

TECHNOLOGY AT HEART

Spotlight on Sweden



In this series Orgalime, the European Technology Industries, presents stories showcasing how the companies we represent are shaping a future that's good for Europe's economy and society – and how the right policy framework can help them do even more.



In this edition we shine a spotlight on Sweden with two reports direct from this innovative Nordic nation:

TECHNOLOGY IN ACTION

We zoom in on a research project that shows how industry-academia collaboration can multiply the impact of innovation – combining the strengths of leading tech firms SKF and Ericsson with the academic know-how of Chalmers University of Technology to bring 5G to the factory floor.

TECHNOLOGY MEETS POLICY

We find out how Orgalime member Teknikföretagen is working with policymakers in Sweden and at EU level to shape a framework that can foster innovation and help technology companies compete on the global stage.





TECHNOLOGY IN ACTION

WHEN 1+1+1=5

EUROPE IS HOME TO SOME OF THE WORLD'S MOST INNOVATIVE COMPANIES AND SOME OF ITS MOST GROUNDBREAKING ACADEMIC RESEARCH. BUT WHAT HAPPENS WHEN YOU BRING PARTNERS FROM THESE TWO WORLDS TOGETHER? CAN YOU MULTIPLY THE IMPACT OF INNOVATION AND CREATE A SUM THAT IS GREATER THAN ITS PARTS?

An ongoing collaboration in the Swedish city of Gothenburg is putting this to the test, combining the strengths of two very different industries with top-notch academic know-how – and showing that sometimes 1+1+1 can equal 5.

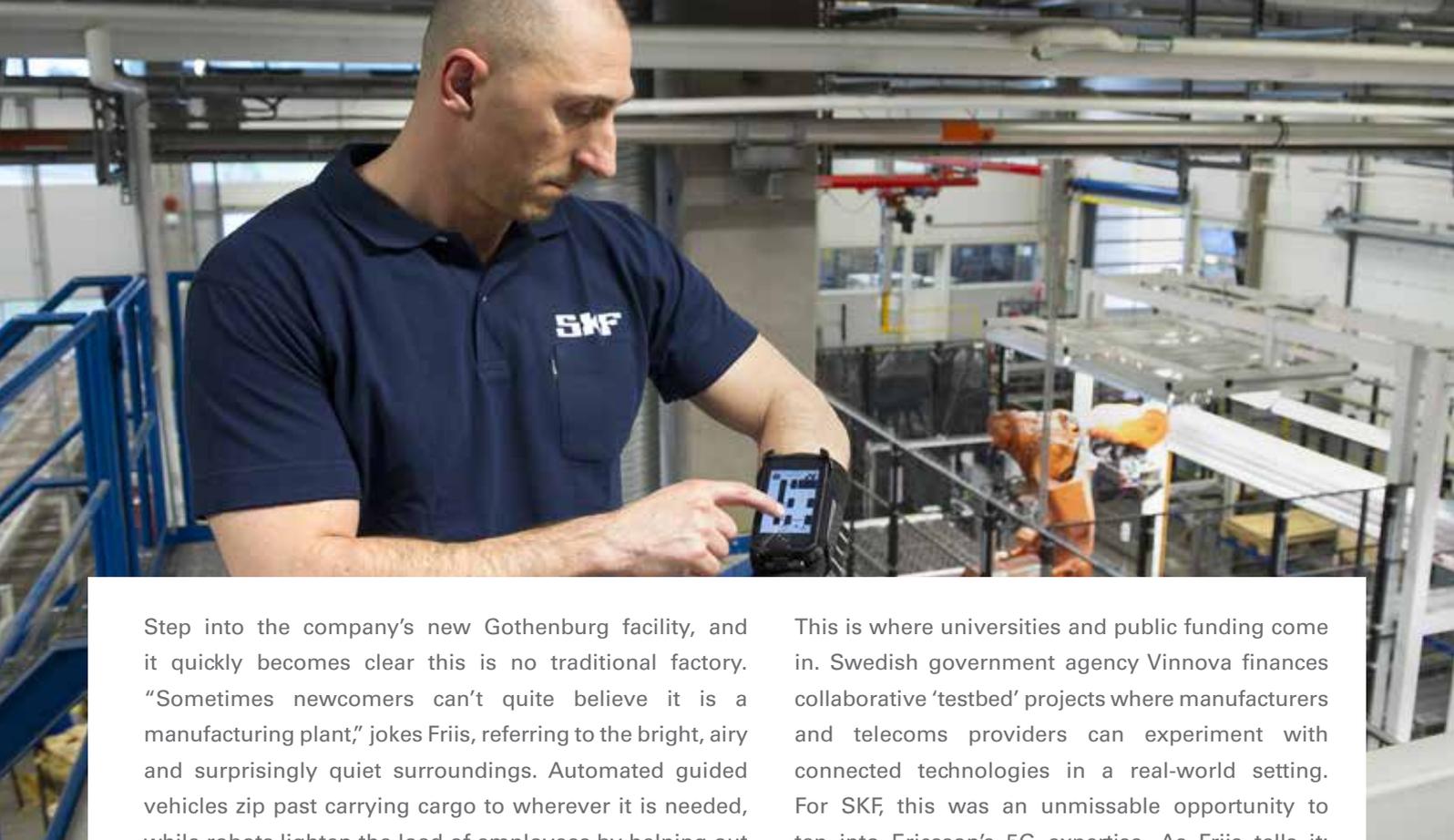
Innovation is firmly rooted in the DNA of Sweden's tech companies. And leading manufacturer SKF is no exception. Ever since its founding in 1907, it has been blazing trails across the technology spectrum – but above all, it is known for advances in a component that is something of a hidden hero of the tech world: bearings.

