

A woman with her hair in a bun, wearing safety glasses and a white lab coat, is focused on her work in a laboratory. She is holding a small vial. In the foreground, a large, blue and white industrial robotic arm is positioned, ready for use. The background shows a bright, modern laboratory setting with various pieces of equipment and shelves.

Smart industry

– a strategy for new industrialisation
for Sweden



A new era of industrial robots that can work collaboratively with humans, mainly in various forms of small-component assembly and material handling, is being ushered in with ABB's YuMi, an industrial robot developed for close cooperation with humans.

Cover photo ABB

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Preface

Sweden's prosperity is built on innovative and successful export companies that time and again have managed to renew and reorganise production and products to keep pace with changing markets.

Over the years, I have met many of these companies in their factories and their design and research centres throughout the entire country. I have also come across them in all corners of the world on my export-promotion trips to important markets. I have often also been impressed by their ability to cope with new challenges. Regardless of whether it involved getting hold of the right skills, getting their foot in new markets or renewing themselves or their range.

The capacity for innovation that the employees and companies in the industrial sector and the industry-related services possess still forms the bedrock of Sweden's prosperity. This may seem obvious. But for too long, the Swedish industrial sector has been treated as a historical remnant on the path towards the post-industrial service society. And this has come at a cost.

When the full impact of the financial crisis hit the economy, there was a lack of desire to mitigate the consequences and many jobs were lost in Sweden. There was significantly more resolute action in many of the countries with which we compete. In Germany, for example, there was a totally different level of preparedness and, with the help of means such as shortened working hours and training, German industrial companies were able to deal with the crisis without unnecessary redundancies, while remaining prepared for when the recovery arrived. An increasing number of countries have also drawn up industrial strategies in order to improve conditions for the industrial sector and to attract new investments.

This has meant that our country has become less attractive to investments in industrial operations. A large number of companies have also chosen to move manufacturing or research and development to other countries.



Nevertheless, Sweden is a strong industrial nation, where the industrial sector, including the industrial services sector, is creating close to one million jobs and is accounting for the major proportion of our exports. But the significance of the industrial sector to Sweden goes beyond the number of jobs and the size of the export income.

If we are to cope with the major challenges that factors such as climate change and an ageing population mean to our society, we need the innovativeness of industrial companies and their employees. The forestry industry can contribute with renewable materials and fuels, the vehicle industry with safer and more sustainable means of transport and information and communications companies are making the connected, smart and resource-efficient society possible.

The Swedish industrial sector is faced with challenges. Digitalisation is pushing the industrial sector's already high rate of transformation even further, paving the way for new business models and making others redundant. For small companies in particular, it is an enormous challenge to keep up with the pace of technological development.

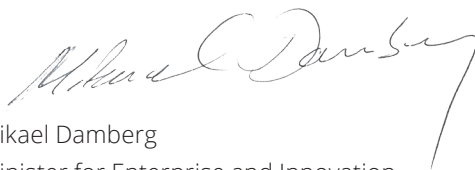
Digitalisation is central to many countries' industrial strategies, not least Germany's Industrie 4.0. The digitalisation of the industrial sector's production, products and capacity to transform enormous quantities of data into new businesses is completely vital to the industrial sector's future competitiveness. But the perspective needs to be wider than this. This is because ever greater demands are simultaneously being placed on the long-term sustainability of production and the utilisation of resources. That is why Sweden's strategy for new industrialisation aims beyond connected industry and also encompasses the ambition to cope with the demand for renewal that growing sustainability requirements are placing on the industrial sector and its products.

The Government's strategy for new industrialisation is to strengthen companies' capacity for change and competitiveness and we have therefore chosen four focus areas of particular importance to this:

- Industry 4.0 – Companies in the Swedish industrial sector are to be leaders of the digital transformation and in exploiting the potential of digitalisation.
- Sustainable production – Increased resource efficiency, environmental considerations and a more sustainable production are to contribute to the industrial sector's value creation, job creation and competitiveness.
- Industrial skills boost – The system for supplying skills is to meet the industrial sector's needs and promote its long-term development.
- Test bed Sweden – Sweden is to lead research in areas that contribute to strengthening the industrial production of goods and services in Sweden.

The Government's strategy for new industrialisation is an important stage of the effort to benefit from the window of opportunity for new industrialisation that is now open to Sweden. Rapidly rising wage costs and problems with the environment, quality and long lead times in the former low-cost countries in Asia have made Swedish production of goods and services more competitive. At the same time, automation and digitalisation are bringing with them new opportunities for profitable and sustainable production in a completely new guise – connected, more automated and knowledge-intensive.

Sweden now has the upper hand and it is high time that the industrial sector was prioritised. It is the companies' responsibility to deal with the challenges and benefit from the opportunities. But policy has to do its bit to strengthen companies' chances of coping with the transition. Thanks to shared priorities and collective effort, the Swedish industrial sector has every chance of emerging from the transition that is now taking place as a winner and thus becoming a world leader within the innovative and sustainable industrial production of goods and services.



