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Nokia's
'conscious'
factory of
the future

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Nokia's 'conscious' factory of the future



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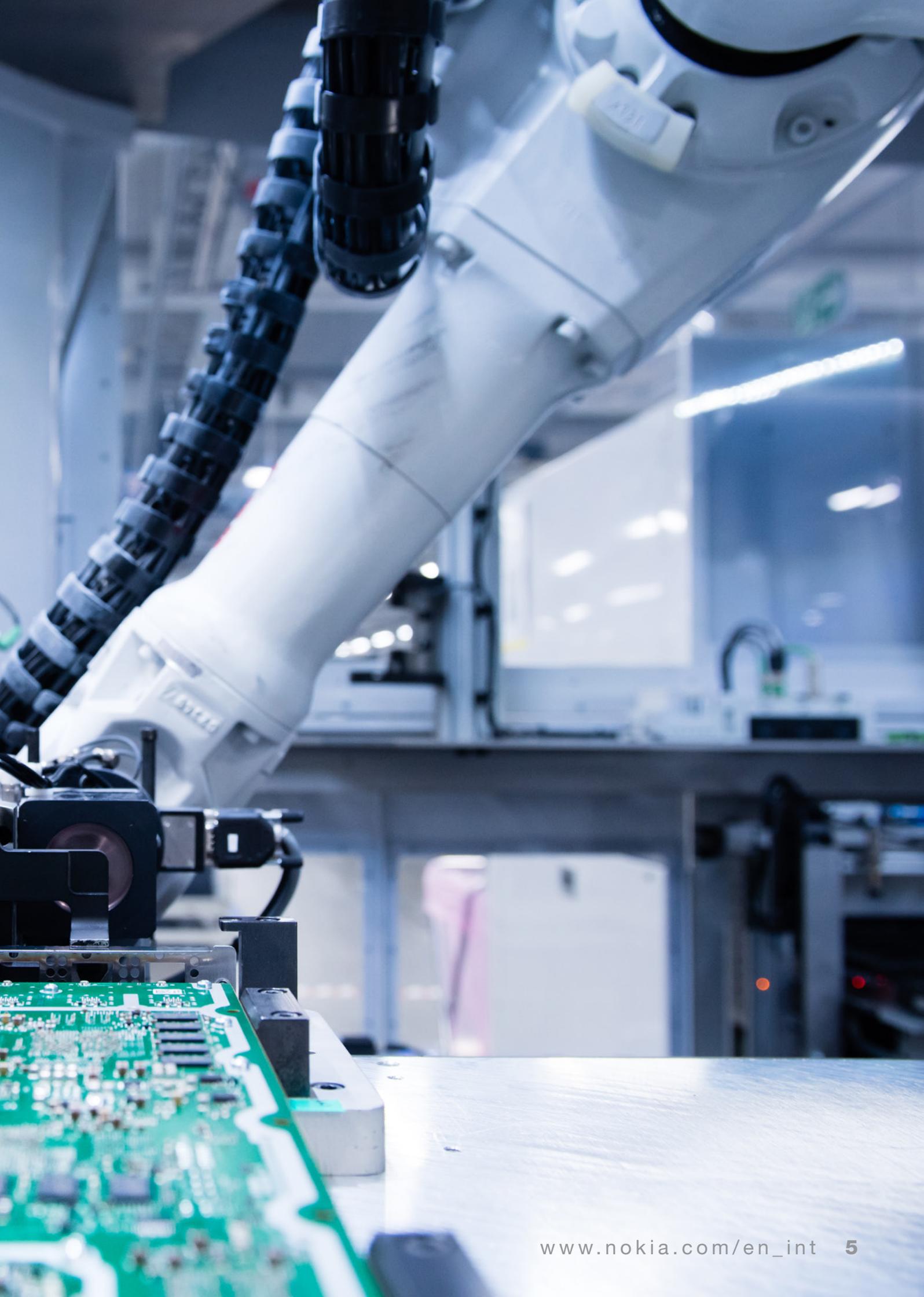
NOKIA



Unveiling its groundbreaking ‘conscious factory,’ telecoms giant Nokia is truly ready for the fast-changing manufacturing needs of the future

Several years ago, Nokia set itself an ambitious objective: to envision and create the ‘factory of the future’. Fast-forward to today and the telecoms giant has made this distant future a reality with its state-of-the-art concept – ‘the conscious factory’.

With every industrial revolution, factories have evolved to create something unlike anything that has come before. Now, in the midst of Industry 4.0, analytics, robotics, and 3D printing are just some of the emerging trends that are redefining the manufacturing space at large. By harnessing the potential of these technological trends, Nokia’s



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“It’s a complete
game changer”

Johannes Giloth (left), Senior Vice
President of Global Operations and
Chief Procurement Officer at Nokia



Conscious Supply Network is ushering in a new era of supply chain transformation and battering down the hatches for Supply Chain 4.0.

