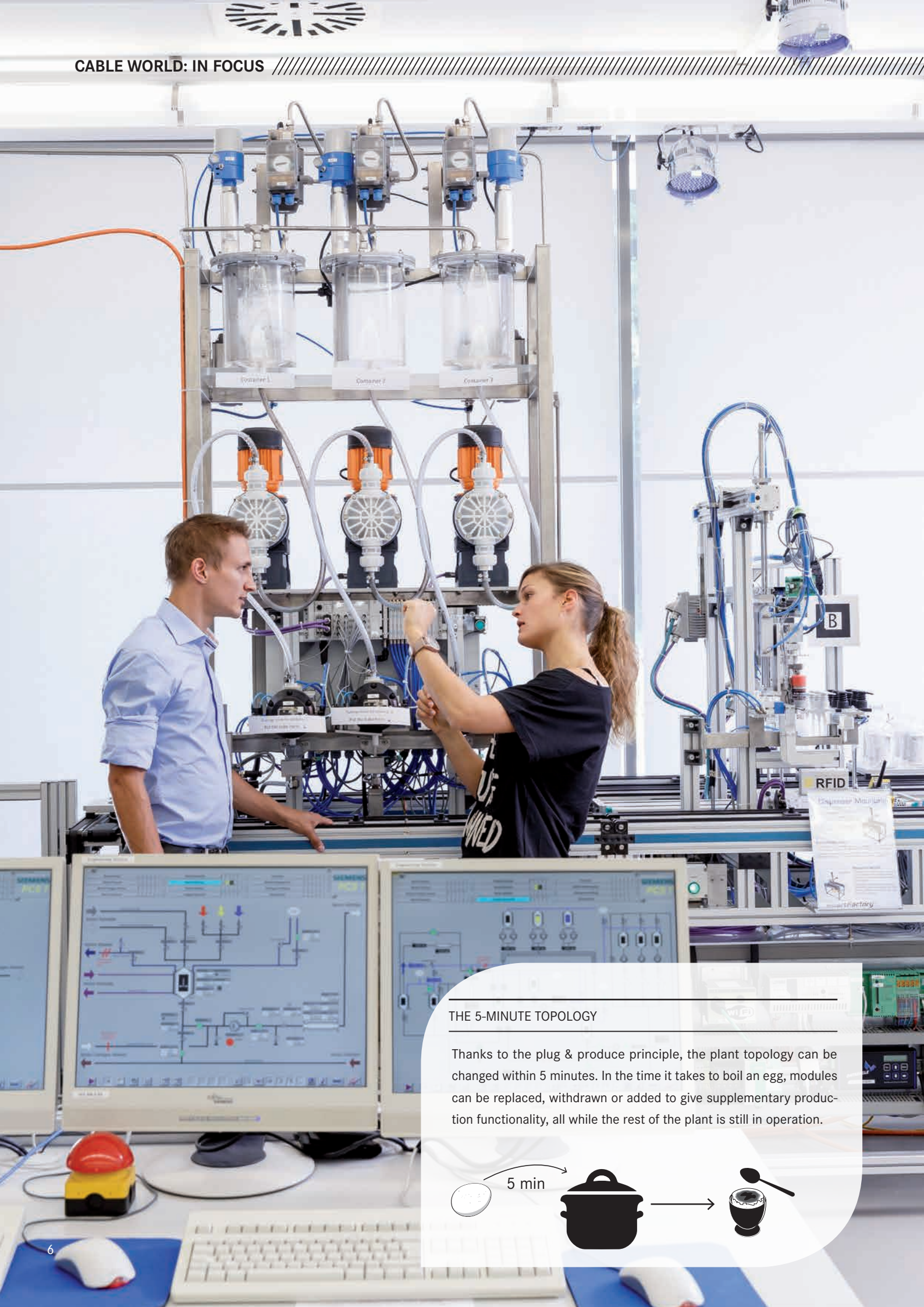
The Lapp Group doesn't just want to be an excited and curious onlooker as this change happens, it wants to help shape it and be part of it. That is why it is actively engaged in developing and testing pioneering products and solutions to meet the increasingly demanding requirements of a changing industrial environment.

