FUJITSU

Whitepaper
Transforming Manufacturing: Co-creating the digital factory

Contents

6am in Augsburg, Germany

As the Bavarian sun peaks through the clouds of a chilly November morning, the shift at Fujitsu's state-of-the-art digital factory in Augsburg is changing. Workers greet each other as they change places. There's a constant, low hum that reminds you that this is a place where thousands of products come off the production line – and many are built to precise customer specifications. But, at first sight, you can't quite grasp just how vast the facility is.

The numbers tell their own story: 11,000 work place devices – from tablets to desktop computers – are assembled here each day. 1,000 server and storage products, 50 racks and 9,000 systems or add-on boards for both Fujitsu's own branded products and those of other OEMs. The 55,700 m² Campus Augsburg has a 10,000 m² of logistics area and 25,000 m² of assembly and testing areas. It's supported by a 4,500 m² dynamic data center. It's the future of manufacturing made real on the outskirts of a beautiful and historic town.

And it works hard. Not just to produce the products that Fujitsu sells across Europe, but to prove a point: the future of manufacturing is digital, and it's real. It can be delivered by the people who have a proven track record in doing just that: turning theory into practice and overcoming the challenges that face manufacturers all over the world. Because Fujitsu is a manufacturer as well as a company that consults with customers to digitally transform their organizations, their real-world experience is far more valuable.

Smart production by design

The entire manufacturing value chain has been brought together in a campus at Augsburg. The development of manufacturing techniques and technologies as well as Fujitsu's products takes place here, right through to interactions with customers. IT and OT are at the heart of it all. And the innovations on offer are path-breaking. For instance, Fujitsu created an interim storage facility, dubbed 'The Supermarket' where components are sorted and stored in individual pallets ready for that day's specific production. E-Ink based displays at each trails show workers which components go together, and a 'logistics train' takes each set of components to where they need to be exactly at the time they are to be assembled. Everything is done in sequence. Each production cell gets all specific parts they need when they need it. It's more than 'Just in Time' – it's 'Just in Sequence' – and, it all just happens.

The whole process is digitally supervised. Applications and systems that have been developed to ensure that not only does the factory produce products at speed, and at the right quality and price – just like any competitive manufacturer should – but also showcases Fujitsu's pioneering approach to manufacturing. If the company is to advise manufacturing clients about how to transform their operations, then being able to show practical proof points of success marks Fujitsu out from the competition.

Understanding the challenges by sharing them

Manufacturing has always been the engine of industrial revolutions. The need to make more goods faster and cheaper has driven economic development for centuries. From steam to electricity to digital, manufacturers have tailored technological innovation to deliver progress and productivity.

The basic challenge of manufacturing is the balance between the human worker and the machines they use. Over the last century, from the introduction of the continuous production line through to the rise of robotics and the coming of digital, that challenge remains: how can machines support human workers to carry out ergonomically difficult tasks, or free them from having to do them so they can become more skilled at the things that humans are better at doing? Solving those dilemmas must be an evolutionary process. Change can't be abrupt. It must be managed and staged.

And that's the first challenge that faces a modern manufacturer. The pace of change. How fast do you need to go? As Thomas Rohrbach, MD of German company, Staufen, put it, "More and more companies are realizing that Industry 4.0 is not about building a complete smart factory from scratch overnight, rather, carefully tackling the theme as a whole."[1] GE Digital's Chief Commercial Officer, Kate Johnson, agreed: "The trick is... dealing with two modes at a time. We have got to get used to living in two modes for some time."[2] The two modes are the long cycle development and inflexibility that characterizes most legacy architecture, and the emerging mode where a cloud-based approach delivers the increased flexibility and agility which comes from Industry 4.0.

Industry 4.0 is a term that's gaining traction. It describes the Fourth Industrial Revolution. It could easily be just another buzzword, but within the manufacturing sector it's taken very seriously. It actually means something very concrete. Though predictions about how the future vary, there's a definite understanding amongst manufacturers that this is no time to wait to see how things play out. As Ian Isaac, MD of Lombard put it, "It's easy for [us] to focus on what needs doing today and it is a challenge to find the time to think about the future. However, if that time isn't set aside the future has a habit of catching up on us."[3]

Time to harness the future, time to think 'cloud'

It's no surprise that much of Fujitsu's own digital factory is cloud-based. The ability to process and analyze data as well as store it in the cloud and make it instantly available for real-time decisions and adjustments to the production process is key to achieving agility and flexibility. The challenge is to ensure that you make cloud work for specific needs.