Mikael Damberg
Minister for Enterprise and Innovation

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Sweden is a strong industrial nation

Sweden has a long and successful industrial tradition. The industrial sector is a driver of growth in the Swedish economy that creates jobs – both directly and indirectly – and is of major significance to Sweden’s prosperity and the collective welfare system. The industrial sector and the industrial services sector are responsible for a fifth of the country’s gross domestic product (GDP) and are present in all parts of the country. The industrial sector and the industrial services sector together account for 77 per cent of the total value of Swedish exports, which is equivalent to almost half of total GDP.

Sweden has benefited from its openness towards the rest of the world, which has opened up a large market. Simultaneously it has forced the industrial sector to undergo constant renewal and structural transformation in order to cope with global competition. Swedish industry has also demonstrated the feasibility of using modern technology to transform environmentally unsustainable production processes.

Swedish innovations have gained ground throughout the world and Swedish industrial companies have grown big and won significant international successes. The industrial sector’s great capability for renewal has been a decisive factor in its success. A clear development in recent years is the increasing service content of industrial goods. The industrial sector is increasingly selling a complete solution, rather than simply a product. A restructuring of industry has also resulted in more people being employed in service-sector companies that supply the industrial sector, rather than being employed directly in the industrial sector, which was often the case in the past. This also means that both the traditional industrial sector and the industrial services sector are the focus of this strategy for new industrialisation.



Vocational education provides young people with an opportunity to enter the labour market. Volvøsteget is one such example.

Now is the time for a new industrialisation of Sweden

Globalisation is reshaping the conditions of industrial production

Technological development is constantly altering circumstances under which the industrial sector has to compete. Developments in recent decades have been marked by the way in which information and communications technology has shrunk geographical distances and created opportunities for new products, processes and business models. Globalisation has intensified, and for the industrial sector this has opened up new markets as well as created opportunities to break up production processes into increasingly small constituent parts and spread these around the world, in order to benefit from the differing competitive advantages of different locations. Production is now largely linked together in global value chains. Coordination of these takes place with increasing simplicity and efficiency using digital solutions that are being developed rapidly.

This results in tougher global competition, with those who are capable of benefiting from the advantages having much to gain. Specialisation is becoming ever greater in the various elements of the production chain and trade is becoming even more important to maintaining and strengthening competitiveness. Location still has a major significance. Some knowledge is not restricted by national boundaries, while what is known as tacit knowledge is often based on experience and has a strong basis in local or regional networks.

Swedish companies have so far fared well in the global value chains and have primarily taken up positions in the parts of the production process that add the most value. These parts are also generally characterised by a high level of service content. Goods and services are increasingly being integrated in more complete offerings, and services now constitu-



3D technology has great potential and is leading to entirely new opportunities. This 3D-printed designer shoe made from Swedish steel has been created by Sandvik in partnership with Jernkontoret (the Swedish Steel Producers' Association) The shoe was ordered by the artist Lady Gaga and designed by Swedish designer Naim Josefi.