INFO BOX – INDUSTRY 4.0

Every revolution has its fathers and its ancestors: The **first industrial revolution** brought mechanical production facilities based on water and steam power.

The **second industrial revolution** refers to mass production using production lines.

The **third industrial revolution** is considered to be the digital revolution, associated with automation using robots.



THE 5-MINUTE TOPOLOGY

Thanks to the plug & produce principle, the plant topology can be changed within 5 minutes. In the time it takes to boil an egg, modules can be replaced, withdrawn or added to give supplementary production functionality, all while the rest of the plant is still in operation.

THE FUTURE FACTORY

ON THE EDGE OF THE PALATINATE FOREST, RESEARCHERS, PRACTITIONERS, ACADEMICS AND INDUSTRY ARE ALL WORKING TOGETHER ON PAVING THE WAY FOR THE FOURTH INDUSTRIAL REVOLUTION. TO SUPPORT THE PROCESS, THE SMARTFACTORY^{KL} RESEARCH FACILITY IS NETWORKING DEVICES TO CREATE AN INTELLIGENT PRODUCTION FACILITY. A VISIT TO THE FACTORY OF THE FUTURE

When those who work here in Kaiserslautern look into the future, they see talking products that tell production what to do. They see industry that produces one-off products. And they see totally flexible and modular production facilities. Here at the German Research Centre for Artificial Intelligence (DFKI), the SmartFactory^{KL} is working on creating this future.

The aim of the research facility is to integrate innovative information technology into factory automation. For instance, technology from tablet PCs, smartphones or navigation systems. These are everyday applications from consumer electronics that can enrich traditional working methods in industry and smooth the way towards much more flexible and efficient factory operation.

This is where the things that sound so exciting in theory are being put into practice. The main aim of those involved was to "establish an actual facility to demonstrate things rather than just talking about them" – as Stephan Weyer, Project Manager for development of the SmartFactory^{KL} demonstration facility explains.

PLUG & PRODUCE WITH MINIMAL INTEGRATION WORK

Neither the plant nor the product reveal their innovative nature at first glance. The product being made is a humble business card holder. The future lies in the detail, and in the modular structure of the plant. The intelligent workpiece finds its own way through the production facility. "You have to imagine that the product is writing a journal during production", explains Weyer.

PAGE 6 – 7 In the SmartFactory^{KL} the future of production is already a reality.


LAPP KABEL
PHOENIX CONTACT
HARTING
Rexroth
Bosch Group

The modules are not linked electronically, mechanically or by communication technology, and their topology can be rearranged at any time. Even while operating, a module could be withdrawn from the plant and another one integrated. This is known as hot swapping. Of course, this level of modularity calls for innovative cabling and connection solutions for data network cables and the rest.

HOW LAPP SEES THE FUTURE

This is exactly why the Lapp Group, as a specialist in cable and connection technology, has entered into a partnership for one production module of the SmartFactory[KL]. The Lapp module is responsible for quality control. And quality and Lapp are things that go together well. The entire cabling and connection technology for the module has been realised using Lapp components. Lapp also supplied the cabling for the backbone of the plant, used to transfer data between modules and for the power supply.

"We want to understand the future", says Ralf Moebus, Lapp product manager for Automation & Networks, when describing the commitment to test Industry 4.0 technologies in a genuine production environment. "The more components we use that are networked and can communicate intelligently with one another, the more systems such as cables will be needed to transfer the data. To this extent, Lapp is playing a key role in the SmartFactory[KL]", says Stephan Weyer.

PROGRESS 4.0

Is the SmartFactory[KL] the factory of the future? And the future of factories? That remains to be seen. But it is definitely the first plant in Europe to provide practical proof that Industry 4.0 is already within reach. Here in Kaiserslautern, the vision is already a reality. This is a key finding for Lapp. "What we have proven here is that we can already connect the things that people will need to connect in the future", says Moebus. Development will not stand still either. As the applications change and develop, we can expect that new Lapp products will appear before too long.

