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An Industry Action Plan for a more competitive, sustainable and strategic European Union

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with

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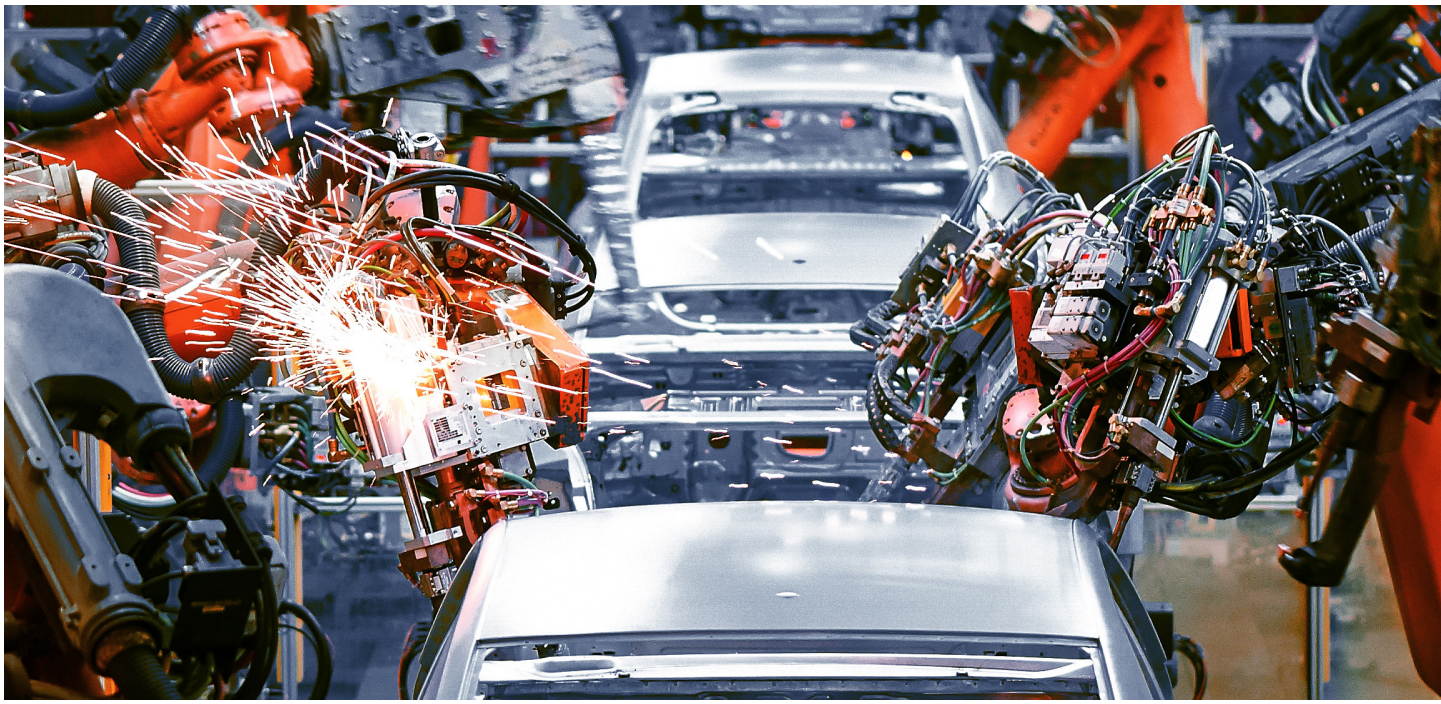

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Throughout the project, the EPC has also been regularly engaging with EU institutions and governments. For example, the EPC outlined its views on EU industry at the Competitiveness Council meetings of February and September 2018. Public events included high-level speakers such as Peter Altmaier, German Minister for Economic Affairs and Energy; Margrethe Vestager, European Commissioner for Competition; Jean-Luc Demarty, Director-General for DG Trade; and Johannes Laitenberger, Director-General for DG Competition.

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List of abbreviations

5G	fifth-generation cellular network technology
AI	artificial intelligence
BAT	best available technology
BREF	Best Available Technique reference document
BusinessEurope	Confederation of European Business
CAP	Common Agricultural Policy
Cefic	European Chemical Industry Council
CO_2	carbon dioxide
COSME	EU programme for the Competitiveness of Small and Medium-Sized Enterprises
CSR	country-specific recommendation
DEP	Digital Europe programme
DG	Directorate-General
DG GROW	European Commission Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
DIH	digital innovation hubs
DSM	digital single market
EEA	European Economic Area
EFPIA	European Federation of Pharmaceutical Industries and Associations
EFSI	European Fund for Strategic Investments
EGF	European Globalisation Adjustment Fund
EII	energy-intensive industry
EPS	emission performance standards
ENISA	European Union Agency for Cybersecurity
ESIF	European structural and investment funds
EU ETS	EU Emissions Trading System
ERDF	European Regional Development Fund
ESF+	European Social Fund Plus
FDI	foreign direct investment
FTA	free trade agreement
GDPR	General Data Protection Regulation
GHG	greenhouse gas
GVA	gross value added
GVC	global value chain
I-DESI	International Digital Economy and Society Index
ICT	information and communications technology
IED	Industrial Emissions Directive
Interreg	European Territorial Co-operation
IoT	Internet of things
IP	intellectual property
IPCEI	Important Projects of Common European Interest
IPI	International Procurement Instrument
IPR	intellectual property right
KET	key enabling technology
MFF	Multiannual Financial Framework
OECD	Organisation for Economic Co-operation and Development
PP	public procurement
PPA	power purchase agreement
PPP	purchasing power parity
PPS	purchasing power standards

RES	renewable energy sources
REACH	European Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals
R&D	research and development
R&D&I	research and development and innovation
R&I	research and innovation
SDGs	UN's Sustainable Development Goals
Set Plan	Strategic Energy Technology Plan
STEM	Science, Technology, Engineering and Mathematics
SME	small and medium-sized enterprise
TFP	total factor productivity
ULC	unit labour cost
UN	United Nations
WEF	World Economic Forum
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Executive summary

Industry in Europe is faced with an unprecedented number of new challenges and megatrends, from a slowdown in global trade to digital disruption and climate change. In a fast-changing world, industry remains the backbone of the European economy, delivering high-quality jobs, innovation and world-class companies. Thus, to stay ahead of the curve and retain its competitive edge, the EU must embrace change and renew its industrial strategy.

There is growing momentum for a revived EU industrial strategy. EU leaders have called on the European Commission to present a new "long-term vision" for the EU's industrial future by the end of 2019. Commission President-elect Ursula von der Leyen has pledged to put forward a new industrial strategy as part of a "European Green Deal". Several member states have also been vocal on the need for a gear change in the EU's approach, including the much-debated calls from France and Germany to modernise EU competition policy and support the creation of 'European champions', as well as others underlining the well-functioning of the Single Market as the basis for competitiveness.

European industry is therefore set to become a priority for the upcoming Commission, with important cross-cutting implications for major portfolios such as "The European Green Deal", "A Europe fit for the Digital Age", "An Economy that Works for People" and "A Stronger Europe in the World". It is important, however, that a renewed industrial strategy recognises all of these diverse goals and can be translated into a concrete, actionable plan at the EU level, with a clear governance structure.

This Issue Paper argues that in renewing its industrial strategy, the EU should put in place an 'Industry Action Plan', complete with new policy tools and concrete industrial initiatives. Beyond mainstreaming industrial competitiveness across policy areas, an Action Plan should provide a more holistic and policy-oriented approach, with a vision towards 2030 that focuses on competitiveness, sustainability and strategic autonomy.

Firstly, to ensure that the European industry remains competitive, the EU should aim to play a stronger role in global value chains, with a higher value-added. Secondly, the EU must create the conditions for the European industry, as well as the products and services it provides, to become sustainable and thus contribute to achieving the Sustainable Development Goals and climate-neutrality in alignment with the United Nation's Paris Agreement. European industry should become fully climate-neutral by 2050 and seize the opportunity to become a global leader in sustainable and circular business models. Finally, an Industry Action Plan should contribute to achieving greater strategic autonomy for Europe by better responding to distorted competition and levering market power, and moving towards more technological sovereignty. Europe should mobilise all the tools at its disposal to become a global leader in developing digital technologies that address the societal, environmental and health challenges of today.

This Paper includes a list of recommendations centred around five policy strands: (1) making the Single Market (including competition policy) work, (2) improving innovation policy and achieving technological sovereignty, (3) acting strategically and enforcing reciprocity, (4) ensuring a fair and inclusive industrial transition, and (5) climate-proofing industry with a 2050 climate neutrality roadmap.

Introduction

"To help drive the change we need, I will put forward my plan for a future-ready economy, our new industrial strategy."[1]

Ursula von der Leyen

In a fast-changing world, a solid industrial base remains crucial for Europe to take on the many challenges it currently faces. Industry[2] is one of the largest employers in Europe, accounts for most EU exports and provides the majority of investments in research and development (R&D). Manufacturing industries increasingly buy, produce and sell services, and it is estimated that one additional job in manufacturing can create 0.5 to 2 jobs in other sectors.[3] Industry is therefore essential to secure future jobs, growth and innovation and develop new technologies. It also plays a central role in assuring transition towards a more sustainable, circular and climate-friendly economy. The goal of attaining a climate-neutral Europe by 2050, as proposed by the European Commission,[4] will not be met unless industry is involved.

However, industry in Europe is faced with unprecedented new challenges and megatrends,[5] from a slowdown in global trade to digital disruption and climate change. Some have come to the fore in recent months, while others have been present for several years.

Global competition is increasingly fierce, and Europe's competitors do not shy away from adopting more aggressive industrial strategies or protectionism, subsidising and shielding their own national industries. Europe's open and competitive Single Market represents the greatest added value for industry to flourish. However, while Europe has opened up much of its market to the rest of the world, European industry rarely enjoys equal market access to third countries.[6] Some countries, such as China, are even increasingly closing off further market segments to bolster their own companies and become 'self-sufficient'.

Industry in Europe is faced with unprecedented new challenges and megatrends.

Furthermore, the technologies of the future are, to a greater extent developed outside Europe, and industries in Europe are becoming more dependent on high-tech and raw materials from a limited number of suppliers in third countries.[7] While this dependence places European industry at a competitive disadvantage, it also poses a challenge to the EU's 'strategic autonomy'; meaning Europe's "ability to set objectives and mobilise the necessary resources in ways that do not primarily depend on the decisions and assets of others".[8] Being dependent on external resources, innovation and technological solutions weakens the EU's standing in global negotiations, making it more of a follower than a leader in shaping international rules and standards, and more vulnerable to cyber threats. Such elements are crucial for achieving 'technological sovereignty', as called for by European Commission President-elect Ursula von der Leyen's political guidelines for 2019-2024, and some of the mission letters to future Commissioners.[9]

There is a growing internal push to achieve a climate-neutral EU by 2050, which can only be delivered if supported by the industry.

At the same time, climate change and environmental challenges are trends that pose direct challenges to the industry, increasing uncertainty around the availability and pricing of energy and materials, for example. Climate change and global commitments stemming from the Paris Agreement[10] and the United Nation's (UN) Sustainable Development Goals (SDGs)[11] create additional pressure, as they require active contributions from the industry in the form of more sustainable processes, products and services, which implies profound industrial transformations. There is a growing internal push to achieve a climate-neutral EU by 2050, which can only be delivered if supported by the industry. Delivering on these commitments would create winners and losers and potentially short- and long-term losses. For an industry that recognises and adapts to these trends and provides market solutions to address the sustainability challenges, the possibilities can be great and are only growing, but they need the right conditions to prosper and benefit from a first-mover advantage.

A NEED FOR EU ACTION

Increasingly, the EU and its member states, both individually and collectively, have sought to develop strategies to meet these challenges. While the EU's approach has traditionally focused on creating the necessary ecosystem for a more competitive Europe, the member states' strategies underline the need to support and promote domestic industries. Although it makes perfect sense for national initiatives to support domestic industries, the aggregation of national measures can lead to further fragmentation of the Single Market and related EU policies in some cases.[12] The multitude of national strategies that have emerged in recent years says as much about the magnitude of the megatrends currently facing industry as it does about the lack of a strong and efficient strategy at EU level.

As many of the biggest challenges faced by European industry are global, the best way for the EU and its member states to support the industry is to coordinate their efforts and address the challenges together. Protecting one's own national industry may not only be costly and ineffective but also risks undermining the EU policies (i.e. Single Market, competition, trade) that are fundamental to the competitiveness of European industry. A common EU approach would allow member states to respond to initiatives being developed by the EU's main competitors (e.g. Made in China 2025, Belt and Road Initiative, America First), distorted competition and unfair trading practices.

BUT WHAT KIND OF ACTION?

Despite the long debates and numerous calls for a European industrial policy, getting it off the ground has not been easy. Recent EU industrial strategies have been described as "inconsistent and weak"[13] or equivalent to a "UFO: much discussed but impossible to describe".[14] Two elements make the formulation of a strong EU industrial strategy particularly challenging. Firstly, the fact that industrial policy is a "meta-policy"[15] – stemming from a set of already established policies – implies that it requires a high level of coordination across a wide array of policies such as trade, competition, cohesion, education, R&D, climate, energy, innovation and digital policy.[16] A high degree of coordination may be difficult to achieve at the EU level as competences in these areas lie alternatively with member states, the EU or both; and member states have diverging interests within them. Moreover, member states also have different views on what an EU industrial policy should do or aim for.

Secondly, EU efforts have mostly focused on 'mainstreaming' competitiveness across policy fields; few concrete policy tools and new initiatives have been launched. In recent years, progress has been made with the European Commission's focus on concrete value chains, thus enabling better coordination and cross-cutting approaches across policy areas. However, the megatrends currently faced by European industry call for a more targeted and comprehensive EU industrial strategy.

The megatrends currently faced by European industry call for a more targeted and comprehensive EU industrial strategy.

This Issue Paper argues that in order to tackle the challenges and harness the opportunities, the EU requires an Industry Action Plan that would provide a more holistic and policy-oriented approach to restoring Europe's industrial competitiveness. While "a systematic consideration of competitiveness concerns across all policy areas"[17] will remain important, the EU needs to take a more active approach to provide European industry with the framework conditions to become competitive and sustainable in an ever-tumultuous world. In developing a new industrial strategy, the EU should build upon its strategic value chains approach as well as go further to set up a dedicated governance structure, introduce new policy tools and launch new industrial initiatives.

OUTLINE

This Paper is divided into four chapters. Chapter 1 provides a short state-of-play of Europe's economy and industry and describes some of the major challenges and megatrends the EU industry is currently facing. Chapter 2 assesses Europe's efforts to deal with said challenges and opportunities, singling out some of the EU's main strengths and weaknesses. Chapter 3 offers a vision and priorities for an Industry Action Plan for the EU, as well as how it should be shaped. Chapter 4 highlights some major recommendations for a more sustainable, competitive and strategically autonomous EU industry.

Chapter 1: European industry today

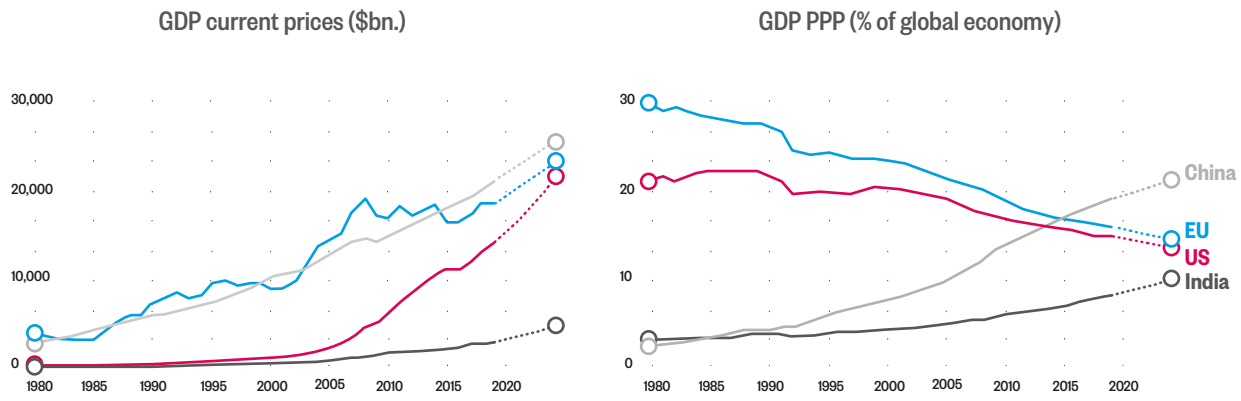
1. A SHORT STATE-OF-PLAY: EU ECONOMY AND INDUSTRY

The EU, which in the early 2000s was the world's largest economic block in absolute terms, has in the last decade been overtaken by the US. Additionally, its relative share of the world's GDP has been declining, and the world's economic centre is gradually moving eastwards. China's share of the global economy in purchasing power parity (PPP) was less than 10% in 2005, but it more than doubled to reach 20%, the largest in the world today. Between 2005 and 2020, the Chinese economy grew by more than sixfold (see Figure 1).

There is a high level of heterogeneity within the EU. Its 28 member states and their respective regions differ greatly. Starting from the simplest economic indicator, GDP per capita, a dividing line between member states in the northwest and those in southeast becomes apparent. While the average GDP per capita in purchasing power standards (PPS) of the EU is around €30,000, the Netherlands, Austria, Denmark and Germany (around €39,000) are twice as rich as Romania, Croatia and Bulgaria (under €20,000).[21] However, since member states with a lower GDP per capita tend to grow at faster rates (around 5% in Poland, Hungary and Latvia in 2018), there is an overall degree of economic convergence, although

Fig. 1

GLOBAL GDP COMPARISON:
EUROPE LOSING ITS PLACE IN THE GLOBAL ECONOMY (1980-2020)



Source: *International Monetary Fund*[18]

The consequences of the 2008 economic crisis were felt more strongly and for longer in Europe than in the rest of the world. After a double-dip recession, the EU has been sustaining moderate levels of economic growth since 2014, with real GDP growing at a yearly rate of around 2%.[19] The crisis also had other impacts, including on the levels of unemployment and investment. The unemployment rate in the EU peaked at a remarkable 11% in 2013 (though it was above 26% in Greece and Spain) and has been steadily recovering since, reaching 6.8% in 2018, which is even below the 2007, pre-crisis level. The employment rate is at an all-time high of over 73% of the EU population (18 to 65 years old), which is not far from the 2020 target of 75%.[20]

There is a high level of heterogeneity within the EU.

arguably at a less-than-desirable pace.[22] However, it must be noted that just as the EU aggregate hides differences between member states, national figures also conceal the high degree of diversity between its regions. It appears that some relatively poor regions, especially in Southern Europe, show very low growth rates, thus going against the overall pattern of convergence.

Europe has not been exempt from deindustrialisation.

Another consequence of the crisis was the drop in the investment level, which is yet to reach the 2007 peak of 23% of EU GDP – although it has been growing for several consecutive years.[23] It must be considered that investment as a percentage of GDP has been consistently

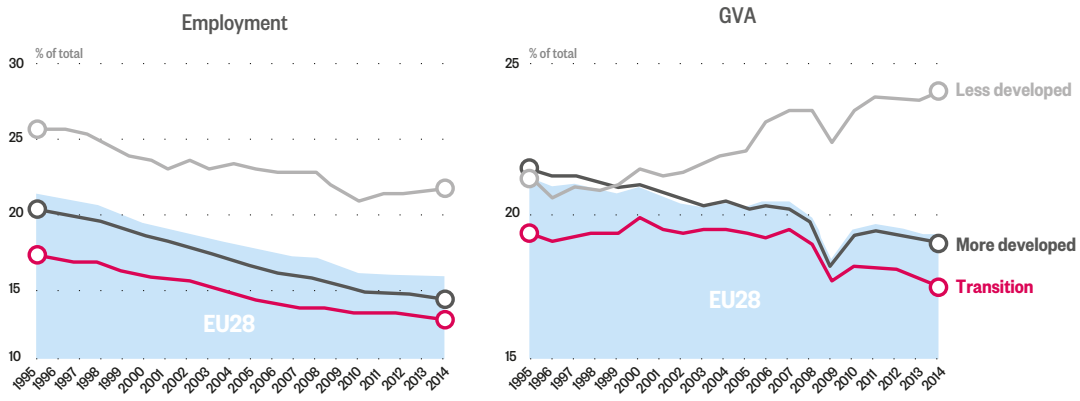
lower in the EU than in the US, Japan and South Korea since the 1990s.[24] The recovery of productivity growth is taking place, but at a slower pace than before the crisis. In fact, productivity growth has been stagnating for several years and has only recently picked up, especially in the euro area. Conversely, the US performance is markedly higher. Similarly, labour productivity in the US and Japan has exceeded that of the EU, both before and after the crisis.[25] The European economy's ability to increase its total factor productivity (TFP) and as such improve how efficiently it uses factors of production is thus lower than in the US, suggesting that there is untapped potential for further GDP growth.

While industry has been one of the main sectors affected by the crisis, it has also been a source of resilience, innovation and social stability in subsequent years. Despite representing a smaller share of the EU economy over time, manufacturing accounted for half of the EU's productivity growth and its value-added growth post-crisis.[26] Overall, EU industry currently provides for more than 52 million jobs (directly and indirectly), represents over 80% of European exports and, crucially, around 65% of investments in R&D in Europe.[27] Hence the recurring mantra that industry remains the backbone of Europe's economy.

As in other developed countries, however, Europe has not been exempt from deindustrialisation.[28] The contribution of manufacturing to EU GDP dropped from 18.5% in 2000 to 15% in 2012, and the industry share of EU gross value added (GVA)[29] decreased from 22% in 2000 to 19% in 2016.[30] Globalisation, the offshoring of manufacturing jobs and the rise of services have contributed to this trend. Today, the EU's economic structure is increasingly dominated by services. In 2017, services accounted for more than 70% of both GVA and employment, and have

Fig. 2

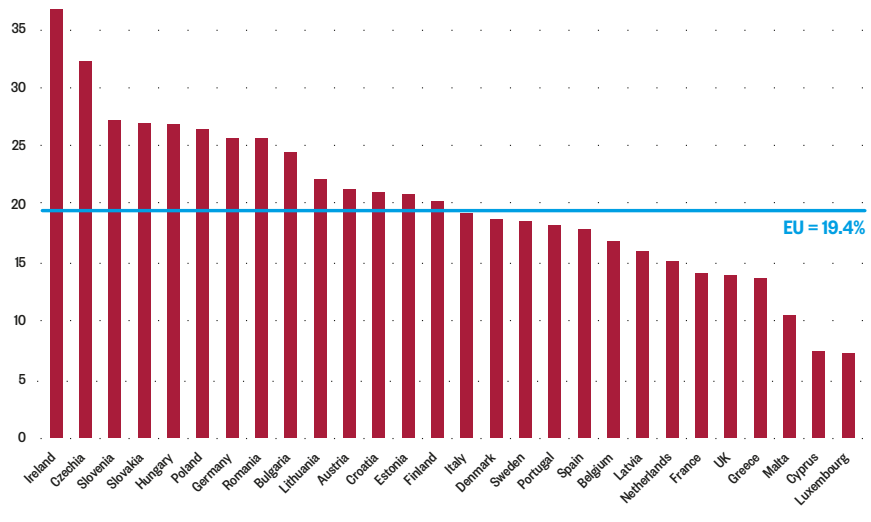
GVA SHARES IN INDUSTRY: MANUFACTURING COMPRISES A LARGER SHARE OF THE ECONOMY IN LESS DEVELOPED REGIONS (%, 1995-2014)



Source: Dijkstra (2017)[33]

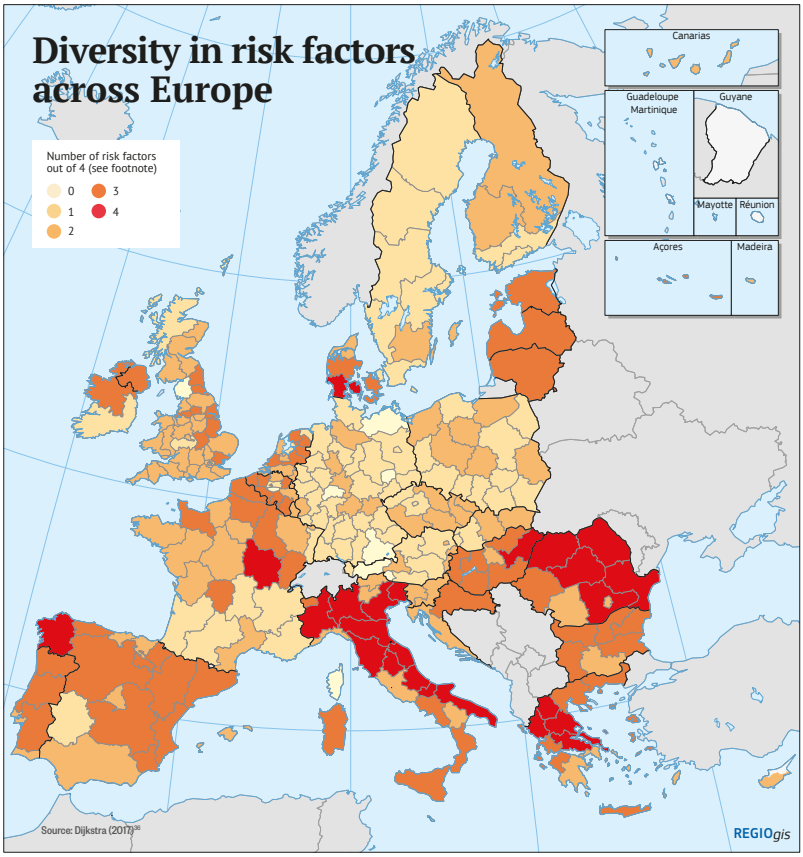
Fig. 3

SHARE OF INDUSTRY IN TOTAL GVA IN EU MEMBER STATES (%, 2016)



Source: *Eurostat*[34]

Fig. 4



INFOBOX 1: Future trends put some EU regions more at risk than others

Globalisation and technological change exert different impacts onto the EU's many regions and member states, in relation to their economic structure and local attributes. Those characterised by relatively high industrial unit labour cost (ULC), relatively large employment in low-tech manufacturing, relatively low educational attainment level and a decrease in employment in industry are considered more at risk (see Figure 4, in darker colour). A clear geographical pattern emerges, as regions in Southern and Eastern Europe are more at risk than others, though France and Denmark are exceptions.

since grown in their relative share of the economy. The fastest-growing sector is ICT, whose value-added increased by 80% between 2000 and 2015 in the EU, and by more than 100% in the US.[31]

Within the EU, the share of industry in the economy varies across member states and regions. Less developed regions tend to be more industry-intensive than the rest (see Figure 2). Industrial GVA in less developed regions has been steadily increasing since 1996 (except for during the crisis), while it has been declining in all the other regions. Industry accounts for over 36% of GVA in Ireland, 32% in Czechia, 27% in Slovenia and Hungary, 26.5% in Poland, and 26% in Germany and Romania (see Figure 3). At the same time, it accounts for less than 15% in France, the UK, Greece and Malta; and less than 10% in Cyprus and Luxembourg.[32]

As assessed in the next part, EU industry is currently being impacted by major transformations: a slowdown in global trade and a rise in protectionism, the emergence of new technologies, the development of global value chains (GVCs), the need for industry to become more sustainable and emission-free, and increased competition for human and natural resources. These constitute some of the main drivers for industrial transformations and must be addressed effectively by an EU industrial strategy.