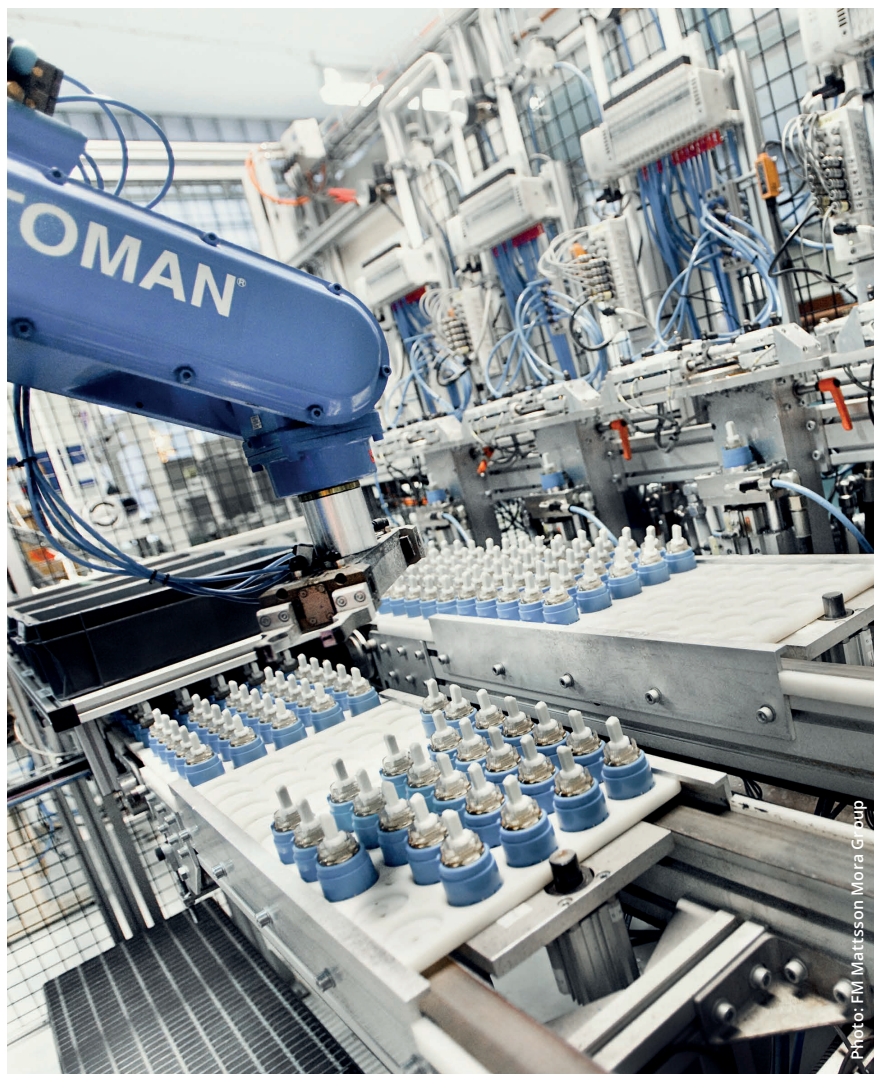


Photo: FM Mattsson Mora Group

Many industrial companies have moved their production abroad over the years, but there are also examples of the opposite journey. One such is FM Mattsson Mora Group with production in Mora that has brought its production home from China for reasons such as streamlining production and reducing carbon dioxide emissions.

te a large and growing portion of Swedish exports.

Employment opportunities in the Swedish industrial sector have been redistributed from simpler manufacturing jobs to more highly qualified, often service-oriented jobs. At the same time, this structural transformation has resulted in difficulties for

those individuals, industries and regions that are directly affected. Many regions that are heavily dependent on industry are clearly vulnerable in this respect.

This development has also resulted in many industrial companies concentrating on their core business and outsourcing services that were previously undertaken in-house. These services are now undertaken by people employed in service companies. The staffing sector has gained increased importance in terms of supplying skilled labour to industrial companies.

New conditions for the production of goods and services in Sweden

Technological advances have allowed production processes to be distributed and have given rise to a worldwide hunt for the best competitive advantages in various elements of productions. Many factors are of significance to a company's decision about where to locate its operations. These include wages and transportation, but also access to local markets, access to skilled labour, the conditions for research and development (R&D), regulations and the tax system, as well as the business climate in general.

So far, the major gains for industrial companies have often been in moving simpler manufacturing

jobs to low-cost countries. But the map for decisions about where to locate is in the process of being redrawn. Wages are increasing in the new emerging economies and are on the path to eroding the cost savings that previously formed the basis of the decision to move. At the same time, production technology is developing rapidly and an ever greater degree of automation in the manufacturing process is making wage costs less decisive. In the light of this, the return of production to Sweden and other industrialised nations from what were previously low-cost countries is increasingly being viewed as a likely scenario.

When wage costs become less decisive, other factors gain greater significance when faced with decisions about where the production of goods and services is to be located. Proximity between production and R&D, as with that between production and market, is increasingly emphasised in order to enable more flexibility in relation to customer demand and allow new models to be put into production faster.

Moving out still remains more widespread than moving back. While about 17 per cent of the industrial companies in Sweden have moved operations abroad in recent years, only just over 4 per cent have moved operations home again. Nevertheless, there are an

increasing number of companies who have chosen to once again locate or make new investments in production in Sweden. Production often returns in a new guise with a significantly higher degree of automation. The reasons for returning include bringing development and production closer together, gaining access to specialist skills and ensuring high quality.

Digitalisation is changing everything

Digitalisation is resulting in enormous opportunities to develop a new, smarter and more sustainable industrial sector. The sweeping changes that increasingly sophisticated digital technologies bring with them have given rise to the term *the fourth industrial revolution*. Following the steam engine, electricity and electronics, embedded and connected systems are now on their way to revolutionising industry; when things can be connected to the internet and communicate with their surroundings and when the boundary between the real and the virtual is erased.

In the smart factory, machines and components can communicate with each other. The development is moving towards self-regulating production that can be adapted to individual customer demands and that optimises the flow by, for example, identifying maintenance requirements at the

right time. Automation is an important component of the smart factory. Sophisticated robotics is creating increasingly advanced robots at lower prices. Additive manufacturing technology (known as 3D printing) is one further example of a technology that can revolutionise production by offering profitable production even at a small scale and making it possible to create individualised products to order.

It is not only production that is becoming smart, the products are as well. The Internet of Things involves various products equipped with sensors and inbuilt systems that are connected to the internet, enabling them to communicate with their surroundings. At the same time, a mass of operational and user data is being created that has major potential to be used in product development and to be transformed into new smart services. The significance of fast and effective data analysis will in the future gain an ever more important role in the industrial sector's business models and its competitiveness.

Digitalisation is increasing the interaction with customers and members of the public, which is placing new demands on companies and opening the door to completely new business models. Digitalisation is also making smart workplaces possible.



Photo: Siemens

In these, people work together with automation, creating a high level of competitiveness. Jobs that are automated are lost, but digitalisation also creates new jobs, which are more likely to end up in Sweden if society and the business sector are quick to make the transition. These are jobs that create the new technology, that use it, but also jobs that are created indi-

In order to increase the competitiveness and attractiveness of the industrial sector, many companies are working on comprehensive solutions for increased productivity, flexibility and higher quality. Siemens, which has operations at around 40 locations in Sweden, is working actively on research and development within the areas: industry of the future, intelligent infrastructure and sustainable energy.

