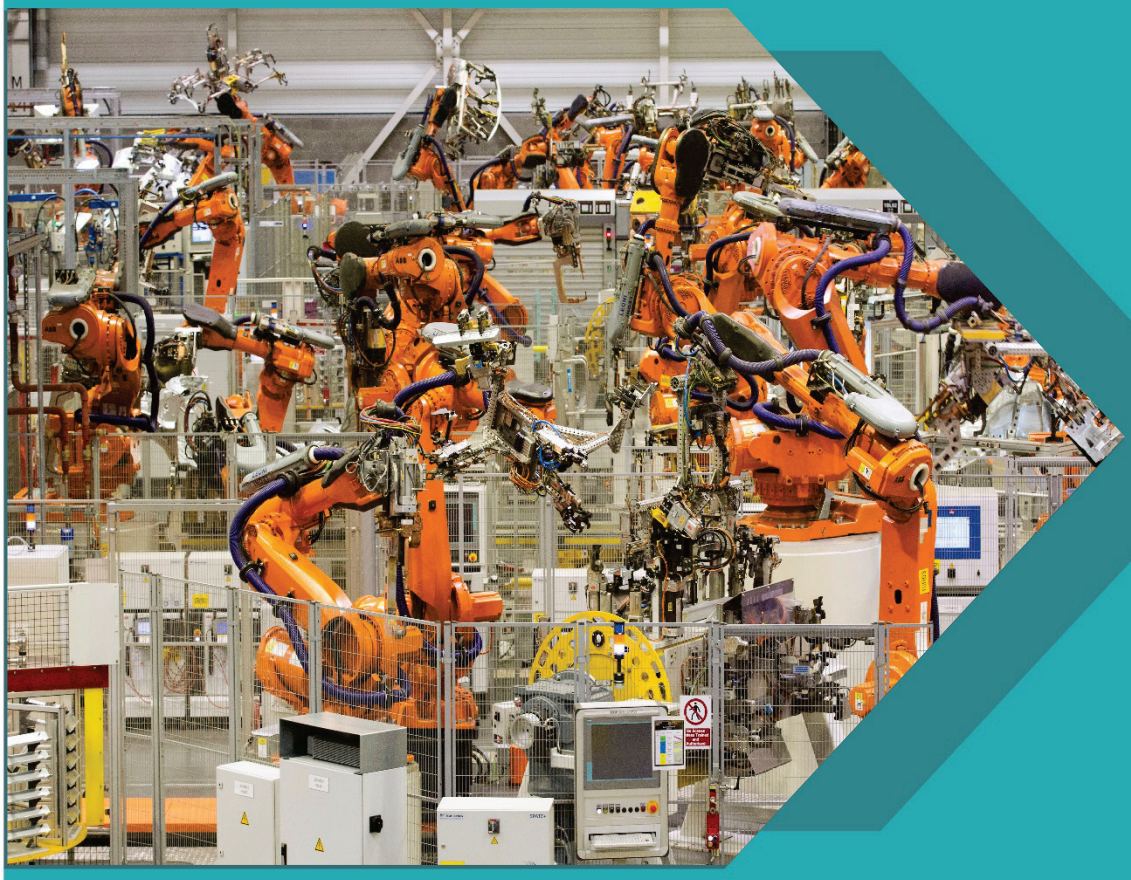
TUC
Changing the world of work for good

# All Tomorrow's Jobs

## How robotics and new technology can create better work



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# The TUC's manufacturing employment target

The TUC calls for a target for the creation of a million more manufacturing and high-tech jobs by 2030. This target dovetails with the government's aim for reducing carbon emissions by 57 per cent by 2030 compared to 1990 levels. The TUC believes that sustainable industry and green technology could be one of the key planks in delivering new manufacturing jobs. We also believe that productivity improvements from artificial intelligence, can be directed towards the creation of manufacturing and high-tech employment.

The TUC's five key priority policies to deliver new manufacturing and high-tech jobs, based on the evidence set out in this report, are:

- to make more of the Industrial Strategy Challenge Fund (ISCF) work for manufacturing employment
- to build local eco-systems to deliver employment-rich economic growth
- to offer new skills to those at risk of industrial disruption
- for trade unions to be fully represented on the new Industrial Strategy Council and on sector deals
- for the UK to remain in the EU single market and customs union.

# Foreword – Frances O'Grady, General Secretary, TUC

The TUC publishes this report, *All Tomorrow's Jobs*, at a critical time for the UK economy. It is now ten years since the financial crisis. Some economists predict that we are close to the next economic downturn, yet the pain felt by many working people since the last, great recession seems never to have gone away.

This is felt most keenly in wages. As the TUC has documented, a decade on from the financial crisis, real wages are worth £18 a week less than in 2008. Wages are not forecast to return to their pre-crash levels until 2024.

Economic growth remains stagnant. From the third quarter of 2017 to the third quarter of 2018, growth was just 1.5 per cent. Meanwhile, productivity – the amount we produce per hour of work – has been flat for a decade.

Into this cocktail of economic gloom we must add Brexit. Nearly three million UK jobs rely on trade with the EU and around £120bn of trade could be at risk from a Brexit deal that limits UK businesses' access to EU markets.

The government has responded to this tide of economic woe with an industrial strategy. A focus on skills and research and development in this strategy is important, albeit that more money is needed to match the ambitions set out in the strategy. The section on local growth is weak, however, and there is no mention of workers voice. Moreover, a year on from the publication of the strategy, it has achieved very little.

## The role of manufacturing

The TUC has called for a 'jobs and rights-first Brexit deal', to defend people's living standards and their employment rights. We have called for an end to austerity and for investment in new infrastructure, as well as our cash-starved public services. We have sought an industrial strategy that raises the productivity of so-called low value work, in the retail and hospitality sectors, among others.

But manufacturing has a very specific role. According to the EEF, who contribute a chapter to this report, it makes up 10 per cent of the economy's output and employs 2.6 million people across the UK, with many more in industrial supply chains. Manufacturing is also responsible for 44 per cent of all UK exports and a whopping 70 per cent of business research and development.

Despite this, manufacturing has performed below its potential for years. The decades since 1960 have witnessed a decline in the UK manufacturing sector, both relative to other sectors of the economy and also relative to the manufacturing sectors of other countries.

The fact that UK manufacturing has declined more than that in comparable economies highlights the role of politics. Put simply, governments have allowed manufacturing to decline. That has to stop. Instead, we need a government that believes in manufacturing, working with employers and unions, to meet the challenges ahead. Alongside jobs in manufacturing, we need more jobs in high tech sectors in the broadest sense. We hope that many, perhaps most, will be in manufacturing, but some will exist in other industries and some will be in the private sector.

In this report, we invite a range of experts to share their thoughts and experiences on how to take this agenda forward. Ricardo Rodriguez Contreras from Eurofound considers how automation and

digitalisation, including game changing technologies, affect work relationships and the role of trade unions in meeting the new challenges that this brings.

Patrizio Bianchi and Sandrine Labory, from the University of Ferrara, describe the role of a regional eco-system, in which a holistic approach improves innovation, upgrades the skills of the workforce, and creates inclusive and sustainable social and territorial conditions.

Maximilian Waclawczyk of the German metalworkers' union, IG Metall, describes Germany's next turn, the energy revolution. This will help to meet the urgent challenge of climate change and will do so in a way that allows unions to help to shape the fundamental changes that this will require in the interests of working people.

Maddie Scott of the EEF, the manufacturing organisation, discusses the digital challenge. Tim Page of the TUC sets out in detail our manufacturing jobs target and our five priority policies to bring it about, as described above.

I hope that everyone with an interest in the future of UK manufacturing reads this report. Debate with us, challenge us, argue with us. But let us not give up on our manufacturing and high-tech industries, which are too important – for exports, for R&D and for good jobs – to be cast aside.

# Introduction

This report is about the future of manufacturing employment. It was developed in response to a general narrative, that as countries get richer, their manufacturing sectors decline and their service sectors increase, and a more specific one, that the rise of digital technology will make more and more manufacturing employment redundant. The TUC wished to test those assumptions.

We care so much because manufacturing has a very specific role. The TUC General Secretary, Frances O'Grady, writes above about the contribution of manufacturing to economic output, jobs, exports and research and development. Happily, the UK has a number of world-class manufacturing companies, such as Rolls-Royce and BAE Systems. We have attracted high-quality inward investor companies, like Toyota and Nissan, the latter being the most productive car plant in Europe. Those companies offer first-class apprenticeship systems. They are also unionised companies, where managers and workforce representatives engage to build a profitable, successful company with excellent terms and conditions of employment.

## The decline of manufacturing

But if all was well in the world of manufacturing, there would be no need for this report. Indeed, while UK manufacturing has the strengths listed above, it has nevertheless performed below its potential for years. As Frances also describes, UK manufacturing has declined more than that in comparable economies and this means that governments – Conservative and Labour – have allowed manufacturing to decline. That may have been due to a fatalistic belief that the growth of developing economies, most obviously China, would make it impossible to maintain a future manufacturing industry of any real value. It may have been the idea that services, and financial services in particular, offered richer pickings. Either way, UK governments, more than their European counterparts, allowed manufacturing to fall.

## The challenges facing manufacturing

If British governments have believed since the 1960s that manufacturing faced challenges, they were right. In addition to the growth of China and its perceived capacity to crowd out other countries, the last decade has also seen the world wake up to the scale of climate change and the urgency of addressing this challenge, which could have profound implications for industry. The latest challenge is digitalisation, also mentioned above, which could also have a large disruptive effect on our manufacturing sector. The TUC is going to suggest, however, that rather than see these challenges as reasons to give up on industry, they are actually reasons to develop a far-sighted industrial strategy. We will see in the chapters below how, looked at from a 'glass half full' perspective, these challenges are actually massive opportunities.

## Responding to the challenges

The TUC's 2013 report, *The Way of the Dragon,* argues that the growth of China has great potential as a source of new markets. This is because, as China gets richer, its growing middle class is developing a sophisticated taste for western goods. China is also not yet able to produce all the modern technological goods that it needs. *The Way of the Dragon* proposed an export strategy focusing on what China, its government and its people increasingly want to buy. And before anybody asks: yes, we

could have done that from within the European Union. Germany sells over four times as much to China as does the UK[1], from inside the single market and customs union.

There are other, quite simple things we could do to improve our trade with China. Making the UK one of the best places in the world for attracting Chinese students would help to foster the cultural and ambassadorial links of tomorrow. As well as the teaching of traditional modern languages, the study of Mandarin in the UK education system should be stepped up.

Meanwhile, the Stern Report, commissioned by Tony Blair and Gordon Brown as far back as 2006, highlighted that by 2050, global markets for low carbon technologies could be worth at least $500bn. The right industrial strategy could win a share of those markets for UK industries. That strategy, working with employers and unions, could also provide a just transition for those currently employed in fossil fuel intensive sectors, so that today's workers can become tomorrow's workers.

The TUC has proposed setting a target of 50 per cent of our energy coming from renewable sources by 2030. We have specifically called for the targeting of new, clean technology towards communities in the UK that have seen the demise of heavy industry. Those communities have an industrial heritage that could be of massive benefit to new sectors.

On digitalisation, we have two decades to prepare for the full impact of this technological change. Countries as diverse as Germany and China have shown that, if the government is committed, two decades is plenty of time to get ready for even large-scale technological disruption. That's why the TUC was not shy in saying that we should step up our investment in artificial intelligence and other technologies, seeking to become a top five digital economy by 2030.