Nokia's vision was a simple one: to transform its factories into 'the conscious factory' – an agile and intelligent manufacturing service that is fully-automated, green, self-learning, and able to predict and prevent supply flexibly.

To make this hi-tech network a reality, the Finnish giant zeroed in on four crucial areas: digitisation, analytics, robotics and transparency. It leveraged tools such as cloud computing, Internet of Things (IoT), analytics, machine learning, robotic process automation (RPA) as well as augmented and virtual reality. In doing so it has created an end-to-end supply chain solution that is more visible, adaptable, and smarter than anything before.

A conscious supply network

It has been a mammoth task for Nokia, but it is one which the team believes will revolutionise manufacturing forever.

“In former times, if you outsourced a factory it was like a black box,” explains Johannes Giloth, Senior Vice President of Global Operations and Chief Procurement Officer at Nokia. “You placed an order there and waited until the delivery arrived but, in between, you couldn't see anything. With our conscious factory, I can see in real-time



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Taco Zwemstra, Senior Vice President and Chief Operating Officer: "With our balanced mix of in-house and external manufacturing, supported by state-of-the-art planning and execution tools, Ampleon is prepared to embark on the next journey towards greater customer collaboration and support."

Arttu Ollinaho, Global Key Account Director: "By closely collaborating with Nokia, the flexibility of the entire supply chain is being significantly improved. This increased flexibility and an overall lead-time reduction are needed to meet the volatile market requirements and to speed up new technology developments."



TRANSFORMING THE SUPPLY CHAIN FOR BETTER CUSTOMER EXPERIENCES

Ampleon, being a young company with a long history in RF Power, has had the ideal opportunity to transform its supply base and supply chain operations. Following the carve-out from a large company, the establishment of an independent company created many challenges, but also many opportunities which allowed us to improve the support for our customer base.

First and foremost is the ability to transform our previous in-house manufacturing to a balanced combination of in-house and external manufacturing. Partnering with leading companies, leveraging their strengths with our needs, offered us the chance to optimize our supply chain. Our own in-house back-end manufacturing gives us the flexibility and quality to launch key technologies which help to boost our business.

Secondly, we have had the opportunity to redefine our IT landscape and advance our business processes and associated tooling. Choosing state-of-the-art business planning and supply tooling will enable Ampleon to become even more flexible with the aim to further grow our business with our key customers. Ampleon has embraced "Partnering for Success" as one of the key business drivers towards future growth. Together with our customers, suppliers and R&D partners, and with a next step in supply chain excellence and system support, we are well on our way.

Nokia is a leading customer in the Mobile Broadband business, purchasing high volumes of Ampleon's Radio Frequency Power Amplifiers (RFPA) for 4G and 4.5G base stations.

Examples for 4G RFPA high volume parts:



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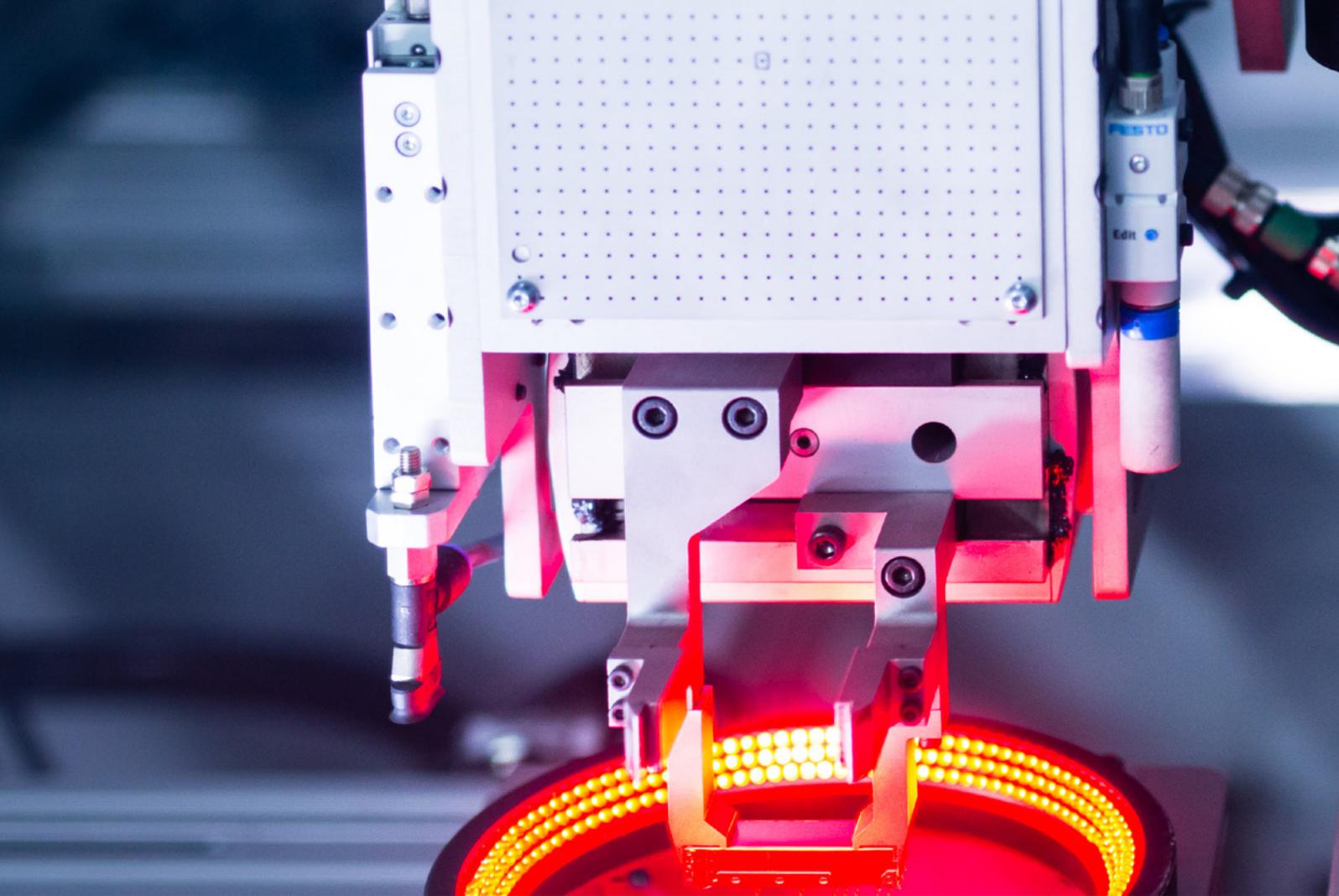


