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Advanced Technologies for Industry – Policy brief

Industrial recovery and technology policy



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Section 1

1. Background

This Policy Brief has been developed in the framework of the Advanced Technologies for Industry (ATI) project, initiated by the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW), and the European Innovation Council and Small and Medium-sized Enterprises Executive Agency (EISMEA). Policy Briefs analyse national and regional policy measures focused on a specific challenge, technological area or mode of implementation, and they explore policy tools designed and implemented with the aim of fostering the generation and uptake of advanced technologies. The reports provide a comparative analysis and bring examples of relevant national and regional policy measures in the EU.

This report focuses on a review and analysis of recent policy actions across EU Member States that address the industrial recovery through research, technology and innovation.

In the past decade the drive for industrial transformation has largely been motivated by the desire to boost productivity and growth in an increasingly competitive manufacturing landscape. Policies have promoted the positioning of businesses higher up the value chain and often targeted 'high tech' sectors. The industrial transformation has been seen as a way to increase exports through competitiveness and even to address regional economic disparities.¹

At the same time, many 'low tech' companies, as part of cost reduction strategies, have moved part of their production to Asia and other parts of the world. However, those companies were often producers of essential goods such as for example medical supplies. In addition, European companies

have become extremely dependent on third countries for critical raw materials.² The pandemic has thus revealed how vulnerable and dependent the production chains of European companies (both in high and in low tech sectors) have become due to globalisation.

As a result, some policymakers looked at ways to incentivise companies to shorten their production chains and move their production capacity and jobs back to their countries of origin ('reshoring'). This applied especially to vital sectors such as medical technology and critical ICT technologies (such as cloud computing, micro- and nano-electronics).

In this context, this report begins by identifying the main drivers of industrial transformation before and after Covid-19. It then gives examples of how different advanced technologies could support recovery, diversification and resilience of manufacturing in the EU. After pointing out the key policy challenges for the industrial recovery, it finally analyses national policy responses to accelerate industrial recovery and puts forward best practices by giving examples of policy measures at national level that address these issues.

It is important to note that this brief does not aim to provide an exhaustive overview of all the different strategies and policies addressing industrial recovery but rather to give a brief description of practices in a selected number of EU Member States and highlight key policy challenges.

This report is based on desk research, expert assessment and interviews with policymakers.

¹<https://www.ciip.group.cam.ac.uk/reports-and-articles/role-industrial-digitalisation-post-covid-19-manuf/download/2020-10-08-DigitalBR.pdf>

²https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

Section 2

2. Key policy challenges of the industrial recovery

Key messages:

In the midst of the technological competition with the US and China, European industry is challenged to speed up technology uptake and adapt its business models. The EU needs to find its place promoting **more resilience in terms of supply chain transparency, predictability and flexibility** to production. The long-term competitive advantages that lie in **a sustainable, human-centered industry** should be also recognised and better promoted by taking into account the needs of society, our future workforce and customer base.

While 'Industry 4.0' reflected the highly transformative impact of a digital, data-driven and interconnected industry, the concepts on **'Industry 5.0' or even '6.0'** have emerged in the policy debate with the question of **how to make industries more future-proof, resilient, sustainable and human-centred**.

2.1 Main drivers of industrial transformation before and after the Covid-19 pandemic

Before the pandemic, digital transformation and the industrial internet were already paving the way of European industry forcing it to change or fall behind. Despite its research excellence in many fields, the EU has been facing serious gaps compared to the United States in digital technologies and it has been also losing ground against China in areas such as Artificial Intelligence or even Robotics. The EU's R&I performance compared to its global competitors (US and China) has raised concerns over future technological dependencies.

While the EU is still a global R&D 'powerhouse', accounting for almost 20% of R&D worldwide, it is threatened by global competitors in a number of innovation key indicators, including business expenditure on R&D (BERD), scientific excellence (top 1% cited publications) and patenting³.

Europe has been dependent on US Big Tech (such as Facebook, Amazon, Netflix, Google, Apple, Microsoft) and also on China (raw materials, components or the question of 5G). As often cited in media, the Covid crisis has made these challenges only bolder.