## The role of trade unions

Trade unions have a critical role to play in meeting these challenges. For example, German unions are engaged with their government and with employers on how to maximise the benefits, and minimise the risks, of the fourth industrial revolution. Airbus in Germany has negotiated an agreement with its unions which guarantees that no jobs will be lost, and no salaries cut, as a result of this technology. A White Paper on the future of work, involving government, business, unions, churches, community groups and others has considered the full impact of digitalisation, not just on specific companies but on the wider economy and society. And that's before we even consider the new opportunities, some of which – such as battery technology – we can foresee, and others which we cannot.

To take this agenda forward, we have invited a range of experts to share their thoughts and experiences with us. Their contributions form the bulk of this report, along with the latest thinking from the TUC. It is clear to us from the chapters to follow that manufacturing employment has a bright future in the UK, if guided by an intelligent industrial strategy, supported by employers and unions.

[1] https://wits.worldbank.org/CountryProfile/en/Country/CHN/Year/LTST/TradeFlow/EXPIMP/Partner/by-country

Section One

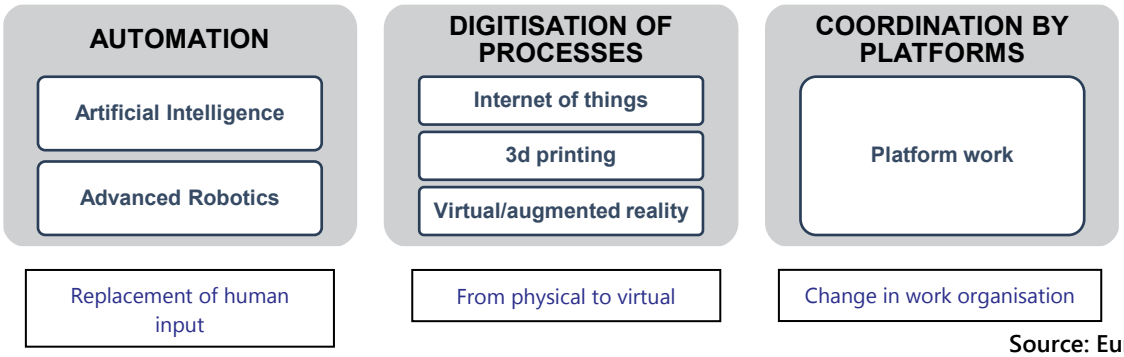
# Social dialogue and game-changing technologies in manufacturing


## Ricardo Rodríguez Contreras, Eurofound


Technological development influences everyday tasks in the same way that game changing technologies are strongly impacting manufacturing and the world of work in the 21st century. From a conceptual point of view it is important to distinguish the effects of technological change in order to understand it better.

Three main drivers of technological change can be identified (Eurofound 2018a): automation, digitisation of work processes and coordination by platforms. Each of these drivers groups technologies with similar effects; first, automation can be seen as the group of technologies connected with advanced robotics and machine learning (or 'weak' Artificial Intelligence[2] as the current public discourse currently calls it). Second, digitisation of work processes groups together technologies linked to the internet of things, additive manufacturing (industrial 3d printing) and virtual and augmented reality: these three technologies have in common the fact that they facilitate the transformation of physical inputs into digital /virtual ones, thus facilitating the manipulation of information in the virtual realm. Third, coordination by platforms has an effect on the organisation of work by allowing a division of jobs into tasks and by coordinating these tasks through algorithms.

**Figure1: Drivers of technological change**




**Source: Eurofound, 2018a**

These effects are not so clear-cut in the real world where technologies can be adapted, combined and customised to interact with workers. Depending on the way a company uses technology, this could have an impact on the type of jobs a company could require workers to perform.

Different technologies can have different impacts on different sectors, depending on the technology readiness level (TRL) (EU Commission, 2014) of the technology. For example, for the industrial internet of things (IIoT) where a great emphasis is based on the use of sensors, there are distinctive differences across sectors. In the oil sector the technology is at TRL level 9, the highest, since the adoption and implementation of the technology is already in use. In other sectors, such as food products and machine

[2] 'Strong AI' defines a system which displays human like capabilities and can exercise freedom of choice. A good description is available here britannica.com/technology/artificial-intelligence

manufacturing the introduction of IIoT could have a potentially disruptive impact and its implementation is still at development or piloting level. Another example is advanced industrial robotics, which is used in the automotive sector (TRL 9) but it could have disruptive effects if adopted in the textile industry (TRL 4-8) where the handling of soft materials such as fabric is still widely carried out by human workers.

**Table 1. Description of game-changing technologies**

| **Advanced industrial robotics** |
|---|
| Advanced industrial robotics is the branch of robotics dedicated to the development of robots which, through the use of sensors and high-level and dynamic programming, can perform 'smarter' tasks, that is, tasks requiring more flexibility and accuracy than those of traditional industrial robots – for example, a robot that can handle lettuce without damaging it. The term applies to digitally enabled robots working within industrial environments that are equipped with advanced functionality (for example, sensors detecting potential collisions, and halting or performing a programmed motion with a very limited lag), allowing them to deal with less structured applications and, in many cases, collaborate with humans (instead of being segregated from them for example in a special cage). |
| **Additive manufacturing** |
| Additive manufacturing, known also as industrial 3d printing, is a technique using the addition of successive layers to build a product. It is 'additive' in the sense that products and product components are built up rather than cut out of existing materials as it occurs in traditional 'subtractive' manufacturing. The key prerequisite of the Additive manufacturing process is that products can be digitally modelled before being physically generated. The "revolution is … the ability to turn data into things and things into data'" (Gershenfeld, 2012). |
| **Industrial internet of things** |
| Sensors applied to the manufacturing industry create cyber-physical systems where the information collected from the sensors is fed, through the internet, to computers in order to gather data about the production process and analyse these data with unprecedented granularity. In advanced cyber-physical systems, a whole factory can be digitally mapped and controlled using the virtual model built on data from such sensors. |
| **Electric vehicles** |
| Electric vehicles are vehicles for which the main system of propulsion depends on electricity and not on fossil fuel. The vehicle relies on the storage of externally generated energy, generally in the form of rechargeable batteries. The main current example is the battery electric vehicle. |
| **Industrial biotechnology** |
| Industrial biotechnology uses biotechnological science in industrial processes. Modern biotechnology is based on the most recent scientific insights into the specific mechanisms of biological processes within living organisms (for instance, through systems genomics and metabolomics research). These are used to design processes in industry using yeasts, bacteria, fungi and enzymes (biological catalysts that improve reaction processes and that are relatively easy to obtain) to produce biomaterials and biofuels. |

**Source: Eurofound, 2018b. 'Game changing technologies: Exploring the impact on production processes and work'**

## *Implications for employment*

What do these technologies have in common? Their implementation could affect employment, working conditions and social dialogue in the companies and sectors where they are adopted. In general, the

introduction of a technology will prompt changes to a production process, a reorganisation of work and consequently the need to change job description and workers' tasks. Previous scenarios on automation predicted job loss (Frey and Osborne, 2013) as a likely outcome of the introduction of new technology, such as advanced industrial robots; this job loss would have cascading effects throughout the economy due to the reduction of purchasing power of the workers. However, it could imply job creation elsewhere in the economy. It could also mean that new job profiles are needed in the company.

The automation theory has now moved the focus onto the automation of tasks, not jobs: the view on substitution of human input tout-court by a machine is not nuanced, jobs are made of different tasks and while some tasks might be automated very easily some will remain requiring a reshuffling of non-automated tasks. For example, in the case of additive manufacturing, loading and unloading 3D printers and clearing the production space has been identified as a possible new task, unless automation of this task also occurs. A Eurofound study found that an average European job would involve "a high level of intellectual tasks (particularly the processing of business-administrative information and problem-solving), a mid-high level of social tasks (particularly serving and selling), and a low level of physical tasks" (Eurofound, 2016).

Caution should be exercised on employment effects since technology adoption will not be happen everywhere and at the same time. A set of considerations is applied by companies before adopting a technology and these includes: initial set up costs (quite high for advanced robotics and industrial biotechnologies, less for advanced manufacturing and IIoT since they can be implemented incrementally); level of unionisation and resistance or acceptance towards technological change; and to some extent, supportive policy initiatives from regional and national institutions.

The fact that machinery and other tools are brought into the factory could mean that, since technology will perform and substitute human input, smaller teams could be required but also that these teams need to have a higher skills level, be more specialised, but also be able to communicate effectively in an interdisciplinary environment.

### *The great challenge: education and skills*

The introduction of new technologies will prompt manufacturing companies to increasingly look for high skilled workers such as the traditional engineer profile, process engineers, quality control, and chemical, electronic, mechanical or mechatronic engineers, but also high skilled workers who can work with the amount of data generated by digitised process. These profiles are likely to be designers, industrial data scientists, 'big data' statisticians/mathematicians and data security analysts. Nevertheless, it is rare that one person can hold all these skills hence the importance of teamwork and communication skills. Large companies are increasingly making IT skills training, including basic coding, mandatory for all new employees 'from top floor to work floor'.

Cedefop's European Skills and Jobs survey shows that around 43 per cent of EU adult employees recently experienced new technologies at work, such as introduction of machines and ICT systems. About seven in ten EU workers require at least moderate digital skills to do their job (Cedefop, 2017). But evidence also shows that basic ICT skills will not be enough. The demand for higher skills points to the ongoing debate of how Europe can meet the demand for a workforce made of high skilled workers. Workers in low-skills occupation should have the possibility to re-skill in order to be able to maintain their jobs and those in higher skills occupations should keep in mind that continuous professional development is needed in an environment where technological change is bringing new tools and ways of working (Cedefop, 2017; Eurofound 2018a).

The slogan behind this has been that 'workers should be protected and not jobs', so policy makers should think about ways to provide a package of benefits, in monetary and training terms, to help those who lost their job due to digitalisation to re-enter the job market.

### *Monitoring and updating working conditions*

The impact on working conditions varies across technologies but a common observation would be that disruptive technologies could attract new competitors which might be tech companies looking to expand their range of activities (for example Apple and Google looking at self-driving cars or Tesla adding car manufacturing to its business). These tech companies have a different management style within a relatively new business model which could, on the one hand, attract employees interested in the combination of technology and industry, and in the remuneration deriving from a high skill job, but on the other hand could see the emergence of issues if the psychosocial risks such as stress, work-on-demand or at unsociable hours were applied tout-court to the manufacturing business. Other risks identified by early studies on the implementation of additive manufacturing are the use of new materials (powders, nano-materials), as the long –term effects of the exposure to these materials are still unknown (EU-OSHA, 2017); another risk could be the motion of hot nozzles on the shop floor.

One of the advantages of internet of things and digitisation is that many jobs could become largely location independent thus enabling telework and ICT mobile work. Although for the advanced industrial robots applications, a recent study (Eurofound, 2018c) found that there could be a reduction in flexibility due to the necessity of running a plant 24/7 and having human controllers monitoring the plant thus diminishing predictability of working schedules.

The digitisation of processes involves also a closer monitoring of workers actions through sensors and interaction with machine and robots. On the one hand, monitoring could improve the level of health and safety but on the other hand, it could invade the privacy of workers through collection of personal data. This can amount to a form of Bentham's 'digital panopticon' in which an individual's rate of work, rate of task completion, work presence and absence, and potentially even physical measurements such as heart rate and blood pressure, are capable of being actively monitored by employers.