If you were to make a list of discoveries that have shaped modern life, the invention of the bearing in the 18th

century would rank up there with the combustion engine or microprocessor. As Martin Friis, Manufacturing Automation Project Manager at SKF, explains: "Think of virtually any moving system we rely on today – from cars to trains to wind turbines – they all rely on bearings to regulate motion and reduce friction." SKF has been working for the last hundred-plus years to perfect this technology for the 21st century.

Beyond the components manufactured, SKF has also continuously pioneered innovation on the production line. In recent years this has meant mainly one thing: digitisation – the integration of connected digital technologies on the factory line.





Step into the company's new Gothenburg facility, and it quickly becomes clear this is no traditional factory. "Sometimes newcomers can't quite believe it is a manufacturing plant," jokes Friis, referring to the bright, airy and surprisingly quiet surroundings. Automated guided vehicles zip past carrying cargo to wherever it is needed, while robots lighten the load of employees by helping out with heavy lifting and more repetitive tasks.

Facilities like this squarely place SKF among the best-in-class in digital industrial innovation. But the question soon arose: what next? How could they take digitisation to the next level?

MANUFACTURING, MEET TELECOMS

Often innovation emerges through a simple change in perspective, by looking at your challenge through someone else's eyes. In 2015 SKF encountered just such a fresh viewpoint in the shape of fellow Swedish heavyweight Ericsson. The telecommunications provider has been spearheading development of 5G in Europe – the fifth generation of mobile communications, set to mark a quantum leap in the volume, speed and security of data transfer.

Ericsson is in no doubt that 5G can deliver massive benefits for manufacturing. Explaining the latest phase of evolution, Research Director Torbjörn Lundahl explains: "With the advent of 5G, the mobile network becomes much more than a consumer proposition. Like electricity or water, it will become a vital infrastructure for our future industry and society."

But it is still early days for 5G adoption: while providers are already working on commercial offerings, many potential customers in manufacturing and beyond remain unaware of the benefits the technology can bring. What can be done to bridge this gap?