2. DRIVERS FOR CHANGE: MEGATRENDS AND INDUSTRY

A. Industry facing a slowdown in trade and a rise in protectionism

A slowdown in global trade

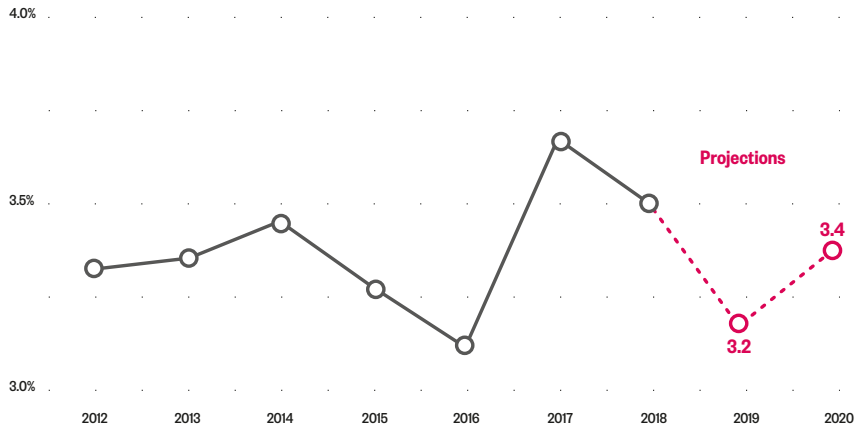
European industry muddles through an ever more challenging trade environment for the goods and services it generates. Over the last decade, trade integration has slowed down worldwide: while the period between 1990 and 2008 might be remembered as a 'golden age' with the trade in goods and services rising from 39% to 61% of global GDP,[37] global trade fell sharply following the financial and economic crisis in 2008.

Over the last decade, trade integration has slowed down worldwide.

Global trade is picking up gradually and currently represents 58% of global GDP.[38] Still, the last decade did not see global trade and trade integration develop at the same pace as in the two previous decades. In its latest "Economic Outlook", the Organisation for Economic Co-operation and Development (OECD) has identified the current slowdown of trade and growing trade uncertainty as the main reason for the weakening

Fig. 5

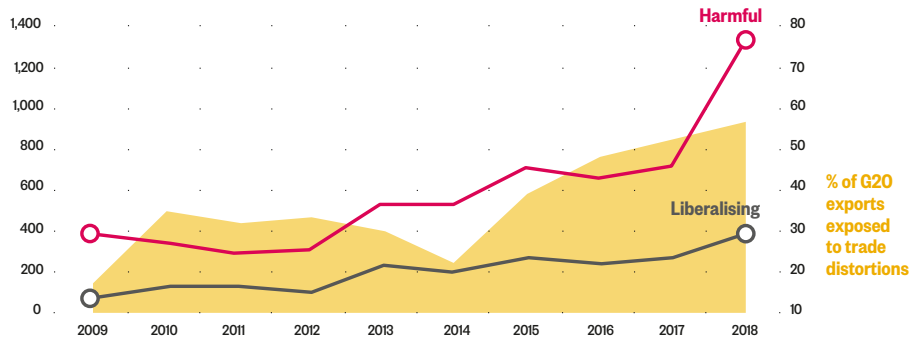
GLOBAL GROWTH PROJECTIONS (%, 2012-2020)



Source: Organisation for Economic Co-operation and Development (2019a)[40]

Fig. 6

A RISE IN 'HARMFUL' TRADE MEASURES (2009-2018)



Source: Gunnella and Quaglietti (2019)[48]

of global growth. The OECD projects that global trade is to grow by only 2% in 2019, the lowest rate in a decade. This will inevitably impact global growth. The world's GDP grew by 3.5% in 2018, but the projections for 2019 (3.2%) and 2020 (3.4%) have been revised downwards[39] (see Figure 5).

A multilateral trading system in crisis

Even more concerning, however, is the fact that the multilateral trading system, which enabled the initial rise in global trade and growth, is now in crisis. The World Trade Organization (WTO) is facing significant difficulties in advancing its negotiation agenda, updating and modernising its rulebook, and ensuring the well-functioning of its dispute settlement mechanisms. Today, the multilateral trading system seems increasingly incapable of doing what it was initially set up for: combating tariffs and trade restrictions.

The negotiation agenda of the WTO has now been stuck for almost 20 years, with little or no progress within the Doha Development Round.[41] Disagreements that have existed for years within the WTO – between North and South, East and West; and between developed and developing countries (on e.g. agriculture, services, procurement, rules of origin) – have now been compounded by US disengagement.[42] Not only has the multilateral trading system lost one of its most ardent supporters and driving forces, but the present Trump administration has also undermined the WTO by blocking appointments to its highest dispute settlement body, the Appellate Body.[43]

The multilateral trading system, which enabled the initial rise in global trade and growth, is now in crisis.

If the current stalemate continues, the Appellate Body is expected to have less than three members, the minimum number required to hear an appeal, by December 2019. The breakdown of the Appellate Body would significantly reduce the attractiveness of multilateral trading system in settling disputes, leading to further trade uncertainty and countries eventually imposing additional tariffs and trade restrictions, without worrying about cases being brought to the WTO.

A rise in tariffs and protectionism

In recent years, policymakers have become increasingly willing to make use of tariffs and protectionism to protect or promote national industry. Both tariffs and non-tariff measures – think export subsidies, restrictions on foreign direct investments (FDIs), domestic clauses in public procurement (PP) – have increased steadily, limiting access to foreign markets.[44] The number of new trade restrictions announced by G20 economies has risen sharply since 2012, and peaked in 2018 (see Figure 6). Anti-dumping measures and import tariffs accounted for 30% of all measures imposed.[45] The use of indirect tools (e.g. state loans) for exporting companies has also increased over time.[46] In Europe, manufacturing and especially the automobile, information and communications technology (ICT), electronics, chemicals and textile industries are among the most impacted by the rise in tariffs and protectionism.[47]

US tariffs and America First

Throughout 2018, the US administration adopted a wide range of tariffs on imported goods on the grounds of 'national security' and in support of its own industry.[49] These tariffs, adopted under the banner of their America First policy, have included tariffs on solar panels and washing machines (20% to 50%), later followed by tariffs on steel (25%) and aluminium (10%), which have led to several retaliatory measures, including from the EU.[50] Further tariffs were also set on a wide range of goods (25%) imported from China. The US administration has (until now) delayed deciding on whether to impose tariffs on automobiles and auto parts, including those from the EU, amid allegations that they pose a "national security threat".[51]

These tariffs are estimated to impact €6.4 billion worth of EU goods, mostly in manufacturing.[52] The ensuing escalation of retaliatory measures also directly affects European companies integrated into GVCs and one-third of EU companies operating in China.[53] Additional US tariffs on cars would also have a substantial effect on European industry. Germany, for example, could see its global car exports cut by 7.7% (equivalent to €18.4 billion) and its car exports to the US halved in the long term.[54] In recent months, rising US-China trade tensions have intensified the pressure on EU manufacturing economies and are seen as the main reason for the recent economic contraction in some EU member states.[55]

The EU and the US have agreed to work together towards "zero tariffs, zero non-tariff barriers, and zero subsidies on non-auto industrial goods",[56] thus avoiding additional tariffs while trade talks are ongoing. Future trade negotiations may be difficult given the US' express call to include agriculture in the negotiations, and the EU's consecutive opposition.[57] The US administration has even alluded that additional tariffs could be imposed if the EU does not accept their proposition.[58]

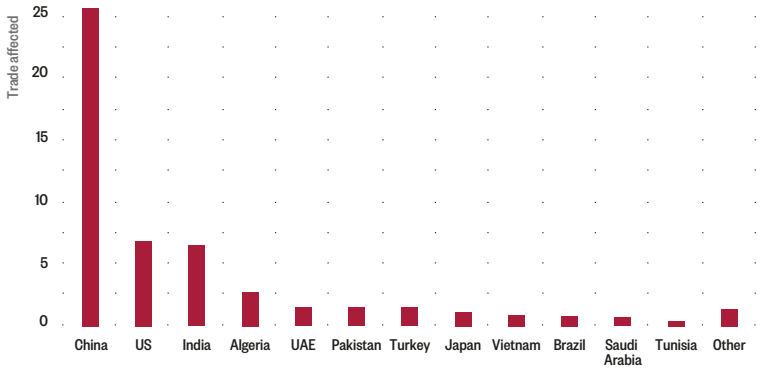
Trade barriers and Made in China 2025

The most recent Trade and Investment Barriers Report by the European Commission concludes that European industry currently faces a record number (425) of active trade and investment barriers in 59 third countries.[59] Interestingly, for the first time, China is topping the list of recorded barriers, followed by Russia, India, Indonesia and the US. The Commission also estimates that the new barriers recorded in China in 2018 have a significantly larger impact (€25.7 billion) than the restrictions imposed by any other trade partner (see Figure 7).[60]

This significant increase in trade barriers in China is mostly explained by new restrictions within the ICT sector and on high-tech industries, several of which have been implemented under the banner of Made in China 2025.[62] This strategy is an industrial programme aiming to make China a dominant player in ten industries: ICT, machines/robots, space/aviation, maritime, railway, energy-saving vehicles, energy equipment, agricultural machines, new materials and biopharma/high-tech medical devices.[63]

Fig. 7

EU28 TRADE FLOWS AFFECTED BY PARTNER COUNTRIES' NEW BARRIERS (€BN., 2018)

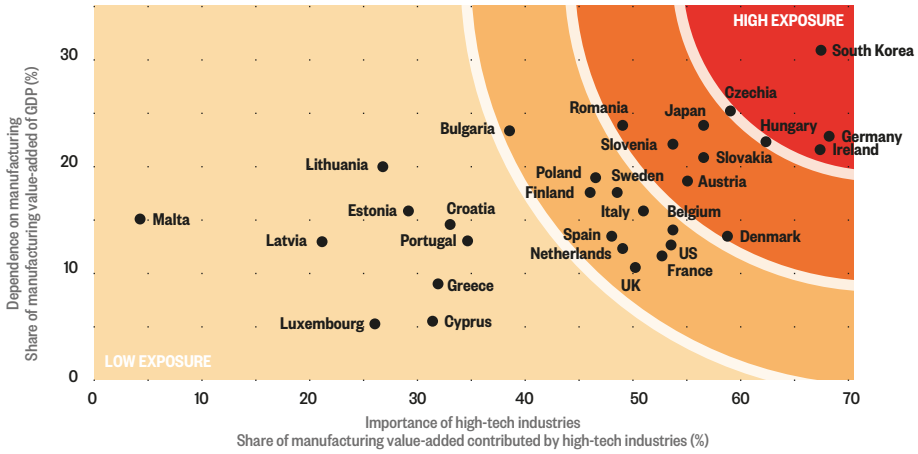


Source: European Commission (2019a)[61]

In recent years, policymakers have become increasingly willing to make use of tariffs and protectionism to protect or promote national industry.

Fig. 8

VULNERABILITY OF SELECTED INDUSTRIAL COUNTRIES TO MADE IN CHINA 2025 (%, 2016)



Source: Wübbeke *et al.* (2016)[67]

Made in China 2025 is currently the most comprehensive and ambitious initiative undertaken by any country to protect and promote its own industry. It is a top-down strategy aiming to make Chinese high-tech industry more competitive within and outside of China.[64] In doing so, China does not shy away from using protectionist instruments. In combination with earlier restrictions, foreign industry now faces a wide range of challenges when exporting to China, including massive subsidisation of Chinese firms, forced technology transfers, unjustified standards and obligations.[65] European countries with an important high-tech sector and dependence on manufacturing (i.e. Germany, Czechia, Hungary, Ireland, Slovakia, Austria, Romania, Slovenia) will be highly exposed to competition from Made in China 2025[66] (see Figure 8).

The European Commission concludes that European industry currently faces a record number of active trade and investment barriers in 59 third countries.

Since its launch, Made in China 2025 has allowed for the substitution of foreign technology with Chinese technology.[68] Chinese authorities have set detailed targets for various sectors, including "basic core components and important basic materials" to be produced by up to 70% of Chinese suppliers, 80% for new energy vehicles and renewable energy equipment, 70% for industrial robots and medical devices and 40% for mobile phone chips.[69] The sharp criticism levelled against the Chinese approach has led to the country toning down its reference to the strategy in official statements and media coverage – but this is merely a rhetorical concession.[70]

Made in China 2025 is currently the most comprehensive and ambitious initiative undertaken by any country to protect and promote its own industry.

Highly exposed manufacturing goods and Brexit

On top of the major challenges stemming from the US and China, the UK's withdrawal from the EU (i.e. Brexit) is also expected to represent an important slowdown in trade for industry. Once Brexit takes place, the UK is expected to leave the Single Market (provided that no agreement on this is found) and EU27-UK value chains will be disrupted, to the detriment of both UK and EU firms. The projections of a 'hard Brexit' on UK GDP loss varies between 2% and 10%, while it varies between 1% and 2% for EU member states.[71] Projections are a little less negative – but still considerable – in the case of a 'soft Brexit', with a negotiated comprehensive free trade agreement (FTA) or the UK remaining within the European Economic Area (EEA). While wholesale trade in the UK is to be impacted the hardest by Brexit, manufacturing goods are expected to lose out the most amongst the EU27. For a country such as Germany, some of the main sectors exposed are cars, machinery, pharmaceutical products, chemicals, and food and beverages.[72] For Belgium, highly exposed sectors are food and beverages, textiles, pharmaceuticals and chemicals.[73]

Brexit is expected to represent an important slowdown in trade for industry.

Growing trade challenges within Europe

In addition to the resurgence of trade barriers worldwide, European industry must also face growing limitations within the Single Market to trading within Europe. New barriers often take the form of national or even regional measures adopted on the grounds of public safety, environmental or health concerns, and which sometimes result in 'gold-plating' (e.g. technical requirements, requests for additional documentation, testing). Even if disproportionate and discriminatory, such barriers do not always take place on a large enough scale to be picked up by the European Commission for infringement proceedings. They can nevertheless represent significant barriers for businesses and may, in some cases, even dissuade them from entering new markets.[74]

European industry must face growing limitations within the Single Market to trading within Europe.

Moreover, even certain EU policies and approaches could be considered to undermine its calls for free and open trade. It should be recognised that although its import tariffs for industrial products are among the lowest in the world, the EU has been criticised for remaining too protective, especially of its food and agricultural market. Certain elements of the EU's Common Agricultural Policy (CAP) have been criticised both within and outside of Europe for creating distorted competition and hindering a level playing field within Europe.[75] Arguably, some interventions within the CAP (especially direct payments) are not necessarily conducted in the public interest or justifiable on environmental grounds.[76] Direct payments to the agricultural sector can create impediments to the EU's own ambition to open up world trade (e.g. current trade negotiations with the US, challenges with Mercosur), and may still add distortions on world markets.[77]

B. Digital technologies transforming industry

There is little doubt that recent developments in new technologies and digital solutions are radically transforming industry. Digital advances in artificial intelligence (AI), robotics, the Internet of Things (IoT), blockchain, big data, fifth-generation cellular network technology (5G), 3D printing, nanotechnology and biotechnology – to mention just a few – are allowing for more interconnectedness in manufacturing, more efficiency in processes and new products and services to emerge. The degree to which industries are impacted and transformed by these developments varies across sectors and countries. Understandably, different terms are therefore employed in describing them, from 'disruption' and 'revolution' to 'change' and 'transformation'.[78] Still, all industrial sectors and even the most remote regions will be impacted in one way or another. The use of terms such as the 'fourth industrial revolution' or 'industry 4.0' reflects the magnitude of change that is expected.[79]

Automation potential across the industries

In terms of both workforce and competitiveness, industry is one of the economic sectors that will be most impacted by automation brought about by new technologies. Manufacturing, transport and warehouses are estimated to have an automation potential of 60%, of 51% of jobs in the mining industry and 47% in the construction sector.[80] Meanwhile, sectors such as education (27%), management (35%) and arts and entertainment (41%) have a lower degree of automation potential. 'Physical' and 'predictable' work[81] could be more easily automated than 'managerial' and 'unpredictable' tasks[82] (see Figure 9, page 16). However, with the evolution of deep learning and machine learning, the potential of AI performing more 'unpredictable' tasks will also rise.

Industry is one of the economic sectors that will be most impacted by automation brought about by new technologies.

Increased productivity...

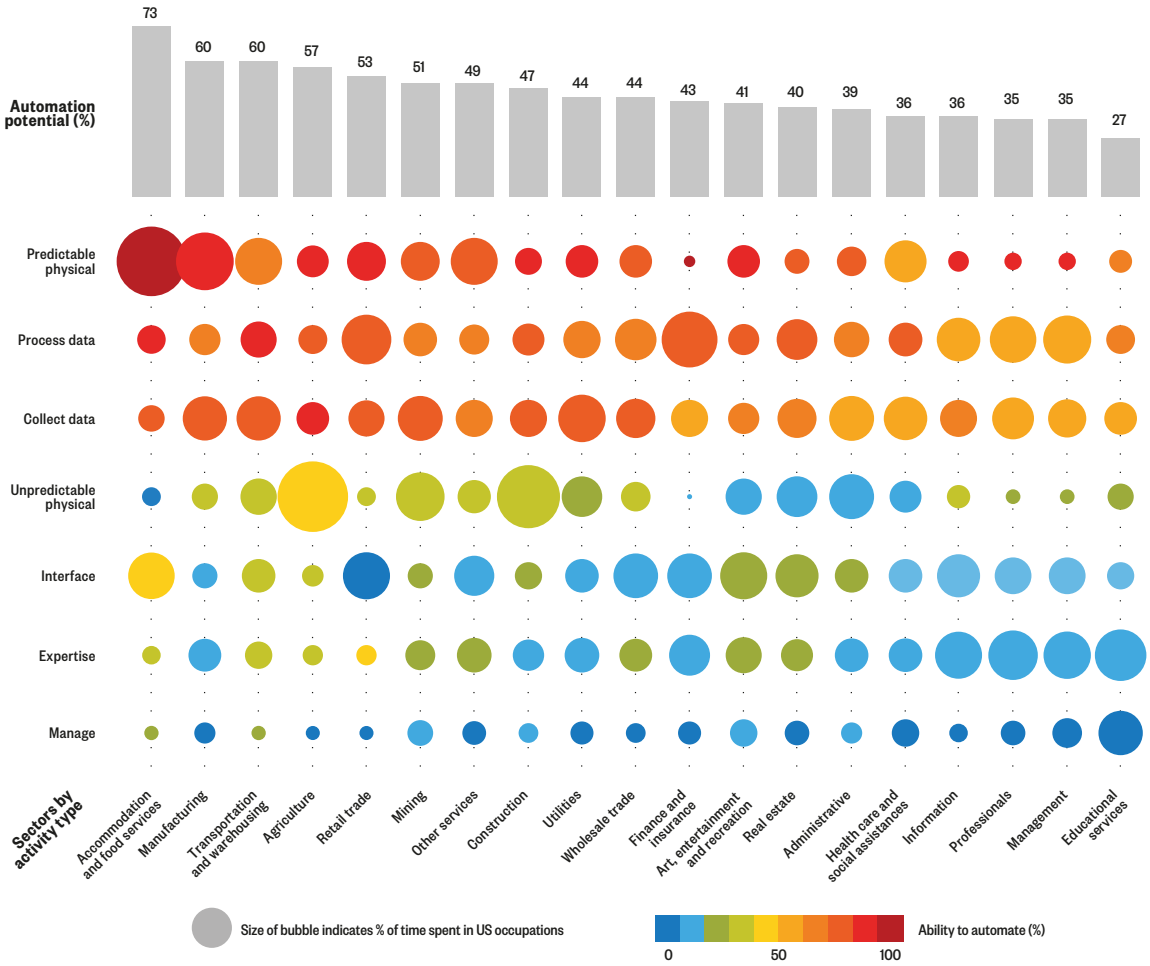
While the automation of work has been around for some time, recent developments in robotics and AI have enabled the automation of decision-making and cognitive processes that until recently were considered only possible for humans. With the development of big data, algorithms are increasingly replicating human decision-making processes, especially on the factory floor. According to estimates by the McKinsey Global Institute, robotics, AI and automation could raise global productivity growth by 0.8% to 1.4% annually.[84] For highly industrial countries (e.g. Germany), a more digitised industry is estimated to contribute an additional revenue growth of about €30 billion per year and create as many as 960,000 new jobs.[85]

CASE STUDY 1: Automation in the German automobile industry

The automobile industry is already one of the most impacted by new technologies and automation.[86] Germany's car industry is planning to increase the deployment of digital technologies even further, to become more competitive with rising Asian firms and cope with an ageing workforce. German car companies were among the first to introduce advanced robots in its factories, since the early 2000s. Audi has introduced a robot into its Neckarsulm production facility which hands coolant expansion tanks to line workers. Other companies such as Volkswagen, Mercedes-Benz and Opel employ 'helper robots' that assist car assembly.[87] Despite the fear that automation will eliminate thousands of jobs, the automobile industry workforce in Germany expanded by 14% (i.e. 710,000 jobs) between 2010 and 2015.[88]

Fig. 9

TECHNICAL POTENTIAL FOR AUTOMATION ACROSS SECTORS, DEPENDING ON MIX OF ACTIVITY TYPES, IN THE US ECONOMY: PREDICTABLE AND PHYSICAL IS MORE LIKELY TO BE AFFECTED BY AUTOMATION (2017)



Source: Manyika *et al.* (2017a)[83]

...and new jobs

At the same time, new technologies are also expected to create new jobs within industry. Most studies highlight that while less than 5% of all jobs could be entirely automated, about 60% of jobs could be automated up to 47%.[89] So while most jobs are expected to change with digitisation, few are expected to disappear in the near future completely. New jobs will appear, focusing on the interaction between humans and machines. Given the current fear that new technologies will massively destroy jobs, it is worth remembering that for advanced industrial countries like the US, one-third of new jobs created in the last 25 years was unheard of before 2005.[90]

In the short- and medium term, up to seven million new jobs within ICT and linked to digital skills could be added to the European economy in the years to come.[91] Amongst others, these could include cybersecurity experts, big data analysts, hardware manufacturers, app creator and coders. While some jobs could be created in direct relation to ICT and digitalisation, others could result from the growth and boost in productivity triggered by these new technologies (e.g. within the service sector). Moreover, technologies such as AI may also introduce completely new types of jobs that may be difficult to apprehend for the time being. A list of such jobs has been supplied by the MIT Sloan School of Management and includes examples such as 'ethics compliance manager', 'AI trainer', 'transparency analyst', 'AI usefulness strategist', 'automation economist' and 'machine relations manager'.[92]

In the EU, professionals and technicians are expected to become the largest occupational forces by 2025 (both above 15% of total employment), while the share of clerks and craft workers will be significantly lower than in 2003.[93] Although it is clear that the workforce needs new skills, education and training of the working population remains minimal and has not increased in the past decade: only 10% of low-skilled and around 15% of medium-skilled workers participate in lifelong learning.[94]

CASE STUDY 2: 3D printing in manufacturing – Bringing jobs back home

The Futurecraft 4D is a new 3D printed shoe developed by Adidas and the manufacturing company Carbon. 3D printed footwear requires fewer materials – some of which are recyclable – and is more durable. Carbon's 3D technology speeds up the production process significantly: 20 minutes per shoe or up to 100 times faster than other additive manufacturing techniques. In recent years, 3D printing technology has allowed Adidas to establish two so-called 'speed factories' (i.e. digitised factories with a small but skilled workforce) in Germany and the US, de facto delocalising factory jobs from Vietnam back to Europe.[95] These new factories allow for more personalised products, moving away from mass production which usually takes place in third countries like China, Indonesia and Vietnam.