It's the only way to not only enable digital, but to harness its benefits swiftly. Mastering 'real-time' is key. "Connecting industrial machines to the Internet through the cloud is a huge step toward simplifying business processes and reimagining how work gets done," said GE's CIO, Jeff Immelt.[4] His statement echoes the entire history of manufacturing. That worker-machine interaction. It's what Henry Ford did when he broke up the established process of making cars and introduced the continuous production line. And in the 1950s business school professor, James Bright, testified to the US Congress that the future of manufacturing depended on enabling machines to talk to one another so that products could be made cheaper and more efficiently; "We need to build human skills into machines," he said.[5]

We are building those machines, and the machines are also capable of learning from 'experience' and the cloud facilitates a new era in digital manufacture. McLaren Technology Group's CIO, Craig Charlton, outlines the challenge comprehensively: "We want more focus on digital transformation through cloud-based products to remove legacy, improve compute performance and rebalance capex and opex costs. We need to focus more on mobility as we have a growing global footprint and a mass deployment of mobile technology. In terms of the core we need to renovate technology platforms in areas such as design and engineering, manufacturing, finance and HR, and leverage SaaS solutions."[6]

What Charlton's comment highlights is the need for a comprehensive transformation of the entire business – from technology to, importantly, culture and work practices. The interface between people and machines. If machines talk to each other, then people still need to be in the loop.

People and machines at the heart of automation

The rise of Artificial Intelligence, Augmented Reality and machine learning is delivering automation in areas that used to be considered untouchable by technology. This is causing people to worry for their jobs. Manufacturing has been at the forefront of automation for three hundred years! It's a sector that should understand the balance between people and machines, and how to ensure that they complement each other.

The rapid adoption of robots within factories is well documented. It's been a process of continuous development and fine-tuning. But the challenge of matching human skills with what machines are good at will only get more complex as the software becomes more intelligent and self-supporting.

At Augsburg, Fujitsu works hard to ensure that its people feel valued. The point is to be clear about what a machine can and should do, and what value a human can contribute to the manufacturing process. The reduction of 'heavy-lifting' work has always been important. The introduction of robots enabled workers to become more highly skilled and focus on tasks that are uniquely human.

"We use smart robots... where there are ergonomic issues, ultimately creating a safer environment for workers and it gives them time back to focus on other, more important tasks," said Gregoire Ferre, Chief Digital Officer of Faurecia recently.[7]
The approach can be characterized as 'side-by-side' for the benefit of everyone. The fact that machines (be they robots or software) are seen to complement and support people, is an important mindset. "Robots working together with skilled workers in hybrid teams will care for future growth," commented Dr. Wolfgang Wahlster, CEO and Scientific Director of the DFKI.[8]

Again, the use of teams on the factory floor is not new, but the addition of new technologies is transforming how those teams can work and react to real-time demands of a fast-paced market place. "Whilst today, robots are mainly operating in demarcated production cells with a severely limited activity range, the new robot generation are in full contact with their human colleagues, both parties often working hand-in-hand," said Dr. Olaf Munkelt, CEO of MVTec Software GmbH.[9]

That's a great definition of a 'hybrid team' – and the word 'team' is of vital importance. It suggests co-operation and balance between human skills and that of the technology. At Camp Augsburg, the technology isn't seen as the most important part of the production process: it facilitates human ideas and objectives. The technology serves human needs: of workers, management and, of course, customers.

Stefan Aßmann, Head of Automation at Bosch, described how it should work: "Our employees use a tablet or smartphone on the workshop floor and receive a text from the machine, telling them what happened and how to fix the problem. If a machine needs a spare part, the employee simply scans the corresponding barcode and the part is ordered online. [...] Human's helping machines – and communication between man and machine – is already normality."[10]

Employees should be the focal point of digital transformation

"Every industrial revolution so far has changed jobs, but the amount of work in the world has always gone up. If we play this intelligently together, the fourth industrial revolution also will create work. It's our responsibility between enterprise, education and government to take the people with us," said Ulrich Spiesshofer, CEO of ABB.[11] He's right. The challenge for all manufacturers seeking to harness the power of digital is to take their people on the journey and ensure they get as much out of it as the enterprise does.

That takes communication and training. "Employees must be intensively trained, [they] often do not understand why machines are now able to communicate with one another. Today, it is necessary to explain why machines can self-regulate in the context of Industry 4.0." stated Kai-Oliver Schocke, Deputy Spokesperson of DSAG.[12] The information that employees received needs to be tailored to their specific needs – it has to be valid for the task in hand. That's the only way to avoid problems on the production floor, as well as to ensure that productivity per employee rises along with their commitment to their work.