By reducing the acceleration and breaking of industrial robots, their energy use can be reduced by up to 30 per cent – without reducing the rate of manufacture. This is demonstrated by the first tests of an optimisation algorithm developed by researchers at Chalmers University of Technology. This research has been started together with General Motors.



Photo: Chalmers



Recycle and re-use is the key term among many clothing companies. Nudie Jeans has specialised in organic, unwashed denim and offers repair services as one aspect of a sustainable development.

Photo: Nudie Jeans



One example of a company that is working with recycling is the copper smelter Boliden Rönskär that, since the 1960s, has handled various types of recycled material using technology developed in-house and has a great capacity for these materials.

Photo: Boliden

rectly by increased growth and increased incomes.

Sustainability is a prerequisite for competitiveness

Globally, there is a need for innovative, resource-efficient and environmentally friendly goods, services and systems in order to meet rapidly growing societal challenges, which can involve major business opportunities. Global demand for environmental technologies and recycling technologies is becoming greater in line with increasing urbanisation and continued environmental problems – particularly in developing countries. Requirements for sharp emissions reductions at the global level can also be expected. This will contribute to creating demand for environmental technologies with a high level of environmental performance, as well as the industrial production of bio-based goods and fuels. Furthermore, the transition to more sustainable production will be important to Sweden's chances of achieving the Government's goal of becoming one of the world's first fossil-free welfare states.

Sweden is currently well-placed to achieve this. At present, Sweden has globally competitive advantages within the fields of recycling and environmental technology. Accordingly, there is great potential to increase exports of Swedish environmental technology and to

increase employment. Sweden's strong track record in the field of systems analysis and systems solutions and in cooperation between the research community, industry and the public sector can be built on, contributing to increased competitiveness.

Industries and individual companies that are able to supply goods and services on a large scale, using a small amount of resources and with a generally low detrimental environmental impact have a good chance of being winners in the future. By transitioning to business models based on a circular economy¹, in which the main principles are closing the flows of materials and resource efficiency throughout the entire production chain and the product's life cycle, Sweden's international competitiveness can be improved. Digitalisation, a bio-based economy and an increased use of key enabling technologies can contribute to this development.

¹ Circular economy is based on the definition in the European Commission's communication, Closing the loop – An EU action plan for the Circular Economy (COM[2015] 614/2). Key aspects of a transition to a more circular economy are that the value of products, materials and resources can be maintained for longer than is the case today and that the formation of waste is minimised. Other important aspects are increased resource efficiency, reuse and recycling.

Challenges for a new industrialisation

In the light of Sweden's historic success and the recovery from the economic crisis of the 1990s, the recovery following the financial crisis has been relatively slow. At the same time, Sweden is subject to greater competition from the rest of the world. The knowledge and technological advantages that the Swedish business sector has relied on can no longer be taken for granted. The emerging economies are catching up and the centre of gravity for both production and investments in research and development is shifting eastwards.

At the turn of the millennium, Asia's proportion of the world's total GDP was less than one third. The International Monetary Fund predicts that this proportion will increase to greater than half in ten years. The emerging economies are also competing increasingly with a higher knowledge content and attracting a higher proportion of international

companies' R&D investments.

Up until the turn of the millennium, international companies primarily made R&D investments in Europe, the United States and, to some extent, Japan. Subsequently, there has been a significant redistribution of R&D investments to the rapidly growing Asian economies. China's R&D intensity (total R&D investments as a proportion of GDP) has tripled since the end of the 1990s and the country now has a higher R&D intensity than the EU.

There is stiff competition between developed countries to have the most innovative and adaptable business sector. Sweden usually ranks highly in various international indexes of competitiveness and innovativeness, but the gaps between the countries at the top is shrinking and the internal rankings can change in a short space of time. One trend seen in recent years is that Sweden has lost its

lead over other countries in several indexes. Other countries are catching up quickly and, in some cases, overtaking Sweden. One example is the World Economic Forum's Global Competitiveness Index, where Sweden was ranked the world's second most competitive country in 2011. In the measurement for 2015, Sweden had sunk to ninth place. Another example is the Innovation Union Scoreboard, where Sweden has been the EU's most innovative country since 2007. According to the index measurements, Sweden's innovativeness increased up until 2012, but this development has subsequently not been as strong and Sweden's lead over other countries has decreased. In addition, Sweden is not receiving an appropriate return on the major investments being made in innovation. While Sweden performs better than average in almost all of the index's dimensions, the outcome is somewhat poorer in terms of the economic impact of the resources that are invested.

The potential of digitalisation must be exploited

The improvement in productivity in the Swedish economy has largely been driven by digitalisation since the middle of the 1990s. However, it is primarily the information and communications technology (ICT) sector that has been

behind this improvement. Other sectors also need to take advantage of the opportunities of digitalisation. The conditions for a digital transformation of Swedish industry are relatively good. Sweden is ranked in third place in 2015 in the World Economic Forum's Networked Readiness Index. But other countries are catching up. At the same time the readiness of Swedish companies to exploit the potential of digitalisation is slowing down when compared with Denmark and Norway. A significantly lower proportion of Swedish companies than Danish and Norwegian companies state that they have a strategy to improve their utilisation of the potential of digitalisation and that they see before them a digital transformation of industry within the next five years.