BRIEF INFO – SMARTFACTORY[KL]

The SmartFactory[KL] is a test platform for new technologies, control architectures and components. It is a manufacturer-independent real world research and demonstration facility set up by a network of research institutions and industrial companies. The Lapp Group is involved as a module partner.

THOUGHT LEADER

AS THE ACADEMIC DIRECTOR OF THE DFKI AND CHAIRMAN AND MAIN INITIATOR OF THE SMARTFACTORY^{KL} TECHNOLOGY INITIATIVE, PROFESSOR DETLEF ZÜHLKE INVENTED THE SMART FACTORY CONCEPT AND HELPED BRING IT TO LIFE. WE INTERVIEWED THE TECHNOLOGY PIONEER ABOUT PRODUCTION IN THE FUTURE.

Professor Zühlke, the SmartFactory^{KL} was set up as a technology initiative. Who was the actual person behind the initiative?
The basic concept came about in 2002, when I led a working group on "ambient intelligence in automation" at an event – that is what we would now call "smart technologies". We looked at the first smart homes and, on the way back, we realised that we could apply the same kinds of technologies to a factory.

It all started with an idea. Today, it's an association with 32 members. How do you turn that kind of vision into reality?
You need an overview of what is happening in the world of technology and a clear understanding of the problem. In industry, the essence was that we had to reduce our engineering workload. Things have to be done more quickly. We are under time pressure because we need to produce an increasing number of product variants, in increasingly small quantities and modify them in increasingly short times. We need new solutions to solve the problem.

What drives you personally?
The fact that we have initiated something and the idea has fallen on extremely fertile ground. Not just here, but worldwide. We have taken advances from information and communication technology and applied them to industrial machinery engineering. Then we asked ourselves why do we still need complex engineering and connections to incorporate scales into a machine? Why can't it just be plug & play? Plug it in and the whole thing works right away. This is exactly what we want our plant to show – that this kind of thing is already feasible and that it works.

So industry is learning from IT?
That's right. Let's stay with the plug & play example for a moment. In the past, when we acquired a printer there was a complex setup process, we had to install drivers and adapt the cable. On my own first printer I even had to resolder the connector. Today, I can buy any old printer, plug it in and start using it. That's how simple the future has to be. But simplicity is always based on complexity. On the inside, the systems are certainly getting more complex, but externally they need to have a much simpler design.

What role is Lapp playing in the SmartFactory^{KL}?
Lapp is a very important and active partner for us. They are providing great support in the area of connectivity. It is apparent that new challenges are coming up for connectors and cables. This is because we want to be able to interchange as many things as possible as easily as possible. So we now have cables that carry power current, network, safety engineering and compressed air. Of course, this makes plug & play much easier for the end user.

To what extent does the SmartFactory represent the intelligent factory of the future?
In the future, there will definitely still be many different types of factories, including those that operate mass production. But these old, non-intelligent technologies are no use where we no longer have mass-produced goods, where we need much more customer focused production, in smaller quantities. Ultimately, we can only act effectively in the market if we play to our strengths. And our strengths now lie in high-end solutions. To that extent, I firmly believe we are on the right track.

How does it feel to come in here, press start and see that it actually works.
It's an amazing feeling. We set up the plant in just 7 months and many people were saying it would be impossible. But we have an extremely motivated team and some extremely motivated companies have been involved. So we made it. Now we have to keep the wheels turning. We can't let up. We have to be better and faster than the rest. That is an art.

"THE FUTURE HAS TO BE SIMPLE. BUT SIMPLICITY IS ALWAYS BASED ON COMPLEXITY."

ABOUT

Professor Detlef Zühlke studied electrical engineering and information technology at the RWTH Aachen and did his doctorate in robot programming in 1983. He then led automation projects in aircraft maintenance at Lufthansa.

In 1991 he was appointed Professor of process automation at the University of Kaiserslautern. In 1993, he was appointed head of the Centre for Production Technology and in 1998 he set up the Centre for Human/Machine Interaction.

INTERJECTION FROM CINCINNATI

THE MULTIPLE AWARD-WINNING EXPERT DR. JAY LEE ON THE OPPORTUNITIES PRESENTED BY INDUSTRY 4.0.