This is where universities and public funding come in. Swedish government agency Vinnova finances collaborative 'testbed' projects where manufacturers and telecoms providers can experiment with connected technologies in a real-world setting. For SKF, this was an unmissable opportunity to tap into Ericsson's 5G expertise. As Friis tells it: "Manufacturing we know inside out. But when it comes to big data analytics and the infrastructure behind it, we are on a steep learning curve."



"With the advent of 5G, the mobile network becomes much more than a consumer proposition. Like electricity or water, it will become a vital infrastructure for our future industry and society."

Torbjörn Lundahl
Research Director, Ericsson



“Innovation happens when you have a new technology and you find a new application for it – and often this simply cannot happen without collaboration.”

Prof. Johan Stahre
Project Leader, Chalmers
University of Technology

THE MISSING INGREDIENT

Put together SKF’s manufacturing expertise and Ericsson’s 5G know-how, and you already have some promising chemistry. But they needed a catalyst to trigger the magic reaction – a research partner with the academic chops to steer the collaboration. Enter Chalmers University of Technology, a leading research and education institute based in Gothenburg and specialising in industrial digitisation.

Chalmers added some blue-sky thinking to the mix. For project leader Professor Johan Stahre and his team, limitations were out and experimentation was in. The project was dubbed ‘5G-enabled manufacturing’ (5GEM), and the starting point was a simple question intended to open up boundless possibilities: “What if we had unlimited communications on the factory floor, what would we do then?”

The three partners started looking for answers by building two testbeds: an experimental test lab at Chalmers and an industry-grade test facility at SKF’s Gothenburg site. At the heart of the SKF system is a grinding machine equipped with sensors to measure every imaginable parameter: from vibration to energy consumption to current flow. This data is transmitted via a custom-built 5G network to the cloud, to data centres hundreds of kilometres away in Lund and Stockholm. Here, powerful processors crunch the vast volumes of data, transforming the zeros and ones into valuable insights that are beamed back to the factory floor in almost real time.

THE BENEFITS OF 5G-ENABLED MANUFACTURING

To the uninitiated a bearing seems a pretty simple product: typically two metal rings or disks, rotating around spherical ball-bearings or rollers. So it can be hard to grasp at first the true value of analysing all this data. But sometimes producing simplicity can be a very complex task indeed. As Friis explains: “Our products may only comprise a few parts. But to make them, many different processes work in sequence. At each stage, the quality of the ingoing components is crucial for the quality of the next stage.”

This means that all insights into the parameters determining that quality becomes immensely important to the quality of the finished product. “Real-time data capture and analysis allows us to see if one process is drifting – for example due to wear and tear – affecting the entire sequence,” Friis continues. This means SKF can identify problems before they occur, improving outputs while minimising downtime and extending equipment lifespan.

The benefits of a 5G-enabled production line have also been felt by the team on the shop floor. Operators enjoy anytime-anywhere visibility into their machines. An urgent problem requires immediate attention? An alert is pinged directly to a smartphone worn on their arm. The analysis flags up an issue new to this employee? No problem, the system can send an instructional video directly to their device. In this way, the data empowers the team to act while continuously building competence.

COLLABORATION = INNOVATION

Following a resoundingly positive initial response, phase two of the project is already in the pipeline and will also be promoted by the Swedish government. The key to this success? A collaboration where each partner benefits from the unique vantage point of the others: SKF delivered the manufacturing expertise needed by Ericsson to explore 5G applications in industry; Ericsson showed SKF what high-speed, high-volume and secure data transfer could do for their operations; and Chalmers provided a robust scientific framework for experimentation, validation and public dissemination of the results.

As Stahre underlines: "Innovation happens when you have a new technology and you find a new application for it – and often this simply cannot happen without collaboration."

The testbeds allowed Ericsson to pilot their technology in

completely new scenarios. "The project has definitely given us an insight into the needs of industry," explains Lundahl. "We are used to delivering large-scale systems to cover a whole nation, but we have learned that the requirements for a factory are totally different."