The shift to cobots (collaborative robots) and the requirement for operators to monitor an increasingly automated process could mean a reduction of social interaction and thus a risk of isolation feelings, especially for shop floor workers, while for managers this doesn't seem to be a risk given the requirement to work in interdisciplinary teams.

### *What role for trade unions in digital transformation?*

Technological shift challenges social dialogue at sector and company level in manufacturing within a context of broader digital, economic, social and environmental transformation. Deep change in manufacturing is not an isolated process, but one interacting with large-scale transformations in economic activity. Digitalisation along with globalisation is generating greater opportunities and will increase potential growth in national and regional economies. The deployment of combined technologies and particularly automatisation in manufacturing opens possibilities for rethinking and redesigning production processes, applying innovation and re-organisation of work. Labour and industrial relations will be affected by these changes and trade unions are aware of the significant times to come in order to deal with these transformations.

Automation is not a new phenomenon in industry; automated machines were present in manufacturing long time ago. Lessons learnt some decades ago at the time of introducing the first robotic arms building cars or negotiating the introduction of ICT in firms and factories should be remembered and refreshed.

The current state of the play in technological innovation foresees different levels and paces of change in manufacturing. The deployment of technology and the combination of specific technologies, particularly artificial intelligence (AI), using big data will transform production across the whole factory and consequently tasks and jobs. Indeed, the deployment of some of these technologies is still at a very early stage and predictions on future developments, particularly with regard to the number of jobs

affected, must be taken into account cautiously. The effects of digital change in the composition of employment and occupations are still unclear and further intensive research is required. However, managing this transition period properly represents a challenge for social partners and particularly for trade unions in Europe.

To manage digital transformation, social partners and particularly trade unions need to know and understand technological change. Multiple initiatives under the generic term Industry 4.0 – a term born in Germany, but is also known as advanced industrial manufacturing in the US – have been set up in many EU Member States by public authorities mostly involving businesses and unions. These initiatives focus on how to design a suitable national approach and an effective implementation of technological changes. Industry 4.0 describes an industrial space where machines' and sensors' roles have changed, opening discussions on skill needs and on adaptation challenges for people working in industry.

Trade unions should approach digital transformation pro-actively, but also dealing with the risks and threats derived from workers who need to be re-skilled in order to keep working in the new digital labour environment. Digital transformation increases the risk that a substantial proportion of people currently lacking elementary e-skills will hardly be employable. It is likely that those with a low level of education and older job-seekers will have the most difficulty in finding new jobs. Negotiating the protective support for this workforce and helping to organise the re-skilling needs will be a crucial task for unions, particularly in the likely frictional unemployment period that will take place shortly.

Far-reaching policies and social partners' agreements to support groups of workers in this transition period and to prevent structural long-term unemployment through timely training and retraining are crucial. Digital skills shortages significantly affecting the workforce in SMEs in the manufacturing sector must also be addressed by unions, as these firms are essential to the supply chain, apart from being the backbone of Europe's economy.

In this context, avoiding a potentially wide gap between the salaries and work opportunities of digital skilled and well-educated employees and those of less-educated employees is a challenge not only for unions, but also for employers and public authorities. Unions would take part in the discussions concerning the deployment and implementation of technological change in industry. Discussing the equitable distribution of productivity gains boosted by the digital transformation between capital and labour will likely be a core target.

Furthermore, the changes in workforce composition due to the full introduction of automation in manufacturing and also in the services sector may undermine the representativeness of unions at company level. More robots or autonomous systems may mean less numbers of human workers, which affect the required threshold levels for unions or for works council to be consulted at the workplace. Therefore, workers' representation can be altered by these changes as well as the process and the content of collective labour bargaining.

Additionally, unions must play a key role negotiating the working conditions in the new workplace environment. This is particularly necessary with regard to the complex implications for health and safety at work, for example, participating in the design of safe workplaces used simultaneously by robots and workers. The way of working with robots in this transition period in manufacturing is still to be defined. The area of human–machine interaction in the work context has not been researched in detail, whether it is the interaction of assembly-plant workers and supervisors with assembly robots, or engineers with increasingly intelligent software systems. Hybrid jobs, where human workers cooperate with a robot or a smart system in order to perform their tasks are more and more frequent. However, little is known yet of the psychological impact and perceptions that such interactions have on human workers.

Section Two

# Industrial policies for the manufacturing revolution


## Patrizio Bianchi and Sandrine Labory


### *The manufacturing transition*

The last thirty years has seen the emergence of global value chains.[3] Although the phenomenon is varied across firms and across sectors,[4] the overall evidence is that trade in intermediate products has substantially increased in the last decades, as firms have increasingly focused on core competencies and have offshored phases of their production process.[5][6] As a result, they have built global value chains, driven by factors including: efficiency, namely access to lower-cost inputs in the foreign country (especially labour); knowledge creation, when R&D is offshored in order to get access to a wider knowledge base; or foreign market access. Global value chains have thus become the main feature of globalisation.

Technological change has been another driver of structural changes in the last decades, with the diffusion of ICTs, biotechnologies, nanotechnologies, robotics, artificial intelligence and the Internet of Things. A new technological system is emerging, made of numerous and varied new technologies, supported by intensive scientific research and discoveries, with deep implications for the structure of the economy and society. This has led to what we now call the fourth industrial revolution.[7]

The key aspect of this industrial revolution seems to be the digitalisation of production and connected services, with a profound impact on industrial organisation. The digitalisation of the different phases of production processes favours the organisation of production on a global scale, by distributing production phases in different countries, exploiting each country's comparative advantages, together with a strong unity in data sharing, codification, management lines and long-term strategies. Large amounts of data and information have to be generated and managed at a speed that was not conceivable just a few years ago.

In the fourth industrial revolution data is the main raw material, because it is characterised by 'hyperconnection'. Sensors and ICTs connect everything and everyone. In the factory (the 'digital factory' or 'internet factory'), cyber-physical systems are established, with complex networks of machines, physical goods, virtual objects, computing and memorisation structures, communication devices (video, sound, …) and energy containers, which interact together and with economic operators. This merges the real world of industrial plants and the virtual world, leading to what is known as the Internet of Things

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[3] Bianchi P, Labory S (2011), *Industrial policy after the Crisis. Seizing the Future*. Cheltenham: Edward Elgar.
[4] Contractor FJ, Kumar V, Kundu SK, Perdersen T (2010), "Reconceptualizing the Firm in a World of Outsourcing and Offshoring: the organisational and geographical relocation of high-value company functions." *Journal of Management Studies*, 47(8), 1417–1433.
[5] Sturgeon TJ (2008), "From Commodity Chains to Value Chains: Interdisciplinary Building in an Age of Globalization." *Working Paper, Sloan Industry Studies*, WP-2008-2.
[6] Gereffi G (1994), "The Organisation of Buyer-Driven Global Commodity Chains: how U.S. retailers shape overseas production networks." in Gereffi G and Korzeniewicz M (eds.), *Commodity Chains and Global Capitalism*, Westport, CT : Praeger, pp. 95–122.
[7] Bianchi P, Labory S (2018), *Industrial Policy for the Manufacturing Revolution*. Cheltenham: Edward Elgar.

(IoT). With IoT the products being realised in the production system 'communicate' with machines and 'tell them' what to do.

Consumers are also hyperconnected, through their smartphones, computers and digital watches; their 'things', even their cars and homes, are also connected.

This hyperconnection on all sides of the market allows a real time dialogue between supply and demand, consumers' requests, product development, and manufacturing. Production processes can rapidly be changed to adapt to specific varieties of goods. Differentiation therefore increases a lot, even allowing mass customisation[8].

In this context, the distinction between products and services becomes blurred: the service content of products rises in importance, and manufacturing firms offer solutions, services as well as products. This means that the knowledge content of products grows. In terms of value added, the pre (R&D and design) and post (marketing and commercialisation) manufacturing phases of production become essential.

### *Jobs and skills*

The nature of jobs is changing. Digital factories have few employees, but these employees cannot be low-skilled. They must have skills in information technology, robot and machine programming, in order to control the production system. Since robots can perform the simplest tasks at low cost, human labour is used mainly in the most value-adding phases, where creativity and capacity to think outside the box are key.

Social inequalities have been rising in the last decades and the fourth industrial revolution risks accentuating this trend. Low-skilled people, and early school-leavers, will be confined to lower-paid jobs such as the delivery of goods and services ordered on the Internet.

The new technologies are changing people, the way they perceive and behave; they are changing society and culture.

Industrial revolutions require multidimensional policies, impacting not only on industry and the economy, but also on society. A new economy is developing, based on a different culture and different society; governments have to prepare the ground for the new economy to be inclusive and conducive to long-term development.

As in all industrial revolutions, social and educational policies become paramount. The first and second industrial revolutions raised the need for basic skills in the population, such as reading and writing, which led to universal educational systems slowly being established in the 19th and early-20th century, in Europe and the USA. Progressively during the second industrial revolution the need for secondary education was felt and educational systems extended to obligatory schooling up to that educational level.

In the fourth industrial revolution people must have both basic IT skills, such as coding, to understand the basic functioning of pervasive hyperconnection (ICTs) and its implications, such as the possibility to control individuals through the private data they release on connected technologies. People must also develop soft skills, such as the ability to communicate, to collaborate, to create and to think outside the box.

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[8] Bianchi P., Labory S. (2017), "Manufacturing Regimes and Transitional Paths: Lessons for Industrial Policy", *Structural Change and Economic Dynamics*, available online 12 October 2017, https://doi.org/10.1016/j.strueco.2017.10.003.

### *Territories and industrial policy*

Territories have to develop contexts favourable to these technological developments. This means having the necessary infrastructure and also knowledge and skills. Human capital has to develop, since the new industries will mainly require high skills. This means complementary action at the national and regional level. While the national level implements policy to support technological development, favouring advanced manufacturing, the development of new materials, biotechnologies and their applications, nanotechnologies, and clean technologies, the regional level has to become a focal point where industries can find the needed innovation capacity and skills. Factors of attraction are both tangible and intangible: tangible resources include infrastructure, natural resources and physical capital; intangible assets include the knowledge base accumulated through time. Individual intangible resources such as innovation capabilities and individual competencies work with collective intangible assets created by specific institutions and society.

The long global crisis which started in 2007 has demonstrated the destructive nature of an economy that grows without producing and creating jobs. It also showed and how destructive is a political system which does not put equity between citizens at the centre of its actions. The school plays an essential role in these dynamics; school is the essential social infrastructure that is provided by the education and training system. Individuals grow up at school, where they develop awareness of capacities and consolidate behaviour and talents. It is at school that an individual confronts with society, with the opportunities it offers and sometimes to the disillusions it provides. The school and then the university embed people in territories and develop their opportunities as citizens, able workers and innovators. If this infrastructure is weak, because society is divided, the school becomes the place of social injustice, where disparities and inequalities are perpetuated and deepened. The effective rights of citizens are indeed consolidated at school.

During periods of economic and social discontinuity, the possibility of a country to grow depends on the capacities offered to all citizens to effectively take part in the development process. Social and economic innovations emerge and strengthen as engines of development where free and competent persons interact.

The end of the 20th century represents one period of discontinuity. The old bipolar world is disappearing, a new world is being born, along with new means of communication. In this context the need for education has grown enormously, not only to allow all people to use new technologies, but also to provide everybody with the instruments needed to understand the complexity of the world and to strengthen the social capital which is at the basis of innovation, learning and development.