Professor at the University of Cincinnati and founder of the Industry/University Cooperative Research Center on Intelligent Maintenance Systems at the National Science Foundation, winner of several awards for his work and the author of numerous highly-regarded specialist articles – Dr. Jay Lee. He holds over 20 patents and registered trademarks. He is regularly invited as a guest speaker and has given over 180 keynote speeches and presentations at major international conferences.

His current research work is focused on information technology involving large data volumes in production, cyber-physical systems and Industry 4.0 systems in production. He gave Cable World his opinion of Industry 4.0.

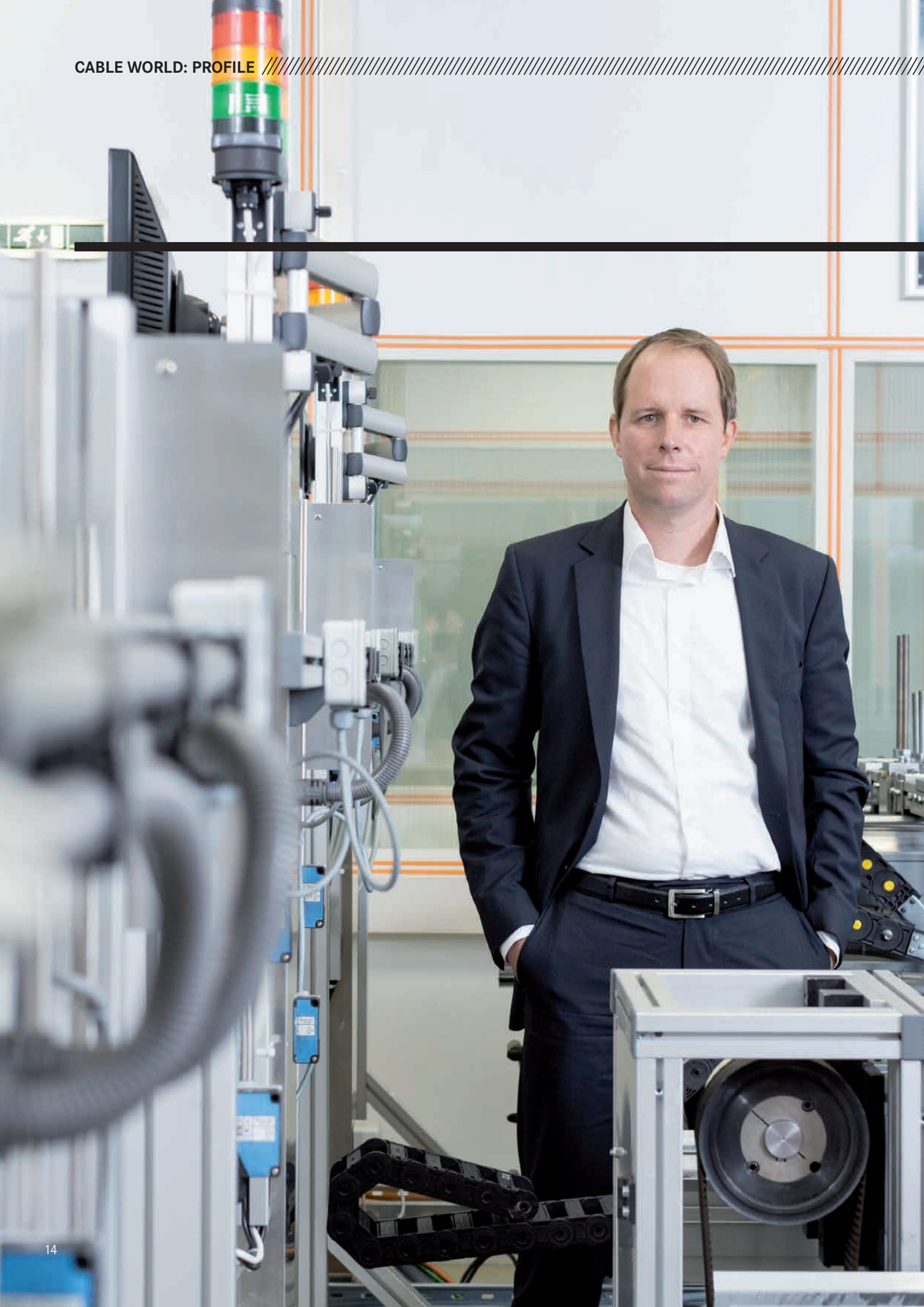
"I think that the current Industry 4.0 initiative in Germany is heading in a very good direction. Industry in the USA and in other countries is still finding it hard to understand the true value of Industry 4.0.