Digitalisation penetrates deeply into all parts of the industrial sector's activities and affects such aspects as product development, production, business systems, interaction with subcontractors and customers and relations with employees. The pace of development is rapid and being left behind carries major risks in terms of lost competitiveness. In the context of production, digitalisation is strongly linked to automation, but in terms of the use of robots in production, Sweden is

losing ground in comparison to other countries. While it is true that Sweden occupies fourth place in the world with respect to the number of robots per 10 000 industrial employees, the gap to the countries ahead is relatively large. Since the 1990s, when Sweden was a clear leader in this development, the increase in the number of robots in Swedish industry has been significantly more modest than in other countries. Robot density is greatest in the automotive industry, but robots are making inroads in additional sectors. It is, however, feared that this development is weaker in Sweden. Setting aside the automotive industry, Sweden drops one place in the list of countries with the highest robot density. Some small and medium-sized enterprises may find it difficult to keep up with the global drive for automation.

If they are to be part of and lead the digital transformation, Sweden and the Swedish industrial sector need to take on the major challenges they are faced with. This requires advanced technological development with industrial applications, development of new business models, the ability to reorganise the organisation and develop the skills of staff so as to benefit from the new technology.

If companies' chances of being able to seize the potential of digitalisation are to be improved, the public sector needs to meet the new demand for knowledge and skills that this development brings with it, ensure the basic infrastructure is in place and develop regulations for the digital era. Digitalisation also requires new standards, for example in order to create uniform data structures and to increase the security of IT systems. Standards are also important in order to allow innovations access to markets, to assure quality, to facilitate trade and to simplify cooperation and the sharing of data with business partners.

Green transformation requires sustainable production

In the current economic system, goods are produced, used and thrown away in what can be described as a linear economy, where the flow has a clear beginning and a clear end. Many of the products that are currently discarded have a significant value that could be utilised again and again. The industrial sector's use of resources needs to be transformed to make it more sustainable and more of a circular economy – creating not only solutions to societal challenges, but also competitive advantages and opportunities for sustainable growth.

This transformation to more sustainable production brings with it several challenges, but also opportunities. Research and innovation initiatives are key to improving existing technologies or developing new ones that make more efficient use of resources, use less energy and have a better environmental performance. New technologies, goods and services need to be developed in order to make it possible to recycle additional and more complex types of materials and avoid the degradation of valuable resources. A perspective focused on preventing waste should be present in all stages of a product life cycle: research and development, including the design phase, the choice of input materials, the manufacturing stage, the user stage and ultimately the disposal stage. A transformation towards a more circular economy is dependent on a cycle that is free of toxins. The manufacture of products based on non-toxic recycled materials creates a demand for new production processes and methods to assure the quality of the recycled materials. New technologies such as additive manufacturing has the potential to contribute to improved resource efficiency, for example by reducing the use of materials, the quantity of waste and the need for transport. This transformation also places demands on the

business sector to develop new business models that are more resource efficient and environmentally adapted throughout their entire life cycle, reuse through upgrading, innovative substitutes for many traditional raw materials and chemicals and increased focus on function rather than physical products.

The public sector plays an important role, for example with respect to long-term means of control, regulatory frameworks, research and development initiatives and procurement processes that promote the transition to a fossil-free and circular economy. Well-adapted regulatory frameworks with adequate product and environmental requirements are a prerequisite. Transparent, clear and effective permit and supervisory processes can facilitate the industrial sector's effort to produce in a way that is more resource efficient and environmentally friendly. Global standards can open up international markets, ensure the correct quality of materials and that environmental and social requirements are met for renewable and recycled raw materials.

The supply of skills to the industrial sector must be improved

In the knowledge society, skills are a decisive factor to companies'

competitiveness. Finding the right person, in the right place and at the right time is a major challenge and the competition for skills is global. At the same time, Sweden is coming up against ever greater challenges in terms of the supply of skills to the industrial sector and there are reasons to worry about the future. In Sweden, the proportion of the population who have recently gained a scientific or engineering degree is lower than the EU average. The OECD's PISA survey shows a dramatic decline between 2000 and 2012 in Swedish school pupils' knowledge of mathematics, reading comprehension and science. Young people's interest in mathematics and technology is lower than it is in social issues and the teaching is rarely set up in a way that allows the perspectives to meet. There is an even less interest in training as a teacher in these subjects. Demographic changes also entail a challenging generational transition in terms of both management and other staff in the industrial sector, particularly in certain parts of the country.

In the long term, there is a risk of shortages, particularly of those with industrial education at upper-secondary school level, as well as of civil engineers with certain specialisations, especially in the field of data. The industrial sector

is already noticing a shortage of people with professional experience in electronics, computer technology and automation – specialisations that employers judge will be in even greater demand in years to come.