The former division between manufacturing and services has lost relevance as they have become a joint production.

Blurred lines: Manufacturing and services

Digitisation has also reinforced the servicification of manufacturing, meaning that manufacturing and services are increasingly intertwined. The degree to which manufacturing buys, produces, sells, and exports services has grown exponentially. Since the beginning of the century, industry has been investing more in 'intangible assets' (e.g. software, data, business models, organisational innovation) and high-level services (e.g. branding, design, technology) than in machinery, hardware or property.[96] Therefore, in many ways, the former division between manufacturing and services has lost relevance as they have become a joint production; a combined sector representing 24.3% of value-added in the European economy, and 20.8% on average for the rest of the world.[97]

Digitalisation and digital technologies will not automatically lead to more sustainable production and consumption.

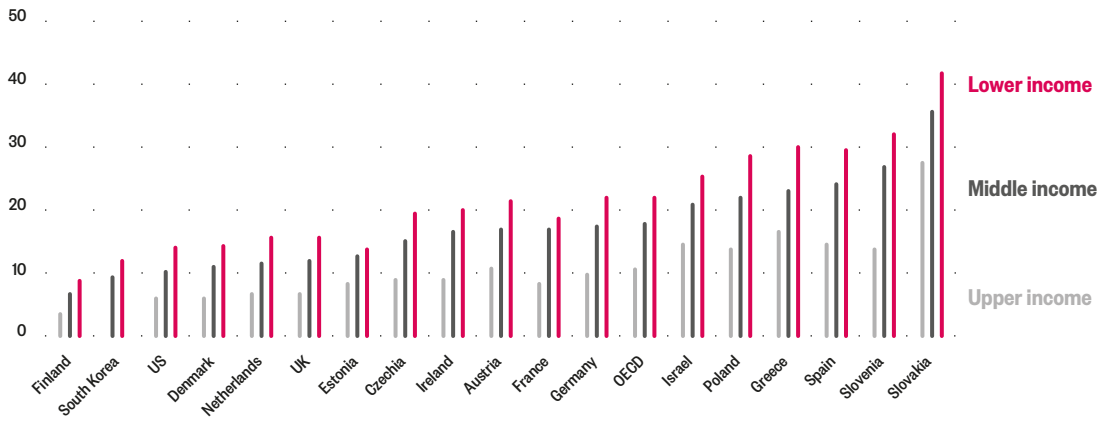
Unintended consequences

Technological progress and the transition to the knowledge economy also have the potential to increase job polarisation and wage inequality further. In the years between 2002 and 2016, most EU countries witnessed a reduction in their share of middle-income jobs by at least 10%, while jobs at the two ends of the wage distribution have been growing.[98] As industry becomes more technology-intensive, demand for skilled workers will increase, thus raising their wage level. Consequently, middle-skilled workers increasingly have to retrain and gain new skills or face being forced into low-skill jobs. Additionally, workers earning a low income are more exposed to the risks of automation (see Figure 10). The OECD estimated that 20% of low-income workers are at high risk of automation, while the same is true for 15% of middle-income and 10% of high-income workers. In Greece, Spain, Slovenia and Slovakia, around 30% or more low-income workers are at high risk of automation.[99] These trends suggest a likely increase in wage inequality.

Moreover, digitalisation and digital technologies will not automatically lead to more sustainable production and consumption. In fact, digitalisation could very well lead to the opposite if not guided and governed well. There is a risk that new digital technologies may result in unwanted consequences, such as overdrive of the linear 'take-make-

Fig. 10

SHARE OF WORKERS IN OCCUPATIONS AT HIGH RISK OF AUTOMATION BY INCOME CLASS: LOWER-INCOME WORKERS FACE HIGHER RISK OF AUTOMATION (%, 2019)



Source: Organisation for Economic Co-operation and Development (2019a)[101]

dispose' economy or increased emissions. However, if adequately steered, digitalisation could certainly help boost the transition to a circular economy by improving processes, enabling new sustainable business models and helping industry to be smarter with their use of resources.[100]

The capacity of a given industry to integrate itself into different segments of global value chains has become crucial for competitiveness.

C. Industry increasingly reliant on global value chains and innovation

The advances in new technologies and the trade liberalisation described above have led to the development of integrated and highly innovative industrial value chains. In recent years, these value chains have become one of the main characteristics of competitive industries. In simple terms, a GVC can be defined as the chain of all the activities and inputs that go into the creation of final good or service.[102] By lowering the cost of moving knowledge, goods and services, digital technologies have enabled firms to establish a vast amount of international production networks, leading to what some have called a new "global value chain revolution".[103] Globally, the capacity of a given industry to integrate itself into different segments of GVCs, and especially within high-value segments, has become crucial for competitiveness.

GVCs are characterised by increased specialisation, as cross-border trade is comprised of intermediate products (i.e. parts and components, raw and processed materials) by up to 80%, significantly outnumbering final or fully assembled products.[104] Assembly lines and production methods are therefore more fragmented, with production processes taking place across several countries. A good example of such a value chain can be seen in Figure 11, indicating where different parts of wind turbines are made in Europe. Meanwhile, Figure 12 shows the global supply chain needed to assemble a Mini car, as currently produced by the BMW Group.[105]

Global value chains vary across industries (see Figure 13)

Highly innovative industries such as automobile, computer and electronics, pharmaceuticals and chemicals constitute the most valuable and trade-intensive value chains.[109] Most trade within these value chains is done with intermediate goods, and investments into R&D remain crucial as competition is mostly based on innovation and quality. Participation is highly concentrated around a small number of advanced economies (12 countries represent 75% of global exports),[110] within which China's presence is rising.[111]

Industries reliant on **regional processing** (of e.g. food, beverage, paper, glass, cement, plastics) use fewer intermediate goods than other GVCs. They are mostly traded within regional value chains and, to a lesser extent, across GVCs due to factors such as varying consumer preferences and the weight or perishability of the traded goods.[112] While production is still spread across the world and most trade is done at intraregional level,[113] regional value chains are growing faster than those for innovative and/or labour-intensive industries.

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Industries centred on **resource-intensive goods** (e.g. mining, agriculture, basic metals, energy) generate

Fig. 11

The value chain of European wind turbine manufacturers: main locations of manufacturing facilities

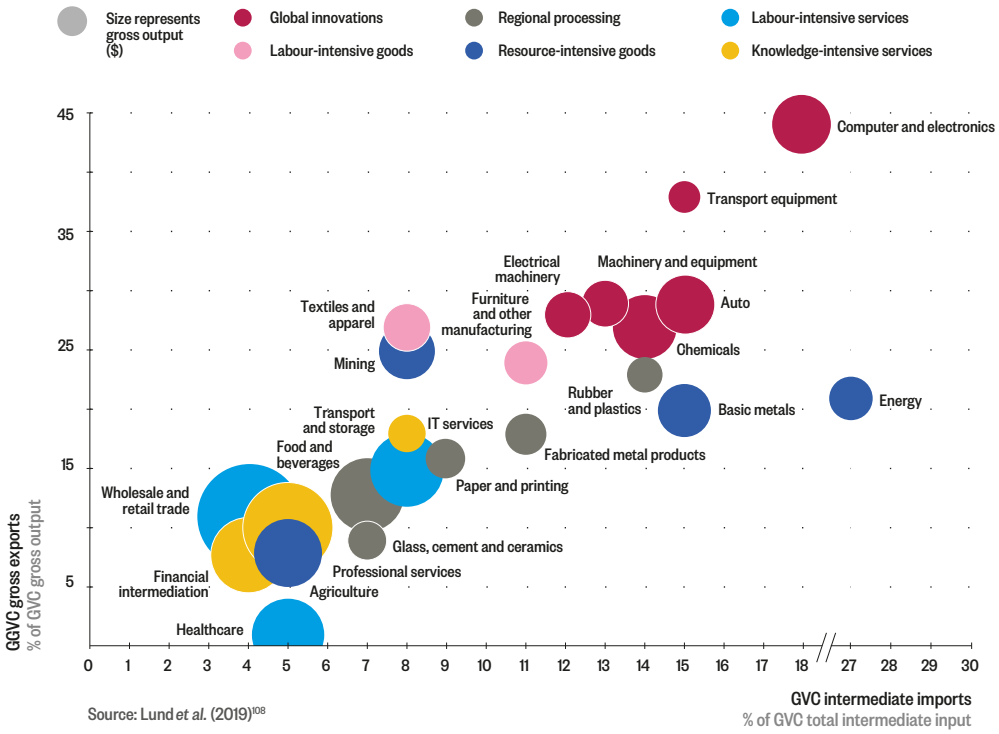
Source: European Commission (2018d)[106]

Fig. 12

Source: Unsöld (2018)[107]

Fig. 13

TRADE INTENSITY IN GLOBAL VALUE CHAINS: TRADE INTENSITY IS HIGHEST IN GLOBAL INNOVATIONS VALUES CHAINS AND GENERALLY MUCH LOWER IN SERVICE VALUE CHAINS (2017)



Source: Lund *et al.* (2019)[108]

almost as much gross output as highly innovative and/or labour-intensive industries. Most of these outputs are intermediate goods that are redirected towards other value chains. 19 countries spread across the world account for 75% of export within this value chain.[116]

Finally, **labour-intensive services** (e.g. wholesale, retail, transport, storage) and **knowledge-intensive services** (e.g. financial services, IT services, professional services) have a lower trade intensity across GVCs than goods-producing industries. Services, in general, are less easily tradeable across borders due to their intangible nature and regulatory barriers. Still, activities in services (e.g. transport, storage, retail) have also increased following the rise of cross-border trade in goods and e-commerce. Labour-intensive services (especially wholesale and retail) now represent the second-largest job creator worldwide.[117] Knowledge-intensive services depend on skilled labour and five countries – the US, UK, Republic of Ireland, Germany, France – make up 46% of global exports.

Advanced economies are facing growing competition from China within highly innovative value chains.

Transformations of global value chains

Worldwide, industry and especially manufacturing are increasingly becoming reliant on GVCs. Goods-producing industries are more integrated into GVCs than services-providing ones. In recent years, however, trade in services has grown to a greater extent than that for goods. In the last decade, trade in IT services, professional services and intellectual property rights (IPRs) have grown almost three times faster than trade in goods.[118]

GVCs have expanded into developing countries, and manufacturing jobs disappearing from more advanced economies: about a 39% loss in the UK, 24% in France and 23% in the US since 1997. Notably, however, only 3% in Germany.[119] Conversely, industries specialised in regional processing have been better protected from the rise in competition from developing countries. Trade is more regional than global in these value chains, and EU firms crucially benefit from the Single Market.

CASE STUDY 3: Spain's success story

Over the years, Spain has specialised its food industry through regional, intra-EU value chains, and is more shielded from global competition than before. Spain's food exports increased by 80% in the last decade, and the country is currently the first exporter of fresh fruit and vegetables globally.[120]

On the one hand, automation and rising wages in developing countries may lead to the creation and relocation of manufacturing jobs back to advanced economies. Automation would make labour costs less relevant for firms with regard to determining where to locate their production. On the other hand, advanced economies are facing growing competition from China within highly innovative value chains. China is becoming less reliant on intermediary goods and services from advanced economies, and its Made in China 2025 strategy aims to reduce its dependence further. China strongly supports its technological industry in AI, 5G and smart robotics, and is already a world leader in industrial robotics.[121]

The importance of innovating within global value chains

Many EU companies have traditionally positioned themselves on the high added-value end of GVCs. In an increasingly competitive and fast-changing environment, innovation is crucial to maintain their position and comparative advantage. In this case, innovation should be understood as being beyond technological development, to also encompass the adoption of new business models, market sophistication and institutional stability. This includes extensive investment in human capital and skill training; innovative infrastructure; a sound IPR and patent framework to reward innovative efforts; and attracting FDIs. For manufacturing activities, this means innovating the methods of production, moving away from traditional schemes, and embracing the link with services and knowledge-intensive activities.

In terms of innovation framework, European countries continue to rank among the strongest in the world.

In terms of innovation framework, European countries continue to rank among the strongest in the world. The Global Innovation Index 2019, published by the World Intellectual Property Organization (WIPO), ranks six EU member states (i.e. Sweden, the Netherlands, the UK, Finland, Denmark, Germany) among the top ten most innovative economies. Ireland, France and Luxembourg also rank among the top 20. Although the US, China and Japan outperform EU countries in terms of public and private R&D expenditures, European countries score among the highest on several indexes: institutions (political, regulatory and business environment), human capital and research, business sophistication, and knowledge and technology outputs.[122]

D. The need for a sustainable industry

Climate change is arguably the greatest global challenge of our time. The science is clear: human activities have led to the emission of greenhouse gases (GHG) that are warming our planet and, as a result, are destabilising life on earth.[123] The world is not on track to limit global warming – on the contrary, with the current trend, the global temperature is expected to increase 2°C by 2060, which could lead to unprecedented economic, societal and environmental costs. There is a growing recognition amidst politicians and citizens[124] as well as within industry that the time for climate action is now. While addressing the climate crisis will require actions across economy, society and different sectors, industry will be a major player in accelerating the transition towards a climate-neutral and zero-emission economy.[125]

Climate change is arguably the greatest global challenge of our time.

The global commitments stemming from the Paris Agreement[126] and the UN's SDGs[127] provide a vision and a direction for measures to be taken. The Agreement sets the ambition of achieving a climate-neutral world by mid-century. The SDGs again define objectives for inclusive and sustainable industrialisation, and also responsible consumption and production, which all have direct implications for industry. These global commitments, together with consumers' calls for more sustainable products and services, provide a strong sense of direction for industry.

Taking action is also in the interest of industry. For example, climate change-related catastrophes and disruptions can lead to substantial economic and societal costs as well as affect industry.[128] Major risks include damage floods, wildfires, storms and droughts, as well as food and water shortages. Moreover, climate change can accelerate competition over natural resources. Scarcity of natural, non-renewable resources is already reflected in supply risks and volatility of prices. The total cumulative global cost of climate change by 2030 is estimated to be between $2 trillion and $4 trillion.[129] The OECD projects that global GDP would be reduced by up to 10% if temperatures continue to rise to 4°C above pre-industrial levels.[130]

Many industries are adapting by developing more sustainable business models and contributing to a circular economy.

Moreover, there is a growing market for sustainable products and services not only in the EU but also beyond its borders, from China and India to Africa. Many industries are already adapting by, for example, developing more sustainable business models and contributing to a circular economy and reaping the related benefits. The clean economy is growing fast, and

the total number of people employed in the renewable energy industry is growing rapidly.

Arguably, at the core of future-proofing any industry is a recognition of the sustainability challenges and aligning actions with the aforementioned global commitments. Only industry that adapts and reacts to these trends and commitments and brings solutions to the market can be expected to have long-term competitive prospects.

Calls for climate neutrality and lower emissions

Industry is directly affected by the global commitments that most countries around the world and all EU member states committed to in 2015 through the Paris Agreement. The Agreement set out the goal of maintaining the increase of the average global temperature to well below 2°C, and even to pursue efforts to reduce it to 1.5°C. Realistically, if such a goal is to be achieved, a long-term objective should be to reach net-zero emissions by 2050.

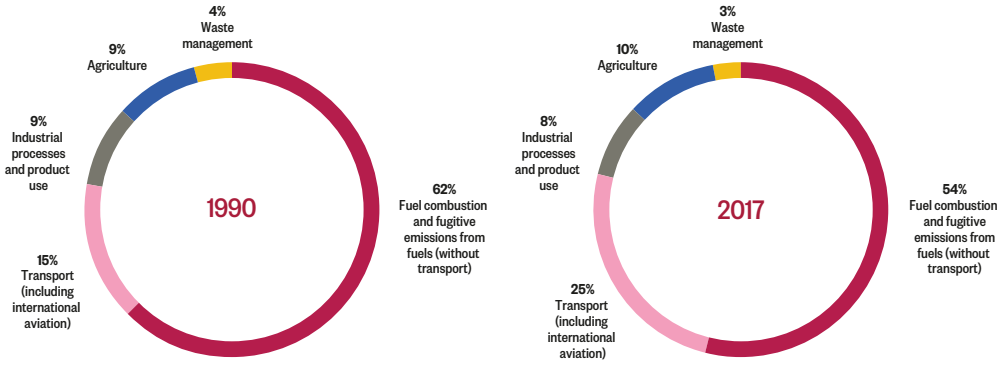
At the EU level, the Commission has called for an EU-wide 2050 net-zero emissions target, with several EU member states having already defined national net-zero goals.[131] Within the European Council, close to all member states have already agreed to a 2050 net-zero target, barring Czechia, Hungary and Poland.[132] To increase the ambition also in a medium-term, several member states, as well as incoming Commission President von der Leyen, have called for increasing the previously agreed GHG emission target from 40% to up 55% by 2030. The EU-wide 2050 net-zero emissions target has also been endorsed by several environmental NGOs[133] and industry.[134] Overall, the strong focus on a new 'European Green Deal' and climate action, indicates the political priority given to the topic in the EU at the moment.

It is clear that achieving net-zero emissions by 2050 would require a deep economic transformation.

It is clear that achieving net-zero emissions by 2050 would require a deep economic transformation, like a drastic GHG emission reduction across all sectors, especially in the highly polluting energy, building, transport, industry and agriculture sectors. The implications of these commitments and the scale of the challenge for policymakers, for the public and private sectors, as well as for citizens are significant.

Fig. 14

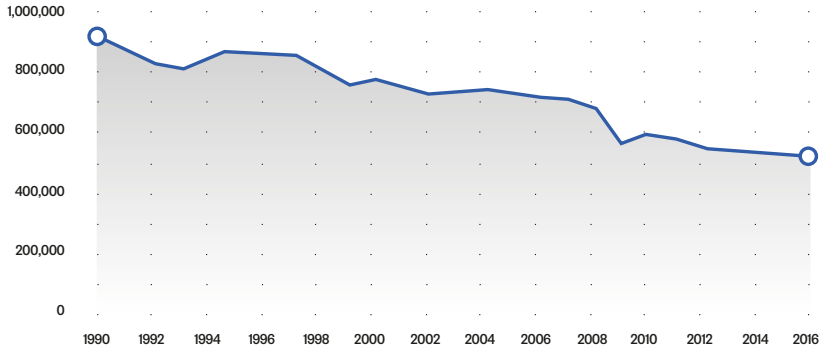
GREENHOUSE GAS EMISSIONS BY SECTOR IN THE EU (CO_2, T.)



Source: Eurostat (2019)[136]

Fig. 15

GREENHOUSE GAS EMISSIONS FROM ENERGY-INTENSIVE INDUSTRY: A STEADY DECLINE (CO_2E, THOUS. T., 1990-2016)



Source: Authors, based on Eurostat data[139]

Industry emissions in the EU

In the EU, 'industrial processes and product use' represent around 8% of GHG emissions (see Figure 14, page 21). However, industry is also responsible, through related activities, for some of the emissions within 'fuel combustion and fugitive emissions from fuels' (54%) and the transport sector (25%).[135] It is alarming that GHG emissions from 'industrial processes and product use' have not significantly reduced since 1990 (a mere 1% difference), while emissions from fuels and transport have dropped by 8 and 10 percentage points respectively.

A closer look at energy-intensive industry (EII)[137] (producing e.g. steel, plastics, ammonia, cement), shows that it emits 500 million tonnes of carbon dioxide (CO_2) per year. The sector accounts for 14% of the EU's CO_2 emissions and 20% of global CO_2 emissions.[138] Efficiency gains and structural change towards a more services-based economy contributed to reducing GHG emissions from European EII by 43% between 1990 and 2016. This is a trend that has been slowing down since 2010, however (see Figure 15, page 21).

It is worth noting that the European industry also has a climate and environmental footprint beyond its borders. For example, a study by the UN Environment Programme evaluates that extraction and processing account for half of the world's carbon emissions and 90% of biodiversity loss.[140] Also, if businesses move operations to countries with laxer emission constraints, for example, due to costs related to EU climate policies, this would lead to the risk of carbon leakage and thus a possible increase in industry's total emissions.

Industry's climate action

Many industries are committing to tackle climate change and promote decarbonisation via their own processes, products and services. Maersk, the world's largest container shipping company, has declared that it aims to be carbon-neutral by 2050.[141] The oil and gas company Shell has set a long-term ambition of reducing its net-carbon footprint and has linked these ambitions to the remuneration of its executives.[142] Moreover, over a hundred major global firms spanning 23 countries (e.g. Electrolux, L'Oréal, Sony, McDonald's) have committed to emission reduction targets through the Science Based Targets initiative, in cooperation with the UN Global Compact.[143] Hundreds of companies have also committed to 100% renewable energy.[144] Others have made voluntary commitments through the **We Mean Business coalition**.

The European industry has a climate and environmental footprint beyond its borders.

While the Trump administration announced its intention to withdraw from the Paris Agreement,[145] over 1,700 US businesses and 200 US cities have signed up to the **We Are Still In coalition** and **America's Pledge**, reaffirming their commitment to the Paris goals. Still, far from all companies have clear targets to reduce their emissions.[146]

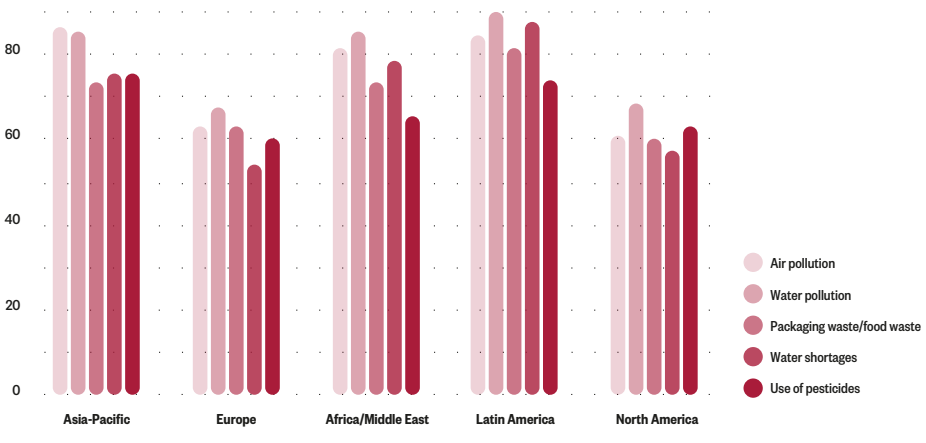
Changing consumer preferences

In addition to global, national and local commitments, citizens themselves are showing increasing concern about the environment and climate by changing consumer preferences. Consumers are increasingly interested in sustainable products and services, supporting fair trade, and reducing food waste and/or energy consumption. Citizens are increasingly holding industry and politicians accountable on these grounds.

In fact, according to studies conducted by the market research consultancy Nielsen, up to 81% of consumers worldwide strongly feel that companies should help improve the environment.[147] 15- to 20-year-old and 21- to 34-year-old respondents agree (80% and 85% respectively) that it is "extremely or very important" that companies

Fig. 16

PERCENTAGE OF RESPONDENTS WHO ARE EXTREMELY OR VERY CONCERNED ABOUT THE FOLLOWING ENVIRONMENTAL ISSUES (%, 2018)



Source: Nielsen (2018a)[148]

implement programmes to improve the environment, while the same response varies between 65% and 79% for 35-year-old respondents and older. Consumers in emerging and developing countries feel especially strongly about issues such as air and water pollution, waste, water shortages and the use of pesticides, and more than half of all respondents feel "extremely or very concerned" about all these issues (see Figure 16).

Such sentiments are gradually being reflected in consumption trends, as studies from the fashion industry and for other products increasingly show.[149] Studies focusing on chocolate, coffee and bath products found that products with sustainability claims grew twice as fast in sales in comparison to others.[150] The industry itself is also becoming aware of these changes, as several companies are already investing in and adopting more sustainable business models, goods and services. Examples include an increase of vegan options in food and beverages companies; packaging companies producing products that can be more easily recycled; and household and personal care businesses replacing petrochemicals, parabens and micro-plastics with biodegradable and natural ingredients.[151] Still, companies could do more to respond to these demands.[152]

E. Growing competition over human and natural resources

Competition over natural resources

Industries are facing growing, fierce competition for natural resources. Globalisation, the emergence of new economic players and demand for new technologies are increasing the race for limited available resources and spurring higher price volatility for primary products. The competition is growing evermore vigorous also due to the additional constraints on supply, such as climate change, water scarcity, political instability and conflicts that affect the availability of raw material stocks already facing depletion.[153] Overexploitation of resources and environmental destruction are leading to resource scarcity, which can have far-reaching and unforeseeable economic, social, environmental and security implications. Thus, arguably, to ensure prosperity in the long term, there is a need to create a new kind of economy that decouples growth from resource use and impacts.[154] It is becoming clear that the current 'business as usual' and 'take, make and dispose' economic model, which places an enormous strain on global resources (i.e. energy sources, water, land, food, minerals) is no longer sustainable.