Alongside previous drivers for industrial transition such as competitiveness, productivity and growth, the Covid-19 pandemic has highlighted several new reasons for accelerating the industrial transformation in the EU, including:

- **Increasing resilience** in terms of e.g. supply chain transparency and predictability as well as flexibility to production. Although the debate to **bring critical industries back**

home is more nuanced in the EU, reconsidering value chains should be a priority both in national and European level economic strategies enhancing a more competitive industry base across the EU;

- **Greening industrial production** is becoming more and more a new pathway for growth both driven by public and private initiatives. Industries will need to undertake more green investments that respect the environment.
- **Creating not just a sustainable but a human-centered industry** should serve the needs of society and become a solution-provider for user needs. Following up the mission-driven research concept, industry should also lead the example to care about society.

While 'Industry 4.0' reflected the highly transformative impact of a digital, data-driven and interconnected industry, the concept on **'Industry 5.0' has emerged recently in the policy debate with the question of how to make industries more future-proof, resilient, sustainable and human-centred**. Covid-19 has been an important catalyst for the drive to actively shape and renew the role of industry in society and to connect digital transformation with societal goals such as environmental sustainability, human wellbeing and resilience.

As a recent Commission brief points out "*Industry 5.0 should not be understood as a chronological continuation of, or an alternative to, the existing Industry 4.0 paradigm. It is the result of a forward-looking exercise, a way of framing how European industry and emerging societal trends*

³ https://ec.europa.eu/info/sites/default/files/swd-strategic-dependencies-capacities_en.pdf

and needs will co-exist".⁴ Nonetheless, any naïve approach should be avoided. Companies will address societal challenges only if those challenges can be translated to market demand through policies and/or end-user behavioural changes. By developing innovative technologies such as AI, robotics or digital twins in a human-centric way, Industry 5.0 aims to support and empower workers, rather than make them redundant, to increase industry's resilience and to make it more sustainable.

2.2 The role of advanced technologies in supporting the recovery

Evidence from around the world shows that **advanced digital and green technologies** can play a key role in the post-Covid-19 **manufacturing recovery** (i.e. resuming operations), **diversification** (i.e. exploring new products and new markets) and **resilience** (i.e. preparing for supply/demand shocks and operational risks).⁵ Technology can thus help industries to adapt both during these turbulent times and in the longer term. According to McKinsey⁶, those companies that invest in innovation during a crisis outperform their peers during the recovery. Industry leaders could potentially achieve a greater productivity increase from investments in new technology than followers (70% vs 30%) according to a study from the World Economic Forum⁷.

Recent examples have shown that new technology, such as robotics in combination with 5G technology, is essential to facilitate reshoring.⁸ In addition, digital technology and automation is vital in order to increase EU resilience and competitiveness, for example by facilitating remote working, enhancing supply chain agility and monitoring infrastructure.

To give a few concrete examples, **Internet of Things (IoT)** applications can make it safe to return to work and also create future work experiences. New sensors can collect real-time data on occupancy, enabling employees to reserve workspaces and maintain social distancing. In addition, **Artificial Intelligence (AI)** can help build more resilient supply chains through advanced supply forecasting to predict demand and accurately plan manufacturing activities. **Additive manufacturing** also supports flexible production and agile response to demand fluctuations.

Moreover, new green technologies for a circular economy can also contribute significantly to creating autonomous production. Eco-innovation is only recently starting to be seen as a tool to boost productivity and growth but more and more strategic documents and commentators are making the **business case for the green transition**. Circular production processes produce less waste and use less of imported raw materials thereby decreasing dependency for such materials on third countries and creating additional revenue from existing products and processes.

As we can see, besides European technological leadership, European production sovereignty and industrial recovery are also becoming a feature of innovation policy. Research, development and innovation (RD&I) have been part of the solution to the health crisis (including better scientific understanding of the virus and the development of vaccines) but is also recognised as key to rapid economic and social recovery by accelerating the digital and ecological transformation of our societies. Technology, research and innovation have a key role to play in supporting the European economic recovery from Covid-19 by delivering economic and productivity growth, new jobs and at the same time in building a sustainable, inclusive and resilient economy.