As a result, territories become smart and competent contexts, where knowledge is not only individually generated and acquired, but also collectively shared and transferred.

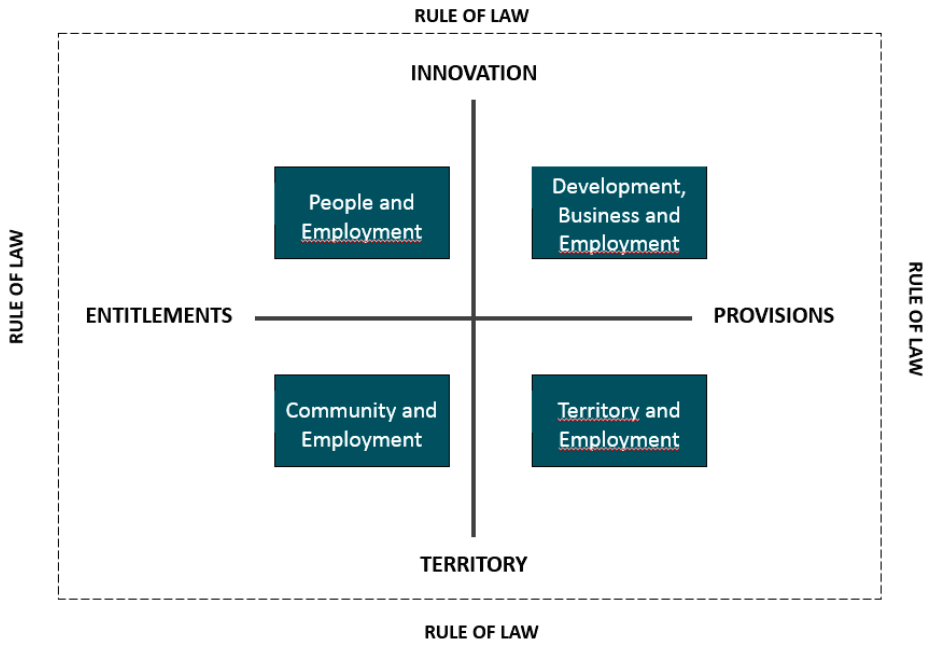
Industrial policy has to be comprehensive, in the sense of including subsidies, export promotion and other similar types of measures, but also the construction of an educative and research infrastructure able to generate positive externalities for the growth of each part of the community, be they persons, firms and institutions.

An example of such comprehensive industrial policy is the one implemented in the Emilia Romagna region in Italy. The regional government has developed a policy approach based on a strong dialogue and sharing of objectives and instruments with workers' representatives, businesses, cities, universities and other educational institutions. The region has a strong industrial base, at the centre of a triangle between Milan, Venice and Florence.

This dialogue has led to an agreement, called Patto per il Lavoro (Labour Pact), defining the industrial policy of the regional government for the period 2015 to 2020. The pact was signed by all regional stakeholders on 20 July 2015. The main objective was to raise the employment level in the region to the levels experienced prior to the financial crisis.

The methodology of this policy followed the framework proposed by Bianchi and Labory (2011), according to which industrial policy should focus on four important dimensions that drive structural changes, namely innovation, territory, entitlements and provisions. Those four dimensions are essential to guarantee inclusive and sustainable growth. They, in turn, define four policy areas that have to be managed in an integrated manner: policy for technological innovation, for territorial development, for welfare and for human resources (Figure 1).

**Figure 1: Policy framework of "Patto per il Lavoro"**




**Source: Patto per il Lavoro, 2016, Regione Emilia-Romagna.**

The aim is to increase the added value generated in the region by upgrading the whole productive structure, through both investments in human resources and innovation and in their creation of inclusive and sustainable social and territorial conditions.

The measures therefore include vocational training policy, from basic to the highest level (Ph.D.), in order to raise the quality of the territory's human resources.

Simultaneously the different centres of high-tech manufacturing of the region have been networked in order to generate and diffuse knowledge and transform it into new productions.

A big data centre has also been created, putting together the big data storage and analytics capacity already present in the region, but also substantially investing to increase this capacity, using both European and national funds. The big data centre of the international agency for weather forecasting will move as a result from Reading to Bologna, the capital city of the region.

Territorial development also includes action to upgrade cities, which constitute the main platform for the growth of new products and services. Strong actions aimed at consolidating social cohesion have also been implemented. All these actions have contributed to create stable conditions, which have favoured private investment and the upgrading of global value chains.

Employment has grown in the region as a result: the unemployment rate has fallen from 10 per cent in 2015 to 6 per cent in 2018, close to full employment. The areas which have received most investments are mechanical automation, automotive, food, big data and artificial intelligence.

The Emilia Romagna region has also implemented a strong policy of linkages, building cooperative relationships with other European advanced regions (Vanguard Initiative), as well as peripheral ones (the

Adrion programme including all regions bordering the Adriatic and Ionian seas). This policy has enabled the exploitation of complementarities between industrial actors of different regions, thereby consolidating businesses able to compete on a world-wide basis in the emerging mass customisation production system.

Section 3

# Manufacturing and jobs of the future

## Maddie Scott, EEF

For decades the concept of job creation and manufacturing didn't necessarily go together. But in recent years this has changed with the UK's industrial sector contributing to one of the bright spots of the UK economy – its labour market performance.

There are two sides to this employment coin. On the plus side, UK manufacturing offers more highly skilled, and therefore highly paid, job opportunities than many other sectors in the UK. On the other, however, this employment growth has been a contributing factor towards the UK's flat lining productivity performance over the past decade and the associated sluggish growth in real incomes.

There are a number of new forces at work on UK manufacturing companies that will affect their decisions on training, recruitment and investment. Getting these right are important in ensuring UK industry can remain competitive in an international setting and retain its position as a good employer that offers rewarding – in every sense of the word – career opportunities.

The EEF's contribution to this debate starts with why we should care about this at all, what the fourth industrial revolution could mean for manufacturing and what industry will need to do to keep up with the global journey. Finally, we have some reflections on how manufacturers think that government policy can be most effectively deployed to fully capture the economic benefits for all from this technological transformation.

### *Manufacturing matters*

We'd all be hoping not to have to make the case for a focus on manufacturing, but we, at EEF, still don't take its vital statistics for granted. Moreover, the disappointing performance of the UK economy as a whole since the Brexit referendum and the, now consensus, view that long-term potential growth has also slowed, means that we need a greater focus and understanding of the economic segments that can step up and support growth in output, exports and investment.

While on the first of these, UK manufacturing is often discussed in terms of its contribution of only 10 per cent of output, on other metrics manufacturers punch above their weight, being more internationalised, more innovative and investing much more than its output share on modern machinery.

Critically, since the financial crisis manufacturing has also taken on more importance in driving overall economic growth. Manufacturing has seen very robust expansion in the eighteen months since the Brexit vote, across all sub-sectors. 466,000 jobs have been created in the sector in the year to 2018Q1. This has brought its challenges, given a weaker pound, better employment opportunities in other countries and the uncertain migration status of non-EU workers since the Brexit vote. The global outlook is also bumpy in the short term. Having said this, the future for manufacturers everywhere could and should still be bright.

### *Another industrial revolution*

Manufacturing is, once again, entering an era of considerable change. Over the last few years there has been increasing discussion about the digital future of industry – the 4th industrial revolution, or Industry 4.0, smart manufacturing, connected factories, factories of the future – the choice is yours!

Essentially this is the next iteration of manufacturing. It is ushering in new technologies and techniques that will change the products, processes and supply chains involved in every aspect of industry. Ultimately it is about enabling manufacturers to respond to modern industrial competitiveness pressures, while allowing them to serve customers who will increasingly expect a nimbler approach to manufacturing.

### *One step at a time*

Our research on this has identified some clear milestones for manufacturers in the journey to a more digital future. The journey starts with conceptualising the realm of possibility from their unique business context, to optimising or evolving existing processes, before a revolution is ushered in and with it, fundamental changes in current business models. All these steps will be driven by business ambition and strategy, which will not be the same for everyone.

There are many different benefits to this transformation. In the short term, the focus will be on improved operational efficiency through better use of capital, workers and resources. Over the medium term the transformation will unlock new products, services and business models that will allow value to be added and captured in different ways.

### *'Fabbrica Intelligente'*

This isn't just a UK phenomenon. It is a global shift, which offers opportunities for UK manufacturers as global supply chains are joined up more effectively. But this worldwide change also presents a risk if UK manufacturers fail to keep pace. Manufacturers currently feel UK industry isn't geared up for the change, but that their business is – demonstrating a need for greater communication across supply chains and industrial sectors about the benefits.

This highlights an early warning – not enough of the UK manufacturing sector is confident to start discussions about this with their peers in industry. Without industry and supply chain leadership, the risk is that the UK will be left behind. There is also a risk of complacency of understanding. Change will be happening quickly and while the outcomes from technology may be clear now, new insights may change the manufacturing process in unforeseen ways within some sectors. Keeping abreast of change will be a significant requirement for industry leaders.

### *Do we have the skills?*

Decisions on what and when to apply evolving technology is not plain sailing. Despite the high capital intensity of the sector and the increased use of technology that will come about as a result of the changing industry, the availability of talent will continue to influence the success of a business. It is not just the ability of key workforce members to implement technology, but also the leadership skills needed to manage change.

Across all of our research, retraining and upskilling employees is identified as important to fully realise the benefits of 4IR. With the number of people coming into the industry not sufficient to cover those leaving, companies know they must look to the existing capabilities they have in their workforces, upskilling and reskilling employees in order to make technology implementation a success and ultimately, to achieve their firm's growth ambitions.

IT skills will need to step out from a single department and cross into all areas and disciplines of manufacturing. There will be a blurring of lines between engineers and IT specialists.

Alongside the need for digital skills to help prepare themselves for this transformation, manufacturers see that the change will also create new highly technical skills requirements through new and changing job roles in production and design. The move towards greater use of technologies (such as wearable augmented reality) may increase the number of generalist roles within manufacturing.

During our extensive discussions with manufacturers, it is absolutely clear that industry expects future employment in the sector to be different rather than greatly reduced. In the same way that the demise of piano manufacturing – a consequence of the invention of the radio – cannot be viewed in isolation, our economy, businesses and individuals need to be geared up to respond and adapt to changes in future skills needs.

### *Do manufacturing leaders have the right stuff?*

Leadership and management skills will be just as important – while uncharted waters lay ahead, manufacturers recognise that for 4IR to be a success, they must lead by example. Boards must outline a vision for the future, their ambitions and goals, and drive this strategy through the business.

Not all change associated with the 4th industrial revolution will be technology focused; there has been a clear steer from manufacturers that they recognise the need to foster the appropriate culture at all levels of the business in order for any endeavours to be a success. And, given the interconnected nature of manufacturing, there will also need to be this culture embedded in companies across supply chains for future technologies to deliver the competitive advantage and step change in performance that can be achieved.

### *The UK's industrial strategy*

While a lot of the focus for implementing 4IR will be down to manufacturers, there are a number of unknowns which could hold back investment which needs an industry level discussion and solution. There are also business environment factors which need to be addressed by policymakers.

The UK now has an industrial strategy that could help but that is still, some one year on from the white paper, more theory than practice. What is the right approach to take things forward and ensure a competitive manufacturing sector that continues to invest and evolve in the UK?