To ensure prosperity in the long term, there is a need to create a new kind of economy that decouples growth from resource use and impacts.

European industry is extremely vulnerable in the face of this global resource challenge. European companies outsource the largest share of resource extraction in the world. The EU is dependent on energy imports, such as oil and gas, from just a few suppliers (i.e. Russia), as well as raw materials for chemical, construction and other industrial sectors.

Many of the industries that will be essential for creating a sustainable economy and that wish to benefit from digitalisation are dependent on raw materials from outside the EU. Rare earth, for example, is a key component for industrial goods (e.g. smartphones, windmills, electronic vehicles, robots, cybersecurity technology).[155] E-mobility and information technology depend on rare earth, and batteries on lithium, cobalt and graphite. As Europe

Fig. 17

EUROPEAN DEPENDENCE ON CRITICAL RAW MATERIALS BEYOND THE EU (%, 2017)

Source: European Political Strategy Centre (2019a)[156]

currently produces only between 1% to 8% of the world's cobalt, natural graphites, lithium and rare earth, critical raw materials represent a high-supply risk as they mostly originate from a limited number of countries and often lack substitutes (see Figure 17, page23).

Europe is becoming a hub for innovative, digital solutions that accelerate the transition to a circular economy.

Many businesses already acknowledge that better use of resources would help to cut costs and thus improve competitiveness, so it follows that it is in the EU's interest to be smarter with its domestic resources. The notion of transitioning to a circular economy is gaining traction as it allows for better use of the limited available resources by encouraging reusing, repairing, remanufacturing and recycling existing materials.[157] As a result, the European industry is in a good position to build on this challenge and the related possibilities. Many European businesses are already leading in developing new business models and are adapting their processes, products and services accordingly. Moreover, Europe is becoming a hub for innovative, digital solutions that accelerate the transition to a circular economy.[158]

Competition over human resources

At the same time, the transition of most advanced industrial countries into knowledge-based economies has made high-skilled and specialised workers a major resource for competitiveness. In knowledge economies, the creation of most goods and services requires a specialised set of skills over which many firms compete. Some industries (e.g. oil and gas, automobile, mining, ICT) are also more dependent on the influx of highly skilled workers.[159] New skills most in demand include cloud computing, big data analytics, mobile application development, sales leadership, translation, social media marketing, business analysis and industrial design. The more innovative and well-off companies and regions are often more successful in acquiring the talents they need, meaning that others lag and do not have equal opportunities to succeed. Some commentators even talk about a "war for talent".[160]

Knowledge-based economies has made high-skilled and specialised workers a major resource for competitiveness.

Many countries have formulated a range of policies to attract the same pool of highly skilled talents.[161] Some have been more successful than others: over 70% of software engineers in Silicon Valley are foreign-born.[162] In addition to economic incentives, highly skilled talents also look for other incentives when deciding on where to settle: good quality of life, access to higher quality research infrastructure, the opportunity to work with other talents and academic freedom.[163]

According to the graduate business school INSEAD's Global Talent Competitive Index, European countries and the US remain top countries in attracting talents.[164] However, Asian nations, such as Singapore and Japan, also do well. Other countries, such as the United Arab Emirates and Qatar, are also high on the top 25 list. Overall, the most competitive countries are all defined as high-income countries. Some industries could face significant talent shortages by 2030, including within the ICT and manufacturing sectors, which in turn would also affect high-income countries the most.[165]

European countries and the US remain top countries in attracting talents.

According to the OECD, skills shortages are among the biggest challenges faced by businesses today, affecting management, health care and ICT sectors particularly hard.[166] Shortages of skilled workers are also increasingly playing as a factor that impedes production and growth.[167] In Europe, some even talk about a "skills-shortage crisis",[168] with increasing skills mismatch between under- and overqualified workers. Across the EU, professions that do not meet current demand include ICT professionals; medical doctors; science, technology, engineering and mathematics (STEM) professionals; nurses; midwives; and teachers.[169] The European ICT sector is expected to have 756,000 unfilled jobs by 2020, and already 40% of ICT companies report difficulties in finding skilled workers in Europe.[170]

Chapter 2: Towards a European response

1. THE EU'S INDUSTRIAL POLICY

The need for a European industrial policy has long been debated. While 'industrial' policies were somewhat out of fashion for much of the 1970s to 90s, they regained importance among policy policymakers in the early 2000s, with renewed political concerns surrounding deindustrialisation and the migration of manufacturing jobs to third countries.[171]

The need for a European industrial policy has long been debated.

Between 1970 and 1990, policymakers preferred notions of competitiveness, innovation and enterprise policy, focusing on stimulating the competitiveness of businesses more generally and steering away from direct state intervention in the economy. In the European Commission, the name and responsibilities of the departments in question have somewhat changed over the years. In 2000, the Directorate-General (DG) Industry became DG Enterprise, which was then expanded in 2005 to DG Enterprise and Industry. In 2014, the DG merged with DG Internal Market, resulting in the current DG for Internal Market, Industry, Entrepreneurship and Small and Medium-Sized Entreprises (DG GROW).[172] This merger reflected a recognition that industry and the Single Market are two sides of the same coin.

For quite some time, European industrial policy was almost summed up by the creation of Airbus, the aviation champion set up as a consortium of European firms in 1970. Airbus has now become an unavoidable point of reference when discussing new industrial initiatives launched at the European level. Recent examples include an "Airbus for chips" in microelectronics,[173] an "Airbus of the Seas" for shipbuilding,[174] an "Airbus of batteries" for electric vehicles,[175] an "Airbus for artificial intelligence" as called for by German Minister of Economic Affairs and Energy Peter Altmaier,[176] and more recently an "Airbus of trains" with the (blocked) merger of Siemens and Alstom.[177] However, as some of these examples show, attempts to copy past successes do not always work. The Commission has therefore focused on creating firstly the necessary framework conditions for industry to flourish.

Early Commission initiatives

The Maastricht Treaty was the first to reference industrial competitiveness, stating that the "Union and the Member States shall ensure that the conditions necessary for the competitiveness of the Union's industry exist."[178] Following the entry into force of the Treaty, a new sense of activism could be discerned from the formulation of the Commission's notes and communications on industry and its competitiveness.[179] EU member states – especially larger ones – also called on the Commission to be more active. In 2003, the then German Chancellor Gerhard Schröder, French President Jacques Chirac and British Prime Minister Tony Blair called for more targeted policies to address deindustrialisation and support manufacturing in light of globalisation, as well as avoiding "unnecessary burdens on the industry" in a letter addressed to Commission President Romano Prodi.[180]

In the aftermath of the 2008 financial crisis, industrial policy was again viewed as an important tool to stimulate jobs and growth.

In the aftermath of the 2008 financial crisis, industrial policy was again viewed as an important tool to stimulate jobs and growth.[181] In 2010, the Commission published the Communication "An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage", highlighting the central role manufacturing could play in creating jobs and growth and addressing challenges such as climate change and an ageing population.[182] It was followed by the 2012 Communication "A Stronger European Industry for Growth and Economic Recovery", with the Commission emphasising investment and innovation needs in six areas: advanced manufacturing, key enabling technologies (KETs), bio-based products, sustainable industrial policy, clean vehicles and smart grids.[183] It also stated that it would aim to reverse deindustrialisation and raise manufacturing's contribution to Europe's GDP to 20% by 2020. Finally, in yet another Communication in 2014, "For a European Industrial Renaissance", the Commission recalled its earlier positions and called on member states to mainstream industrial competitiveness in all relevant policies.[184]

Under the Juncker Commission

The Juncker Commission defined "a deeper and fairer internal market with a strengthened industrial base" as one of its priorities for the 2014-2019 cycle.[185] In practice, this has meant focusing on the regulation of the digital single market (DSM), updating Single Market rules and working towards a 'capital markets union'.[186] In September 2017, the Commission unveiled the Communication "A renewed EU industrial policy strategy", which recalled the importance of bringing "industry's weight in the EU GDP back to 20% by 2020"[187] and listed current and new initiatives under related policy areas such as the circular economy, Single Market and

skills agenda. Mostly seen as a stocktaking exercise, the Communication was criticised for not having included new strategic objectives, clear goals and indicators.[188]

The current fresh momentum and calls for a strong EU approach to industry should lead to something new.

A more concrete exercise has been the Digitising European Industry initiative under the Digital Single Market strategy, which followed the example of various national 'industry 4.0' initiatives to invest and support the deployment of technologies for industry, small and medium-sized enterprises (SMEs) and public authorities.[189] However, initiatives and investments deployed would still have to be significantly increased to be comparable to strategies developed by competitors such as the US and China.

Arguably, as it stands today, the EU industry strategy does not adequately respond to the challenges currently faced by industry.[190] The EU's aim to mainstream industrial competitiveness across policy areas can be an excellent added-value if implemented efficiently, but more could be done. This would require the support also especially from member states. Although the Commission has been criticised for this lack of ambition, it is important to keep in mind the limits to the EU's competence in crucial policy areas, not to mention disagreements between member states about what an EU industrial strategy should include. The current fresh momentum and calls for a strong EU approach to industry should lead to something new.

New momentum

Until now, EU industrial actions have been moderate in scale and have generally focused on framework conditions through related policies, such as the Single Market, research and innovation. Even if these remain crucial, the current context calls for a new, more comprehensive and strategic approach, targeting the challenges faced by EU industry. EU leaders now seem to be increasingly aware of this. At the European Council of March 2019, they called on the Commission to present, a "long-term vision for the EU's industrial future, with concrete measures to implement it" by the end of 2019.[191] In June 2019, the Council mentioned "designing an industrial policy fit for the future" in the latest EU strategic agenda.[192] As such, European industry is set to become one of the first tasks to be dealt with by the incoming Commission and its President Ursula von der Leyen.

The recognition of the need for EU action has also been gaining momentum in member states. While most have drafted their own national industrial strategies, they have also come to realise that most of the challenges industry faces are global in nature and are best tackled at the EU level, especially given EU competences on trade, competition and the Single Market. Over the years, the ministerial conferences Friends of Industry – an informal meeting of EU ministers in charge of economy and industrial policy – have repeatedly called for the bolstering of EU industry and for the Commission to become more involved in formulating a common EU approach.[193] Most recently in December 2018, for their sixth meeting, ministers defined their first objective: to "[o]btain that the new European Commission, as soon as it is in place, propose an ambitious and comprehensive industrial strategy based on priority objectives to be reached by 2030 as a part of EU long-term strategy."[194] Note the similar wording to the March 2019 Council conclusions, but with more direct references to an "ambitious" and "comprehensive" strategy, with "priority objectives" for 2030.

But what kind of policy?

Several countries have presented their own views for EU action. Germany's industrial strategy for 2030 includes suggestions on how to reform EU competition rules to better allow for European champions to 'take on' competition from China and the US. It was quickly followed by a "Franco-German Manifesto" on European industry in February 2019, which, beyond reviewing EU competition rules, also focused on technology funding, AI and trade policy.[195] The timing (purposefully) coincided with the Commission's decision on the Siemens-Alstom merger, an initiative heavily supported by the French and German governments, with both insisting that 'European champions' are needed to be able to fend off competition from China. When the Commission, through the voice of its Competition Commissioner Margrethe Vestager, decided to block the merger, French Economy Minister Bruno Le Maire was quick to declare it a "political mistake" which "will serve China's economic and industrial interests". Meanwhile, his German counterpart Altmaier stressed that the decision "demonstrates the urgent need for a European Industrial Strategy" and the need for "strong European champions".[196]

The well-functioning and the 'completion' of the Single Market are the keys to industrial competitiveness.

In July 2019, Poland joined Germany and France in reiterating the call "to modernise European competition policy" in a common statement.[197] Despite using much of the same language on the need to update merger and state aid rules and take better account of state interventions from third countries, it did not refer to a possible "right of appeal of the Council which could ultimately override Commission decisions"[198] – a politically sensitive and much-debated suggestion in the Franco-German manifesto.

These initiatives have sparked lively debate on what a new EU industrial policy should include.[199] Some have

feared that an EU industrial policy would only benefit so-called 'champions' – multinational firms already boosting a strong global presence, and predominantly from the larger member states, such as France and Germany. In response to the Franco-German approach, other member states have underlined the need for a competitive ecosystem to emerge through the Single Market and argued against relaxing EU competition rules, highlighting that an EU industrial policy should benefit all member states. These views have been repeated by Commissioner Vestager, who presented her own vision at the EU Industry Days and the EPC, arguing for a strategy for "all of Europe" and noting that it "can work hand in hand with competition policy".[200]

Member states, such as the Benelux, Nordic and Baltic countries, often emphasise that the well-functioning and the 'completion' of the Single Market are the keys to industrial competitiveness. This was made clear in the letter signed by 17 member states and sent to the President of the European Council, Donald Tusk, in preparation for the March 2019 European Council meeting.[201] The letter highlighted the role the Single Market should play for industrial policy, in enabling digital industries to succeed and in developing the Single Market for services for industry value chains. The letter also referred to an "offensive industrial policy to innovate and remain globally competitive in key technologies and strategic value chains".[202] Recently, the government of the Netherlands referred to a "modern EU industrial policy focusing on research and innovation" in its position paper on strengthening European competitiveness.[203] The Finnish government also stated that it would "promote an active industrial policy for the EU" in its EU Presidency Programme.[204]

Calls from the industry and unions

Beyond national governments, European firms and trade associations and unions have also expressed the need for a strong EU industrial policy. Calls from the industry have come from across sectors and member states. Industry4Europe, a coalition of 147 industry associations, has campaigned for an ambitious industrial policy at the EU level.[205] The European Chemical Industry Council (Cefic) has underlined the urgency for a long-term EU industry strategy in its manifesto for a competitive Europe.[206] Similar calls have been expressed by Orgalim, which represents technology industries in Europe, in their long-term political agenda "2030: An industry vision for a renewed Europe";[207] by the European Federation of Pharmaceutical Industries and Associations (EFPIA) in their 2019 manifesto;[208] and BusinessEurope, the Confederation of European Business.[209] IndustriALL, a global trade union representing over 50 million workers, has presented its own action plan for the future of European industry, with a focus on sustainable growth, and empowering and training the workforce.[210] Similar positions have been expressed by the European Trade Union Confederation.[211]

In other words, currents call for a new, modern and offensive EU industrial policy can be heard across the board. Almost all EU member states and stakeholders agree that there is a need for a gear change in the EU's approach, from passive to active. Disagreements persist on what this new policy should include and which existent policies it should be based around. Chapters 3 and 4 will provide answers to these questions. The subsequent part looks into the EU's strengths and weaknesses in formulating an EU Action Plan for Industry. A few core policy areas have been selected: innovation, the Single Market, digital and climate policy, and circular economy.

2. EUROPE'S STRENGTHS AND WEAKNESSES

A. Single market, competition and trade[212]

Strengths

The EU's Single Market remains the greatest added value for European industries: it guarantees the free movement of goods, services, people and capital by removing internal borders and regulatory obstacles to trade within the EU. It allows European industries to access a consumer market of 500 million, attract intra-EU investments, sell abroad and scale up. It also enables their integration into European value chains, often decisive before scaling up and integrating GVCs. The economic benefits of the Single Market amount to 8.5% of the EU's GDP[213] and 56 million European jobs depend on the trade within it.[214] The EU market is therefore unique: it represents the largest single market and the most integrated transnational market worldwide.[215]

The EU's Single Market remains the greatest added value for European industries.

Within the Single Market, a well-functioning competition policy also represents a strong added value for citizens and businesses. It allows companies to do business on a level playing field and provides a greater variety of products and services. Competition policy ensures that anti-competitive risks that might occur from mergers, public activities or state aid are avoided. The strong role played by the EU in investigating and enforcing competition rules remains crucial for the well-functioning of the Single Market. Together with the Commission, national competition authorities also ensure that EU rules are enforced throughout the EU.

The strong role played by the EU in investigating and enforcing competition rules remains crucial for the well-functioning of the Single Market.

The Single Market also makes Europe one of the most important actors in global trade. It provides Europe with significant leverage in international trade negotiations and helps to attract foreign investments and raise capital within the EU. It has allowed the EU to become and remain the main destination of foreign investment in the world – specifically €6,295 billion by the end of 2017.[216] The OECD also describes EU regimes as the most open in the world in its FDI Regulatory Restrictiveness Index.[217] In recent years, this leverage has been used to open new markets through new FTAs with Mercosur, Japan, Singapore, Canada, Vietnam and South Korea. More are expected to come to fruition, namely with Australia and New Zealand. The EU's trade policy has allowed Europe to become the world's largest exporter of manufactured goods and services, and the largest export market for around 80 countries worldwide.[218] The EU also remains one of the strongest voices championing the well-functioning of the multilateral trading system.

Weaknesses

However, despite its obvious advantages for EU industry, the Single Market is also facing numerous challenges. EU member states are having a hard time agreeing on the Single Market reforms suggested by the European Commission. Furthermore, its well-functioning is facing difficulties from member states being unable or unwilling to implement or apply EU rules correctly. In particular, this has been the case within fields such as PP and services. With growing concerns around protectionism and distorted competition, some member states and companies are increasingly willing to protect themselves by erecting new barriers to trade – in which case national bodies are not always effective in enforcing Single Market and competition rules.[219]

Firstly, despite being the main component of modern economies, trade in services remains underdeveloped within the EU (services account for 8% of EU GDP, compared to 25% for goods).[220] The Services in the Internal Market Directive, adopted in 2006, is far from being fully implemented and enforced across the EU. With manufacturing and services increasingly intertwined, and the growing need for high-skilled workers, a Single Market for services is crucial for EU industry. Full implementation of the Services Directive could add 2% to EU GDP.[221]

Secondly, the re-emergence of barriers to trade within the Single Market represents a serious challenge for EU industry. These barriers may take the form of national or regional measures established on the grounds of public safety, or environmental or health concerns (including technical requirements, requests for additional documentation or testing). Even if disproportionate and discriminatory, they do not always take place on a large enough scale to be picked up by the Commission for infringement proceedings. Nevertheless, they can represent major hurdles for companies and may, in some cases, even dissuade them from entering new markets.[222]

Thirdly, as often pointed out by industry, member states are not equally efficient in enforcing Single Market rules.[223] The enforcement of EU rules is crucial for the overall integration and openness of member states. Currently, countries such as Slovakia, Czechia, Hungary and Belgium have the highest level of integration and openness for trade in goods.[224]

Some member states and companies are increasingly willing to protect themselves by erecting new barriers to trade.

Another issue faced by industry within the Single Market is what is described as the increased complexity of market rules.[225] SMEs, in particular, complain about the complexity of increasing national technical regulations and overlapping EU rules. While larger firms may have the workforce to ensure that they comply with these rules, it is becoming more difficult for new businesses and SMEs to do so.

Finally, the openness of the Single Market allows for foreign firms that do not fully respect EU competition rules to enter the European market. The reality of global competition is that state aid and public subsidies remain an important element of many third countries' industrial policies. So far, the EU's competition and trade policy do not allow sufficient flexibility to react to rapid changes in global competition.

B. Innovation policy

Strengths

Europe has solid foundations upon which it can enhance its innovation performance. First, the EU has a strong talent pool and skilled workforce on which it can build. Europe has the highest absolute number of researchers in the world (i.e. over 1.7 million, overtaking China's 1.5 million and the US' 1.3 million). One-third of the world's top thousand universities for engineering and technology are European, as well as five of the top ten computer science universities. The EU research community accounts for the largest share of 10% of the most cited publications, which in absolute numbers equals that of the US. Second, the EU workforce is becoming more tech-oriented. The number of professional developers in the EU today is greater than in the US, and the yearly growth of the tech worker population is above 3% in France, Germany and the UK.[226]

According to the Consumer Technology Association's 2019 International Innovation Scorecard, the EU scores higher than China and is on a par with the US when it comes to broadband, human capital (i.e. educated workforce) and drones (i.e. law and regulations on the use of drone technologies). There are many EU countries – mostly Nordic – that are considered 'international innovation champions', in terms of broadband, human capital and infrastructure. Similarly, many EU cities are considered tech hubs, paving the way for

entrepreneurial ecosystems at the frontier of computer science. This is not only the case of the metropoles like Paris, London and Berlin but also of newcomers such as Copenhagen, Lisbon and Stockholm. This geographical spread can represent an asset as it avoids extreme agglomeration and capitalises on network effects and cross-border connectivity.[227]

INFOBOX 2. Gaining ground in the app economy[228]

The European app economy consists of 1.8 million jobs – more than the US – and job creation increased by 15% between 2016 and 2017, showing a rapid transformation of the job market. Some EU countries are global leaders: the share of total jobs in this economy in Finland, the Netherlands and Sweden is only slightly below that of Silicon Valley.

Overall innovation performance in the EU has been improving in recent years and, for the first time in 2018, has overtaken the US.

The 2018 EU Industrial R&D Investment Scoreboard is a survey of the 2,500 companies investing the most in R&D worldwide. Of these, 577 or 23% are based in the EU.[229] A sectoral analysis of these companies shows that one-third of them operate in the automotive and transport sector, compared to only 8% of US companies and 11% of firms in China.[230] This suggests that the European automotive sector is a highly innovative one, and where many companies invest significantly in R&D compared to other countries.

Similarly, more than 4% of the EU's most innovative companies operate in the aerospace and defence sector, which is a larger share than in the US and China (2.7% and 0.5% respectively). The stronger presence of highly innovative firms in these two sectors, compared to the EU's global competitors, suggests a global comparative advantage. The health industry accounts for 22.4% of the EU's most innovative companies and 26.7% for the US.[231] This suggests that both countries are significant global innovators in the sector, while China lags with only 3% of its most innovative companies operating in the health industry.

Overall innovation performance in the EU (as defined by the European Innovation Scoreboard 2019)[232] has been improving in recent years and, for the first time in 2018, has overtaken the US. South Korea, Canada, Australia and Japan are the only global competitors that recorded a better innovation performance than the EU in 2018, and more specifically in a variety of indicators, too. For example, South Korea scores twice as high as the EU when it comes to R&D expenditure in the business sector, private cofounding of public R&D expenditure, and trademark and design applications. Canada does significantly better in terms of tertiary education, international publications, trademark applications and private cofounding of public R&D expenditure. Australia's international publications, innovation collaboration and trademark applications boast better performances. Japan scores much higher in R&D expenditure of the business sector, patent applications and trademark applications.[233] Since 2011, the EU innovation performance has increased by 7.7%, in line with other advanced economies (e.g. Japan, Australia), but far less than China and South Korea, which both improved by more than 15%.

Finally, EU programmes for research, innovation and development (R&D&I) provide large amounts of funding to universities, research institutions and companies for projects spanning from fundamental research to the deployment of innovations. Overall, it has been estimated that in the 2014-2020 EU budget, around €150 billion were allocated to innovation support. This accounts for approximately 14% of the total seven-year budget.[234] The largest and best-known programme for research and innovation (R&I) is Horizon 2020, a centrally managed programme with a budget of €75 billion over seven years. Additionally, the European Regional Development Fund (ERDF) has a clear objective for R&I activities, to which it allocates more than €50 billion. Other programmes funding R&D&I include structural funds like the European Fund for Strategic Investment (EFSI, also known as the 'Juncker Plan') and the COSME (Competitiveness of Small and Medium-Sized Enterprises) programme.[235]

Weaknesses

Europe's innovation struggles are explained by two factors. First, its investment in R&D&I is lower than that of its international competitors. Second, it is unable to ensure that research results and early-stage innovations are brought to market; that they are not lost to the so-called 'valley of death' in innovation.[236]

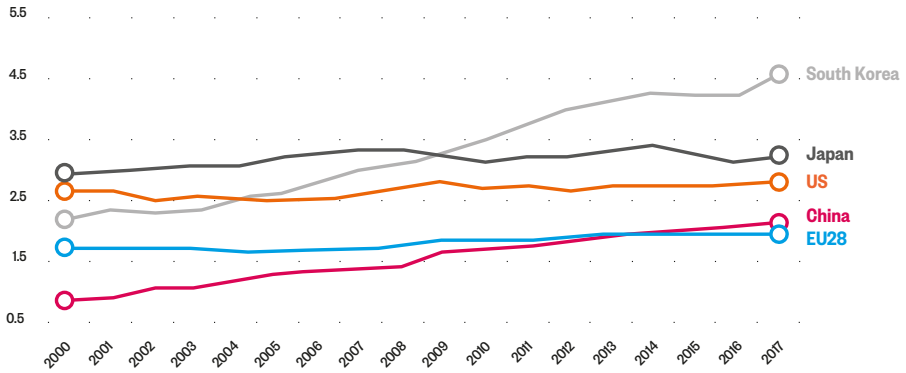
EU spending on R&D as a percentage of its GDP has mostly remained static since 2000. The relative European investment in R&D is now lower than the Chinese and has always been significantly less than other advanced countries, namely the US, Japan and South Korea (see Figure 18, page 30).