2.3 Key policy challenges

The Covid-19 crisis has provided a unique opportunity to 'hit the reset button' and put our economy on a more digital and sustainable path. Digital and green technologies can make manufacturing more productive and less resource-intensive, and supply chains more resilient.

However, a number of obstacles exist in the process of accelerating the diffusion and uptake of advanced digital and green technologies to increase EU resilience and competitiveness. Alarming, recent studies show that the share of high growth enterprises headquartered in the EU27 and adopting advanced digital technologies is lower than in the US or in the UK in almost all the relevant technology domains (cloud computing, high-speed infrastructure, smart devices, big data analytics and artificial intelligence).⁹

The ATI General findings reports analyse the recent trends in the generation and uptake of advanced technologies in Europe. The findings of the ATI business survey¹⁰ show that the adoption

⁴ https://ec.europa.eu/info/news/industry-50-towards-more-sustainable-resilient-and-human-centric-industry-2021-jan-07_en

⁵ <https://www.ciiip.group.cam.ac.uk/reports-and-articles/role-industrial-digitalisation-post-covid-19-manuf/download/2020-10-08-DigitalBR.pdf>

⁶ <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/innovation-in-a-crisis-why-it-is-more-critical-than-ever#>

⁷ <http://reports.weforum.org/digital-transformation/files/2018/05/201805-DTI-Maximizing-the-Return-on-Digital-Investments.pdf>

⁸ <https://www.earto.eu/wp-content/uploads/EARTO-Paper-on-the-EU-Economic-Recovery-Package-19052020.pdf>

⁹ <https://publications.jrc.ec.europa.eu/repository/handle/JRC124469>

¹⁰ The Advanced Technologies for Industry Survey sample consisted of 1 500 interviews of European organisations with more than 10 employees in Denmark, France, Germany, Italy, Poland, Spain and Sweden. The survey was carried out between September and November 2020 and interviews were conducted through a web-based platform (CAWI –

of advanced technologies has increased compared with the previous year, although the economic crisis and contingency measures have severely tested the digital roadmaps of European industries and slowed down progress. The increase in the adoption of technologies has not reached the level of before-Covid expectations especially for some key enabling technologies such as Advanced Materials, Nanotechnology but even Artificial Intelligence. Overall, specific advanced technologies are playing a crucial role in reigniting European industries' return to growth. AI and IoT have been particularly useful, thanks to their impact in terms of achieving enhanced efficiency. Technology adoption and the development of tailored technological applications will, however, take time. The actual impact of the crisis on technology adoption will become visible only the following year or later.

There is a number of policy challenges to better promote the generation and uptake of advanced technologies by European industry after Covid. There is a need **to think both in terms of thriving for excellence and building critical mass, but also in terms of a balanced European development** securing access to opportunities. Existing regional disparities can condition the possibilities of regional industrial ecosystems to bounce back after Covid. External shocks such as Covid can escalate differences between regions. Stronger regions have more resources to manage the crises better and become even stronger with more emphasis on systematically facilitating longer term developments. On the contrary, weaker regions are forced to focus on addressing immediate problems and avoiding imminent collapses, which pulls resources away from longer term investments. While the pandemic has created a significant economic shock, the impact varied across regions with different industrial structure. To this end, rapid and responsive innovation and growth funding will be indispensable for supporting the industrial recovery and transformation.

Stronger **government-industry partnerships** are one of the major pillars to support a transformative economic recovery. Rethinking industry partnerships will be necessary to find joint innovative solutions for a fast and robust recovery in the aftermath of Covid. New partnerships can not only enable adaptation to a rapidly-changing landscape and technological context but also a better integration of industry into the social fabric taking more responsibility for their impact on our environment and our society.