An industrial strategy is not just a document for one department, it is a way of changing the relationship between government, businesses and their employees to deliver outcomes more effectively, but these outcomes must be known and reinforced across government. Clarity is needed on the goals of the industrial strategy, how it will be measured and how different sectors can contribute to success. Horizontal actions can help to give businesses a helping hand by ensuring the fundamental foundations are in place for growth. Implementing Juergen Maier's study on industrial digitalisation would be a positive move. government should also deliver a skills system that ensures lifelong learning and retraining, by focusing the planned National Retraining Scheme on supporting existing employees to up-skill and re-skill – using technology to deliver flexible forms of learning as and when required.

On infrastructure, the government has backed EEF's call for a reliable full-fibre digital backbone. But plans are slow and there is too much faith being placed in the commercial sector to deliver. Getting this right will provide a major boost to productivity and give the UK a strong competitive advantage on 4IR. Work is also needed to look at the regulatory frameworks needed to enable new technologies. Sector Deals could help but the process to unlock these deals is cumbersome, opaque and already turning the business community off. Better project management is needed from government.

Local industrial strategies will be a game changer. As part of the industrial strategy, government must bring forward a framework for devolution setting out the governance needed to unlock the powers needed to take strategic leadership at the local level.

### *Future proofing the industrial strategy*

Lastly, 4IR is in its infancy, so the industrial strategy must ensure action is future proofed, helping rather than potentially hindering. Encouragingly there is some consistency across parties and even across decades on what the right recipe for an industrial strategy is. The fact that the need for an industrial strategy keeps coming back suggests there is a strong will from business and trade unions for it to exist. So future proofing is less about keeping the concept alive and more about showing what an industrial strategy can deliver.

So, if we're now pretty much on the same page, we'll wrap up with two things that look pretty certain for manufacturing. Technology is changing at a faster pace than companies have experienced in the past. Any uncertainty about the returns of investing in 4IR technology or what will deliver the best results at the firm level is being compounded by the known unknown of Brexit.

Manufacturers and the millions of people that innovate and make things in the UK every year have a shared interest in the UK getting on the front foot in this journey. While we (being England – other home nations are available) might relish being in the position of plucky underdog in international football, not so when it comes to global technology shifts.

There will be disruptions we will need to face and overcome along the way. But there will be no long-term upside for our sector or the wider economy if there are blockages placed on the road in this journey. Not for the prosperity of those working in the sector or the productivity and competitiveness of our post-Brexit economy.

Section 4

# Current German industrial policy and future challenges of a social-environmental transformation

**Maximilian Waclawczyk, IG Metall**

Industrial policy is back in vogue worldwide. In economics, there are certainly still discussions about the pros and cons of industrial policy, but even there the proponents of the doctrine of pure market control are tending to withdraw.[9] And above all in economic policy practice, the question of whether governments should pursue industrial policy or not is answered factually: "For a European Industrial Renaissance", "Made in China 2025" or "America First" do indeed cover quite different industrial policy approaches in terms of design, ambition and strategy. However, all three economic regions have made the maintenance and expansion of their own industrial value-added shares a focal point of their political agenda – in some cases also by means of strong market interventions. Trump's confrontational trade policy is also ultimately only an expression of the now rediscovered appreciation for the long neglected industrial sectors.

As was the case at the beginning of the 2000s, hardly any politician today would sing a requiem about the decline of industrial production in their own country. The arguments of those who emphasise the necessity of industrial policy to control markets in a capitalist system are too weighty. The experience of the financial and economic crisis, from which countries with a high industrial share recovered far more quickly, is still having an impact. There is also a growing concern that without an industrial sector strong in exports, we will find ourselves on the "losing side" of the trade balance in the future. And more and more often, after elections, there is talk of the "disengaged" sections of the population in de-industrialised regions, who increasingly give their attention and their votes to right-wing populists in the elections.

The German industrial model, in particular, is often regarded as a model for a stable industrial sector. In the early 2000s, hardly anyone would have thought it possible for German industry to maintain its share of gross domestic product at the relatively high level of around 23 per cent throughout Europe over the last 20 years. At that time, supporters of a financial market and service-oriented economic policy were also growing louder and louder in Germany, claiming that the de-industrialisation of developed industrial nations was only a matter of time due to the price-competitive advantages of developing countries.

They were wrong. Approximately 100,000 industrial companies in Germany still employ around eight million people. Industry accounts for 86 per cent of the economic sector's research and development expenditure and around three quarters of its exports. Industrial value creation is therefore still of the utmost importance for economic, social and political stability in Germany.

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[9] See: Stiglitz, Joseph E. et al. (2013): "Introduction: The rejuvenation of industrial policy." In: Joseph Stiglitz und Justin Yifu Lin (Ed.): *The Industrial Policy Revolution I: The Role of Government Beyond Ideology*. London: Palgrave Macmillan, pp. 1-15.

What supports this stable industrial base? Peter Hall's and David Soskice's 2001 analysis is still largely correct: the incremental pattern of innovation and the resulting competitive advantages of diversified quality production are based on a specific institutional setting of coordinated industrial relations.[10] Institutions such as labour law, collective bargaining and co-determination (at both company and company policy level), which are often branded by employers as hostile to innovation because they get in the way of competition, have a special role to play here.

Without strong protection against dismissal, there would be hardly any incentives for older employees to pass on internal, production-specific know-how to younger colleagues and therefore to train potential competitors to do their own jobs. Without a far-reaching regional collective agreement system, price competition via wage costs would gain greater weight than qualitative competition via advantages in innovation. And lastly, without the institutions of corporate co-determination, there would be a more short-term shareholder value orientation in corporate policy. This is also without the operational co-determination of fewer possibilities to implement process innovations smoothly in cooperation with the employees.

The above examples are well-proven empirical[11] advantages of employee-oriented institutions that have a positive effect on the industrial structure in Germany. In reality, however, only a high-road strategy of qualitative innovation competition is possible. Competition based on price advantages and wage cost pressure can no longer be won by countries with high wage levels due to the comparative cost advantages of low-wage countries.

However, the institutional setting that Hall and Soskice investigated at the beginning of the 2000s has changed dramatically. The liberalisation of the labour market in Germany at the beginning of the 2000s also weakened company and collective bargaining structures. Temporary work, work contracts, the escape from co-determination and the need to make collective agreements more flexible have meant that the coordinating function of trade unions and company representatives has diminished in relation to corporate and industrial policy.

The financial and economic crisis posed a particular challenge to industrial relations. It was by no means clear whether the highly export-oriented industrial sector would ever be able to recover from the collapse of the world economy. During the economic crisis, however, another advantage of coordinated industrial relations became apparent: the regulations negotiated between trade unions, employers' associations and politicians on temporary work, the bonus for new vehicles ("environmental bonus") and the crisis measures agreed in collective bargaining agreements meant that it was possible to overcome the most serious economic slump in post-war Germany without suffering a sustained rise in unemployment and multiple site closures. These measures were the central starting point for industrial policy support measures taken by German industry, which would not have been possible without the participation and initiative of strong trade unions.

The experience of overcoming the economic crisis with the participation of the trade unions introduced a paradigm shift in the sense of a renaissance in dialogue-oriented industrial policy. After years of proclaiming the end of German industry and even reservations about the term "industrial policy", the Grand Coalition set industrial policy in motion in Germany in 2013. In the coalition agreements between the CDU, CSU and SPD, industry was not only mentioned as the "foundation for growth, prosperity and

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[10] "In addition, examination of coordinated market economies leads us to emphasize the importance of another kind of institution that is not normally on the list of those crucial to the formation of credible commitments, namely institutions that provide actors potentially able to cooperate with one another with a capacity for deliberation. By this, we simply mean institutions that encourage the relevant actors to engage in collective discussion and to reach agreements with each other." Hall, P.A. & Soskice, D. (2003). *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford: Oxford Scholarship Online.

[11] F.e.: Ben Kriechel, Samuel Mühlemann, Harald Pfeifer, Miriam Schütte: "Works Councils, Collective Bargaining, and Apprenticeship Training – evidence from German firms", in: *Industrial Relations* 2/2014.

jobs"; rather, policy on industry also changed due to broad-based dialogue processes with trade unions and industrial associations, among other things.

In the meantime, the trade unions, within the framework of several platforms, alliances and initiatives at national and regional level, as well as in various dialogues across different industries, have been able to bring important industrial policy impulses into the work of the Federal government. This does not mean, however, that we at IG Metall are not entirely sceptical about the implications of such industrial alliances. Another dialogue process does not yet constitute a genuinely new industrial policy.

This became particularly clear in the attempt to take a joint position on the report of the expert commission "Strengthening investments in Germany", which was set up by the Ministry of Economic Affairs in 2015. The findings were shared by all sides: there is a deficit of public and private investments in Germany, especially with regard to investments in sustainable infrastructure. However, the fronts hardened when it came to financing proposals to remedy the investment deficits. From a trade union perspective, this would have required a move away from the practice of public-private partnerships, the introduction of a golden investment rule (and therefore a softening of the debt brake) and a fair tax concept. Such proposals were contrary to those of employers' and industry associations. The clear conflicts of interest on financing, and thus distribution issues, therefore necessitated a special vote by the trade unions in the final report.

Given the challenges that industrial transformation will bring in terms of decarbonisation, digitisation, financialization and globalisation, the need for industrial policy dialogue processes is likely to increase. At the same time, however, the gaps between employers and trade unions on these issues are likely to widen. For German trade unions will have to do more in the future than simply defend the advantages of the Rhine corporatist production model and, together with the industrial associations, limit themselves solely to the preservation of industrial value-added shares in the sense of pure industrial lobbying. Transformation processes require strategy and planning. They have to be accompanied by state regulation and investment. This in turn contradicts the neoliberal dogma of interventions which should be minimised in market processes. Far-reaching conflicts over the role of industrial policy are therefore inevitable.

This becomes clear from the example of environmental transformation. With the emergence of the environmental movement, the discussion about the right balance between capital, work and ecology began in German trade unions at the beginning of the 1980s. But unlike then, we are now facing a tougher challenge. The alarming urgency of climate change requires drastic changes in direction in the world's industrialised countries in the foreseeable future. To achieve this, however, Germany must move forward with the energy revolution and the transformation of industrial production faster than has been the case up to now. Employment in the IG Metall industries will be affected to varying degrees.

Individual industries, such as mechanical engineering or the electrical industry, will be able to benefit from the increasing global demand for efficient technologies. In the automotive industry, on the other hand, the switch to electromobility will lead to a considerable structural change in employment, especially in the supplier structure.[12] In energy plant construction, conventional power plant construction and the associated sites and jobs are already coming under pressure today, while employment in the wind industry has steadily increased since the economic crisis. The energy-intensive steel industry is subject to increasingly existential cut-throat competition if we do not succeed in shaping climate regulation in such a way that the international competitiveness of the German locations is maintained.

[12] According to a study launched by IG Metall and conducted by the Fraunhofer Institute of Industrial Engineering, “by 2030 every second job in passenger car powertrain will be impacted directly or indirectly by electromobility.” reuters.com/article/us-germany-electromobility-jobs/switch-to-electric-cars-threatens-75000-german-auto-industry-jobs-idUSKCN1J115L?feedType=RSS&feedName=technologyNews

IG Metall is facing quite difficult conflicts in making adjustments in individual sectors and companies. In order for the necessary environmental transformation to become a social-environmental transformation in which jobs and working conditions do not fall under the wheels, a targeted political restructuring of the transformation processes is required. These processes cannot be left to market mechanisms alone, as the actors involved will remain on the path they have followed to date due to the inevitable uncertainties and costs of transformation.