Europe's investment in R&D&I is lower than that of its international competitors.

The same picture emerges when considering the absolute level of R&D investment. Although this has been increasing steadily in the EU, the rate of growth is slower than the US, and both are overshadowed by the exponential increase in Chinese investment. The latter increased from virtually zero to the same level as the EU ($350 billion) in just over a decade. In particular, the EU

Fig. 18

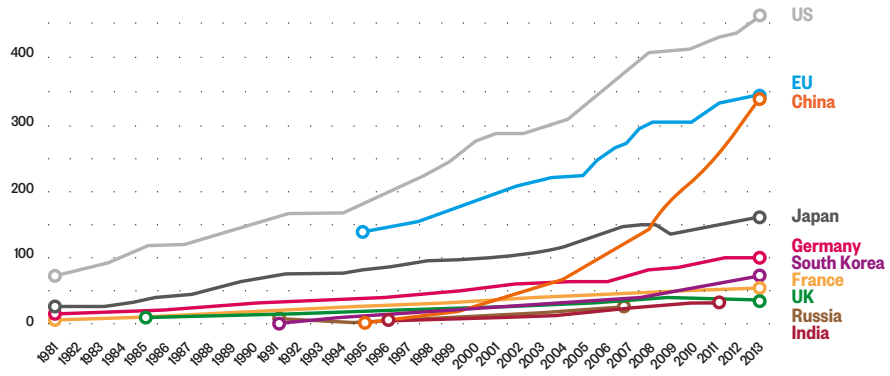
GLOBAL GROSS DOMESTIC SPENDING ON R&D:
THE EU INVESTS LESS IN R&D THAN ITS GLOBAL COMPETITORS (GDP%, 2000-2017)



Source: Authors, based on Organisation for Economic Co-operation and Development[237]

Fig. 19

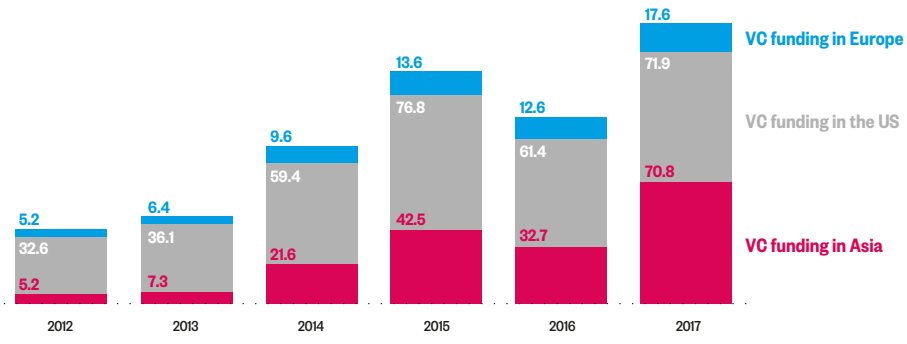
GLOBAL R&D SPENDING IN PPP: CHINESE INVESTMENT IN INNOVATION
IS NOW ON PAR WITH THE EU ($BN., 1981-2013)



Source: European Political Strategy Centre (2018c)[239]

Fig. 20

TOTAL ANNUAL VENTURE CAPITAL FUNDING: EUROPEAN VENTURE CAPITAL
IS A FRACTION OF THE US AND ASIA ($BN., 2012-2017)



Source: PricewaterhouseCoopers and CB Insights (2018)[240]

lags when it comes to R&D investment in ICT and digital technologies. Only around 20% of the most innovative European companies operate in ICT, compared to 52% of US and 49% of Chinese companies[238] (see Figure 19).

Nonetheless, spending on R&I does not necessarily translate into the commercialisation of new products and services or higher productivity. Regardless of the vibrant start-up environment, European venture capital funding is only around 25% of that of the US and China,

and its rate of growth has been much slower – although it did increase threefold between 2012 and 2017 (see Figure 20).

In particular, the difference in funding availability for EU and US companies to gain access to capital in later stages is substantial when scaling-up.[241] Funding for basic, early-stage R&D is fairly available in the EU, often coming from public (i.e. EU, national) wallets. However, later-stage development is less publicly funded. Thus, in the absence of venture capital, a valley of death is created. The lack of growth capital in Europe is of central importance as it impedes the scale-up of young, innovative firms, which are either forced out of business or bought by larger companies.

The lack of growth capital in Europe is of central importance as it impedes the scale-up of young, innovative firms.

The consequences of these weaknesses are apparent in innovation outputs. For example, Europe lags behind both the US and China in the number of patent applications and patents in force.[242] Finally, the high degree of fragmentation within the EU must be noted. Concerning investment in R&I, some European countries are world leaders: in 2017, Denmark, Germany, Austria and Sweden all invest more than 3% of their GDP in R&D. This level is on par with Japan and significantly higher than the US. However, the R&D investment made in Slovenia and Latvia is below 0.5% of their GDP.[243] Similarly, the European Innovation Scoreboard 2019 shows high diversity among member states when it comes to indicators such as employment in knowledge-intensive activities, exports of medium- and high-tech products and of knowledge-intensive services, and sales of new-to-market and new-to-firm product innovations.[244]

Unfortunately, the large number of EU programmes targeting R&D&I, mentioned above, does not solve this bleak picture. On the one hand, the size of the programmes remains relatively small – €150 billion over seven years result in just over €20 billion invested per year across all 28 member states. On the other, these figures are just allocations (i.e. stated intent), while evidence of the real impact on innovation results is still missing. Additionally, the main EU programme for R&I (i.e. Horizon 2020) arguably focuses on universities and academic research disproportionally. While EU funds are crucial and to be encouraged, the issue of the valley of death still looms.

C. Digital agenda

Strengths

The Single Market is the basis for developing, investing and deploying digital technologies throughout Europe. The EU has aimed to create a DSM in Europe; and as such focus has been put on stimulating a European data economy, fostering cybersecurity and maximising the potential of online platforms.[245] The Commission has put forward a wide range of initiatives and progress has been seen in recent years (e.g. removing roaming charges and unjustified geo-blocking, modernising rules for e-commerce, digital contracts, online purchases).

Another focus has been to boost the free flows of non-personal and public sector data, and agreeing on common data protection rules through the General Data Protection Regulation (GDPR). These initiatives can be crucial in boosting data mobility in Europe, a prerequisite for the development of industrial technologies such as AI, IoT and robotics. The GDPR has been a flagship initiative of the Juncker Commission and is described by some commentators as setting "a New Digital World Order", defining a new global standard for data sharing.[246] If the GDPR evolves into an international standard, it can represent an important added-value for EU industry. There are, however, certain challenges associated with the GDPR, too, which are covered in the next section.

Furthermore, the EU is among the most developed regions in the world when it comes to digitalisation and digital skills. The International Digital Economy and Society Index (I-DESI) – which looks at digital skills, internet usage, integration of technology and digital public services – places several EU member states among the top ten performers worldwide. These include Finland, Sweden, the Netherlands and Denmark.[247] While there are significant gaps between the top and bottom four most digitised EU countries, all EU members have progressed overall since 2013.

The digial single market is far from complete.

According to the I-DESI, the EU on average performs relatively well in deploying broadband infrastructure[248] and in digital skills[249] compared with the rest of the world – especially within knowledge-intensive industries (see Figure 21, page 32). EU businesses also perform relatively well in integrating digital technologies. The World Economic Forum's (WEF) Global Competitiveness Report places 13 EU countries among the top thirty in ICT adoption, with most EU countries performing better than the US and China.[250]

Weaknesses

Nevertheless, the EU also faces significant challenges in digitalisation. For one, the DSM is far from complete. Many of the DSM rules adopted still require transposition or implementation at the national level. Also, many of these rules do not go far enough in dismantling regulatory barriers across Europe. Unfortunately, some of the new rules (e.g. GDPR) have

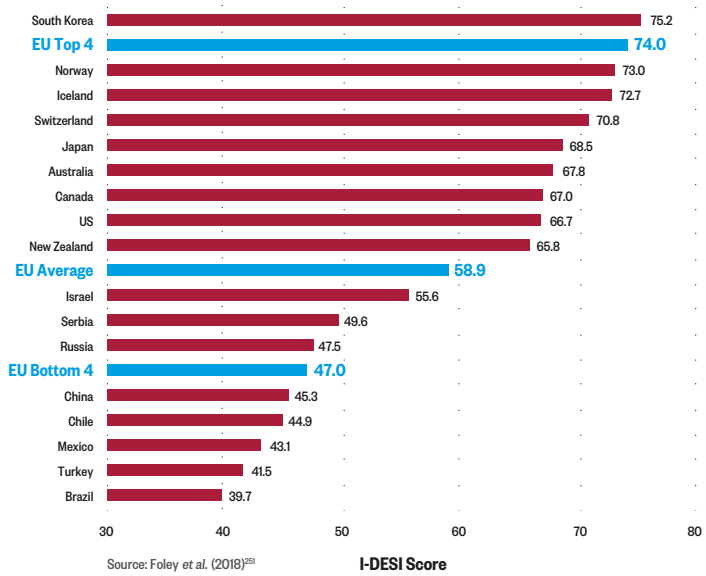
been a source of additional administrative burdens for businesses, hitting SMEs and start-ups particularly hard. If the EU struggles to enforce GDPR and impose it as a global standard, it could become a significant disadvantage for European firms trying to compete against foreign firms that do not face the same restrictions. If not enforced properly GDPR will also fail to deliver real harmonisation.

The digital performance in the EU varies greatly among its member states.

Moreover, the digital performance in the EU varies greatly among its member states. In Hungary, Greece, Italy, Latvia, Romania and Bulgaria, more than 50% of enterprises have very low digital intensity,[252] while in Finland and Denmark it is under 20%. Similarly, in Bulgaria, Romania and Croatia, more than 30% of all individuals have no digital skills, while the percentage is almost zero in Sweden, Luxembourg and Denmark.[253]

Fig. 21

INTERNATIONAL DIGITAL ECONOMY AND SOCIETY INDEX (2018)



Source: Foley *et al.* (2018)[251]

On a global level, Europe has not been able to claim its place within the global platform economy (see Figure 22). Indeed, the EU global market share of online platforms is almost non-existent (i.e. 3% in 2018) with the US dominating the market – although it is losing shares to China. EU companies also remain underrepresented in ICT GVCs, with the production of major technologies increasingly being based outside of Europe. The EU has a strong trade deficit towards China when it comes to high-tech imports, especially electronics communication and computer office machines.

In addition to being dependent on critical technologies, Europe's digital infrastructure will have to be significantly upgraded if the EU is to become a leader in emerging technologies. Technology such as 5G is crucial to the development of AI, IoT and advanced manufacturing. However, Chinese companies such as Huawei appear to be in a strong position to emerge as technological frontrunners in 5G. According to patent analytics firm IPlytics, companies from China have filed around 34% of 'standard essential patents'[255] (i.e. "those that any company will have to use when implementing the standardized 5G technology"),[256] compared to 25% for firms from South Korea, and 14% for both the US and Finland.[257] The remaining top ten countries are Sweden with 8%; Japan with 5%; and Taiwan, Canada, the UK and Italy with less than 1% each. In terms of companies, China's Huawei leads with 15%, followed by Finland's Nokia with 14% and South Korea's Samsung and LG with 13% and 12% respectively. Given the current debate around the strategic importance of new technologies, it is also worth noting that EU member states struggle to adopt a common position on Huawei's 5G. The Chinese company has been effectively banned from 5G networks in the US, Australia, New Zealand and Japan, with concerns regarding Huawei's proximity to the Chinese government and the possibility that its equipment could be used to spy on other governments and companies.

The EU is lagging in investing and developing the technologies of the future, such as AI, IoT and robotics.

The EU is also lagging in investing and developing the technologies of the future, such as AI, IoT and robotics. Instead, both the US and China are emerging as strong frontrunners in the digital race. A WIPO report analysing AI-related patent applications and scientific publications concludes that "China and the U.S. are now leading research in the field of AI in applied as well as more fundamental research".[258] Of the 100 most promising AI-related start-ups in 2019 identified by CB Insights, 77 are based in the US.[259] China, the UK and Israel come second with six start-ups each. Meanwhile, Germany and Sweden only have one each. CB Insights' top hundred list includes 11 AI 'unicorn' start-ups (i.e. private companies valued at more than $1 billion) with China and the US accounting for five each, while the remaining firms are based in the UK.

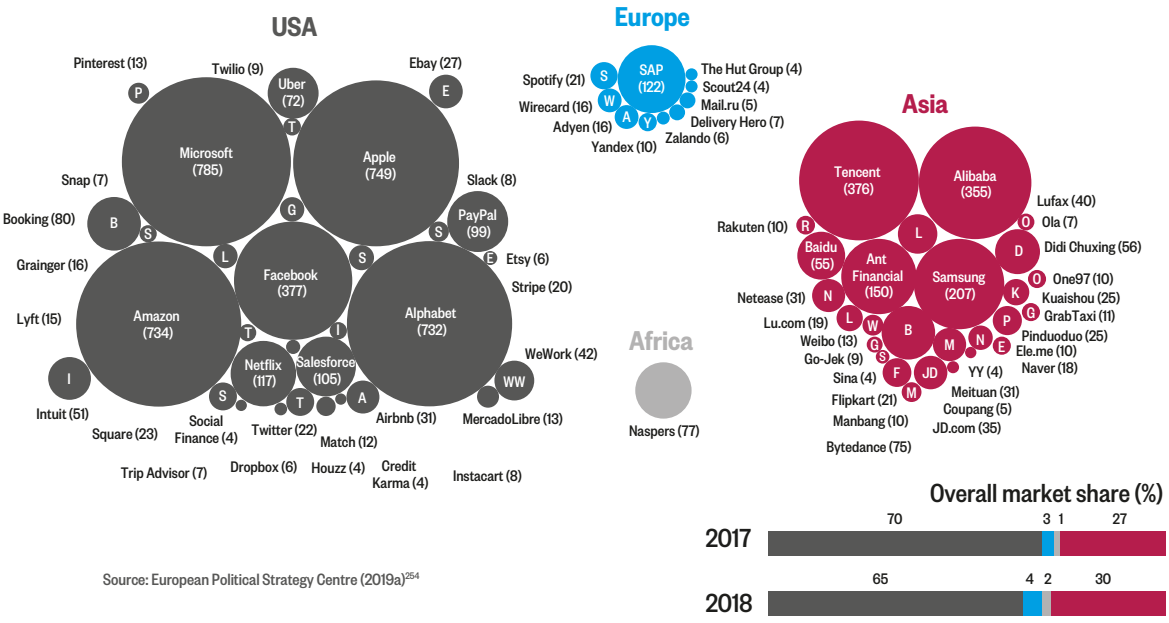
D. Climate action and circular economy

Strengths

The EU is a global leader in advancing the environmental sustainability agenda globally, including climate action. It employs regulation, voluntary measures, funding and awareness-raising to promote the agenda within its border. Globally, in addition to funding, it is using tools such as diplomacy and trade to get others on board. The

Fig. 22

MARKET VALUATIONS OF ONLINE PLATFORMS BY CONTINENT: EUROPE'S IRRELEVANCE IN THE GLOBAL PLATFORM ECONOMY ($BN., 2018)



Source: European Political Strategy Centre (2019a)[254]

EU displayed leadership, for example, in the negotiations leading to the Paris Agreement in 2015, and it continues to engage with global partners on taking the agenda forward. Climate mitigation, environmental protection and smarter use of resources via the circular economy are increasingly important policy priorities for the EU. This is also reflected in the focus given to the European Green Deal and the sustainability agenda under the incoming European Commission. The EU is politically and socially well placed to lead in a transition towards a more sustainable economy, with competitive sustainable industries at its core.

The EU has shown global leadership in reducing GHG emissions and decarbonising its economy, and by aiming to provide the industry with a stable and predictable framework for the low-emission transition. The EU has a substantial policy framework for promoting climate action and the much-needed energy transition. As a contribution to the implementation Paris Agreement, the EU has adopted climate targets for 2030. These include a 40% reduction in GHG emissions compared to the 1990 level, a 32% share of renewable energy sources (RES) in the energy mix, and a 32.5% target for energy efficiency. The EU's climate mitigation efforts have been supported by the EU Emissions Trading System (EU ETS) and funding. For example, the EU is committed to spending at least 20% of its current budget on climate action. The Commission's proposal for the EU to become climate-neutral by 2050 is already supported by most EU member states, which sends another strong sense of direction for industry.

The production of RES in the EU is faring well:[260] almost half of all EU member states have already reached or are about to reach the 2020 renewable energy targets. These include Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, Italy, Hungary, Lithuania, Romania and Sweden.[261] Between 2005 and 2017, the share of renewables in the European electricity generation doubled from 15% to 31%, with a significant increase in wind and solar power.[262] As the cost of energy in the EU and dependence on external sources are often seen as challenges for industry, advancements in cost-efficient, domestic renewable energy would contribute to the competitiveness of European industry.

Several European industries are already global leaders in sustainable solutions.

Significant EU acquis has also been enacted on the wider sustainability agenda, covering housing, transport, agriculture, chemicals, sustainable consumption (e.g. eco-labelled products) and waste management. The EU has developed several initiatives under the Circular Economy Action Plan.[263] European countries, regional authorities and businesses are leading in defining strategies in favour of a more circular economy,[264] and the European Commission has been recognised as a global leader for said economy by the WEF and Ellen MacArthur Foundation.[265]

The EU has a diverse set of tools to advance environmental sustainability at its ready disposal. Europe has a strong innovation ecosystem, which is a

considerable asset for developing and deploying more sustainable products and services on the EU and global market. The Single Market provides a vast home market for scaling up sustainable products and services. EU funds are an important source of investment for especially climate-related R&I, helping to improve infrastructures and contributing to regional development. The EU's trade instruments can also help establish international standards for sustainable products.

It is worth to note that several European industries are already global leaders in sustainable solutions. For example, European industry is substantially less energy- and CO_2-intensive than competing ones in China, Russia or the US, with the European share of global CO_2 emissions having fallen to 10%.[266] European businesses are also prominent in using, for example, digitalisation to improve the use of resources within the EU.[267]

Environmental sustainability is often prioritised higher on the European business agendas than elsewhere in the world. This is guided not only by policies but also demands from citizens and consumers, who are showing a growing interest in sustainable products and services. EU citizens declare a high level of environmental awareness. For example, 92% of EU citizens view climate change as a serious problem, and a vast majority of 79% agree that more public support should be delivered to clean energies, to shift away from fossil fuels.[268] This broad consensus for environmental sustainability provides a strong basis for strengthening the needed conditions for industry to contribute to this transition further.

Weaknesses

The European industry operates in a global environment and competes on a global market. Thus EU's stringent climate targets and environmental regulation compared to those of the like of the US, China, India or Russia are at times seen as a hindrance to competitiveness, as they imply that the industry does not operate on the same level playing field.

Another challenge is the EU's failure to implement its own rules. If businesses within the EU do not play by the same rules and there is no adequate punishment for failing to follow the EU's environmental regulation, for instance, that means that there is no level playing field nor incentive for industries to become more sustainable. For example, despite a comprehensive regulatory approach on chemicals (especially REACH, or the Registration, Evaluation, Authorisation and Restriction of Chemicals), at least one-third of chemicals in the EU market do not comply with the legal requirements.[269] European products can also face harsher scrutiny than products that reach the Single Market from third countries (e.g. via e-commerce). This can be attributed to a lack of market surveillance, for example, including proper customs control. This is also the case for extended producer responsibility which, although primarily envisaged to incentivise producers to design more eco-friendly products, it is usually not implemented efficiently throughout Europe.

On the other hand, as EU member states are left with considerable room to implement the EU's environmental rules, this sometimes leads to unnecessary market distortions and gold-plating, whereby an excess of norms or procedures are added when national authorities transpose EU directives. Moreover, although climate action is a priority for the EU, this has not automatically lead to European industry becoming a leader in needed solutions. For example, European industry has lost ground in developing renewables. Worldwide, the increase in renewable energy production is mostly due to a booming solar panel industry in China. Although Europe took an early lead in the development of solar panels and cells with five European firms being among the top manufacturers from 2001 to 2004, no European firms were present by 2018. Meanwhile, seven of them were Chinese.[270] The US, India and China are also expected to account for two-thirds of global renewables expansion by 2022. China is also a global market leader in hydropower, bioenergy and electric vehicles.[271]

As EU member states are left with considerable room to implement the EU's environmental rules, this sometimes leads to unnecessary market distortions and gold-plating.

The EU is also facing certain horizontal challenges related to the marketisation of new sustainable and innovative processes and products. These difficulties include the challenge for R&I projects to overcome the valley of death in innovation; the persistent shortcomings of the Single Market; rising production costs related to decarbonisation of industries; and the EU's specific investment profile characterised by slow growth, weak demand and declining demographics. In the absence of a clear industrial policy that would combine the objectives of competitiveness and sustainability, corporate boardrooms are often reluctant to take investment risks and change practices. When new sustainable technological solutions are being developed in Europe, they are not always picked up because of their higher cost or regulatory barriers.

The contradictions between the EU policy instruments remain a challenge, too. An example is the current EU ETS, a pan-European carbon pricing scheme whose underperformance – mostly triggered by an abundance of free emission allowances that do not react flexibly to a declining demand – is portrayed as having contributed to a 'lost decade' in industrial decarbonisation due to insufficient pricing signals.[272] Some national schemes have even proved more effective than the EU-wide one. Another EU policy weakness affecting the prospects for deep industrial decarbonisation is related to the discrepancy between short-term (i.e. 2020 and 2030)[273] and long-term emission targets (i.e. 2050), with the former not being demanding enough to trigger

investments consistent with the latter's ambitions.[274] Arguably, although representing a great added-value, the EU's budget or Multiannual Financial Framework (MFF) does not invest in sustainable prosperity and competitiveness enough.[275]

Moreover, the absence of a Single Market for energy, renewable electricity, and circular services and products hinder the transition to a sustainable economy. The EU would need, for example, an electricity market for renewables whereby i) installations are placed where they are most efficient, ii) electricity flows in a smart grid that connects different parts of the EU and allows for demand side response and management and iii) energy storage is deployed on a large scale. Member states still do not recognise the benefits of collaboration and often oppose, for example, building interconnectors and/or receiving neighbours' renewable electricity as it creates competition on their market.

Despite the EU's dependence on raw materials from outside its borders and recent efforts to accelerate the transition to a circular economy, it also lacks a systematic approach to the retention of critical materials in its economy. This results in less than optimal material recovery from end-of-life products, but sometimes also in exports of critical materials to non-EU countries.

Finally, instruments such as taxation, which can provide essential support and incentives for businesses and consumers to develop and deploy more sustainable products and services, are missing from the EU's toolbox.

Chapter 3: An Industry Action Plan for the EU

1. DELIVERABLES OF A EUROPEAN INDUSTRY ACTION PLAN

A. Vision and priorities: Sustainability, competitiveness and strategic autonomy

The European Council in March 2019 called on the European Commission to present a "long-term vision for the EU's industrial future" by the end of 2019, addressing the challenges faced by industry.[276] It also underlined that this "vision" should include concrete measures, touching upon all the relevant policy areas to be implemented. In her political guidelines for 2019-2024, President-elect of the Commission von der Leyen announced her intention of putting forward a "new industrial strategy" for "a future-ready economy" and in achieving "a just transition".[277]

President-elect of the Commission von der Leyen announced her intention of putting forward a "new industrial strategy" for "a future-ready economy" and in achieving "a just transition".

An EU Industry Action Plan, as suggested in this Issue Paper, would go a long way to delivering precisely these objectives. It would constitute a new strategy for Europe, which includes a vision, concrete actions, new policy tools and a governance structure to be implemented. A vision for European industry for 2030 should be built on three pillars: sustainability, competitiveness and greater strategic autonomy.

The EU Industry Action Plan must create the conditions for European industry to contribute to improving EU's competitiveness, sustainability and strategic autonomy. More specifically, the aim should be to create the conditions for European industry to:

- contribute to high-quality employment and R&D;
- help to achieve the SDGs, including good health and well-being, affordable and clean energy, decent work and economic growth, inclusive and sustainable industrialisation, and responsible consumption and production;
- support the transition towards climate neutrality by 2050 and help to deliver on a European Green Deal;
- become stronger and competitive in value chains and key technologies that are strategically crucial for achieving the EU's competitiveness, security and sustainability goals (e.g. smart health, industrial AI);
- become a global leader in developing and deploying technology solutions that address today's greatest environmental, societal and security challenges;
- contribute to achieving greater strategic autonomy by better responding to distorted competition, leveraging market power and moving towards more technological sovereignty.

B. Principles for action

A holistic approach

Given the unprecedented and multidimensional challenges faced by industry, this Paper argues that a new, more holistic approach is needed. The member states' call for a "long-term vision for the EU's industrial future" is a welcome starting point, as arguably the basis for any action is an agreement on the vision and the direction of travel. For too long, the EU has lacked an agreement on a vision. 28 member states wishing to promote their national industries has not been an adequate basis for action.