I think we need a clear message, which has yet to be developed, to clearly address what is actually lacking in industry currently. It's not just about the requirements for a plant or its intelligence. Industry 4.0 is really about improving performance of the plant, of the factory and ultimately of industry as a whole. In the Internet of Things there are huge data volumes and just as many invisible sensors. How can we integrate these smartly to analyse, forecast, optimise and reconfigure plants, with the aim of achieving minimal down times and maximum productivity? This is the biggest benefit of Industry 4.0.

In simple terms, Industry 4.0 is all about intelligent plants that have a kind of self-awareness, that can produce their own forecasts and establish their own relationships - and also redesign and optimise themselves. It is all about this added value, which will not only help people to reduce and avoid problems, but ultimately will bring innovation and productivity and contribute to a greater focus on service."

You can find the video on our "Lapp Group" YouTube channel.

"The biggest benefit of Industry 4.0? Almost no downtimes and maximum productivity."



"WE WANT TO STAY AHEAD OF THE MARKET"

OFFICIALLY HE IS "PRODUCT MANAGER, AUTOMATION & NETWORKS" AT LAPP. BUT HIS BUSINESS CARD COULD ALSO INCLUDE "INDUSTRY 4.0". RALF MOEBUS PREDICTS THAT: "IN THE FUTURE, WE WILL SEE MUCH MORE NETWORKED MACHINES."

For Ralf Moebus, the Internet of Things is not hype, it is just a question of time. It is linked to the exciting question of how networked will individual devices actually be in production in the future? And what added value can this generate for users and customers? Industry 4.0 is the industrial engineering graduate's main focus, and he sees plenty of new challenges ahead.

There will no doubt be big changes in machinery and plant engineering. "As a cable and connection technology specialist, it is crucial to us to understand the environment our products are used in. This is the only way we will be able to develop optimum solutions for our customers", says Moebus.

This also means not just keeping an eye on the latest research but being actively engaged in it. The "smart factory" is the key. "We want to be able to respond quickly to trends and not wait until the customer asks us for a solution. We want to be ahead of the market", is how he describes the challenges facing Lapp.

That is why he and his colleagues are paying very close attention to the way data network cables are going in the future. And where they will end up. "For example, if a motor has a direct network connection, that means that the data network cables will look different."

MISSION ADDED VALUE

He proudly reports that Lapp already has solutions for tomorrow's factory in its portfolio, including field bus and Industrial Ethernet cables, fibre optic cables and the appropriate connections. Moebus emphasises the integrated approach, the fact that customers get not just individual components but complete answers – even a fully assembled plug & play solution. He sees Lapp increasingly as a "one stop shop" where the customers describe their requirements and he and his colleagues find the solution, and provide the customer with comprehensive advice, knowing what goes together and which will be the optimum solution for that particular requirement. The way that customers order their products from Lapp and store them in the future is something else that Ralf Moebus believes will change significantly. "This will also become smart", he predicts.

He is certain that there are ways for this process to be simplified, automated and accelerated. "We are constantly working on the speed with which we can supply the cable to the customer. There are lots of new ideas in this area. We are also looking closely at our internal processes and how we can make the best use of Industry 4.0 ourselves. The key is to ensure that customers always get added value and that we make their lives a little bit easier".

THE ORDERING DRUM

THE EXTENT TO WHICH INDUSTRY 4.0 CAN ALREADY EXIST IN A COMPANY IS SHOWN BY THE FACT THAT LAPP IS WORKING ON A MINOR REVOLUTION – A DRUM KANBAN SYSTEM. IT REPRESENTS NOTHING LESS THAN THE END OF LABELS AND THE ADVANCE OF SMART BUSINESS.