A competitive industrial sector requires workers who have both the right knowledge and are highly skilled. The high rate of change in society is putting pressure on the overall system for supplying skills, which must meet the emerging knowledge and skills requirements. Proficiency in using digital tools and services is required, pretty much regardless of industry or job. Technological developments within the industrial sector in areas such as robotics, automation and additive manufacturing demand new production skills. Technological developments in the field of IT are driving the need for completely new specialist skills within, for example, the analysis of big data in order to utilise the opportunities to create value from the huge volumes of data that are growing at an explosive rate. The industrial sector also needs specific knowledge in order to enable it to transition to a more circular and sustainable economy. On top of this, the increasing specialisation means a growing problem in terms of labour market matching efficiency.

In a fast-moving society, knowledge and skills quickly become obsolete, which brings the importance of lifelong learning to the fore. Lifelong learning involves providing people at all stages of their lives with opportunities to improve their skills, retrain in order to change career or periodically return to university. Increased mobility between academia and industry is also important. By instilling industrial perspectives in both education and research, this mobility can contribute to both increasing the education system's relevance to industry and improving the conditions for the utilisation of the results of research.

Globalisation means that competition for skills is also global. However, when compared with their counterparts in other countries, Swedish employers have not been as inclined to search for the right skills outside the country's borders. The ability to attract people with various skills and backgrounds is vital to the economy and to the development of the industrial sector. This requires a comprehensive view and sectoral coordination that creates attractive living and residential environments throughout the entire country. Given the prevailing situation and the large number of people that are currently seeking refuge in Sweden, it is also vital

that these people's knowledge and skills be made use of, with validation of skills being one tool.

An increased pressure for societal and industrial transformation, combined with a somewhat worsened outlook for Sweden's knowledge base, makes the supply of skills a vital issue for a strategy for new industrialisation. The system for supplying skills must function and major responsibility here is in the hands of the public sector, but the industrial sector and the industrial services sector also have opportunities to influence the attractiveness of the industrial sector and the conditions for lifelong learning.

Sweden must remain an attractive research nation

The research and development of new, enduringly sustainable and improved goods, services and manufacturing processes is essential to allowing companies to maintain and increase their productivity and competitiveness. The Swedish tradition of research collaboration between industry and research groups from the higher education sector in strong research environments has historically formed the basis of many large industrial companies' international successes.

Sweden has long had a high proportion of research expenditure

re in relation to GDP, compared with other countries. Research in Sweden is highly concentrated to large and high-tech companies. Among companies with at least 250 employees, the twenty largest multinational groups in Sweden are together responsible for a full 54 per cent of all in-house R&D. Goods producing companies with 250 or more employees were responsible for 70 per cent of the total expenditure on R&D in the business sector in 2014. Sweden comes in fifth place in a comparison with the 22 richest OECD countries measuring R&D intensity by calculating the business sector's R&D expenditure as a proportion of GDP. In the OECD as a whole, R&D expenditure as a proportion of GDP increased between 2005 and 2013, but in Sweden it instead decreased relative to GDP over the course of the same period. Companies' investments in R&D in Sweden need to increase in order to preserve the country's relative position as a research nation.

More needs to be done to increase the output from and impact of private and public investments in research. In particular, small and medium-sized enterprises' collaboration with the research community needs to be improved, as does the interchange between industries and between companies.

Research institutes work at the boundary between academic research and industrial development. They are important in order to provide the industrial sector – especially small and medium-sized enterprises – with access to new and up-to-date technology and knowledge that is internationally competitive. In addition, the research institutes can function as an important complement and offer companies and individuals access to testing and demonstration facilities, which are important to making it easier to bring new goods and services on to the market. A strong and active institute sector is key to value-added collaboration between the actors participating in the transformation and future competitiveness of the industrial sector. Other areas that are important to address are those that have a particularly great potential to contribute to the transformation of the industrial sector. Examples of such areas are robotics, artificial intelligence and additive manufacturing, as are the fields of research encompassed by the term *key enabling technologies*². Such technologies can also contribute to achieving climate, environmental and resource-efficiency targets faster.

2 These fields are: nanotechnology, micro- and nano-electronics, photonics, industrial biotechnology, advanced manufacturing technology and advanced materials.

When new technologies and new solutions are developed at, for example, universities and university colleges, the innovation system needs to capture and support the development of their commercial potential. The innovation offices of universities and university colleges are important actors in the initial work that takes place prior to the point at which companies are ready to adopt new technologies and new solutions. The various actors in the innovation system may need new skills as a result of, for example, digitalisation, which also requires new organisational models, new forms of innovation management and new business models.

Central government has an important role to play in terms of ensuring that the conditions for conducting research in Sweden are attractive to companies' research investments. This attractiveness is dependent on the framework conditions for the companies and the individual researchers, as well as on suitable research infrastructure. Well-functioning collaboration between the business sector and the higher education sector in the field of research and innovation is also of major significance to this attractiveness. One challenge in terms of increasing companies' investments in research in Sweden is that of maintaining a good col-

laborative climate and creating driving forces for the mobility of researchers between countries and sectors. Good research exchanges with other countries can bring knowledge that is valuable to Swedish higher education institutions and companies home.

The public sector can also drive innovation processes in several ways. The development and spread of new technology can take place through processes such as procurement, which the Government intends to address within the scope of a specific strategy. As a skilled and active buyer, the public sector is, for example, able to offer companies opportunities to test new goods and services in real-world test and demonstration environments. This drives the industrial sector's technological development forward towards more technologically advanced goods and services at the same time as new solutions to societal needs are developed. Public-sector test and demonstration environments of this type should be built up so as to invite the active involvement of customers and citizens as a strong driver of innovation.