The EU Industry Action Plan must create the conditions for European industry to contribute to improving EU's competitiveness, sustainability and strategic autonomy.

Once the vision has been agreed upon, it is possible to discuss a strategy – that is, a grand plan to achieve said vision with concrete measures to support the strategy. It is clear that merely mainstreaming industrial competitiveness across policy areas is not a sufficient measure. Greater efforts are needed to create conditions for those industries to successfully bring sustainable and innovative solutions to the market and create the basis for long-term prosperity in the future. There is a role for promoting innovation, digitalisation, more strategic thinking, and fairer and more inclusive approaches. An EU Industry Action Plan should build on the initiatives already in place. For example, those under the Single Market, trade, energy, climate, research, innovation, competition and digital policies. Moreover, it should include new and additional initiatives and instruments, specifically targeted to tackle some of the most pressing issues mentioned in this paper. 'More of the same' is not an option. A more holistic approach that recognises the inherent cross-cutting nature of these challenges and develops initiatives to restore industrial competitiveness is necessary. Such an approach would also imply that industrial policy should enjoy a strong coordinating portfolio within the European Commission.

A role for coordinated EU action

National industry initiatives could potentially undermine EU industrial competitiveness in the long run if it is not in line with EU policies such as the Single Market, competition and trade policy. The EU, therefore, has a strong role to play in complementing and coordinating various EU member states' initiatives. An Industry Action Plan would foresee a substantial role for the Competitiveness Council, especially its High-Level Working Group on Competitiveness and Growth and the Commission's DG GROW.

'More of the same' is not an option.

Moreover, coordinated EU action would enable member states to provide a coherent response to competition from third countries, something they are currently unable to do effectively at the national level. EU industry would thus be able to react to the rise of protectionism and adopt distorted trade as part of foreign industrial policies. Finally, it would strengthen Europe's position to protect EU interests within a rules-based system and champion the necessary reforms to global trade.

Making it work: A designated governance structure

For proper enforcement of the Industry Action Plan, a designated governance structure should be set up within the EU institutions. Given the cross-cutting nature of the issues to be addressed, the Industry Action Plan should be defined, implemented and monitored from a high level within the Commission, with a designated project team that includes all relevant Commissioners.

Within the proposed von der Leyen Commission, two central personalities would be Executive Vice President Margrethe Vestager, in charge of Europe fit for the Digital Age and DG Competition; and the would-be Commissioner in charge of DG GROW, DG CONNECT and the future DG Defence Industry and Space. Due to his or her direct access to the most relevant DGs, the future Commissioner in charge of DG GROW should provide leadership in developing an Industry Action Plan. Overall, close cooperation between Vice President-designate Vestager and the upcoming Commissioner of DG GROW will be paramount: they will both have to combat distorted competition as well as make the Single Market work through the enforcement of EU rules. The Commissioner of DG GROW should also monitor and coordinate EU member states' industrial initiatives.

The nominated First Executive Vice President Frans Timmermans, in charge of the European Green Deal, should also be involved in this work. Other relevant portfolios would include the Executive Vice President for An Economy that Works for People; the High Representative as well as Commissioners for Trade, Jobs, Innovation and Youth, and Cohesion and Reforms.

Furthermore, an Industry Action Plan should create substantial roles for EU member states and the European Parliament. The European Council could provide conclusions and political support for the development of an Action Plan, based on the renewed vision to be presented by the Commission by the end of 2019. The Council's Competitiveness Council, and especially its High-Level Working Group on Competitiveness and Growth, should be closely involved and consulted in the formulation of the Action Plan. The Competitiveness Council should also meet regularly to monitor the implementation of the Action Plan. The European Parliament Committee on Industry, Research and Energy should provide input to the Action Plan. Other relevant committees, such as on Internal Market and Consumer Protection, Employment and Social Affairs, Budgets, and International Trade should also be consulted.

An Industry Action Plan should create substantial roles for EU member states and the European Parliament.

2. OBJECTIVES OF A EUROPEAN INDUSTRY ACTION PLAN

Leveraging market power more strategically

An Industry Action Plan should take into full account the geopolitical realities faced by the EU. Access to critical raw materials, foreign takeovers of major European tech companies and distorted competition constitute growing strategic challenges which threaten Europe's aim to promote peace and protect its citizens and freedoms.

Combating distorted competition

In third countries, industrial policies are increasingly justified on the grounds of national security: they do not hesitate to intervene in their economy by shielding companies from international competition, imposing tariffs on foreign goods, providing export subsidies for their own companies or forcing foreign firms to share its technology. Moreover, even if Europe has opened much of its market to the rest of the world, European industry rarely enjoys equal access to markets in third countries. While the EU should continue to champion free and open trade, it cannot remain naïve in granting access to foreign industry that does not play by the same rules. A priority for an Industry Action Plan should be closer coordination between EU Trade and Single Market policies to ensure better reciprocity in market access and counter distorted competition from third countries. Additional tools should be defined at the EU level to limit access to parts of the Single Market, if and when reciprocity is not respected.

Screening foreign investments

The lack of growth capital in the EU has too often led to increased foreign influence and takeovers of major European tech firms and start-ups. This may have security implications, with key technologies possibly moving abroad and complicating the control and imposition of cybersecurity standards. The lack of investment reciprocity with several third countries also implies that foreign investors enjoy far greater access to the European market than is true of the reverse. The fact that Europe is the top destination in the world for FDIs remains important for EU industry to grow and scale up. However, Europe must find ways to scrutinise foreign investments in major European industries and critical technologies more effectively. The new EU rules on FDI screenings are a step in the right direction but arguably do not go far enough to allow for binding measures in cases where FDIs might represent a security threat.

While the EU should continue to champion free and open trade, it cannot remain naïve in granting access to foreign industry that does not play by the same rules.

Facing digital competition better

The European data industry is already competing against foreign (especially Chinese) companies that enjoy much wider access to vast amounts of data in their home markets – both with and without express consent. In China, many of these firms are also state-owned, -subsidised and/or benefit from regulatory advantages. This often gives foreign firms a significant competitive advantage in developing AI, IoT and robotics that are fuelled and constantly improved by large datasets. In formulating an Industry Action Plan, the EU should be aware of the reality the European data industry faces. Although the European model should remain based on a high level of data protection, safety, transparency and liability for individuals and companies, new and improved systems should also be put into place in order to make foreign companies comply with EU rules when operating in the Single Market. Complying with EU rules cannot represent a competitive disadvantage for EU companies.

Allowing for a free flow of data

A review of current EU legislation will also be necessary to boost the development of data-related technologies. New EU rules on the free flow of non-personal data and the reuse of public sector information provide a great first step in unleashing data mobility. The GDPR represents one such significant step in harmonising data protection rules across member states and arguably makes Europe a global rule-maker for digital technologies (provided that the rules are effectively enforced by all member states). It is, however, important to make sure that administrative costs and limitations on the use of data imposed by GDPR do not lead to a competitive disadvantage for European industry, especially for SMEs and start-ups that do not possess the same resources and skills as large (and often foreign) digital firms do. While a review of GDPR might become necessary, new data legislation should aim to find a good balance between the principles of data protection and free data flows. The EU should find ways to include cross-border data flows in their FTAs and international trade agreements negotiated under the WTO more actively.

Complying with EU rules cannot represent a competitive disadvantage for EU companies.

Safeguarding critical raw materials

Europe's industry has always been dependent on certain raw materials to produce a wide range of goods and applications. Still, materials like metals and minerals (e.g. tungsten, cobalt, antimony, palladium) are becoming ever more important for developing digital technologies. In the EU, 88% of raw material imports are used for electrical and electronic equipment.[278] However, climate change, water scarcity, political instability and conflicts have further reduced stocks that are already facing depletion. The European Commission has therefore created a list of "critical raw materials" that are deemed essential to the EU's economy and for which supply chain disruptions persists.[279] In order to minimise such disruptions, the EU should invest in finding alternatives (i.e. redesigning products and processes to reduce critical materials consumption and make them easier to recover), recovering materials (e.g. urban mining, circular processes) as well as continue to update its list of critical raw materials. The fact that on certain occasions, the EU exports critical materials to be processed in non-EU countries is arguably a cause for concern and an issue to be addressed in an industrial policy aiming for smarter use of resources.

CASE STUDY 4: Urban mining

Urban mining – recovering raw materials from IT and electronic waste – has become increasingly common for industry given the limited number of raw materials, and that classic mining cannot meet the rising demand for electronics. The ProSUM project, funded by the EU and Swiss government, has developed the Urban Mine Platform, the first European open-access platform containing all available data on the composition and waste of electrical and electronic equipment, batteries and end-of-life vehicles.[280] The database aims to improve the traceability of products, materials and waste by creating a unified inventory to recover and retain the value of secondary raw materials. It is a first step towards mapping Europe's 'urban mine', although some challenges persist, such as waste and product characterisation; the quantification of stocks and flows in the urban mine; and the data harmonisation, quality and interoperability of datasets.

Smarter use of resources within the Single Market

Thinking more strategically should also include a smarter use of the resources at our disposal. Better product design can ensure greater durability, reusability, reparability, recyclability and more. So far, energy-related products are the only products covered by the EU's ecodesign requirements. Further developments should entail the inclusion of circularity aspects into ecodesign requirements and standards, and extension of the ecodesign rules to cover non-energy-related products. When it comes to end-of-life materials, the focus of existing EU policies and legislation has mainly been on recycling. This approach downplays the opportunities reuse, repair and remanufacturing provide for better retention of the value of components and materials. Although the amended Waste Framework Directive places a greater emphasis on reuse and repair practices,[281] more can be done to incentivise such practices via regulatory measures and economic instruments.

Thinking more strategically should also include a smarter use of the resources at our disposal.

The EU has already set ambitious targets for the recycling of municipal and separate waste streams (e.g. packaging, electronics, vehicles). Besides exploring possibilities to increase current separate collection recycling targets (e.g. to retrieve critical materials and recover textile and construction materials), additional steps are required to increase the uptake of recycled contents into new products (e.g. plastics). The EU can do much to improve the situation (e.g. by defining end-of-waste criteria and specifying quality criteria for recycled materials). Member states and subnational authorities can further boost the demand for such criteria via Green Public Procurement and taxation policies within the framework provided by the EU.

The existence of industrial symbiosis since the 1970s demonstrates the potential for these types of business models to generate value for the industry and retain materials and energy within the economy. These initiatives have so far mainly been confined to specific industrial zones (i.e. limited by geographic constraints due to efficiency and convenience of such collaboration). The development of innovative technologies, especially digitally-enabled solutions, provide an opportunity to enhance information sharing (i.e. in terms of supply and demand for materials and energy, and the conditions for such exchange). The EU should take note of such developments and support prospective projects on industrial symbiosis that are coupled with the deployment of digital tools, to scale up collaboration beyond specific industrial zones.

CASE STUDIES 5-6: Industrial symbiosis – A way forward for sustainable industries

Industrial symbiosis[282] describes a process whereby instead of throwing away or destroying surplus resources, industries cooperate to redirect them into other companies' processes.[283] It can significantly reduce costs and waste and promote eco-innovation, with companies (usually) cooperating in geographic proximity within an industrial ecosystem.

Äänekoski industrial site

Metsä Group – a Finnish forestry industry firm – has developed an industrial ecosystem at Äänekoski, Finland, where surplus materials like bark pulp and sulfuric acid are converted into new materials or energy (e.g. biogas, bio-composites, fertilisers) by industrial partners in the region. This collaboration allows the bio-product mill to become 240% self-sufficient in electricity, run without fossil-based energy and create 1,500 new jobs in the value chain.[284]

Kalundborg industrial site

Another example of industrial symbiosis can be found in Kalundborg, Denmark; the first of its kind when established in 1972.[285] It now comprises of six private and three public partners who employ around 5,000 employees in total. Partners exchange materials, water, energy (over 25 different resource streams) as part of their industrial operations. This collaboration developed organically over the past decades and now includes a set of shared values and a formal structure (i.e. Kalundborg Symbiosis). Before making a decision, companies consider the potential impact of their decisions on other partners. Business savings are estimated to be €14 million per year; socioeconomic savings, €28 million; and emission reductions, 635,000 tonnes of CO_2 per year.

Enabling more innovation

The ability to innovate creates the basis for sustainable growth in a mature economy, such as that of the EU. To achieve this, an Industry Action Plan must present a holistic innovation strategy that addresses the shortcomings that currently affect innovation performance. The main aspects to be tackled are the commercialisation of research outcomes, access to capital, risk-taking behaviour, IPRs, the regulatory framework and human capital.

The ability to innovate creates the basis for sustainable growth in a mature economy.

Improving commercialisation

The thriving, world-class academic research environment in the EU struggles to translate its outcomes to the market. Research results are lost in the valley of death before they are commercialised. An industrial strategy should bridge the gap between the academic and business world to foster communication and partnerships between the two sectors. To create new products and processes from academic and lab research, innovation policy should assess and break down the practical and cultural barriers to such cooperation.

Accessing capital

Young innovative companies in the EU face more difficulties accessing growth capital than those in the US, for example. Banks provide most of the capital available to growing firms, including innovative start-ups. These institutions, however, require collateral and tend to avoid lending to firms deemed too risky. Such practice negatively affects innovative start-ups; precisely those companies that would need funding the most. The consequence for those that cannot access finance is being driven out of business or bought up by an established (and often foreign) company. There needs to be an alternative source of growth capital for innovative companies other than banks. The EU's industrial strategy should facilitate access to alternative sources of funding and support the growth of EU venture capital and investment funds that are willing to take higher risks. Public venture capital cannot replicate such an environment but can encourage its emergence by leading by example and offering incentives to private investors.

Allowing risk-taking

Innovation and failure go hand in hand, as not all innovative ideas or products can expect to be successfully adopted or profitable. Risk-taking is thus intrinsic to the concept of innovation, implying the persistent possibility of failure. This is true for both private investors, which leads to the inadequacy of banks, as mentioned in the previous point, and for public investment. Funded by taxpayers' money, public investment is usually directed to 'safe' projects that ensure a (monetary or social) return. When it comes to innovation, a fully-fledged cultural change is needed to accept that not all funded projects may be successful. An Industry Action Plan that aims to promote innovation with public EU funding amongst others must recognise the possibility that parts of that investment will be lost. Once this dynamic is admitted, special instruments should be used to fund risky projects, some of which may become ground-breaking innovations, while others may never even leave the testing facility.

When it comes to innovation, a fully-fledged cultural change is needed to accept that not all funded projects may be successful.

A solid intellectual property framework

The protection of intellectual property (IP) on innovations and the resulting monetary returns are fundamental reasons why a company should research and create new products. In an increasingly fast-paced, tech-heavy environment, the rate of obsolescence is high. To maintain their market share, firms must innovate existing products and create new ones very quickly. It is thus crucial that the system protecting IP operates promptly to assess and eventually grant IPRs. A solid and well-functioning IP framework is becoming increasingly important as open access systems gain ground. The Industry Action Plan must ensure swift and effective IP protection, not only to encourage firms to innovate by protecting them from competitors but also incentivise them to take part in publicly funded projects that require open access to research results.

Boosting skills

Innovation policy must also promote education and training. A skilled workforce is a prerequisite for innovation, and the lack thereof is a significant barrier. A firm cannot adopt new technologies and innovate its processes if its workforce (or the one available in the labour market) is not skilled enough to use and implement them. Similarly, a high level of skills is required for research and disruptive innovation. Thus, an Industry Action Plan that seeks to promote innovation must prioritise education policy to ensure that new additions to the workforce have the adequate skills and training. Additionally, it should continue to upgrade the skills of the existing workforce to keep up with technological change. Although EU competence remains limited when it comes to education policy, member states should envisage delegating shared competences – those important for industrial competitiveness – for certain parts of vocational training to the EU.

Member states should envisage delegating shared competences – those important for industrial competitiveness – for certain parts of vocational training to the EU.

Sustainable finance

The ongoing sustainable finance agenda[286] aims to align the EU's financial sector with the sustainability agenda (i.e. environmental protection and climate mitigation) by defining which activities are sustainable and setting the rules for the disclosure of information, for example. This is an opportunity for the EU's financial sector and consequently the industry to lead the way in 'greening' its operations. Conversely, avoidance of excessive regulatory detriments must be taken into account (especially for start-ups and SMEs) as well as ensuring that the EU financial and industrial sectors can retain their global competitiveness.

Innovating towards net-zero emissions

Technological upgrade has optimised industrial processes for decades, providing significant achievements in terms of energy efficiency and overall emission reduction. However, further emission abatement potential with the best available technologies (BAT)[287] is limited. BAT could reduce the iron and steel industry's carbon footprint by 7.5% using an electric arc furnace, or just 2% with a blast furnace. In the

petrochemical sector, emission reduction under BAT is expected to be between 2% and 10%, while in cement it is between 6% and 8%.[288] These limited gains risk being overcompensated by the expected growth in production. Efficiency and a switch to less carbon-intensive fuels (i.e. from coal to natural gas) can only serve short-term mitigation ambitions. In supporting the 2050 climate-neutral goal, an Action Plan should identify all the possible pathways for the decarbonisation of industry and mobilise different EU policies in achieving net-zero emissions. Particular attention will have to be placed on infrastructure build-out and heavy industries such as cement, steel and chemicals, which are heavy users of fossil fuels and account for 14% of Europe's GHG emissions.[289] The most significant technological pathways include electrification and fuel switching in fossil fuel-based processes, low carbon processes based on material substitution, carbon capture and storage,[290] and enhanced circularity. The role of an Industry Action Plan in triggering different pathways will, therefore, need to be comprehensive and include a mix of regulatory and financial support, protection, and policy coordination and coherence.

CASE STUDY 7: The pharmaceutical industry and innovation

The EU remains the world's leading exporter of pharmaceutical products, with a record trade surplus of €91 billion in 2018.[291] Pharmaceuticals account for almost 11% of EU exports, after 'machinery and vehicles' (50%) and 'non-electrical goods' (27%).[292] The pharmaceutical industry is a sector where Europe has a significant competitive advantage. However, in order to remain competitive, the pharmaceutical and biotech industry is dependent on R&D&I more than any other industry. On average, a new medicine takes 12 to 13 years and costs €2.33 billion to develop, representing a significant investment for a company. In the EU, 28% of new medicines originate from large pharmaceuticals companies, compared to 48% from SMEs and intermediate-size companies, 17% from academic or public bodies, and 7% from public-private partnerships.[293] A sound regulatory ecosystem, solid IP framework and access to capital are therefore all crucial for Europe to retain its competitive advantage. The future competitiveness of the pharmaceutical industry will be tied to its ability to access health data and develop data-related products and services.

Technological sovereignty and digitising industry

New digital technologies represent an opportunity to reinvent industrial production and promote more competitive and sustainable business models. An Industry Action Plan should embrace digitisation and the rise of new technologies such as AI, IoT and industrial robotics. A comprehensive regulatory and financial boost to digital technologies is an absolute prerequisite for Europe; retaining the status quo would only imply a significant loss in competitiveness and strategic autonomy. Ensuring that the basic infrastructure is deployed (e.g. broadband, 5G, fibre) is a necessary prerequisite to achieving the transition to a more competitive and sustainable industry. The EU should also ensure that data and digitally-enabled solutions are developed and deployed to make the economy and industry more sustainable. It is worth keeping in mind that digitalisation alone will not bring greater sustainability, but can lead to the higher consumption of precious (i.e. critical) materials and energy for electrical and electronic equipment, if not steered and governed well.

An Industry Action Plan should embrace digitisation and the rise of new technologies such as AI, IoT and industrial robotics.

Achieving technological sovereignty

In recent years, digital technologies have become strategic tools with the potential to heavily influence society, economy and political processes. They increasingly define the ability of international actors to project soft and hard power. In such a context, the EU will fail to advance towards strategic autonomy if it is not at the forefront of technological innovation and efforts to regulate emerging technologies.[294] Firstly, vulnerabilities in cellular networks and digital and critical infrastructure can be targets of cyberattacks, industrial espionage and disinformation campaigns.[295] The EU and its member states should, therefore, make sure that they develop the necessary cybersecurity tools to address these challenges. Secondly, Europe's inability to be at the forefront of technological leadership suggests that it will become ever more dependent on foreign components and digital solutions developed in countries – even authoritarian – that do not necessarily uphold the same cybersecurity standards. Innovation in digital technologies is therefore imperative for Europe, while strict standards and a common EU precautionary stance should be applied to critical digital infrastructure.

The EU will fail to advance towards strategic autonomy if it is not at the forefront of technological innovation and efforts to regulate emerging technologies.

Enabling a European industry 4.0

Industry in Europe is already innovating and investing in new digital technologies, thus allowing for the emergence of new products (e.g. 3D printing, new materials), better planning and testing (e.g. digital twin, AI) and in improving processes (via e.g. robotics, IoT, smart communication systems). These developments must be supported and diffused throughout the EU. Europe's reindustrialisation will only come about if industry 4.0 and the development of more competitive, innovative and sustainable industries are fully embraced. Important work has already commenced at the EU level via a network of digital innovation

hubs (DIHs): ICT for manufacturing SMEs, data pitch innovation programmes, open robotics and technology transfer, photonics innovation, supercomputing, and DIHs supported by the European Institute of Innovation and Technology.[296] Still, not all of the regions of the EU are adequately covered by DIHs – especially the newer EU13 member states – and consequently are not in a position to benefit from digitisation equally.

Europe's reindustrialisation will only come about if industry 4.0 and the development of more competitive, innovative and sustainable industries are fully embraced.

Moreover, the transition towards a circular economy could be enabled through the development of industry 4.0. Digital technologies would help to improve connectivity and information sharing; make products, processes and services more circular; and influence and empower consumers.[297] For example, service-based business models, often enabled by digitalisation, can result in reduced material consumption and emissions and better end-of-life treatment. Servitisation should merit closer attention from the EU and its member states. Different sets of regulatory and financial tools (i.e. standards, tax incentives) should create favourable conditions for service-based business models.

CASE STUDY 8: Blockchain and the circular economy

The Dutch company Circularise uses blockchain to improve transparency and communication across the circular value chains for industry. Its Smart Questioning technology enables companies and stakeholders to gain information about the content of a product via a securised Q&A system. It allows for more efficient data sharing while also addressing the industry's need for data protection. Improving information-sharing across the value chain is considered one of the major challenges in achieving a circular economy.[298]

Creating new jobs within manufacturing

While in recent decades Europe has had to contend with deindustrialisation and the massive offshoring of manufacturing jobs, new digital technologies offer the opportunity to bring jobs and growth 'back home'. Automation means that labour costs are less relevant when deciding where to locate production, and the development of knowledge-intensive value chains tend to favour a high-skilled workforce. Digitisation is already creating new types of jobs that did not exist until a few years ago. An Industry Action Plan should aim to support smart manufacturing throughout Europe by enabling the creation of new jobs for the future. The focus should be placed on technologies that can provide positive spillovers in creating jobs.

CASE STUDY 9: Digital manufacturing

Digital technologies are increasingly being deployed on the factory floor. The Amberg factory in Bavarian Germany is a digitised electronic equipment factory developed by Siemens, paving the way for industry 4.0.[299] There, technologies such as IoT, AI, edge computing and sensors allow for the identification of all objects (i.e. components, products, production steps), the recording of all process parameters, real-time data analysis and automated predictive maintenance. Some 75% of the value chain is automated.[300] With an open cloud system, the algorithms used are continuously trained with data from all over the world. Digital factories can reduce energy consumption and waste during production, as well as improve productivity and cut costs.

Investing in digital skills

Beyond the creation of new jobs, automation will also bring about significant transformations to current jobs and working conditions while some jobs will undoubtedly disappear. As acknowledged by the Commission, digitisation is already "replacing low-skill routine tasks and raising the skill threshold of employability".[301] Some speak of 'dark factories', where no light is needed since all production processes are fully automated around the clock.[302] However, while only a few jobs can be fully automated in the short and medium term, most jobs could be automated by up to 40% to 50% today. In other words, rather than immediate substitution, digitisation is more likely to lead to a high level of interaction between workers and technology. Therefore, the importance of digital skills cannot be overstated. An Industry Action Plan should support a wide range of initiatives aiming to re- and upskill workers in all sectors of industry. Education and vocational training programmes must also be reviewed and adapted to anticipate and prepare for the changing nature of work. Failure to do so will only lead to greater polarisation and exclusion on the labour market and between EU regions.

New digital technologies offer the opportunity to bring jobs and growth 'back home'.

CASE STUDY 10: Increased interaction between workers and technology

Airbus is cooperating with Bosch to develop smart and connected handheld tools (e.g. drill, saw, power tool).[303] Employees can be redirected to the appropriate tool for certain tasks, with smart tools guiding them to the next step and automatically calculating the correct calibration.[304] Smart tools can also record the operation and ensure better quality control and significantly improve the safety and efficiency of workers. It also allows for improved optimisation of tools and machines, reducing the need for replacement and avoiding unnecessary waste. However, in such a setting, digital skills and retraining workers becomes essential.