BLC9G20XS-400AVT

As Nokia's business is moving towards 5G, many business opportunities are linked to the multitude of new 5G frequency bands. These 5G products require complete new RFPA technologies for various power levels and frequency bands. At the same time, the speed of development and technology creation in the entire supply chain is challenged: the even more complex new products must be available way faster than before. This requires high attention to the overall lead- and cycle times within the global supply chain. The way towards a massive MIMO (Multiple Input Multiple Output) type of Base Stations in 5G requires scalability in volume capacity and an adjustable supply chain more flexible than ever before. This can only be achieved when supplier and customer are partnering for success.

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what happens in each factory and I can optimise the process.

“It’s a complete game changer.”

With over 30 factories worldwide, Nokia’s supply chain is a far-reaching one spanning several continents. However, the Finnish company only owns three of these factories with the rest being outsourced. Instead of focusing on owning bricks-and-mortar, Nokia is concentrating on owning the information, the data, and knowledge behind it. By understanding how the industry is connected together, the

organisation is creating a conscious supply network, an end-to-end ecosystem built on end-to-end understanding and knowledge.

“Only three of our factories are owned by Nokia because we have not been focusing on manufacturing, we have been focusing on managing a manufacturing network,” observes Giloth. “I only can manage this network if I have data. I don’t care about owning the equipment, but I care about owning the data.

“We are putting thousands of sensors in our factories and



*Nokia has more than 30
factories around the world*

connecting all our manufacturing and logistics assets together so that they can talk to each other,” he continues.

“With that, we are creating what we call a ‘conscious factory’, where all transactions are visible in real-time in a controlled centre. With that, you can optimise throughput, inventories, quality, and you can apply machine learning to it. It helps you automate the entire process, it helps you ensure quality, it helps you to reduce cost in inventories, and it helps you be more flexible in adapting your supply chain. But having one conscious

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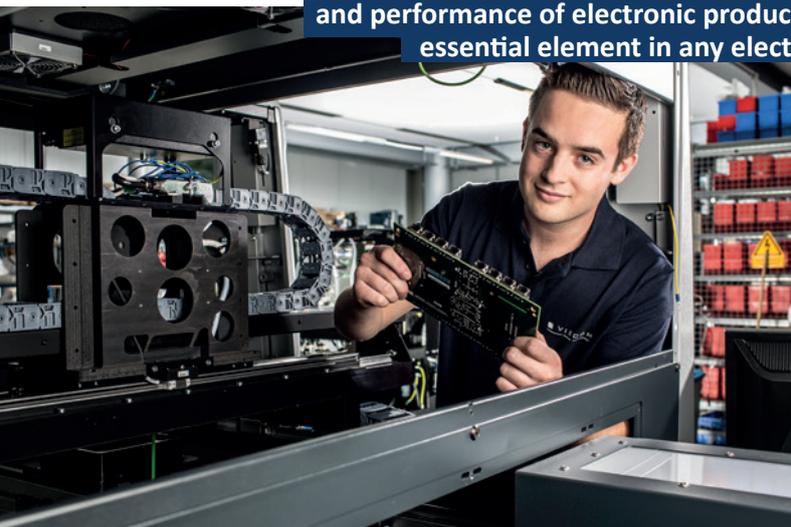
The portfolio comprises automatic optical inspection, solder paste inspection as well as automatic and manual X-ray systems with

micro-computed tomography. The offer also includes solutions for conformal coatings and wire bond inspection. Thus, all inspection gates are covered by a single source.