Smart industry

The industrial sector throughout Sweden has to continue contributing to prosperity and employment through sustainable solutions to societal challenges – regionally, nationally and globally. Sweden is a successful industrial nation with a strong industrial foundation, which has to be built upon in order to ensure future competitiveness. Sweden cannot and must not compete using low wages; instead it will compete using digital and sustainable production and advanced or new products. This is where the potential for a new industrialisation of Sweden lies.

Innovative and sustainable industrial production is digitally connected, flexible, resource-efficient, environmentally friendly and provides the conditions for an attractive workplace. This smart industry is at the forefront of the digital transformation, has a high level of automation and is

New industrialisation

The industrial sector is undergoing a structural transformation that is driven by globalisation, digitalisation and the transition to a green, resource-efficient economy. This transformation towards a digitalised and sustainable industrial production creates opportunities to improve the competitiveness of Swedish industry, which can in turn contribute to increased employment and sustainable growth.

Vision

Sweden will be a world leader in the innovative and sustainable industrial production of goods and services.

Objective

The industrial sector throughout Sweden is to increase its competitiveness and participation, primarily in the high-quality segments of global value chains.

well equipped to meet complex customer requirements and new patterns of demand. It competes using both advanced production and products with a high knowledge content, where the boundary between goods and services has been blurred and where huge volumes of data create new assets for both customer and supplier.

The strategy for new industrialisation is to contribute to the creation of the best possible conditions in which the industrial sector and industrial services companies can become more competitive, more sustainable and more productive. The industrial sector is found in all parts of the country, creating jobs and contributing to local and regional competitiveness.

In recent years, the industrial sector in Sweden has become increasingly focused on those components of the production chain that have the highest value-added, i.e. the early and late stages, where the service content is high, for example in R&D, design, logistics and marketing. This improved its competitiveness, but it is also important for Sweden to be an attractive place to locate the manufacturing elements. Otherwise, there is a risk of Sweden also losing the service-intensive parts of the production process in the long term. Attractiveness to industrial investment at all stages of the pro-

duction process must increase, as must the industrial sector's attractiveness to skilled labour.

Swedish competitiveness

The industrial sector, as is the case for the business sector as a whole, is dependent on good framework conditions and fundamental prerequisites in order to do business and develop operations in Sweden. This can relate to laws, regulations and taxes, but also to energy supply and infrastructure. All in all, such prerequisites can be seen as an indication of a country's competitiveness.

The WEF's Global Competitiveness Index shows how the pre-

One well-known and frequently cited index is the World Economic Forum's (WEF) Global Competitiveness Index. In this, countries are analysed on the basis of twelve different parameters:

- institutions
- infrastructure
- macroeconomic environment
- health and primary education
- higher education and training
- goods market efficiency
- labour market efficiency
- financial market development
- technological readiness
- market size
- business sophistication
- innovation.

requisites for companies' competitiveness comprise a range of different factors within a large number of policy areas. This paints a picture of the long-term conditions for economic activity, which all countries need to take into account in order to remain competitive.

The effort to provide good framework conditions and prerequisites for the business sector is addressed within business policy as a whole, irrespective of industry or sector. Some of the factors of particular importance to the industrial sector have been placed in renewed focus within the scope of other processes initiated by the Government. These include the Energy Commission, the Government's export strategy, the long-term infrastructure plan and the national strategy for sustainable regional growth and attractiveness 2015–2020.

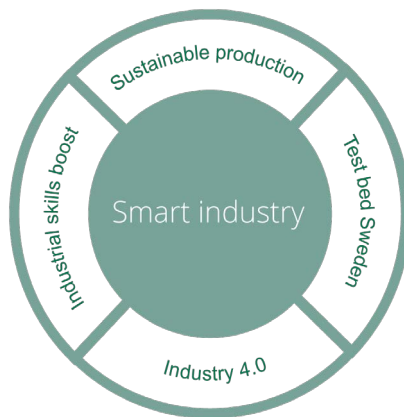
The strategy for new industrialisation focuses on improving companies' chances of dealing with the rapid transformation in which the Swedish industrial sector is currently involved. Four focus areas have been chosen:

- **Industry 4.0** – Exploit the potential of digitalisation
- **Sustainable production** – Improve the industrial sector's capacity for sustainable and resource-efficient production

- **Industrial skills boost** – Ensure the supply of skills to the industrial sector
- **Test bed Sweden** – Create attractive innovation environments

Implementation

The strategy for new industrialisation forms the basis of a concerted national effort relating to a number of challenges that are vital to the industrial sector's ability to adapt. Central government and the wider public sector play an important role. The public sector should take action to facilitate structural transformation in the industrial sector. The tools used in this work include laws and regulations, investments in business, education and research, public procurement and opening up the public sector to offer, for example, test beds and open data. However, the active participation of industry and the industrial services sector will also be required.