Becoming a leader in developing trustworthy and sustainable artificial intelligence

The EU aims to place trustworthy and ethical AI at the heart of AI development in Europe.[305] This constitutes a good basis for defining a genuine European strategy on AI, machine learning and big data. Europe should not try desperately to catch up with the US and China, for instance, in terms of the amount of AI patents or industrial robots being developed). Rather, Europe should adopt its own goals-based strategy, focusing on notions of 'AI for humanity' and 'AI for good' to help solve some of the major challenges it faces. It should support the development of digital technologies in areas such as health, circular economy and sustainability. The EU should set itself the goal of becoming a global leader in using data and AI solutions to achieve a sustainable, circular economy.[306]

An Industry Action Plan should support a wide range of initiatives aiming to re- and upskill workers in all sectors of industry.

Beyond guidelines, it is important that the EU's approach to ethical AI is now translated into concrete actions and projects. It is essential to clarify in regulatory terms what ethical AI implies for the development of industrial AI. An Industry Action Plan should not overregulate emerging digital technologies or unnecessarily limit the free flow of data that is crucial to the development of AI-related technologies. Better liability frameworks might still be necessary to ensure transparent and fair AI systems and algorithms for both consumers and businesses.

Investing in key enabling technologies

An Industry Action Plan should mobilise financial and regulatory support to boost the further development of KETs in Europe. KETs are critical knowledge-intensive technologies for EU industry, associated with "high R&D intensity, rapid innovation cycles, high capital expenditure and highly-skilled employment."[307] KETs have been designated as a priority for EU industrial policy and were defined in 2009 to include advanced manufacturing technologies, advanced materials, nanotechnology, micro-/nanoelectronics, industrial biotechnology and photonics.[308] Given the speed at which new technologies are being developed, the EU should continuously monitor and update its list of KETs. In its latest report, the High-level Strategy Group on Industrial Technologies has suggested updating KETs to include AI, digital security and connectivity; as well as broadening the scope to categories like 'life sciences technologies', 'materials and nanotechnology' and 'photonics, micro- and nano-technologies'.[309] The work of experts groups – such as the Industry 2030 High-Level Industrial Roundtable, the High-level Strategy Group on Industrial Technologies and the Strategic Forum for Important Projects of Common European Interest (IPCEI) – should be continued and made permanent, focusing on what investments and regulatory measures are needed for the effective deployment of key technologies for EU industry.

The Important Projects of Common European Interest has been completely underutilised over the years.

INFOBOX 3: The Important Projects of Common European Interest (IPCEI) tool

Recently, the IPCEI tool has gained much attention within the debate on EU industry. Enshrined in Article 107 of the Treaty on the Functioning of the EU, the tool allows member states to support and provide public funding for highly innovative projects of common European interest, in compliance with EU rules (i.e. internal market, competition, state aid rules). In order to be recognised as an IPCEI, a project should help overcome market failure or funding gaps, involve several member states and generate positive spillovers into the internal market.[310] IPCEI provides a concrete response to the calls from some EU leaders for more flexibility in supporting and creating new industrial champions: public endeavours are welcome as long as they benefit Europe in promoting new innovative and sustainable industries.[311]

However, although an excellent tool, IPCEI has been completely underutilised over the years. The first project on microelectronics was launched only last year, four years after it was initially set up. It is essential to make sure that the proposals currently being developed, on batteries and high-performance computing, can be executed rapidly, and that additional initiatives can be launched, covering for all the key value chains identified by the Strategic Forum on IPCEI:

- clean, connected and automomous vehicles;
- 'Smart Health' (medical devices, personalised medicine and analytics);
- low CO_2 Emissions Industry;
- hydrogen technologies and systems;
- industrial IoT;
- cybersecurity;
- batteries;
- microelectronics;
- high-performance computing.

Increasing EU funding

There is, in other words, no shortage of initiatives to be funded by the EU and its member states. Significantly, more funding should be provided through the EU's budget for the development and diffusion of KETs, DIHs, AI, cybersecurity, digital skills, quantum and super-computing. The EU budget should also support the launch of a series of technological moonshot projects where EU industry is already strong, such as circular economy, low-carbon technologies, quantum, advanced manufacturing robotics and advanced biomaterials. The IPCEI framework should be reviewed and used much more actively to support such initiatives. Through the Digital Europe programme (DEP), Horizon Europe, the InvestEU fund and the Connecting Europe Facility (CEF), the 2021-27 MFF should provide earmarked and targeted funding for such initiatives. If EU member states are serious about achieving technological autonomy and leadership, these MFF programmes should be greatly increased, as called for by the European Parliament.[312]

INFOBOX 4: The Digital Europe programme – A great added-value for Europe

The DEP is a €9.2 billion programme proposed by the Commission as part of the next 2021-27 MFF. It would become the first funding programme specifically focused on building the EU's strategic digital capacities and facilitating the deployment of digital technologies. It supports the funding of high-performance computing (€2.7 billion), AI (€2.5 billion), cybersecurity (€2 billion), advanced digital skills (€700 million) and deployment (€1.3 billion). An excellent added-value for boosting the digital industry in Europe, it can provide some much-needed support for developing technological sovereignty in Europe. Its budget is to be agreed upon within the MFF negotiations and EU member states should consider increasing its financial envelope. To play on the current political momentum, it could be renamed the 'EU fund for technological sovereignty'.

The EU budget should support the launch of a series of technological moonshot projects where EU industry is already strong.

Inclusion and fairness

When it comes to growth and innovation performance, social and spatial imbalances have already materialised. It is possible that the strategy for a successful transition into industry 4.0 has unintended consequences that will further perpetuate these inequalities.[313] An EU industrial strategy that supports digitalisation and the energy transition must pay special attention to the most vulnerable areas, sectors and social classes. Industrial competitiveness at its best can contribute to the promotion of the well-being of EU citizens, and enhance social and territorial cohesion and solidarity among EU countries.

Tackling unintended consequences and facing polarisation risks

The ongoing industrial transition, as well as the policy provisions that would support EU industry in the process, may have uneven impacts. An example is the disproportionately negative effect automation and changes in the labour market have had on low-income workers, who face a higher risk of losing out. The increasing demand for knowledge-intensive jobs raises the skill premium, benefitting those who are already at the top of the wage distribution. Job polarisation and wage inequality may thus increase if industrial policy does not envisage counterbalancing measures.

The geographic dimension of the transition arises from the fact that structural characteristics of regional economies determine whether they are likely to benefit or lose out from changes to a primarily technological and interconnected service-oriented industry. For example, some places may rely more on traditional manufacturing sectors that are likely to be robotised or outsourced to other countries; some may lack the capacity to transform their industrial sectors into more high-value activities; some may rely heavily on fossil fuels and face higher costs for the energy transition.

The agglomeration of economic activity and prosperity in specific centres of production, often around large cities, is already underway and is likely to continue since technology, innovation and services tend to benefit from the accumulation of activities.[314] Winner-takes-all dynamics are emerging and are particularly present in the digital economy where, for example, a couple of very large firms dominate the global market and operate in concentrated areas. The flipside of the coin is that there are many places and social groups that do not participate in these dynamics and are thus excluded from the benefits generated by the fourth industrial revolution.

The flipside of the coin is that there are many places and social groups are excluded from the benefits generated by the fourth industrial revolution.

Ensuring inclusiveness

Firstly, these social and geographic imbalances may be further reinforced if the EU industrial strategy merely focuses on major strategic, high-value sectors at the innovation and productivity frontier, and does not ensure that more traditional activities and all local economies have their place within the strategy itself. The industrial strategy should acknowledge its potential in increasing imbalances, assess these differences and estimate its impact on different social classes and territories.

Secondly, to smooth out social imbalances, coordination with education and training policy is crucial, as already mentioned. The entire workforce should possess the

necessary skills to embrace technological change and innovations in the workplace, whether they are employed in a modern or 'mundane and regular' sector, or not. Special focus should be placed on those whose occupation is at high risk of automation, as well as those who will require retraining in their career.

Thirdly, the industrial strategy should capitalise on the diversity of economic structures across European territories. This is a strength, as it allows for the diversification of economic activities across sectors as well the creation of intra-EU value chains and interregional cooperation. To do so, the strategy should include all regions and ensure that each territory's endowments and specificities are exploited and contribute to economic growth along with the industrial transformation. It should avoid one-size-fits-all policies and instead adopt a tailormade, 'place-sensitive' approach that matches the capacity and characteristics of each region.[315] Building on initiatives such as the Smart Specialisation strategies, local development, innovation and investment strategies should be used to enhance local opportunities and reach untapped potential. This would ensure that each local economy takes part in the industrial transition to its full potential.

Of course, not every EU region can become a global leader in high-tech and/or -value sectors. Indeed, places with relatively low physical and human capacity and ore traditional economic structures cannot compete with the most dynamic and established EU centres of innovative industrial activities. That being said, while promoting the excellence of the latter is important, neither should the European industrial strategy neglect the former. Though such regions may be far from the frontier, they still constitute a large part of local economies and so must be brought along for the transformative ride.

The industrial strategy should adopt a tailormade, 'place-sensitive' approach that matches the capacity and characteristics of each region.

Chapter 4: Recommendations – Policy aims for an Industry Action Plan for the EU

Overarching goals for an EU Industry Action Plan	Challenges to be tackled	Five policy aims	Key recommendations
1. Sustainability 2. Competitiveness 3. Strategic autonomy	► Rise in protectionism ► Distorted competition due to third-country initiatives ► Demanufacturing and loss of jobs in industry ► Digital disruption and automation ► Dependence on foreign technology ► Need for critical raw materials ► Achieving climate neutrality by 2050 ► Increased competition over 'global talents' ► The skills gap ► Regional disparities ► Lack of investments in R&I ► Enforcement of EU rules within the Single Market	1. Make the Single Market work, equipped with a modern competition policy	► Launch a 2022 Single Market masterplan for Europe ► Establish decentralised enforcement bodies ► A Small Business Act 2.0 ► Boost services within the Single Market ► Establish an independent competition authority ► Ensure flexibility on state aid rules (matching-clause, IPCEIs)
		2. Better innovation policy and technological sovereignty	► Increase funds allocated to DEP, InvestEU, CEF ► Earmark Horizon Europe funds for industrial innovation ► Set up strong governance for IPCEIs ► Launch a new strategy on digitising EU industry sustainably ► Encourage the creation of data trusts ► Strengthen ENISA
		3. Act strategically and enforce reciprocity	► Strengthen FDI screenings at EU and member state level ► Adopt an International Public Procurement tool ► Enforce sustainability within EU FTAs ► Champion WTO reforms ► Better enforce sustainability at EU border ► Enhance the EU's economic diplomacy and access to raw materials
		4. Ensure a fair and inclusive industrial transition	► Optimise the synergies between EU funds ► Democratise access to digital skills ► Support and encourage local industrial strategies programmes ► Develop common EU educational programmes for AI and emerging technologies
		5. Climate-proof industry	► Create a favourable framework for low-emission electricity ► Introduce emission performance standards ► Create a business case for ultra-low carbon processes ► Create lead markets for low-emission solutions ► Create a market for secondary raw materials ► Support industrial symbiosis

RECOMMENDATION 1: MAKE THE SINGLE MARKET WORK, EQUIPPED WITH A MODERN COMPETITION POLICY

The European Single Market represents the EU's strongest asset in maintaining and restoring industrial competitiveness. The Single Market is central to establishing European value chains and ensuring that EU companies are well equipped to link into GVCs. Any EU industrial policy should place the revitalisation of the Single Market at its core. A new programme for the Single Market should aim to prioritise services, standardisation, more robust enforcement and better regulation. Within the Single Market, well-functioning and strong competition rules are fundamental to the development of a healthy and resilient industrial ecosystem. For this to take place, however, all companies operating within and with the Single Market – no matter their origin and size – must be bound by EU competition rules. EU competition policy should rapidly adjust to the realities of global competition and be fit for the age of the digital economy.

Any EU industrial policy should place the revitalisation of the Single Market at its core.

► **Launch a 2022 Single Market masterplan for Europe.** The EU should define a new action plan for the Single Market with a reform programme and concrete objectives to be achieved by 2022 – exactly thirty years after the creation of the Single Market and following the strategy set out in the 1992 Programme. The 2022 Action Plan should be structured as a list of reforms and initiatives to be agreed upon as a package deal by the Council, Commission and Parliament. It should be

integral to the EU's industrial policy. It is time to end the artificial distinction between so-called 'Friends of the Single Market' and 'Friends of the Industry'. A list of suggested initiatives can be found in the EPC Discussion Paper, "Making the Single Market work: Launching a 2022 masterplan for Europe".[316]

- **Establish decentralised enforcement bodies.** The next Commission should look into the possibility of setting up national enforcement bodies in each member state, to help monitor the application of Single Market rules and initiate proceedings before national courts. A more decentralised enforcement system would help bring the Single Market closer to EU citizens and remove the barriers to trade that go unnoticed at a higher level by the Commission (e.g. technical barriers to trade, additional paperwork or legal 'gold-plating' when transposing EU law). Decentralised enforcement bodies would supplement rather than replace the role currently played by the Commission and could help bridge the gap between EU and national legal orders.[317] This could be crucial in ensuring that products imported into the EU from third countries also comply with EU rules, especially regarding safety and sustainability.

With the increasing servicification of manufacturing, the EU market for services cannot remain as underdeveloped as it currently is.

- **Introduce a Small Business Act 2.0.** The EU should introduce a second Small Business Act to reinforce the 'think small first' principle and establish a real SME-test within the better regulation agenda. A Small Business Act 2.0 should offer clear guidelines on how to implement an SME test for all relevant Single Market legislation to better assess the possible costs and benefits of new legislation on SMEs. The Act should take a more innovative approach to regulation (e.g. regulating with the 'lifecycle' of start-ups and SMEs in mind), thus easing the regulatory burden on SMEs around important 'life stages' such as scaling-up, recruitment, relocation and such.

- **Set up a single one-stop-shop.** The EU should aim to set up a single one-stop-shop in each member state, to provide industries and businesses with clarity and a better overview of the rules and administrative requirements they must abide by, and how. This would allow the several Single Market contact points that currently exist (i.e. under the Services Directive; the Mutual Recognition Regulation; the Recognition of Professional Qualifications Directive; and the Enforcement Directive on Posted Workers) to better coordinate their decisions and replies.[318] This should be streamlined with the role played by the Single Digital Gateway in making access to information and administrative procedures more userfriendly.

- **Revive European standardisation.** The Commission should review its approach to European standardisation, thus allowing for more industry-led standardisation and innovation to take place. The Commission should reduce administrative burdens, avoid an over-regulatory approach to standardisation and increase the attractiveness for industry wishing to participate in the standardisation process. These efforts are imperative if European standards are to keep up with the current pace of innovation and development of new digital technologies worldwide.

- **Boost services within the Single Market.** With the increasing servicification of manufacturing, the EU market for services cannot remain as underdeveloped as it currently is. The Commission should actively include the free movement of services and the better enforcement of the Services Directive in any future EU industrial strategy. The services notification procedure should be further reviewed and strengthened, including the possibility of granting the Commission the right to take binding decisions on non-compliance. The Commission should send cases regarding possible breaches of the Services Directive to the ECJ more systematically.[319]

- **Adopt an 'integral value chain' approach when regulating.** The European Commission should assess the impact of new EU rules on the entirety of European value chains more actively before regulating. Regulating one part of the value chain can often result in unwanted repercussions or consequences in another part of the value chain, even if done with the best intentions (e.g. out of environmental, safety concerns). An 'integral value chain' assessment should be included in the EU's better regulation agenda.

- **Establish an independent competition authority.** The EU should consider establishing an independent competition authority, building on existing examples in several member states and third countries. This could allow for a clearer separation of EU competition policy from the enforcement of competition rules, as both currently fall under the responsibility of the Commission. This could also help foster greater transparency and clarity around state aid and merger decisions.[320]

The EU should consider establishing an independent competition authority.

- **Set up a high-level group on competition policy.** The Commission should set up a high-level expert group to assess how EU competition policy could be modernised to better reflect the realities of the digital economy and global competition. EU competition policy should be regularly updated, in full compliance with WTO rules, to ensure that European and foreign

firms compete on an equal basis within the Single Market and thus allow for a global level playing field. It should also assess how competition enforcement could be modernised to keep up with rapid developments in the digital sector.[321]

- **Allow more flexibility on state aid rules.** There should be greater awareness of globalised product markets and international competition while also ensuring compatibility with the WTO framework. The Commission should put forward clearer guidelines and support better use of already existing tools to support EU companies deal with subsidised global competitors. There is scope for increasing the effectiveness of the IPCEI and the so-called 'matching clause'[322] in R&D, which allows for some exemption from state aid constraints in the presence of a subsidised third-country competitor. To incentivise the use of this clause, the Commission should speed up assessment procedures.

RECOMMENDATION 2: BETTER INNOVATION POLICY AND TECHNOLOGICAL SOVEREIGNTY

Given the maturity of EU economies, growth must be sustained through high-value segments of GVCs. For this to happen, keeping industry innovative is critical. Currently, however, the EU has been investing less in R&D (as a percentage of GDP) than global competitors. It also faces a particular challenge in translating knowledge into marketable goods and services. At the same time, Europe's industrial strategy will need to embrace digitalisation and technological progress. The rise of robotics, AI, IoT, Blockchain, 5G and super-computers represents an excellent opportunity to reinvent industrial production and business models, and thereby re-establish European competitiveness. Being at the forefront of these developments would also allow the EU to ensure that digitalisation helps to address its societal, environmental and security challenges and meet its safety, sustainability and ethical standards. Additional regulation will have to be developed with great care to avoid unnecessary barriers to the free flow of data and ensure that digital rules are equally applicable to European as to foreign companies operating within the Single Market.

Keeping industry innovative is critical.

- **Significantly increase funds allocated to the DEP, InvestEU and CEF.** If EU member states are serious about industrial leadership and technological sovereignty, suggested funds for the DEP (€9.2 billion), InvestEU (€14.7 billion) and CEF (€42.3 billion, but including only €3 billion for digital envelop) should be significantly increased under the proposed 2021-27 MFF. The DEP should be increased by at least 50% in order to match the proposed InvestEU and CEF funds. It could also be renamed the 'Technological Sovereignty Fund for Europe'. These funds should be kept separate and distinct under the MFF section of EFSI and not be merged with other funds like Horizon Europe. 'European strategic investments' should target and be earmarked for technological moonshot initiatives, including high-performance and cloud computing, cybersecurity, advanced manufacturing, AI for circularity (e.g. better design, waste management, recycling, retrieving raw materials), sustainability and health.

If EU member states are serious about industrial leadership and technological sovereignty, suggested funds for the DEP, InvestEU and CEF should be significantly increased under the proposed MFF.

- **Earmark more Horizon Europe funds for (industrial) innovation.** The main beneficiaries of the Framework Programme are universities and research institutions, which tend to focus on basic academic research. Horizon Europe should be expanded to invest in close-to-market innovation equally, targeting both firms doing in-house R&I as well as those trying to commercialise and deploy recent innovations. The European Innovation Council's proposed budget of €10 billion is only 10% of the total Horizon Europe budget – it should be considerably increased.

The Commission should encourage and define guidelines for regulatory sandboxes.

- **Create a horizontal MFF indicator for innovation funding.** There must be a common definition, tracking methodology and impact assessment of EU innovation funding. At present, EU support for innovation across the different EU programmes is not commonly defined and is often not clearly reported either.[323] For the MFF to effectively encourage innovation, it must be possible to clearly identify related funding and assess the impact, because budget allocations do not indicate actual results.

- **Set up a strong governance structure for the IPCEI.** The EU should set up a strong governance structure, both within the Commission (e.g. inter-service task force) and the Council (e.g. a working party within the Competitiveness Council) to identify and promote strategic value chains and IPCEIs. A permanent successor to the Strategic Forum should be appointed the role of supporting the Commission in identifying

future strategic value chains and implementing the Forum's recommendations within six strategic value chains: autonomous vehicles, cybersecurity, hydrogen technologies, industrial IoT, low CO_2 emission industry and smart health.

- **Create European regulatory 'sandboxes'.** The Commission should encourage and define guidelines for regulatory sandboxes, allowing the industry to develop innovative products or services with partial or total exemption from regular rules, but still monitored by public authorities. This would allow regulators to protect the public interest while still providing an environment for testing and failing, and avoiding overregulation. The guidelines within the sandboxes could include sector-specific, minimum requirements to be respected. Even if regulatory sandboxes are mostly associated with financial technology, they have also proved useful within other fields (e.g. energy, data, technology). Regulatory sandboxes could also be linked to specific testbed facilities, which are usually equipped with machinery and computer programmes.

The EU should set up pilot projects to boost cooperation between universities and firms in major sectors.

- **Encourage the development of testbed facilities in Europe.** The EU should encourage and invest in the development of testbeds for the development of emerging technologies. Testbeds are research facilities usually equipped with machinery and computer programmes which allow for the testing and development of new products. They can reduce risks and boost rapid innovation, and are especially important for SMEs and start-ups that often lack the resources or facilities to try out new products or solutions. Projects like Sweden's RISE – a national programme operating around a hundred testbeds[324] – should be encouraged in other member states and at the European level.

- **Set up partnerships between academia and the private sector for commercialisation.** In avoiding that innovation gets lost before the commercialisation phase, the EU should set up pilot projects to boost cooperation between universities and firms in major sectors. These collaborative projects would facilitate the market uptake of research outcomes and create stronger links between the two worlds. The partnerships could take the form of enhancing student and faculty exchange and 'corporate visits' via Erasmus+, for example, and provide financial support to research projects carried out by university-firm 'duos' that aim to commercialise the outcomes from the start.

- **Establish a structured consultation process on IPR.** The Commission should set up a structured dialogue with industry representatives to find the balance between open innovation and IP protection. The aim should be to design a framework that ensures the broad availability of partially publicly-funded research outcomes as well as concrete benefits for private investors. Particular attention should be paid to ensuring that IP protection is granted quickly and that delays are avoided. Innovation in fast-changing environments is constrained if bringing products to the market is slow.

Support for digital technologies should be made conditional: the aim must be to promote the development and deployment of solutions with a limited environmental footprint.

- **Accelerate the setup of the Unified Patent Court.** The Unified Patent Court (UPC) is a proposed international common patent court for all EU member states. Already approved in 2012, unitary patent protection and a uniform patent litigation system would help to simplify the EU's fragmented patent protection system and reduce costs linked to R&I. However, because of a delay in the ratification process in Germany and uncertainties surrounding Brexit, the UPC has not yet been able to become effective. An agreement should be found that would allow the UK to remain within the unitary patent system regardless of the Brexit outcome, including a possible review of the UPC Agreement and the locations of the courts.

- **Launch a new strategy for the sustainable digitisation of EU industry.** The Commission should launch a new strategy for the digitalisation of industry and manufacturing in Europe. It should include funds dedicated to the deployment and promotion of the uptake of new technologies within the DEP, Horizon Europe and InvestEU. However, support for digital technologies should be made conditional: the aim must be to promote the development and deployment of solutions with a limited environmental footprint and ensure that they are used to address the likes of sustainability and societal challenges. In addition to R&I investments under the 2021-27 MFF, the EU should especially support start-ups and SMEs in using digital technologies to develop and bring products and services that are beneficial for health, environment and security onto the market.

- **Encourage the creation of data trusts.** The EU should encourage the creation of data trusts or data spaces to stimulate data sharing within various sectors (e.g. health, food, textiles, energy, automotive). Data trusts have been mentioned as new data governance frameworks that would provide for secure ways of sharing data and protect against abuses[325] and would work as a cooperation platform between organisations with data and AI developers using data to develop new technological solutions. Contractual arrangements

could ensure that organisations giving away data benefit from doing so, for example by gaining IPR shares of the resulting technology.[326] The EU should actively engage in creating linkages between national data-sharing systems to enable R&I.

- **Define a list of priorities for funding key technologies.** The Commission should define a list of top strategic technologies to be developed in Europe and thus prioritised throughout EU funding, assessed by their societal and strategic importance. An initial list could comprise the six KETs as identified by the High-level Strategy Group on Industrial Technologies: advanced manufacturing technologies; materials and nanotechnology; photonics, micro- and nanoelectronics; advanced manufacturing technologies; AI; and digital security and connectivity.[327]

- **Establish a European AI university.** The EU should establish a European university or research institute for new emerging technologies such as AI, in partnership with a network of European industries. An alliance of European universities and institutes working on AI should also be established, in which the European AI university could play a coordinating role.

The EU should encourage the creation of data trusts or data spaces to stimulate data sharing.

- **Strengthen the EU Cybersecurity Agency.** The EU should strengthen the mandate and budget of the EU Agency for Cybersecurity (ENISA). Cybersecurity and the reliability of digital technologies is crucial if citizens and industry are to trust and make use of digital solutions fully. The Commission has proposed a 'European Cybersecurity Industrial, Technology and Research Competence Centre and Network'. It is paramount that the Council and Parliament agree on these proposals swiftly and consider whether the mandates and the budget allocated to these centres should be further strengthened.