All three agree on the role of public funding in creating space to take risks in a way that is simply not possible when return on investment is the number-one criterion. For Friis, this support was "crucial – we wouldn't have invested in this technology on our own". As Stahre explains: "Digitisation is make-or-break for industry, but as with any change it involves risk. We can end up in a Catch 22 situation, where no one wants to be the first to move." By showing companies what is possible, testbeds like this can break that cycle.



"Europe is strong in R&D and developing new technology – but we need to move faster."

Martin Friis
Project Manager
Manufacturing Automation,
SKF



TECHNOLOGY MEETS POLICY

IN CONVERSATION

KLAS WÅHLBERG

DIRECTOR GENERAL, TEKNIKFÖRETAGEN

We sat down with Klas Wählberg, Director General of our Swedish member organisation Teknikföretagen, the Association of Swedish Engineering Industries, to talk about how industry and policymakers can collaborate to help companies drive innovation and create jobs.



WHO ARE THE SWEDISH TECHNOLOGY INDUSTRIES - WHAT KIND OF COMPANIES DOES TEKNIKFÖRETAGEN REPRESENT?

The Swedish technology industries are incredibly diverse, spanning sectors from electrical engineering to aerospace. Our companies are responsible for around a third of all Swedish exports and generate 150 billion euros worth of turnover, which is about one third of the total GDP of Sweden.

Teknikföretagen represents companies of all sizes - from large corporations like SKF, Scania or Volvo to small and medium-sized players. This diversity makes for a dynamic ecosystem: the big companies establish R&D and supply chain structures that create many opportunities for SMEs.

AS AN INDUSTRY ASSOCIATION, YOUR ROLE IS TO LIAISE WITH POLICYMAKERS IN THE INTEREST OF YOUR MEMBERS: WHAT DO YOU SEE AS THE KEY TO SUCCESS?

For our companies to be successful, Sweden needs to be successful on the global stage. This is why we focus on strengthening competitiveness through our work in two key arenas.

“Our engagement with EU policymakers is crucial: we need to make sure they understand how these challenges affect our companies.”

Klas Wählberg
Director General, Teknikföretagen



Teknikföretagen

Ever since Teknikföretagen was founded in 1906, the association has stood on two legs. On the one hand we have a ‘business’ or ‘industry’ leg, representing the interests of our member companies in regulatory questions like product or environmental legislation or investment policy. On the other hand, we have an ‘employer’ leg: as Sweden

is a regulated labour market, we represent our members in national wage bargaining procedures and engage in debates on training and skills development.

Which of the two is the most important? Well you have a right leg and a left leg, but you need both to walk. By working across these areas in tandem, we have developed an excellent understanding of how investment is done on the business side - and how this in turn affects the labour market and workforce composition.

HOW DOES THIS TRANSLATE INTO EFFECTIVE POLICYMAKING?

The role of the organisation is to facilitate and find commonalities, leading to insights and opportunities. Public authorities turn to us to understand the requirements of our industries, whether they are considering short-term action such as budgets or planning for long-term evolutions in technology like AI or robotisation.

Take robots: 10 years ago, deploying robots in the factory required a huge safety perimeter to be put in place; today, robots and employees can work side-by-side. These insights from the factory floor can help shape decisions on legislation, but also on policies like training and skills development. We live in an age of career politicians, and we cannot expect that they will have the specialist sector knowledge they need to make these decisions.

The role of industry associations is to show what is needed by giving a rounded picture: big companies can always go directly to government, but where Teknikföretagen as an association adds value is that we can ensure balanced representation of the industry as a whole - from the major corporations to the SMEs.

WHAT ABOUT THOSE AREAS THAT ARE LARGELY GOVERNED THROUGH EU LEGISLATION?