Suppliers to the automotive industry make up the largest customer group. Viscom also has well-known purchasers in other industrial branches such as consumer electronics, aviation and aerospace, medical technology and industrial electronics.

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The quality of PCBs plays a crucial role in the implementation of functions and performance of electronic products. Thus, Viscom's PCB inspection is an essential element in any electronics manufacturing process.



factory is just the start of it. We want to create an entire network.”

Presenting the ‘factory in a box’

This is just the beginning of Nokia’s vision for the future; it is also resigning the idea of large manufacturing locations to the past. [Unveiling its ‘factory in a box’](#), Nokia is anticipating the fast-changing manufacturing needs of the future, by creating a conscious ‘Lego’ building block factory.

Offering unparalleled flexibility and agility, this factory in a box aims to revolutionise today’s factory floor. It can be transported to the location, build the necessary volume for ‘country of origin’ requirements and can be moved again as needed. Agility is a factor which can make or break a company, especially in the telecoms industry, and so the factory in a box could be instrumental as it allows product prototypes to be quickly created, tested and fixed if necessary. What’s more, if a site is hit by a natural disaster, critical customer orders can still be achieved

“Having one conscious factory is just the start of it. We want to create an entire network”

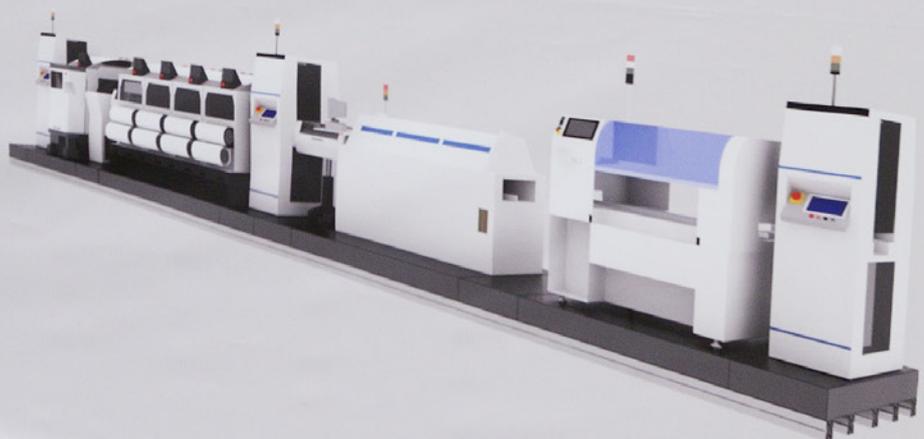
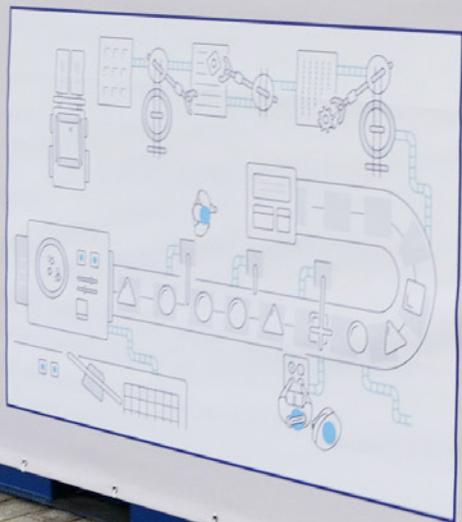
Johannes Giloth, Senior Vice President of Global Operations and Chief Procurement Officer at Nokia

quickly with a portable factory.

“It is a step towards a modular supply chain factory,” says Giloth. “A big problem in the manufacturing space is that R&D and manufacturing should be close together because then you have an immediate feedback loop.

“Every time I have a factory request, whether it’s in Nigeria or elsewhere, I cannot create a factory there and demolish it after a year. With the factory in a box, you can ship that modular container there, produce