In the end, each worker is an essential part of the manufacturing process. Innovation and quality are dependent on people as well as machines. People have ideas; machines don't. So, by making the production process faster and more agile through automation, people can be freed to add value via their human skills: ideas, creativity, teamwork and problem-solving. The technology supports them to do that. Ultimately, that's what makes the difference in terms of customer experience and service.

Digital must be focused on ensuring the best customer experience and service

Digital does make a difference to customer service. At Campus Augsburg, customers can provide exact specifications for what they need, and digital shop-floor data management 'Smart Factory' solutions boost both the transparency and quality that's produced, as well as cutting costs. The data is always current. It's what both the machines and the humans need to deliver what the customer wants.

Manufacturing has been moving to a new business model for some time now: known as 'Servitization' sees manufacturers matching their offering to the precise needs of customers as they change in real-time. It also enables production lines to offer subscription services. That is, customers can use goods and pay for their output and their uptime.

Manufacturing is evolving from the mass production of goods to an era in which they can be tailor-made and produced to order. Customers can customize each product as and when they need to, and the production line can cope with those demands in real-time.

To respond to that growing trend, manufacturing companies are evolving fast to adopt Industry 4.0 standards which will enable them to take unique specifications and ensure that what the customer ordered comes off the production line exactly as they want it to. And that can be in any batch size: the ultimate objective is Lot-size-1.

Ulrich Huggenberger, CEO of Xitaso stated: "With fully automated, networked and customizable manufacturing, the well-known saying, "Do-It-Yourself", is gaining new significance. What was once the prerogative of the craft industry will soon be the standard for every manufacturer: the individual product."[13]

The rise of the Internet of Things (IoT) is ensuring that servitization can be applied to a range of manufacturing concepts. The machines talk to each other and keep track of output as well as any underlying or developing faults. That then aids the subscription model as well as ensuring predictive maintenance so that downtime can be avoided.

Security worries everyone

The vision of a digitally enabled future for manufacturing is a compelling one. But, whatever stage a company has reached on its digital journey, security is always high on the agenda. Cyber-security must be at the heart of any roadmap. The advantages of cloud, AI, IoT, and all other aspects of seamless connectivity across the entire supply chain could be outweighed by the vast 'attack surface' that they represent.

"Industry 4.0 only works with an integrated and sustainable security approach. In particular, the growing connectivity between individual machines attracts attackers to penetrate weak points and to disrupt production processes in such a way that immense damage is inflicted, or so that important information falls into the wrong hands," wrote Oliver Winzenried, Partner and Co-Founder of Wibu-Systems. Robert Holmes, Vice President of Products at Proofpoint, agreed: "The irony is that manufacturers are in reality a prime target, not just in terms of the value of the assets that they have exposed to cybersecurity risk, but also the velocity of their transactions – a velocity that means that there's a higher chance that a cyberattack might be successful. [...] When looking at manufacturing businesses, attackers see opportunities to help themselves to both cash and data."[14]

The challenge is to build operational networks that can be protected properly but without the security measures compromising the manufacturer's every day production. Balancing the two roles of IT – enabling production and protecting its security – must be a priority. One cannot outweigh the other. But, security cannot be taken lightly. It's a dilemma all enterprises must face.

Professor Detlef Zühlke, Chairman of the Board at Smart Factory KL has definite advice: "In order to be able to use cyber-physical production systems without interruption, "Security by Design" must be taken into consideration during the planning phase. Sabotage and industrial espionage can be avoided through this strategy only."[15] Whilst The Open Group identified the pain points associated with that effort. Their CEO, Steve Nunn, summed them up; "The high capital costs of replacing and refreshing systems, the lack of software portability, the need to build advanced cyber security, and the current inability to use third-party components to get the best of breed – are common across all industries."[16]

Questions about the best cyber-security measures to take so that production can be seamless as well as protected will continue to be difficult to answer. But, you need to make the most of digital now. So, the challenges must be faced and that takes collaboration with a partner that truly understands the choices involved.

Fujitsu: we are a manufacturer

Our creation of an end-to-end connected digital factory to make our own products has been of immeasurable benefit, not just to us, but to our customers in the manufacturing sector. We work with leading cyber security vendors, for instance, to ensure that our own operations (some very sensitive) are protected as much as possible. Cyber threats are evolving all the time, so constant vigilance and agile development are important. We are at the frontline of the issue, and our experience is helping our manufacturing customers deal with the world as it is – and will be.

And that goes for all other aspects of the digital factory. The fact that we have built our own, fully functioning manufacturing and operating environment using cutting edge technology and connectivity means that we understand the new relationships of the digital age: between people and machines, customers and producers, and those that threaten our security.

This whitepaper has surveyed some of the key challenges you face. There's much more to talk about. Let's share our experience and co-create solutions that suit your specific needs.

Sources

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