Well the same thing applies at European level: policymakers require specialist industry expertise to make the right decisions. Here, we work closely with Orgalime as they operate at the right level of credibility and with a pan-European perspective. In particular, we collaborate with Orgalime on questions of product regulation, research and innovation, and trade.

IN PROFILE: TEKNIKFÖRETAGEN

“In a globalised world, creativity is Sweden’s strength” - this is the firm belief of Teknikföretagen, the Association of Swedish Engineering Industries. Its goal is to enable Sweden’s engineering and technology companies to play to this strength: by shaping a framework that fosters innovation and helps firms remain competitive on the global market.

Teknikföretagen represents 3,900 member companies: ranging from large multinationals to SMEs, and spanning sectors as diverse as biotechnology, telecommunications and new materials to instrument technology, optics, and transport.

The association has made it its mission to strengthen the competitiveness of its members, by working to create a favourable regulatory and policy environment at national and EU level. In Brussels, it works closely with Orgalime on issues such as digitisation, energy and environment policy, product regulation and trade.

Teknikföretagen also supports its members in questions of labour legislation and employment terms, while being actively engaged in fostering the young talent of tomorrow through initiatives promoting careers in engineering and technology.

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Klas Wählberg is Director General of Teknikföretagen, the Association of Swedish Engineering Industries. He joined Teknikföretagen in 2016 after eight years as Managing Director of Bombardier Transportation AB, where he was responsible for 2,200 employees and a turnover of 750 million euro. Prior to that he held a number of director and senior management positions in the transport and railway sector, after completing an M. Sc. in Civil Engineering and an MBA. Mr Wählberg is a member the Orgalime Board of Directors.

LOOKING AT THE EUROPEAN CONTEXT, WHAT WOULD YOU SAY ARE THE THREE BIGGEST CHALLENGES FACING YOUR MEMBERS TODAY?

The first big issue is around skills and demographics - a problem facing many European countries today. How can we ensure not only that people have the right skills, but that we will even have enough people to meet the demand for employees? This links in with the need for free movement of labour within the EU, and raises the question of whether migration combined with training and skills development could fill the gap.

For the second thing keeping companies awake at night, you just need to open Twitter and read Trump's tirades against free trade. Trade is vital to our industries - one third of all Swedish exports stem from our companies - so this is really worrying. Brexit is also a looming concern, in particular given the uncertainty surrounding the ongoing negotiations.

A third challenge will be to make sure Europe can keep control over our most valuable assets: intellectual property and skills. We have to strike a fine balance when responding to the movement of third countries into the European market, recognising risks as well as benefits.

The common thread is that each of these developments can impact on the competitiveness of European industry. This is why our engagement with EU policymakers is crucial: we need to make sure they understand how these challenges affect our companies.

'CREATIVITY IS SWEDEN'S STRENGTH' IS HOW TEKNIKFÖRETAGEN DESCRIBES THE ROLE OF INNOVATION IN YOUR INDUSTRIES' SUCCESS. HOW DO YOU VIEW THE ROLE OF TEKNIKFÖRETAGEN IN FOSTERING INNOVATION?

Sweden has a rich tradition of innovation, one that we have been actively supporting since Teknikföretagen was founded in 1906.

Today, one way we do this is by fostering an understanding of how research funding can help competitiveness by making innovation concrete - through investment in testbeds, for example. So we work with government agencies on funded programmes to this end. We also support a taxation policy that encourages risk-taking and experimentation in new technologies.

In essence our role is that of a facilitator: we cannot drive developments but we can make sure that policymakers are aware of the priority areas for industry and where gaps may lie in terms of commercialising new developments, for example. On the other hand, we can make sure our companies are aware of the funding opportunities available to them.

WHAT KIND OF BENEFITS DO YOUR MEMBERS REPORT FROM PARTICIPATING IN THESE KINDS OF PUBLICLY FUNDED PROJECTS?

There are a number of benefits for companies. Business model development is an important one: trialling new systems in a testbed environment can help companies gain an understanding of how products or services can be made marketable in the real world.