Conscious Factory in a Box

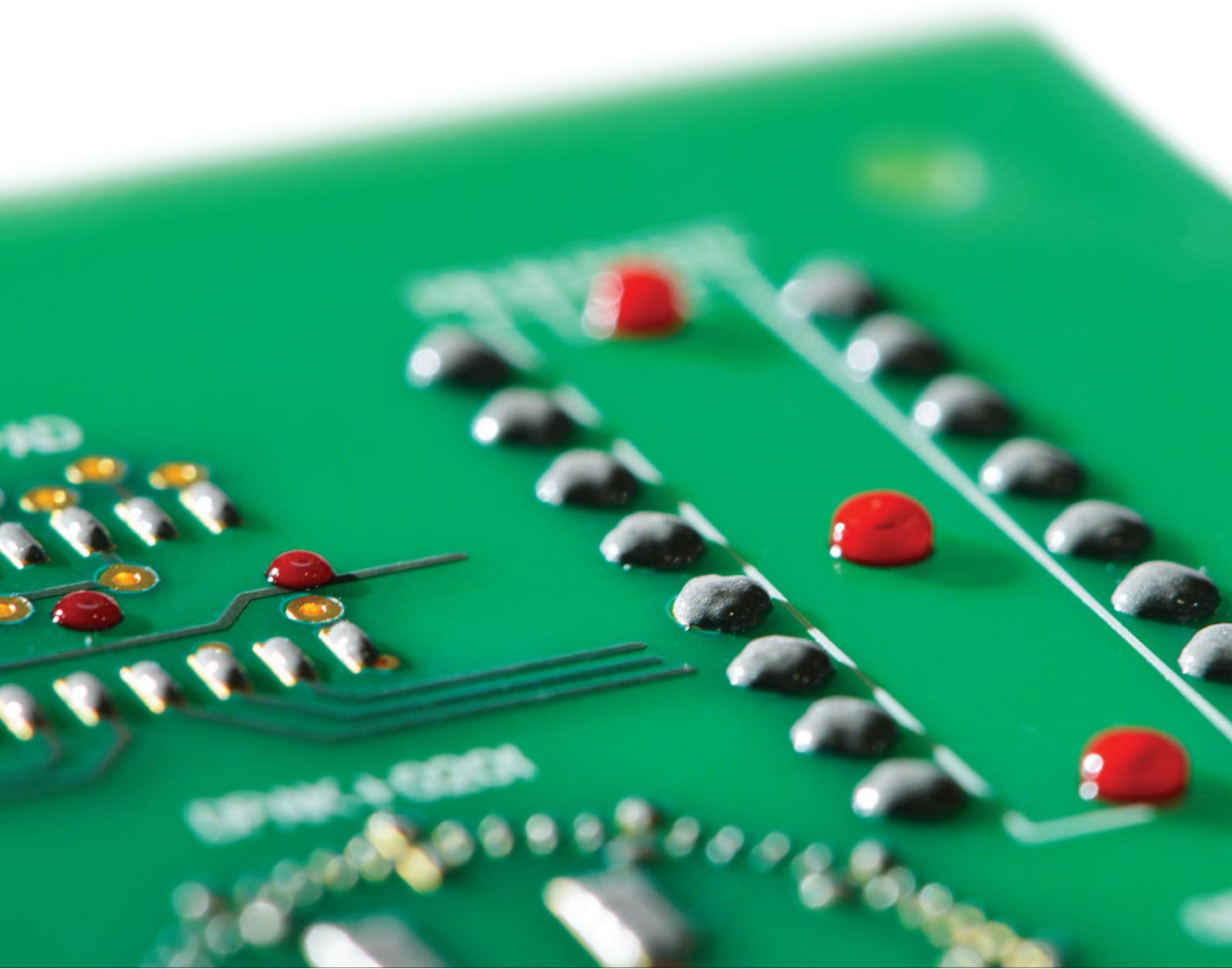


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Whatever your ambitions, the future is already here. In fact, it's just in time.



the product and when it's ready for mass production, you go elsewhere.”

A global company with a local focus

“This will not only transform the supply chain landscape at large, it will also create opportunities for unique regional players,” explains Bo Jensen, Head of Delivery Operations Asia Pacific & Japan at Nokia.

“If we look at it from a local perspective, it also allows us to adapt to local requirements, so this would be advantageous for regions such as Indonesia, for instance, where there's a lot of discussion about local content and requirements. It creates a lot of flexibility and it also provokes our customers to take a bigger step,” he comments.

Sitting in Nokia's gleaming regional office in Singapore, Giloth and Jensen passionately bounce back-and-forth as they talk about the latest exhibitions where they will showcase this ground-breaking concept. Sitting in the epicentre of the bustling business district, Nokia

has firmly cemented itself as a major player in the manufacturing space. The ‘conscious’ factory may have seemed futuristic but it is possible - and Nokia made it happen.

However, this state-of-the-art concept didn't come about in an instant. It is the result of over a decade's work, and it is just one step in what has been a complete root-and-branch transformation of Nokia.

A high-level supply chain transformation

On this journey, the organisation faced three successive challenges that created what Giloth called an ‘existential moment’ for Nokia – one which would bring about one of the biggest supply chain transformations in the industry. In the past two years, Nokia jumped from 101st to 15th in Gartner's Top 25 Supply Chain ranking, an extraordinary turnaround that the research firm hailed as ‘triumphant.’ It has been a lengthy process for both the company and its people but Nokia is keen to keep up this momentum.



“This supply chain transformation has been a journey of around eight years,” Giloth says. “We were undergoing external shocks to a certain extent. The first challenge was the battle of profitability that was driven by major Chinese competitors, and because of this we needed to cut costs and drive efficiency in the supply chain, and therefore one of the solutions was to create an integrated supply chain.

“We applied a lot of lean, Six Sigma, Kaizen continuous improvement efforts – the bread and butter of a good supply chain,” he adds. “We renovated our organisational setup. We introduced KPIs and that was just the first step.”