RECOMMENDATION 3: ACT STRATEGICALLY AND ENFORCE RECIPROCITY

The current context will require the EU to think more strategically about promoting industrial competitiveness and responding to global challenges. Third countries such as the US, China and India do not shy away from adopting protective or protectionist initiatives under the banner of industrial policy. A European response should be based on an open economy and free trade, but Europe cannot remain naïve in granting market access to foreign industry that does not play by the same rules. Tools within different EU agendas, such as trade and the Single Market, should be better exploited to increase the strategic autonomy of Europe. In acting more strategically, the EU should also be smarter with the resources it has within its borders and use innovative solutions and digital technologies for this aim, as well as secure access to raw materials from third countries.[328]

The EU should make the ratification and implementation of the Paris Agreement a pre-condition to concluding FTAs.

- **Strengthen FDI screenings at the EU and member state level.** All EU member states should put FDI screening mechanisms in place, including binding measures in case FDIs represent an external threat to the security or public order of the Union. FDI screenings at the EU level should go beyond merely facilitating the exchange of information; instead, extensive cooperation should be put into place, and a common understanding of what constitutes a threat to national and union security should be developed. The weight of the Commission's (current) 'non-binding' opinions should be strengthened.

- **Adopt an International Public Procurement tool.** The proposal for an 'International Procurement Instrument' (IPI) should be reviewed, updated and adopted as soon as possible by the Council and Parliament. The IPI is a tool that could improve European industries' access to public contracts in third countries. Still not adopted by the Council and Parliament, the Instrument would allow for the leveraging of reciprocal market access by restricting third countries' access to European public markets if necessary.

- **Enforce and monitor sustainability within EU FTAs.** The EU should monitor and enforce the Trade and Sustainable Development chapters it has sought to include in its FTAs more effectively. In cases where a partner country does not comply with these provisions despite enhanced cooperation through dispute settlement mechanisms, the EU should be able to suspend an FTA or adopt sanctions as a last resort. The EU should make the ratification and implementation of the Paris Agreement a pre-condition to concluding FTAs.

- **Champion WTO reforms.** The EU should remain strongly committed to the multilateral trading system and its reform agenda. The EU should work with all partners to improve the efficiency, transparency and fairness of the WTO, including ensuring that WTO countries notify new subsidies and implement the WTO Agreement on Subsidies and Countervailing Measures. The EU should continue to work with likeminded countries and convince others of the need to reform the WTO, including its Appellate Body, and to improve the regulation of the use of industrial subsidies. Temporary alternatives outside of the WTO would possibly need to be found in the event of an Appellate Body breakdown.

Such solutions, however, should be temporary by default and made conditional on the inactivity of the multilateral system's dispute settlement.

- **Enhance Europe's economic diplomacy.** A more strategic agenda for Europe should not, however, mean a more isolationist Europe. The EU should enhance its economic diplomacy in technology, innovation and industry, to build a stronger platform for cooperation with third countries and through international organisations. Several areas will require increased global cooperation, such as ethical AI; the governance of emerging digital technologies; secure data transfers; cybersecurity; and access to raw materials. While many international fora can be adapted and empowered to deal with such emerging areas, others may have to be established.

- **Better enforcement of EU sustainability rules and standards at the border.** The EU must improve its market surveillance and enforcement compliance. European industry is required to comply with strict regulations on safety, standards and sustainability while competitors are often permitted to enter the EU market without having to comply with the same rules or strict enforcement mechanisms. New ways to assess foreign firms' compliance with EU rules should be developed across sectors, and more effective trade enforcement tools should be developed in order to block the Single Market off from firms that do not respect these rules.

A more strategic agenda for Europe should not mean a more isolationist Europe.

- **Secure access to materials.** The EU should map the future demand for raw materials, develop dedicated diplomacy to secure access and enhance circularity to reduce external dependency. Securing access to critical materials will require adopting a more flexible approach externally: while the aim must be to build on multilateral cooperation, the EU must also be prepared to engage in dialogue with upstream countries when needed. As Chinese domestic demand for rare earth is set to expand rapidly, bilateral dialogue should be deepened with Australia, South Africa, Canada and Mercosur countries. In order to limit exposure to external supply shocks internally, critical materials within the economy should be retained in the economcy: via tracking and tracing, separate collection and recycling of products and components that contain critical materials.

- **Create a market for circular products and services.** PP should be used to incentivise the development and deployment of circular products and services. Determining the most adequate product/service must be supported by lifecycle assessments, product environmental footprints and pertinent product/service labels. Taxation can also be used to incentivise smarter use of resources, by removing VAT from recycled materials that would make sustainable business models more competitive, for example, and discourage unsustainable practices (e.g. landfilling, incineration). Agreeing on the definition of waste (i.e. end-of-waste criteria) and developing quality standards for secondary materials could also make recycled materials more competitive than virgin materials.

RECOMMENDATION 4: ENSURE A FAIR AND INCLUSIVE INDUSTRIAL TRANSITION

Ensuring that no worker or region is left behind should remain a fundamental goal of any European industrial initiative. EU citizens and businesses across the EU should have equal opportunities to profit from industrial transformations. The EU should make sure that the transition towards more digital, innovative and sustainable industries does not lead to further unemployment, exclusion or social and geographic polarisation – even if job displacement is inevitable.

The EU should make sure that the transition towards more digital, innovative and sustainable industries does not lead to further unemployment, exclusion or social and geographic polarisation.

- **Optimise the synergies between the preventive and corrective objectives of EU funds.** several EU funds proposed under the MFF 2021-2027 will aim to enhance labour market participation through various measures, such as the European Social Fund Plus (ESF+) and the European Globalisation Adjustment Fund (EGF). The ESF+ and the EGF will follow complementary objectives: the ESF+ will mainly have a preventive mission while the EGF assists vulnerable workers. Having the two aspects covered by EU funds as well as the broader scope of the EGF is both relevant and promising. However, the complementarity of the two funds will only be optimal if the ESF+ is underpinned by a long-term territorial strategy on industrial restructuring, where upskilling workers for digitalisation and emerging technologies plays a central role. There is also potential for better synergies between Horizon Europe and the European Structural and Investment Funds (ESIF). Particular attention should be given to the potential use of ESIF to uptake and diffuse Horizon Europe results.

- **Democratise access to digital skills.** Over 40% of Europeans still lack basic digital skills.[329] Furthermore, it appears that digital skills are unequally distributed within society. For instance, there is a gendered digital skill gap of about 4 percentage points, and which has remained constant since 2015. In the case of senior

workers, only 41% of them have basic or above-average digital skills. In addition, access to proper training and lifelong learning is likely to become increasingly difficult for non-standard workers, in particular those who have no public entity to which training requests can be addressed. Therefore, the EU needs to ensure that all workers, including the self-employed and those taking part in the platform economy, have access to adequate training. In this respect, this must include online training, which is often more flexible than formal academic education. Thus, European universities need to be incentivised to develop their offer of online courses.

Cooperation among European universities as well as with industry must be strengthened and encouraged more actively.

- **Make digital skills an integral part of regional development strategies.** A digitally skilled workforce is crucial if businesses are to remain competitive and make better use of emerging technologies. Therefore, public authorities need to find new ways to incentivise investment in human capital, while ensuring that the strategy benefits all workers and territories. This strategy needs to be closely coordinated with the business sector, which knows best what skills are needed on the labour market. To ensure that businesses contribute their fair share in national efforts, new incentives should be created. For instance, investing in human capital and training in digital technologies should be rewarded by tax incentives. In the case of SMEs – which have limited capacity to invest in training programmes –, local and regional authorities should organise joint training programmes through their chambers of commerce, for example, thus allowing for economies of scale and transfers of knowledge across industries. Such a territorial re- and upskilling strategy should become an integral part of the smart specialisation strategy and the upcoming operational programmes that will form part of the Cohesion Policy in 2021-2027.

The EU should support all regional authorities in the formulation of their own strategy for industrial transition.

- **Develop common EU educational programmes for AI and emerging technologies.** The EU needs to understand better where (i.e. in which industrial sector and region) AI talents are concentrated and to what extent new technologies such as AI, IoT and blockchain are integrated into educational programmes. The relevance of new technologies cuts across levels of responsibility, types of jobs and sectors. Thus, it must become part of all educational and training programmes, regardless of the beneficiaries' level of education and occupational sector. Despite the EU's limited competences in the area of education and lifelong learning, the EU has an important role to play in incentivising reforms in the education system. To this end, the EU should develop a monitoring system highlighting how digital skills and new technologies are embedded in national educational programmes. In addition, the EU should have a few top-ranking universities that lead in new technologies. Cooperation among European universities as well as with industry must be strengthened and encouraged more actively. The EU could promote the user-developed models of responsible data use and stakeholder engagement.

- **Promote a human cost-benefit analysis of industrial transformations.** New technologies are often used and spread regardless of their impact on jobs and workers. Practices among businesses but also within the public sector as regards the ex-ante impact assessment of new technologies varies significantly. While some integrate the human impact, others do not. The EU is not particularly competent in this field, so it would be extremely useful to have a European framework based on a specific methodology with major criteria, to guide employers on whether the application of new technologies would be positive or negative from a human-centred growth perspective. Such a framework should also help employers and industries understand and anticipate how technologies might lead to unemployment and displacement.

- **Critically assess past and future policies for inequality.** The EU should carry out a deep and critical analysis of its policies and their (unintended) negative effects, for example, on perpetuating inequality and polarisation, especially at the regional level.[330] It should lead to the acknowledgement that generally accepted assumptions (e.g. the automatic diffusion of wealth and innovation spillovers) may be misconceived, and that negative consequences (e.g. the concentration of wealth and activities in already advanced areas) may have been underestimated. This process should be followed by an ex-ante assessment of the industrial strategy provisions and estimation of potential negative distributional impacts.

- **Support and encourage local industrial strategies.** To avoid one-size-fits-all policies that could create unintended, uneven consequences, the EU should support all regional authorities in the formulation of their own strategy for industrial transition. After an assessment of local challenges and opportunities, it may transpire that these strategies should not necessarily focus on sectors at the innovation frontier or technologies deemed as strategic, but rather envisage tailored instruments to improve and strengthen existing industrial activities. This can include, for example, investment for incremental innovation of traditional industry towards a more sustainable, energy-efficient production. These

policies can build on Smart Specialisation strategies as well as take a broader approach, linking different areas such as access to capital, innovation, skills and training, and infrastructure investment. The role of the EU should be one of capacity building, technical support and coordination to ensure the ownership of the strategy by local authorities.

- **Use cooperation as the driver for regional development.** To counterbalance geographic disparities, the EU should provide strategic guidance to foster cooperation among regions. This should build on existing initiatives, such as those of the Smart Specialisation policy agenda or the proposed changes to Interreg (or European Territorial Co-operation) to foster interregional innovation investment.[331] Importantly, interregional cooperation should not reinforce the current agglomeration logic by strengthening the existing clusters in the most dynamic centres of production. Rather, it should 'break the bubble' by bringing together actors from different regions and sectors. This would facilitate the diffusion of industrial activity, the spillover of technology and innovation and the creation of new business networks and relationships, as well as intra-EU value chains.

RECOMMENDATION 5: CLIMATE PROOF INDUSTRY

In alignment with the UN's Paris Agreement, the European Commission has proposed a strategy for achieving a climate-neutral EU by 2050 – which most EU member states have already agreed upon. It is essential that a future-oriented European industrial strategy is in line with this vision, placing sustainability and sustainable industries at its core. As the level of climate ambitions differs across the world, it is important to ensure that the EU's strict rules on climate neutrality and sustainability do not result in a global competitive disadvantage for EU industry. In this regard, protective clauses such as carbon border adjustments ought to be considered. Simultaneously, a more assertive EU foreign policy should strive to develop and enforce international rules and standards on climate neutrality that will ensure a global level playing field. In many ways, European industries are already leading this endeavour, but EU policymakers can support this endeavour and further accelerate the transition.

The EU must put its money where its mouth is.

- **Reward sustainable businesses.** The EU must ensure that its framework conditions and support mechanisms reward businesses whose processes, products and services contribute to climate neutrality and the wider sustainability agenda. Creating the conditions to succeed in this transition requires a supportive policy framework, financial incentives, improved infrastructure, and targets to encourage investments in needed innovation. Defining a short-term action plan for 2025 could provide the industry with some of the necessary certainty and milestones to jump into action.

- **Align spending towards climate neutrality.** The EU must put its money where its mouth is. In Europe, around €112 billion were allocated annually to the production and consumption of fossil fuels between 2014 and 2016.[332] Smart spending requires firstly putting an end to subsidies that are evidently harmful to the environment and climate. If the EU and its member states are serious about achieving a new climate-neutral economic model by 2050, this requires huge investments in the energy sector, including in renewables, to improve electricity storage, transmission capacity, energy efficiency as well as to reduce the climate footprint of agriculture, transport and construction sectors. They should be targeted to solutions that can demonstrate full compatibility with a sustainable, climate-neutral future. The EU could use the MFF to attract additional public and private investments for climate-friendly projects, for example.

- **Create a favourable framework to access low-emission electricity.** Deepening and completing a Single Market for electricity in the EU will be essential to reducing and aligning costs, and this will require harmonisation in support schemes, carbon price floors, capacity mechanisms and enhanced interconnections. To encourage a switch to electrification while simultaneously avoiding indirect emissions, corporate power purchase agreements (PPAs) should be incentivised. These contracts have the advantage of encouraging a parallel shift towards renewable energy in both the industrial and energy sectors. The Commission should underline the benefits of PPAs and promote their EU-wide standardisation.

- **Introduce emission performance standards** (EPS) to favour investment in alternative energy feedstock and zero-emission processes. Under the Industrial Emissions Directive (IED), emission limits are based on BAT.[333] Similarly, emission performance standards are also applied to passenger cars, ideally acting as a driver for the expansion of electromobility. The IED's scope could be extended beyond pollutants to include GHGs – currently excluded as covered by the ETS. This would provide a strong boost for the long-term uptake of low-carbon BAT by 2050 and avoid a lock-in effect. In between BAT reviews, the ETS would provide mid-term incentives for the industry to introduce low-carbon techniques. EPS should provide a clear sectoral roadmap with sunset clauses for the phase-out of GHG-emitting technologies. When connecting EPS with low emission requirements, the EU should duly consider the interaction between market-based and regulatory instruments. Any additional extensions of the EPS to include low-carbon requirements should not undermine the incentives provided by the ETS for the industry to achieve carbon neutrality by 2050. Besides

extending the binding legislative scope of the IED, it is also worth considering other options, such as including low-carbon requirements in the BAT reference documents (BREFs) to a greater extent in order to facilitate the uptake of low-carbon BAT by the industry. Arguably, climate neutrality can be ensured by exploiting the full potential of the EU's policy toolbox, while avoiding inconsistencies and unnecessary regulatory burden and tapping the synergies between different instruments.

- **Make the most of EU funding and innovation instruments** including InvestEU, CEF, Horizon Europe, and the EU ETS' Innovation Fund, when supporting the development and uptake of climate-neutral products and services. As a basic principle, no EU money should be spent on subsidising practices that are harmful to the climate, like 'clean coal' or switches to unabated natural gas. Moreover, the Strategic Energy Technology Plan (Set Plan), which coordinate national research efforts, finance projects, adapt governance structures and develop major performance indicators to measure progress, could provide valuable lessons for supporting promising solutions, also in other industrial sectors.

Use taxation to incentivise and disincentivise investment and consumption.

- **Create a business case for ultra-low carbon processes.** Similar to support schemes for renewable electricity generation, 'contracts for difference' should support the investment in low-emission technologies in industrial processes. These contracts would reward industry's investments in low-emission technologies by guaranteeing a payment covering the difference between market and investment prices. They would gradually phase out as technologies reach maturity. ETS revenues could also be used to support contracts for difference. At the EU level, this would require guidance to standardise the practice in order to avoid distortions to the Single Market.

- **Use taxation to incentivise and disincentivise investment and consumption.** Taxation remains one of the most powerful instruments to incentivise the reduction of emissions. The objective of climate neutrality should be fully integrated into the country-specific recommendations (CSRs) in the context of the European Semester. CSR should recommend shifting the tax burden towards fossil fuel or products with high carbon content while simultaneously providing tax incentives for the purchase of low-carbon products.

- **Map infrastructural needs for industrial clusters** that could decarbonise through the use of hydrogen and carbon capture, and support related investments via innovative financing instruments such as Eurobonds. These industrial clusters need cross-border interconnections, notably for hydrogen and CO_2. The magnitude of the required investment would depend on the rate of penetration of hydrogen and carbon capture, storage and usage, which show promising potential in specific regions where transit and storage infrastructures are already well developed. The mapping should, therefore, also help to address potential distributional consequences and identify the potential for peripheral industrial regions to access the infrastructures enabling these low-carbon processes.

- **Support industrial symbiosis** in the form of collaboration between European companies, whereby waste material (e.g. heat) of one industrial facility is used as input feedstock for another. The EU should provide clear end-of-waste criteria, finance prospective pilot projects and facilitate partnerships and the exchange of good practices between industries (e.g. via stakeholder platforms, informative campaigns).

- **Ensure that products in the European market are sustainable by design.** Under the ecodesign rules and based on scientific evidence, the Commission should consider introducing new product requirements and guidelines for new categories of products to support the design of circular (e.g. durable, repairable, recyclable) and climate-friendly products (e.g. setting mandatory requirements to lower carbon content), on a case-by-case basis.

- **Create a global level playing field.** The EU should continue to collaborate and share good practices with its global partners, and use diplomatic and trade instruments to encourage global climate action. The aim should be to link different emission trading schemes and create a global price for carbon.

Conclusion

Beyond the many difficulties confronting EU industry, the current challenges and megatrends also present considerable opportunities for industry to reinvent business models and become more innovative.

European industry is demonstrating ability and interest to adapt and seize the opportunities in the transition. Still, a European strategy is imperative to support industry in this endeavour more proactively.

This Issue Paper underlines some of the major challenges faced by industry and looks at how the EU has sought to develop its industrial policy. Despite their imperfections, EU digital, innovation and climate policies and the Single Market are huge assets in responding to some of these challenges. It is vital to build on these strengths when defining an Industry Action Plan for the EU, which admittedly is not an easy task. Europe does not embody the same economic power it once did and is facing increasingly fierce competition within GVCs. Given the nature of global competition, an effective response can only be found at the EU level. An Industry Action Plan could go a long way towards supporting industry by creating long-term jobs, boosting innovation, contributing to stable growth and reaching international commitments; such as the Paris Agreement and SDGs.

This Paper suggests elements of a vision for EU industry towards 2030 – sustainability, competitiveness and strategic autonomy – and the priorities for realising this vision. It also provides recommendations for an EU Industry Action Plan: how to make the Single Market work; improve innovation policy and technological sovereignty; act strategically and enforce reciprocity; ensure a fair and inclusive industrial transition; and finally, climate proof industry with a 2050 climate neutrality roadmap.

We must ensure that the current momentum for a more offensive EU approach in both Brussels and member states leads to a renewed and more concrete industrial strategy for Europe. 'Muddling through' would only imply 'muddling down'.[334] If Europe fails to take action, its industry could be left further behind. By establishing a new Industry Action Plan, however, the EU can leverage its greatest strength. By acting in unison, its sum is greater than its parts.

Annex

LIST OF EVENTS FOR THE TASK FORCE ON AN INDUSTRY ACTION PLAN FOR THE EUROPEAN UNION

20 February 2018
Industrial transformation: Understanding the real drivers for change

Jacques Bughin, MGI Director and Senior Partner, McKinsey & Company
Mark Nicklas; Head of Innovation Policy and Investment for Growth Unit; Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs; European Commission
Martin Porter, Executive Director of Industry & Innovation and EU Affairs, European Climate Foundation
Paul Timmers, Senior Adviser, European Policy Centre
Laurent Zibell, Policy Adviser, IndustriAll
Fabian Zuleeg, Chief Executive and Chief Economist, European Policy Centre

3 July 2018
European industries in global value chains: Prospects for a more competitive future

Fulvia Raffaeli; Head of Clean Technologies and Products Unit; Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs; European Commission
Tomas Wyns, Doctoral Researcher, Institute for European Studies, Vrije Universiteit Brussel
Guillaume Decorzent, Head of European innovation policies and funding office, Directorate-General for Enterprises, France
Koen Berden, Executive Director for International Affairs, European Federation of Pharmaceutical Industries and Associations
René van Sloten, Executive Director of Industrial Policy, European Chemical Industry Council
Pauli Kuosmanen, Dean, Faculty of Engineering Sciences, Tampere University of Technology

6 September 2018
The future of European industry: From a joint vision to common objectives

Slawomir Tokarski; Director for Innovation and Advanced Manufacturing; Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs; European Commission
Ray Pinto, Director for Member Relations and Digital Transformation, DIGITALEUROPE
Ulrich Schuh, Head of Department, Federal Ministry for Digital and Economic Affairs, Austria
Elizabeth Kuiper, Executive Director of Public Affairs, European Federation of Pharmaceutical Industries and Associations
Dennis Kredler, Director of European Union Affairs and Head of Brussels Office, Dow Chemical Company
Martin Porter, Executive Director of Industry & Innovation and EU Affairs, European Climate Foundation

6 December 2018
After the 2050 strategy review: What role for European industry?

Tom Van Ierland, Head of Strategy and Economic Assessment Unit, Directorate-General for Climate Action, European Commission
Peter Handley; Head of Resource Efficiency and Raw Material Unit; Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs; European Commission
Tomas Wyns, Doctoral Researcher, Institute for European Studies, Vrije Universiteit Brussel
Olga Chiappinelli, Research Associate, German Institute for Economic Research
Martin Porter, Executive Director of Industry & Innovation and EU Affairs, European Climate Foundation
René van Sloten, Executive Director of Industrial Policy, European Chemical Industry Council
Maximo Miccinilli, Director of Public Affairs & Communications, European Aluminium (former)
Rolf Kuby, Director of External Affairs and Head of EU Office, Aurubis
Elizabeth Kuiper, Executive Director of Public Affairs, European Federation of Pharmaceutical Industries and Associations
Fabian Zuleeg, Chief Executive and Chief Economist, European Policy Centre

30 January 2019
What prospects for EU state aid and competition policies?

Johannes Laitenberger, Director-General, Directorate-General for Competition, European Commission

25 February 2019
EU trade in a tumultuous world

Jean-Luc Demarty, Director-General, Directorate-General for Trade, European Commission

27 February 2019
Industrial transformation: What role for digital skills?

Jack Orlik, Senior Researcher, Digital Frontrunners programme, Nesta (former)
Fabrizia Benini; Head of Unit; Digital Economy and Skills; Directorate General for Communications Networks, Content and Technology; European Commission
Austėja Trinkūnaitė, Secretary General, Council of European Professional Informatics Societies
Agnès Roman, Senior Policy Coordinator, European Trade Union Confederation
Fabian Zuleeg, Chief Executive and Chief Economist, European Policy Centre

11 March 2019
SME performance and competitiveness: Addressing drivers for success

Miriam Koreen; Senior Counsellor on SMEs; Centre for Entrepreneurship, SMEs, Regions and Cities; Organisation for Economic Co-operation and Development
Kristian Uppenberg, Head of Division of Advanced Materials, European Investment Bank
Kristin Schreiber; Director for COSME Programme and SME Policy; Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs; European Commission
Gerhard Huemer, Director of Economic Policy, SMEunited
Géraldine Verbrugghe, Adviser on SME Policy and competitiveness, EuroCommerce
Daniel Cloquet, Director of Entrepreneurship & SMEs Department, BusinessEurope
Angelo Parnofiello, Junior Policy Advisor, Eurochambres

1 April 2019
A future-oriented European industrial policy: What do we need?

Peter Altmaier, Federal Minister for Economic Affairs and Energy, Germany
Margrethe Vestager, Commissioner for Competition, European Commission

21 June 2019
Investment in innovation: Incentivising private sector involvement

Jean-Eric Paquet, Director-General, Directorate-General for Research and Innovation, European Commission
Harald Gruber, Head of Digital Economy and Innovation, European Investment Bank
Boris Azaïs, Director of Public Policy Europe & Canada, MSD
Véronique Willems, Secretary General, SMEunited
Fabian Zuleeg, Chief Executive and Chief Economist, European Policy Centre

EXTERNAL EVENTS

26 September 2018
The New EU Industry Strategy: Working towards an Intelligent, Innovative and Sustainable European Industry?
European Forum for New Ideas, Sopot, Poland

12 October 2018
Expert discussion on EU industrial policy
Czech National Convention, Prague, Czech Republic

26 October 2018
Roundtable discussion on the EU's future industrial policy
Council of Tampere Region, Tampere, Finland

18 December 2018
Working session, Which strategic objectives for the future of European industry? Challenges and policy responses
6th Friends of Industry Ministerial Meeting, Paris, France

26 March 2019
An Industry Action Plan for the EU – Better outcomes together
Elcano Royal Institute, Madrid, Spain

17 April 2019
Ein "Industry Action Plan" für Europa
Das Progressive Zentrum, Berlin, Germany

21 May 2019
Roundtable discussion, The future of European competitiveness
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[115] The most represented countries include the US, the Netherlands, China, Germany, France, Italy, Canada and Japan.

[116] They include Saudi Arabia, Russia, Australia, United Arab Emirates , Iraq, the US, the Netherlands, Brazil, Canada, China, Switzerland, Germany, Hong Kong, Singapore and South Korea.

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