So that a change of direction in processes in the economic, environmental and social sense can be successfully mastered, a social-environmental industrial policy within the meaning of the trade unions must therefore be oriented more strongly than previously to two guidelines:

i) Reliable prospects for investment in the form of politically agreed targets and a coordinated combination of support programmes and regulation. Stable long-term conditions to promote certain leading markets and technologies create secure expectations for investors, who can therefore engage in a growing sales market, leading to further investments. The regulatory framework conditions must be set in such a way that they lead to transformation competition and avoid cut-throat competition.

ii) A fair distribution of the resulting costs of a change in direction. According to a study by the German industry association BDI, the path of transformation towards decarbonisation in Germany will require €1,500 billion in additional investments in companies (new technologies and production processes), consumers and in public infrastructure by 2050. There are also additional costs required for social reception measures and for the qualification of those whose jobs will be affected by structural change. Political clarification is required as to how the investment needs can be distributed fairly in society.

One thing is certain: the necessary investments related to sustainable infrastructure will not be financed solely from the uncertain budget surpluses. This requires a much broader financial basis financed by debt and taxes. The German debt cap is therefore at issue, as is a tax system that leaves large parts of major assets and income untouched.

Stronger and strategically targeted public investment could strengthen the leading and sales markets, which in turn would have a positive impact on private investment. However, the policy proposals currently under discussion at both federal and European policy level point in a different direction. To increase private investment, measures to liberalise the financial markets (e.g. in favour of risk capital), a reduction in corporate income tax and further depreciation possibilities are more likely to be brought into play. The fact that companies' investment activity in Germany has hardly increased in view of record profits and low interest rates is an argument against this. Further supply-oriented measures are therefore highly unlikely to lead to a reversal of the trend, but rather, they will contribute to increasing the discrepancy between high corporate profits and restrained capital investment.

If it is taken seriously that the social-environmental change of path can only be successfully managed within the framework of a state that is active in industrial policy and investments, then the question of distribution policy is at the core of good industrial policy. What is therefore needed is a new overall distribution policy concept that aims to overcome austerity, flexibilization and deregulation policies and combines these with the objectives of a social-environmental change in direction.

One of the associated challenges for trade unions will be to focus more on bringing debates on the correct orientation of industrial policy to companies and discussing it with them. Employee representatives and employees not only have to ask themselves the extent to which the products and production methods of their own company are geared towards a sustainable and therefore sustainable business model. At the same time, we also need to debate how this structural change should be shaped in the interests of employees, what demands are necessary of the state and the economy, but also what opportunities arise for the sites and their employees as a result.

This is by no means an easy task and we still have a long way to go. Renewed efforts on the part of the trade unions are needed to bring the contradictions, challenges and perspectives of a socially and environmentally sustainable industrial policy into the companies. Our message here is: industrial policy is feasible within the meaning of good work and sustainable management. However, this is essentially dependant on communicating the necessary political decisions to the population and in particular to the employees affected by structural change. In Germany, as in all developed industrialised countries, the following applies: without trade unions and company representatives, who support the industrial policy discourse in companies and politics as credible mediators of a social-environmental path of transformation, the coming challenges will not be mastered.

Section 5

# Creating the manufacturing jobs of the future: a trade union perspective

## Tim Page, Senior Policy Officer, TUC

Ask the stereotypical London taxi driver about manufacturing and he or she will probably say something like, "The problem is, Britain doesn't make anything anymore." In fourteen years of researching industrial policy for the TUC, it is a refrain I have heard many times. It's one of those phrases that isn't true, but feels as if it is. The EEF points out that manufacturing makes up 10 per cent of UK economic output and directly employs 2.6 million people.[13] Manufacturing makes a major contribution to the UK economy. This good news only becomes bad news, first, when first we consider what manufacturing did contribute 30, 40, 50 years ago, and, second, when we look at how comparator countries have fared.

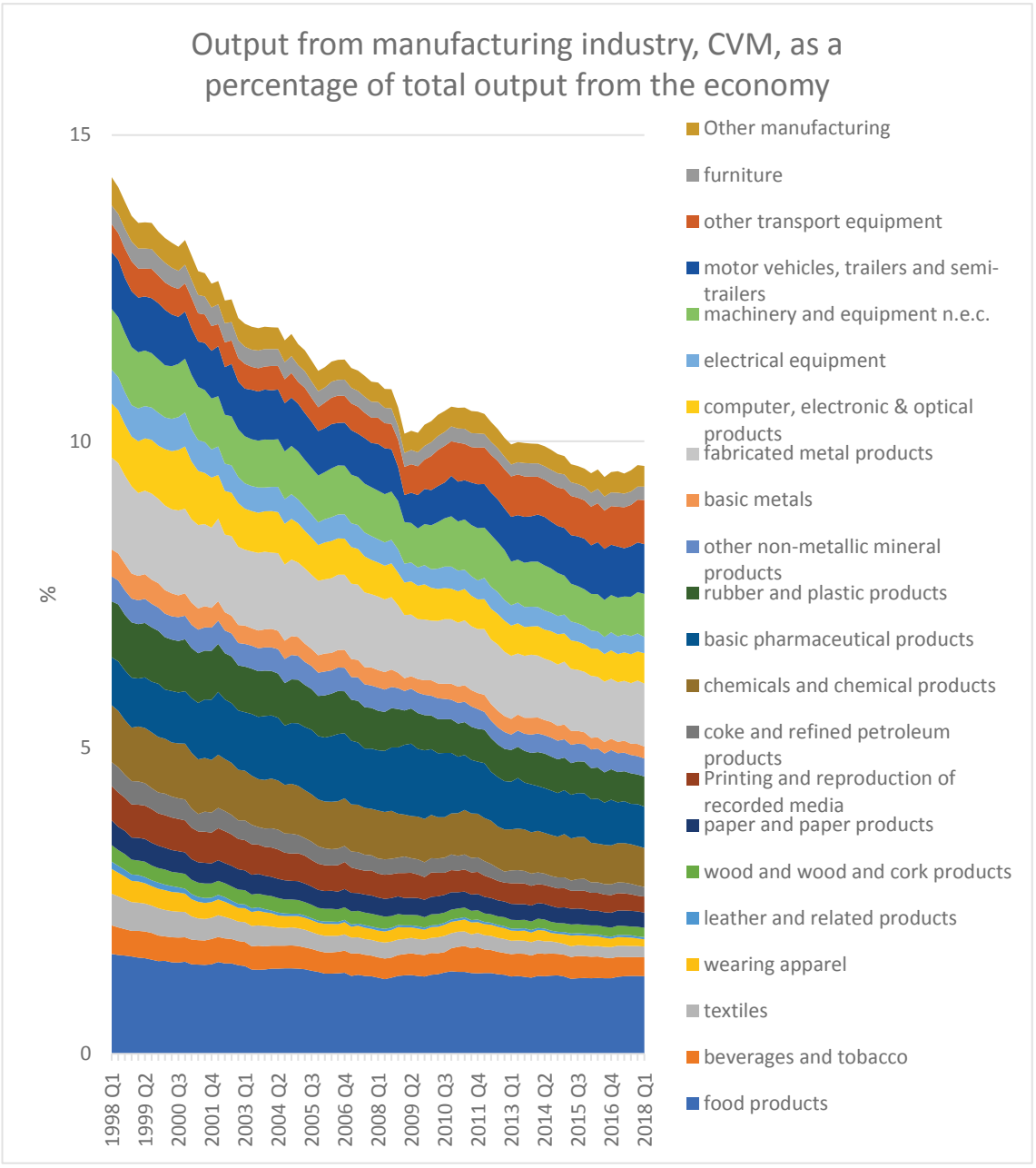
In "The De-Industrial Revolution: the rise and fall of UK manufacturing, 1870–2010", Michael Kitson and Jonathan Michie[14] point out that UK manufacturing has been in decline since 1870. However, at that time the UK was the leading global economy, a strength which derived from the industrial revolution. In that sense, the only way was downwards. The US was always likely to catch up and overtake the UK, if only because of its scale. But the US was better at educating its citizens than was the UK, and this was a major factor in its rise. Kitson and Michie also describe problems going back 100 years that the UK would recognise today, such as our strength in developing new ideas but our weakness in exploiting them.

The period from 1950 to the early 1970s is often referred to as a 'golden age'. 1966 was the high point of UK manufacturing employment, but the economy was already entering a period of 'deindustrialisation' and well-known UK shortcomings – such as a lack of investment and skill shortages – were already in evidence. The years of the Thatcher government are closely associated with the decline of manufacturing; it was during this time that the UK began importing more manufactured goods than it exported. Yet the trend had long started before Margaret Thatcher entered Downing Street.

### *The state of UK manufacturing*

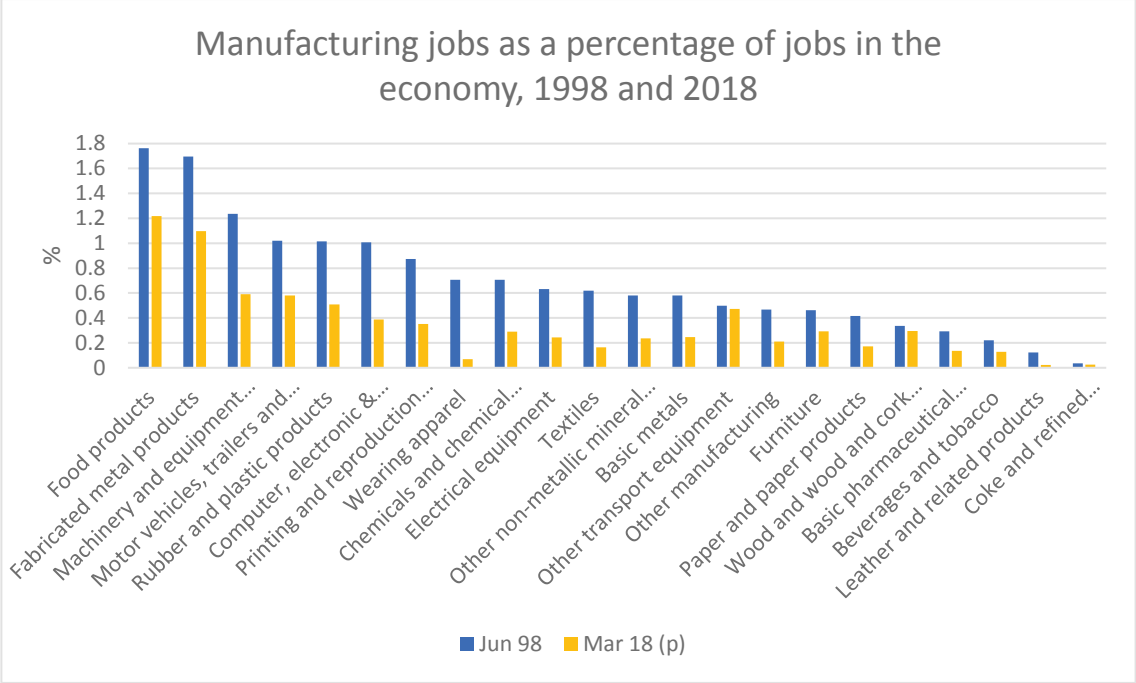
So how is UK manufacturing faring? The following graph shows the decline of manufacturing output, broken down into standard industry classifications, from 1998 to 2018:

[13] file://tucchs05srv/FolderRedirection$/paget/Downloads/EEF-Manufacturing-Factcard-2017-18.pdf
[14] cbr.cam.ac.uk/fileadmin/user_upload/centre-for-business-research/downloads/working-papers/wp459.pdf