The next challenge confronting Nokia was the pressure to be agile and responsive in a volatile market.

“The need for an agile supply chain became more and more paramount,” Giloth reflects. “We invested a lot of time and also money in making our supply chain and demand planning, reacting faster to the market changes while not compromising on the lean setup. Then that created an integrated and demand-driven supply network.”

Customer-focused

The third and perhaps most pressing priority? Customer centricity.

In many organisations, supply chains are seen



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“We used to be in the trenches of the back office but now we’re more involved from the beginning of the opportunity in order to create the best possible customer experience”

Johannes Giloth, Senior Vice President of Global Operations and Chief Procurement Officer at Nokia

as a back-end function, but at Nokia, that notion is being flipped on its head. Giloth and Jensen believe that ‘creating the technology to connect the world’ is more than just a tagline that people associate with the telecoms company – it is a core value that should be interwoven through all aspects of Nokia, including its supply chain.

“Our market is diversifying hugely,” observes Jensen. “We have new customers, new segments, and therefore it’s critical that we are more customer-specific and more consumer-driven. In all aspects, user experience is really influencing our behaviour.

“Interestingly, we’re also seeing that by making our supply chain more customer-centric, we can grow our top line,” he continues. “We are having more strategic engagement with our customers and more what we call ‘stickiness’. This is significant because the more we are in, the more we can help them, and the more likely it is that we can build on this.

“It’s also about building a company

mentality in the organisation that shows we are an important part of what the customer is seeing in their daily life. We used to be in the trenches of the back office but now we're more involved from the beginning of the opportunity in order to create the best possible customer experience."

From top to bottom, customer needs are driving decisions at Nokia. But as each customer has their own unique demands, Giloth describes how the Finnish company has worked to understand and cluster its customers into segments so that it can deliver the things that really matter to them.

"Some customers want to have fast delivery, but they are not really price-sensitive," Giloth says. "Others are looking at the price only, but the supply chain related KPIs are not that important. You need to really understand the different KPIs and what your customers want. Our customers have completely different requirements in terms of throughput, reactivity and on-time

delivery so we need to understand the requests of the customer and segment our supply chain towards it."

However, a customer segmented supply chain is just the start, Giloth says. "You also have to create customer intimacy, to really talk with your customers, and be exposed to the customers.

"Therefore, we have people like Bo in the regions being more and more connected with Nokia customers, rather than it being a very back-ended function. On top of that, you need to design your processes and your tools to make it easy for customers to use. Your product configuration can be cumbersome, or it can be Amazon-like. If the customer has a good feel of that user interface, that's added value in itself."

True digital transformation

Often, 'digitisation' can seem like just another buzzword; a few syllables that have saturated business press releases worldwide. However, Nokia has proven it can be more than just on-trend lingo. Over the



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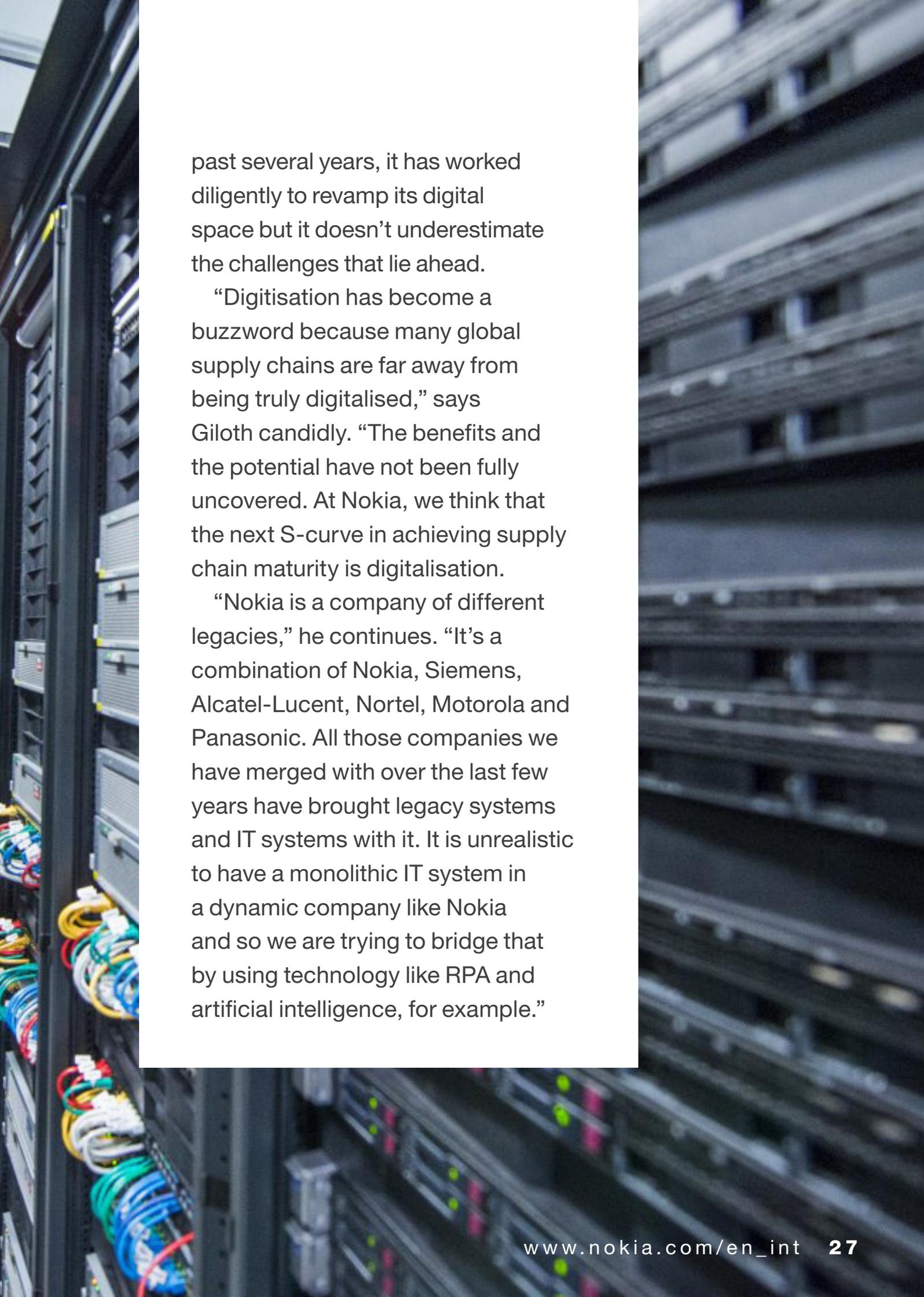