Implementation of the strategy for new industrialisation is an ongoing process that is set out in an action plan that will be developed as this process progresses. Collaboration at several different levels of the public-sector system is needed – from the local and regional to the national level. The regional level plays a vital role in the implementation of the strategy for new industrialisation, not least through its proximity to the industrial sector. This is also where collaboration platforms and regional clusters are found and these are of major significance to industrial development. Work and processes within the EU can also have an impact on the feasibility of achieving the strategy's objectives, for example the work to implement the digital internal market. It is important that Sweden is a strong and active voice in processes that are relevant to the strategy.

Follow-up

The Minister for Enterprise and Innovation's meetings with representatives from the industrial sector and the industrial services sector are the forum used to discuss the development and evaluation of the Government's work on the strategy for new industrialisation.

To support the strategy's implementation, the Government has set up an advisory board for new industrialisation consisting of four members with a wide range of experience and good insight into the conditions and needs of the industrial sector. The advisory board will be monitoring the strategy's implementation and regularly submitting recommendations for future work.

The strategy will be followed up on an ongoing basis and the action plan will be continuously updated. The strategy will be monitored with the help of a number of indicators, which together give an indication of the industrial sectors' ability to adapt and capacity for renewal in relation to the strategy's aims and objectives. The following indicators are used on an overarching level:

- employment in different parts of the value chain
- productivity
- gross investments
- R&D investments

These indicators put a figure on how the strategy is developing, but do not provide a comprehensive view. In time, it may become necessary to develop or supplement these indicators, especially for monitoring and evaluating the concrete measures in the action plan.

The way forward – four focus areas

The strategy's implementation will take place within the four focus areas the Government has identified as vital to the industrial sector's ability to transform. These measures will be collected in a separate action plan that will be updated frequently. The chosen focus areas are judged to have the greatest potential to ensure that the Swedish industrial sector improves its competitiveness in the structural transformation brought about by digitalisation and the transition to more sustainable production. Small and medium-sized enterprises are vital to a competitive industry and the action plan will therefore focus specifically on these. The strategy is the Government's, but the industrial sector's contribution is vital to its implementation.

The child seat Parupu is made of Durapulp, a biocomposite material that consists of completely renewable and biodegradable components. Södra and Swt Paper have produced the chair, together with the design company Claesson Koivisto Rune.



Focus area: **Industry 4.0**

Companies in the Swedish industrial sector are to be leaders of the digital transformation and in exploiting the potential of digitalisation.

Consequently, implementation needs to be directed at the following:

- Stimulating the development, spread and use of the digital technologies that have the greatest potential to lead the industrial sector's transformation.
- Exploiting the potential of digitalisation broadly, irrespective of industry, company size and geographical location.
- Encouraging new business models and organisational models in order to tap the potential of the new technology.
- Meeting new knowledge requirements that are brought about by digital development.
- Adapting framework conditions and infrastructure to the digital era.

Focus area: **Sustainable production**

Increased resource efficiency, environmental considerations and more sustainable production are to contribute to the industrial sector's value creation, job creation and competitiveness throughout the entire country.

Consequently, implementation needs to be directed at the following:

- Encouraging circular economy business models.
- Ensuring that regulations and other governance mechanisms incentivise and facilitate resource-efficient and environmentally friendly production and a sustainable supply of raw materials.
- Developing new or improving existing technologies, goods and services with consideration given to sharp reductions in emissions, the phasing out of particularly harmful substances, higher energy and resource efficiency, greater reusability and recyclability and higher environmental performance.
- Exploiting the potential of new digital and other technologies for the transition to a fossil-free and circular economy.



KomTek is a municipal technology and entrepreneurship school where children and young people experiment and solve technical problems.

Photo: KomTek



To make it easier for the operator to monitor the machinery, SKF has produced specially developed apps and mobile devices for data collection and process control.

Photo: SKF

Focus area: **Industrial skills boost**

The system for supplying skills at the local, regional and national level is to meet the industrial sector's needs and promote its long-term development.

Consequently, implementation needs to be directed at the following:

- Improving the conditions for lifelong learning.
 - Promoting career changes and mobility between the higher education sector and the business sector.
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- Increasing interest in science and engineering and increasing the attractiveness of industrially relevant study programmes.
 - Improving the matching between the industrial sector's labour requirements and the education system at all educational levels.
 - Ensuring that the education system provides students with not only the right knowledge, but also with the right capabilities and skills required in the knowledge society and for the transition to a digitalised and circular economy.

Focus area: **Test bed Sweden**

Sweden is to lead research in areas that contribute to strengthening industrial production in Sweden.

Consequently, implementation needs to be directed at the following:

- Targeting research and innovation investments at areas that have a particularly great potential to contribute to new industrialisation and long-term competitiveness.
 - Opening up the public sector in order to provide the industrial sector with a test bed for solving societal challenges in close collaboration with other actors at the local and regional level.
 - Increasing the use of innovation-friendly procurement practices.
 - Promoting research collaboration between academia and the industrial sector, as well as developing the institute sector.
- Making Sweden a more attractive place for researchers to work.
 - Making Sweden a more attractive place for companies to invest in and carry out R&D activities.



AstaZero is a test environment for future road traffic safety. The various road traffic environments make it possible to test advanced safety systems and their functions for all types of road traffic and road traffic situations.

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