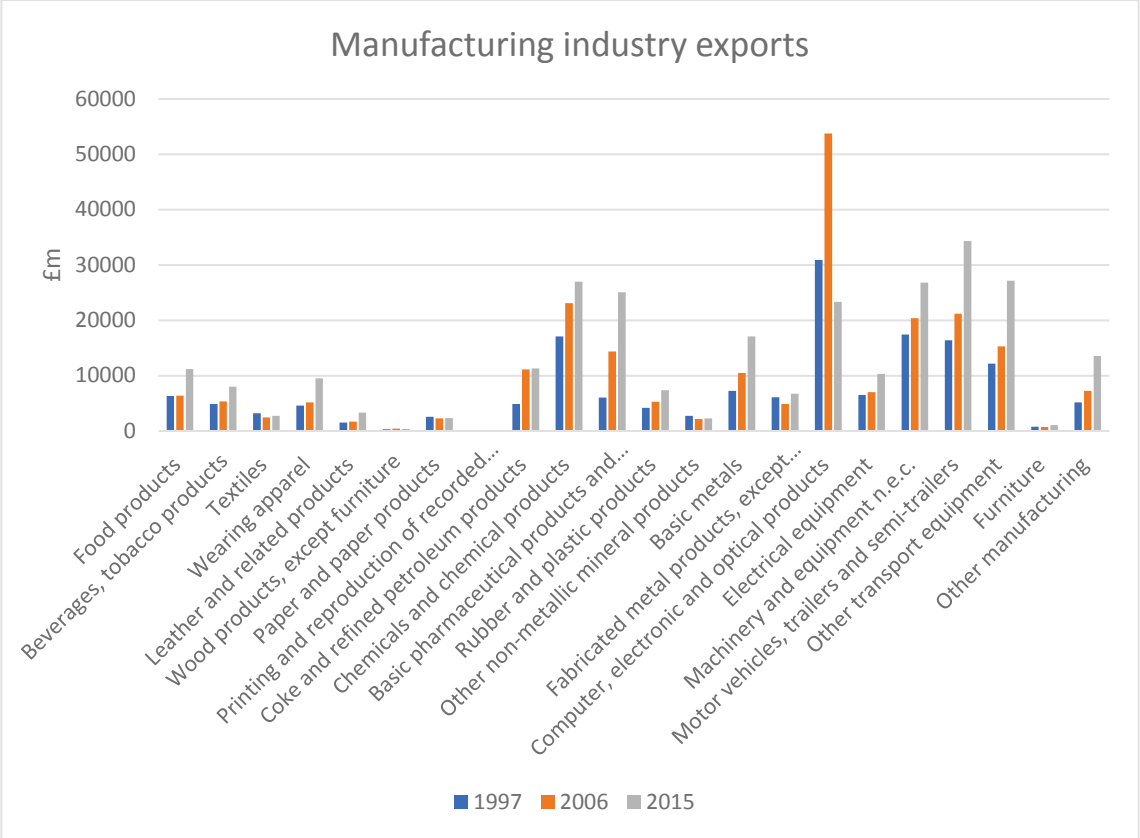

The decline is not dramatic; it is a simple, but continuous fall in output over two decades. Basic pharmaceuticals, motor vehicles and other transport equipment have held up best over this period.

This second graph shows the decline of manufacturing jobs over the same period, again broken down into industry classifications.




In some cases, this fall in manufacturing employment has been steep: the wearing apparel sector has almost disappeared; sharp falls have been seen in computer equipment and chemicals. And where we do have industrial successes, such as in motor vehicles, this doesn't necessarily translate to more jobs. In fact, we have lost over 40 per cent of jobs in the motor industry during this time.

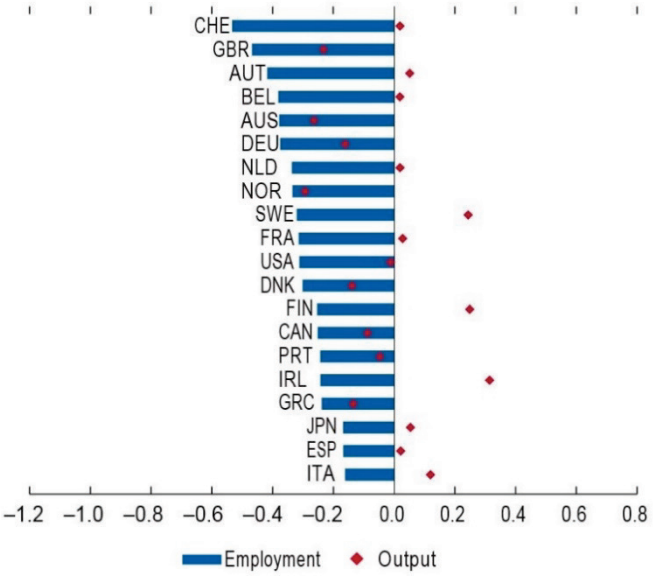
The third graph shows manufacturing industry exports.



A key argument in favour of manufacturing is the level of exports that it provides. In some cases, such as the production of computer and electronic products, exports have risen and fallen again. But we do well in many other sectors, including chemicals, pharmaceuticals, motor vehicles and wider transport products. Given the UK's need to pay its way in the world, this is a strong argument in favour of a healthy manufacturing sector.

If manufacturing output and employment are both down, but exports are strong, how do we compare to other countries? The International Monetary Fund's *World Economic Outlook*, April 2018[15], compared the UK's industrial decline to that of other manufacturing nations. As the following graph shows, between 1960 and 2015, UK manufacturing employment has declined more sharply than any other advanced economy except Switzerland. Our decline has been twice as fast as that of Italy and Spain and about a third again as fast as that of the US and France.

Estimated Trends in Manufacturing Employment and Output Shares, 1960–2015




Some believe this doesn't matter, but the TUC believes that manufacturing is important, because it is good for exports, as we have seen, it is good for research and development and – most of all – because it can provide good quality jobs across the UK, thereby helping to bridge the divide between London and the south-east on the one hand, and the rest of the country on the other.

## *Boosting manufacturing; what have we learned?*

Over the last decade, the TUC has published four studies looking at industrial policies in other countries. All the countries studied have followed more active industrial strategies than has the UK.

### Dirigisme

In *Developing UK Industrial Policy: Lessons from France*[16], we recognised the central role of the French state in directing industrial policy, in line with France's 'dirigiste' tradition. We also called for a strategic investment fund, as had been piloted in France. An advisory board, on which industrialists and trade unionists would be represented, would manage the fund and its accompanying strategy, as in France. The fund should hold stakes in companies over an eight to ten-year period and should expect a return

[15] imf.org/en/Publications/WEO/Issues/2018/03/20/world-economic-outlook-april-2018#Chapter%203
[16] tuc.org.uk/sites/default/files/extras/strategicinvestmentfund.pdf

on its investment, in the same way that any private sector employer would. The fund should be revenue neutral, but it could even make a profit for the taxpayer. Its overarching aim, however, should be to support strategic British companies in their growth and competitiveness.

This paper anticipated some of the arguments later put forward by the innovation economist, Mariana Mazzucato[17]; if the strategic investment fund was revenue neutral in overall terms, but would sometimes make a return on its investment, it follows that it should not be afraid to invest in some risky projects that may make a loss. That is a chance that we must take if we wish to support innovative ideas. However, the nature of the strategic investment fund would mean that, unlike in the UK at the moment, it would not "privatise the profit but socialise the loss". It would actually socialise both profits and losses.

### The social market economy

In *German Lessons*[18], we looked at key features of Rhineland Capitalism, including Germany's world-beating dual system of training and its tradition of co-determination. This latter tradition, sometimes known as the Social Market Economy, is culturally cherished in Germany, in the same way that the National Health Service is culturally cherished in the UK. Well organised trade unions and strong employer organisations work together; differences of opinion, even conflict, are recognised and respected, safe in the knowledge that what unites management and union is stronger than what divides them. Other key arguments of *German Lessons* included the need to specialise in a number of high-skill, high-value manufacturing sectors where we are or could become competitive in the age of globalisation. Siemens, the German engineering company, has identified mega-trends which guide its investment strategy and there are lessons for governments to learn here. We also highlighted the need to grow more small firms, to build something that equates to Germany's 'mittelstand'.

### From a black cat to a green cat

*The Way of the Dragon*[19] asked what the UK could learn from the rise of China and East Asia. We argued that China was moving from the age of the 'iron rice bowl', in which the state provided jobs for all, to an open market economy. As it did so, it sought to respond to genuine fears about employment by targeting, in the words of the Chinese economist Hu Angang, "employment-intensive, high-technology, and new technology industries and … modern service industries, especially those that are information, knowledge and employment intensive." Playing on Deng Xiaoping's famous remark, "It doesn't matter if a cat is black or white, so long as it catches mice", Hu also argued that China must go from being a "black cat", i.e. a country whose energy is based on fossil, "black" fuels, such as coal and oil, to a "green cat", going forward on the basis of green energy.

*The Way of the Dragon* quoted the Singaporean trade union leader and Cabinet Office Minister, Lim Swee Say, as saying: "I would say that for any economy not able to compete with China, China will be a threat. Probably the biggest threat. But for any economy that's able to compete with China, then China will probably be one of the biggest opportunities.". *The Way of the Dragon* sought a strategy to develop the goods and services in the UK that China wants to buy but cannot build or deliver for itself. China's Five-Year Plans, a throwback to its Maoist past, nevertheless provide a direction of travel that identifies China's immediate and future priorities, helping investors and exporters to understand exactly where to target.

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[17] See, for example, *The Entrepreneurial State* https://marianamazzucato.com/entrepreneurial-state/
[18] tuc.org.uk/sites/default/files/tucfiles/germanlessonsedit.pdf
[19] tuc.org.uk/sites/default/files/WayOfTheDragon_0.pdf

### *Sustainable industrial strategy*

*Powering Ahead*[20] called for a roadmap towards a sustainable energy strategy, defining sustainable as balancing the economic, social and environmental needs of communities. We called for 50 per cent of the UK's energy coming from sustainable sources by 2030 and, in order to deliver that, for new, green sectors to be targeted on those communities that lost their livelihoods through heavy industry. Germany and Denmark have led the way in developing green industrial sectors. Both countries embody strong roles for unions in their policy-making approaches.

### *Bringing key themes together*

France, Germany, China, Singapore and Denmark all have active industrial strategies, based on their own cultures and histories. It would not be wise or appropriate for the UK to simply copy the strategies of others. Certain key themes emerge, however:

- France and China recognise the role of the empowering state in promoting industrial success. The UK government has now recognised that the state has a role to play, with the publication of an Industrial Strategy.
- Germany and China both seek explicitly job-centric industrial strategies. In the UK, by contrast, we have taken a long time to accept the idea of industrial strategy at all, having previously focused only on getting the fundamentals right. Not only do we now have a strategy, but we also have a focus on key industrial sectors. In its White Paper on Industrial Strategy, the UK government targets clean growth, artificial intelligence, mobility and the ageing society as 'grand challenges'. This is progress, but we need a hard-headed focus on creating good jobs, across the regions and nations of the UK, as well.
- Germany and Denmark have a strong tradition of trade union and employer engagement in the development of their industrial strategies, securing buy-in from key stakeholders. The UK badly need a social market economy, balancing the power of capital with that of labour.