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A photograph of a server room. In the foreground, there are several server racks with various components and a dense bundle of colorful cables (red, yellow, green, blue, white) plugged into the front panels. The racks extend into the background, creating a sense of depth. The lighting is somewhat dim, typical of a server room environment.

past several years, it has worked diligently to revamp its digital space but it doesn't underestimate the challenges that lie ahead.

“Digitisation has become a buzzword because many global supply chains are far away from being truly digitalised,” says Giloth candidly. “The benefits and the potential have not been fully uncovered. At Nokia, we think that the next S-curve in achieving supply chain maturity is digitalisation.

“Nokia is a company of different legacies,” he continues. “It’s a combination of Nokia, Siemens, Alcatel-Lucent, Nortel, Motorola and Panasonic. All those companies we have merged with over the last few years have brought legacy systems and IT systems with it. It is unrealistic to have a monolithic IT system in a dynamic company like Nokia and so we are trying to bridge that by using technology like RPA and artificial intelligence, for example.”

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Sustaining supplier relationships

Nokia is taking radical steps to accelerate its digital maturity and influence the shape of things to come, but it isn't doing it alone. Sustaining strong supplier relations has been key to unlocking Nokia's supply chain transformation.

"We are working closely with companies to help us automate our processes on a daily basis," Giloth says. "When it comes to that conscious factory environment, we have been working closely with a lot of sensor companies, small IoT startups, and cloud companies to

really get a deeper understanding. When it comes to digitalising entire process chains, we have a lot of internal projects, but these are also supported by specialised consultants in those areas.

"As well as this, we have just consolidated our business process outsourcing and that strong focus has really helped us transform our auto management process," adds Jensen. "We're also using everyday tools like Office 365 and SharePoint Online to digitise the everyday life of the employee as much as possible. We want to change the mindsets

of our people and encourage them to utilise the opportunities that are at our fingertips every day.”

Open collaboration

‘No man is an island’, and the same can often be said about business. In this ever-evolving industry, the right collaboration could set you miles ahead of a competitor and perhaps no one understands this better than Nokia. As a result, the Finnish company has turned to the [Open Ecosystem Network](#). Built on the principle of data democracy,

this innovative platform has shaken up traditional business models and proposed a new way of working with different ecosystems and industries.

By connecting developers, startups, business incubators, universities, subject experts and entrepreneurs, the platform allows groups to share ideas and find the right people to develop them.

“It revolves around co-ideation and co-creation with our suppliers, but also collaboration within the company,” Giloth explains. “It’s a digital platform where you can post

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Video: Open Ecosystem Network

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“Getting that outside-in perspective was one of the key levers that helped us reach the next level”

Bo Jensen, Head of Delivery Operations Asia Pacific & Japan at Nokia.



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your ideas, where you can have private rooms and where you can also have protected information in there, in case of sensitive intellectual property rights (IPR) discussions, for example. In this way, you can just accelerate the way you are dealing with your suppliers and prepare for the future. In the creation environment, it's all about speed.”