"But it needs to be possible to organise material flows in production on a supermarket principle. You take the goods off the shelf, the gap is detected and refilled." That is how Taiichi Ohno, the Japanese inventor of the Kanban system, described his idea in 1947, but it is more relevant today than ever. This thinking is what shapes the smart factory 4.0.

Madlen Bärlin, responsible for planning of logistical services at Lapp, and her colleagues are working on how this principle can be applied to a cable drum. "To guarantee continuous availability of the required cables for our customers and to simplify the ordering process, we have developed the drum Kanban system".

This is designed to ensure that the required quantities of products are always in stock. It is done by attaching a label to the cable or shelf. Lapp then provides the customer with a hand scanner. As soon as stocks are running low, all they have to do is scan the label and this automatically triggers an order. The system means that the sight of employees dashing around the warehouse with a paper and pen, noting down item numbers and meterage and then typing the details in manually will be a thing of the past.

REIMAGINING THE STATUS QUO

That's how things are today. But Lapp would not be Lapp if efforts were not being made to find further innovations in this area. The next stage in drum Kanban will be a cable drum that automatically detects when the reorder point is reached – a drum that actually orders its own replacement.

For customers, this system will not only mean increased convenience. It will also ensure stocks and reduce capital commitment.

"We are testing possible implementations and methods, developing our own ideas and analysing solutions in detail", Madlen Bärlin reports. This involves planning, calculation, research and testing. Whether the reorder point will ultimately be detected based on weight, distance or mechanically is a trade secret that the young employee is keeping close to her chest. However, she is convinced that the intelligent cable drum that detects current stock and automatically reports, is not a distant pipe dream.

"In a few years, it will be a reality", Madlen Bärlin declares confidently. She should know, after all she and her department are on the way to making it happen.

ORDERED IN 5 SECONDS, DELIVERED IN A FEW HOURS.

An order made using a hand scanner takes just 5 seconds – from the shelf to the Lapp ordering department. If it happens before 18:00, in most cases the goods are with the customer the next working day.

4.0 – THE BOTTOM LINE

STRONG GROWTH PROSPECTS

The brave new world will bring great new efficiency. The German Academy of Technical Sciences acatech estimates that Industry 4.0 will enable companies to increase their productivity by **30 percent**.

AUTONOMOUS MACHINES

In the 4.0 era, it will be the machines themselves that independently retrieve updates or new data records for a particular material. By **2020** as many as **50 billion** of these intelligent machines could be linked to one another, according to an estimate by industry associations.

REVOLUTION AS AN OPPORTUNITY

Many experts believe Industry 4.0 is the only logical response to some sobering figures: In the past 20 years, European industry has lost more than **10 percent** of its market share worldwide. At the same time, emerging nations have doubled their market share, which now stands at **40 percent.**

INTELLIGENT ENERGY

This is another exciting application: An intelligent energy supply in which the power supply detects in real time where, when and how much energy is being consumed. The provider China Southern Power Grid is already using **1 million** wireless modules. There is no need for manual meter reading, saving a total travel distance of around **80,000 kilometres.**

INTERNET OF LARGE NUMBERS

Billions of things, trillions of dollars. The Internet of Things will network billions of devices. According to analysts' reports, this will generate added value of **1.9 trillion** dollars across various branches of industry. (That is a number with 12 zeroes.)

THE FACTORY OF THE PRESENT

The factory of the future is already a reality. A survey of 100 companies in Germany revealed that **one fifth** are already using the Smart Factory concept for a production facility. Every second company is planning to do so in the future.

GOOD EMPIRICAL FIGURES

If you ask companies that already have some experience with networked factories for the biggest benefits of the Smart Factory, **52 percent** cite improved quality, **43 percent** greater flexibility, **38 percent** increased productivity and **44 percent** an increase in turnover.

HURDLES RACE 4.0

Many entrepreneurs believe there are lots of hurdles preventing Industry 4.0 from becoming a reality. **36 percent** cite both data security and the financing of implementation, **33 percent** fear the breakdown of established processes and structures, while a similar proportion believe the technologies involved are not yet mature enough.

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