### *The political debate today*

Industrial policy is now back in vogue and whilst it is not necessarily synonymous with manufacturing, there is usually an overlap between the two. Most industrial policy advocates seek greater strength in manufacturing as part of their policy agenda.

The UK government set out its industrial strategy in November 2017[21]. This included four grand challenges, three of which – artificial intelligence and data, the future of mobility and clean growth – would impact on the UK's manufacturing future.

Ambitions in the manufacturing strategy include to raise total research and development spending to 2.4 per cent of GDP by 2027 and to establish a technical education system that rivals the best in the world. That R&D target would still leave the UK lagging average spending across the OECD, but the government's strategy is nevertheless tilting towards more – and more modern – manufacturing.

Labour's 2017 election manifesto[22] committed it to renewable energy products, including tidal lagoons, "which can help create manufacturing and energy jobs as well as contributing to climate change commitments." Both major parties, then, seek more manufacturing strength. Unions have also concentrated on manufacturing, arguing that whilst we must look towards future technologies and industrial sectors, we don't do enough to protect and enhance existing industries.

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[20] tuc.org.uk/sites/default/files/Powering_Ahead_Report.pdf
[21] gov.uk/government/topical-events/the-uks-industrial-strategy
[22] https://labour.org.uk/wp-content/uploads/2017/10/labour-manifesto-2017.pdf

The union Unite has published a policy paper, "Shaping the Future of UK Manufacturing"[23], which recognises the value of digital technologies. It adds, however:

> "While promoting the new, the UK must also ensure the continuation of vital foundation industries. Unite believes direct support for industries shouldn't just come as crisis intervention but should be part of a proactive industrial policy of investment to create a stronger economy."

The GMB has set out a seven-point plan for manufacturing, made up of: investing in manufacturing; developing a procurement strategy that supports UK workers; negotiating good trade deals and avoiding tariffs; building strong UK-based supply chains, promoting equality and inclusion by tackling barriers to work; investing in skills, research and development and the technologies of tomorrow; and pursuing a balanced energy policy.

Other thinkers are also focusing on the sector. The final report of the Institute for Public Policy Research (IPPR) Commission on Economic Justice was published in September. This argued for "an expanded and mission-oriented industrial strategy, focused on achieving investment-led growth, with the aims of diversifying our industrial base, driving up exports, raising productivity and addressing regional imbalances."

Like the TUC, the IPPR stresses the importance of the so-called 'everyday economy', in areas such as retail and wholesale, hospitality and tourism. Those are sectors where many people work and industrial strategy has ignored them for too long. But industrial strategy should, in the words of the IPPR report, "be aimed at strengthening and expanding the UK's innovative and exporting sectors, raising productivity across the economy as a whole and rebalancing its uneven economic geography."

The IPPR report goes on to say:

> "So a key goal of industrial strategy should be to diversify the number and range of the UK's exporting sectors, as well as to support our existing strengths. To achieve this, there should be a sharp focus on tradability as the key characteristic, which in turn will lead to a greater emphasis on manufacturing. This is the strategy we have called 'new industrialisation'."

### *Do we need a manufacturing target?*

Two questions are worth asking at this point, when developing policy for the future of manufacturing:

- Should we set a target for manufacturing to make up a greater share of the economy, providing more manufacturing jobs?
- And to what extent should manufacturing policy protect existing manufacturing sectors, as opposed to developing new ones?

Industrial policy returned to UK policymaking in 2009, after the economic crisis, with Peter Mandelson's *New Industry, New Jobs*. This did not, however, establish a target for manufacturing growth. The coalition government of 2010 saw Vince Cable, now the Leader of the Liberal Democrats, serve as Business Secretary. Cable opposed what he called "arbitrary targets". The former Conservative Deputy Prime Minister, Michael Heseltine, took a different view, however. Heseltine's report, *No Stone Unturned in Pursuit of Growth*[24], published in 2013, stated:

> "The government should produce an overarching and long-term national growth strategy and its vision for wealth creation, with concrete commitments against which it can be held to account."

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[23] unitetheunion.org/uploaded/documents/0250-Manufacturing%20Strategy%20Brochure11-32982.pdf

[24]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/34648/12-1213-no-stone-unturned-in-pursuit-of-growth.pdf

It could be argued that concrete commitments and accountability focus the minds of politicians in a way that arguing for manufacturing strength, in an abstract sense, does not. Clearly any targets would need to be robust; they will probably also be conditional, in the sense that they can only be met if government follows a particular course of action. This is the approach adopted by the Made Smarter Review, conducted by the UK Chief Executive of Siemens plc, Juergen Maier[25].

The Made Smarter Review sets out the benefits for UK manufacturing by the adoption of industrial digital technology. The review argues that, over 10 years, industrial digitalisation could boost UK manufacturing by £455bn, increasing sector growth up to 3 per cent per year. It could create a net gain of 175,000 jobs whilst reducing CO2 emissions by 4.5 per cent.

### *Old jobs or new jobs?*

*Remaking Europe: the new manufacturing as an engine for growth* [26], published by Bruegel in 2017, is more sceptical of targets. It states: "A few years ago, the European Union's institutions promoted the goal of increasing the manufacturing sector's share of EU value added to 20 per cent." The document adds, "… it is doubtful that targeting a minimum share of GDP for manufacturing and focusing on specific sectors and technologies is the right approach".

Instead, Bruegel adopted a more liberal approach:

> "Using new technologies to keep design and manufacturing tightly coupled can shorten lead times, which is particularly relevant in industries driven by fashion. Shorter value chains will allow production jobs to be located close to markets and/or the sources of technological know-how. This could bring back some of the previous offshored jobs. These new production jobs will, however, no longer be the jobs associated with old style assembly lines.
>
> "This potential for growth in manufacturing-related jobs feeds the inclinations of politicians to support the revival of manufacturing. But the realisation of this potential requires (new) manufacturing firms fully to exploit the potential offered by new (digital) technologies and incumbent firms to reinvent themselves. These (re)new(ed) manufacturing firms will provide good jobs, but these will be jobs of the future, not the past; they need skill and adaptability."

For long-standing industrial policy watchers, Bruegel's linkage of design and manufacturing is important. It is not so long ago that policy makers were arguing that production is less important than high-end design. It seems that the need for good jobs is, once again, becoming part of manufacturing policy.

### *Working to target*

The TUC believes that an ambitious but realistic target would be for the UK to commit to delivering a million new manufacturing and high-tech jobs by 2030. This target dovetails with the government's aim for reducing carbon emissions by 57 per cent by 2030 compared to 1990 levels. The TUC believes that sustainable industry and green technology could be one of the key planks in delivering new manufacturing jobs. We also believe that, rather than leading to a reduction in jobs, the productivity improvements delivered by new technology, can help us to deliver more and more advanced manufacturing within the UK.

The TUC's five key priority policies to deliver new manufacturing and high-tech jobs, based on the evidence set out in this report, are:

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[25]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/655570/20171027_MadeSmarter_FINAL_DIGITAL.pdf

[26] http://bruegel.org/wp-content/uploads/2017/09/Remaking_Europe_blueprint.pdf

- to make more of the Industrial Strategy Challenge Fund (ISCF) work for manufacturing employment
- to build local eco-systems to deliver employment-rich economic growth
- to offer new skills to those at risk of industrial disruption
- for trade unions to be fully represented on the new Industrial Strategy Council and on sector seals
- for the UK to remain in the single market and customs union of the European Union.

In order to reach this target, and based on the evidence set out in this report, the TUC calls for the following five policies to be incorporated into the industrial strategy:

### *1 The Industrial Strategy Challenge Fund (ISCF) must be made to work for manufacturing jobs.*

The ISCF[27] aims to bring together UK research with business to meet the major industrial and societal challenges of our time, as part of a £4.7bn government investment in R&D over four years. According to the Department for Business, government has worked with industry and academics to identify the core industrial challenges where the UK has a world-leading research base and businesses ready to innovate, and where there is a large or fast-growing and sustainable global market. These challenges are aligned with the Industrial Strategy's four grand challenges. Labour has proposed something similar, in the form of a national investment bank.[28]

The TUC has supported the creation of the ISCF. We also recognise that there will be many demands on the budget of the ISCF, not all of which will create large numbers of good jobs. But some of them must; so we argue here that an impact assessment should be undertaken, showing how many good jobs will have been created by ISCF funding after two years. We also believe that at least a third of ISCF money must be directed towards investments which are known to be providers of quality employment. We believe that industry and research should have more flexibility to jointly develop ideas to this end than the currently enjoy under the existing funding criteria. The TUC also believes this funding should be additional to research council baseline funding and not a replacement for it. By pursuing these objectives, we will be consciously moving towards an employment rich industrial policy, as pursued in Germany and China.

### *Local eco-systems to support employment-rich economic growth*

The chapter of this report provided by Patrizio Bianchi and Sandrine Labory, from the University of Ferrara, describes the importance and the potential of local eco-systems to support industrial policy. This report argues that all Local Enterprise Partnerships (LEPs) should be required to develop local growth strategies, based on their specific strengths, joining with other LEPs where it would be geographically sensible to do so. This is particularly important, given the centralised nature of UK government policy-making. LEPs should work with trade unions at the local level to develop these strategies. All local growth strategies should feed into the work of the national Industrial Strategy Council (ISC). Consultancy and co-ordination support to LEPs should be offered from Whitehall. It is important that LEPs do not all compete for the same industrial opportunities. It is also important to have a realistic understanding of local weaknesses. Such weaknesses, and programmes to overcome them, should be understood by local stakeholders and the role of the ISC must include a workstream of offering targeted support to LEPs where a simple intervention from national government can help to overcome a local difficulty.

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[27] gov.uk/government/collections/industrial-strategy-challenge-fund-joint-research-and-innovation
[28] https://labour.org.uk/wp-content/uploads/2017/10/National-Investment-Bank-Plans-Report.pdf

### *New skills to support those at risk of industrial disruption*

Two-thirds of those who will be in work in 2030 are already in the workforce. Investing in mid-career workers is essential to making sure that ongoing employment opportunities are provided in the next wave of technological disruption, described by Maddie Scott in her chapter above. At present, the UK invests half the EU average on workforce training. All workers should have access to a mid-life training review to assess their skills and government must reintroduce individual learning accounts to give everyone a personalised budget for training. Some workers will need more extensive support from government to remain in the labour market. Groups facing redundancy due to industrial change should have access to retraining programmes to equip them with the skillsets required in a digitalised economy. It is essential that we avoid the mistakes of past industrial transformations, such as the decline of the coal mining industry, which left unemployment and social devastation in its wake.

### *Trade unions should be fully represented on the Industrial Strategy Council and all sector deals*

Maximilian Waclawzyk describes Germany's tradition of social partnership. A workforce voice, to match that of business, is needed as government develops its industrial strategy. As a first step, trade unions should be given full membership of the Industrial Strategy Council, both as main ISC members and on any ad hoc or study groups established as part of the ISC's work. Trade unions must also be represented within the sector deals currently set up by the UK

### *The UK must remain in the EU single market and the customs union*

By implementing the policies set out above, the TUC believes we can move towards the target of a million more manufacturing and high-tech jobs by 2030. However, this will not be possible to achieve if we put obstacles in the way of ourselves and our closest and most important export market, the European Union. The TUC believes that the UK must retain barrier-free, tariff-free, frictionless trade in goods and ensure that workers continue to be protected by EU levels of rights. The TUC believes that the best option available to achieve this is continued membership of the EU single market and customs union although we are open to alternatives.