These projects can also provide input for skills development, too. Exploring new technologies can show where shifts in skills requirements will emerge in the future - the electrification of cars is a good example. Insights from these projects can feed into the education system and training programmes.

Finally, it is a way for government to take a more active role in industrial research and innovation without jeopardising free trade. It is companies that drive the investment, with government playing the role of facilitator. And importantly, it is not only European companies that can qualify for public funding but also those further afield - so our industries can also tap into insights of international partners.

WHAT ABOUT COLLABORATION BETWEEN DIFFERENT BRANCHES OF INDUSTRY, HAVE YOU SEEN POSITIVE RESULTS FROM PROJECTS OF THIS KIND?

Indeed, cross-industry collaboration can help spread technology evolution rapidly across different sectors. By bringing together industry, researchers and public funding - the triple helix approach - you encourage the emergence of innovation clusters. Plus, when different sectors work together, new insights can emerge: for example, a recent project examined how blockchain can be used to track the use of rare metals in car batteries.

LOOKING TO DISCUSSIONS AROUND THE FUTURE OF EU R&I PROGRAMMES AND BEYOND, WHAT SHOULD BE THE NUMBER-ONE PRIORITY IN YOUR VIEW?

Having the right skills base and the right competence base here in Europe. It all starts with people and jobs: if we don't get this right, nothing else will matter.



“Cross-industry collaboration can help spread technology evolution rapidly across different sectors.”

Klas Wählberg
Director General, Teknikföretagen

SWEDEN SUBMITS THE SECOND MOST **PATENT APPLICATIONS PER CAPITA** IN THE WORLD

6/10 MEMBERS HAVE FEWER THAN **25** EMPLOYEES

 **2 600** MEMBER COMPANIES WORK WITH MANUFACTURING
1 350 ARE SERVICE COMPANIES


ONE IN FIVE
ENGINEERING COMPANIES TODAY EMPLOY ONLY OFFICE WORKERS

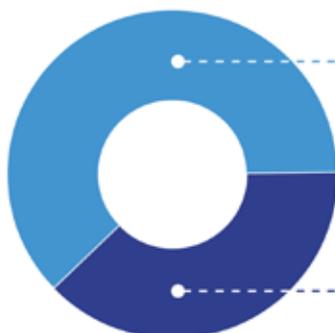


SWEDEN'S ENGINEERING COMPANIES EMPLOY **300,000** DOMESTICALLY AND MORE THAN **600,000** ABROAD



45% OF MEMBER COMPANIES' REVENUE IS GENERATED FROM **SOFT** REVENUE
55% FROM **HARD** REVENUE

ENGINEERING COMPANIES IN SWEDEN RECORD SALES OF **SEK 1.07 TRILLION**



SWEDISH ENGINEERING COMPANIES EMPLOY **60%** WHITE-COLLAR EMPLOYEES
40% BLUE-COLLAR EMPLOYEES

 MORE THAN **30%** OF ALL MONEY SPENT ON RESEARCH COMES FROM ENGINEERING COMPANIES

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Orgalime, the European Technology Industries, speaks for 45 trade federations representing the mechanical engineering, electrical, electronics and metal technology industries of 23 European countries. These industries directly employ nearly 11 million people in the EU and in 2017 accounted for some €2,000 billion of output. They represent over a quarter of the output of manufactured products and over a third of the manufactured exports of the European Union.

The companies represented by Orgalime are at the forefront of the digital transformation of industry, enabling innovation across sectors to deliver solutions to major societal challenges – in areas as diverse as energy, resource efficiency, mobility, the circular economy and healthcare. At EU level, Orgalime promotes a holistic industrial strategy that connects the dots between policy areas, with the aim of building on European industry's competitive strengths to support innovation and strengthen manufacturing investment in Europe.

Read more about Orgalime:
WWW.ORGALIME.ORG

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