An outside-in approach

This sense of open collaboration is largely a result of what Jensen describes as an “outside-in”

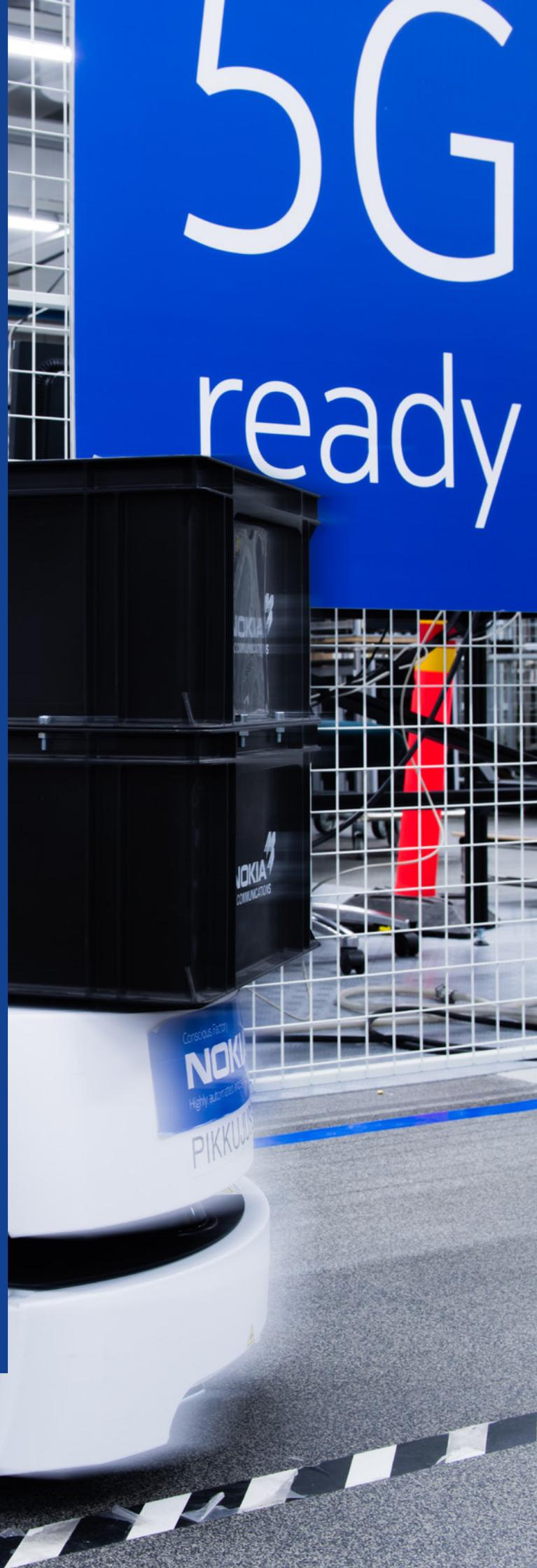
approach. “Getting that outside-in perspective was one of the key levers that helped us reach the next level rather than being satisfied with what we’ve always been doing,” he says.

“After a very long time of trying to optimise looking at ourselves, we managed to turn it around. We are working with a lot of exciting external companies in order to get a perspective on what others are doing.

“Instead of just looking at ourselves and polishing the chrome it’s about really asking ‘okay, what

“Customer segmentation is going to become more important with 5G, because today our major customers are the major telecoms operators of the world, the big internet players. In the future, it could be someone like BMW or Tencent. It could be a bank or a hospital”

Johannes Giloth, Senior Vice President of Global Operations and Chief Procurement Officer at Nokia



can we do substantially different?
How can we disrupt the sector?”

5G ready

With the looming roll-out of 5G on the horizon, the telecoms industry is a thrilling yet unpredictable one to be in. Nokia has consistently been readying itself for 5G, chipping away at any obstacles in its path. Whilst Giloth and Jensen recognise the challenges it still poses, they feel that conscious supply network will propel the firm to new heights.

“The first generations of mobile phone technologies were incremental to each other, but 5G is changing everything,” notes Giloth. “It will open the communications sector to hundreds of other industries because it is vital for uses like autonomous driving and robotics.

“It’s a huge technology shift. We have invested heavily in R&D which has helped to set us apart, but you cannot do this just alone, you need to have partners. We have strategic partnerships that are helping us develop the necessary chips

and technologies. Without those industry ties it’s difficult, and so it takes a much more collaborative approach in many areas. You need to have long-lasting partnerships.

“The market is changing and our customers are changing, and so our supply chain needs to be changing too,” he continues. “Customer segmentation is going to become more important with 5G because today our major customers are the major telecoms operators of the world, the big internet players. In the future, it could be someone like BMW or Tencent. It could be a bank or a hospital. With that, you need to completely rethink your value chains.”

A true telecoms behemoth, Nokia has always left a lasting mark on the sector. The Finnish giant has come a long way since the humble, hardwearing phones it became infamous for and now, as Giloth and Jensen take the ‘conscious factory’ to the global stage, it seems that Nokia’s historic legacy is beginning a new chapter. ■



Karaportti 3

02610 Espoo, Finland

P.O.Box 226, FI-00045 Nokia Group

+358 10 44 88 000

Press.services@nokia.com

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