Technology-based **startups and scaleups are expected to make a difference in the future path towards industrial recovery**. Investments in innovative SMEs (including startups) and midcaps are critical for the recovery as young and dynamic companies constitute the pipeline for future potential high growth companies. As a recent JRC report has pointed out, high growth enterprises make a disproportionately high contribution to job creation and economic growth and through their often technology-based character they can also have a significant impact on industrial renewal, sectoral productivity and regional competitiveness.¹¹ It should be pointed out that both debt and equity funding are important and it is vital to support the whole 'funding escalator' according to the age and the size of the company. While Europe has addressed early stage funding shortages by public support interventions, a growth funding gap still exists as the larger ticket sizes that scaleups need are rare to find outside very few better developed markets (France, Germany, Sweden).

Policymakers will be challenged to manage structural unemployment. Shifts in industrial structures are usually accompanied by shifts in demand in competences as history proved so far. The more rapid the change, the more severe will be the mismatch between the supply of and demand for skills.

Although new jobs are expected to be created through digitalisation, these new jobs will not be able to absorb the workforce that is becoming available due to current industrial challenges. If EU countries are successful to manage a fast recovery from the Covid crisis and allocate the recovery funds to digitalisation, green development, research and innovation, the structural unemployment problem might also further escalate.

Companies with low productivity and less skilled staff will survive less well increasing the availability of less skilled and competent workforce. Nevertheless, the new policy measures that support companies to invest in innovation will create an additional demand for skilled employees.

Skills development will need to be rethought. Industrial transformation needs not only re- and upskilling and more science, engineering and mathematics education **but people who have the skill to translate new technologies into more human value and prosperity**. The skills gap has been a long-standing issue and skill shortages are especially acute in software-related and engineering skills.¹² An increasing number of job activities are becoming reliant on advanced

Computer-Aided Web Interviews), as well as via a Computer-Aided Telephone Interviewing (CATI) system. Additional information on survey methodology can be found in the Advanced Technologies for Industry Survey - Methodological Report available here:

<https://ati.ec.europa.eu/reports/eu-reports/advanced-technologies-industry-methodological-report>

¹¹ Ibid.

¹²<https://op.europa.eu/en/publication-detail/-/publication/66cde22-6fdb-11ea-a07e-01aa75ed71a1>

technologies, for example telehealth activities, the use of digital twins (referring to the virtual representation of a physical object) in manufacturing, and the application of predictive analytics for forecasting demand and optimising supply chain management. These activities require significant training to ensure employees have the necessary digital skills to effectively perform current and future jobs. Covid-19 has dramatically accelerated this shift so it represents both a threat and an opportunity at the same time. In the times of the pandemic there is an increased risk for an interruption to the pipeline of new talent coming from the education system but at the same time a growing number of technology companies are creating more training opportunities for their teams to eliminate a key barrier to their own growth.¹³ Of course, the employers cannot bridge the gap by themselves so the entire higher education system is likely to evolve in the direction of focusing on employment outcomes. And this will require policy vision.

In the context of technology leadership and production sovereignty, Europe should ensure that it has the **proper technology infrastructure to support its key industrial ecosystems** and related value chains. European industries need to rely on these infrastructures to lower the risks of their own research, development and innovation investments, to further develop their innovation capacity and to support their business transformation and digitalisation fitting the EU Green Deal's ambitions.¹⁴

In this context, cybersecurity initiatives are another area to address. While there is a wealth of experience and expertise in cybersecurity research, technology and industrial development in the EU, *"the efforts of industrial and research communities are fragmented, lacking alignment and a common mission, which hinders competitiveness and the effective protection of networks and information systems"*¹⁵. To address this challenge, the European Commission announced its intention to create a Cybersecurity Competence Centre Network with three components: a European Cybersecurity Industrial, Technology and Research Competence Centre (ECCCC), a Network of National Cybersecurity Coordination Centres (NCCCs), and the Cybersecurity Competence Community (the Community) in December 2020¹⁶.

On the one hand, the pandemic has highlighted the need for robust research and digital infrastructure. More European initiatives will be necessary to build own capacities for instance around Big Data, Cloud and Cybersecurity but also to strengthen research infrastructure in biotech or advanced manufacturing. In this field, one ongoing pan-European project is GAIA-X, launched by ministers from France and Germany in 2019 with the aim to establishing a unified cloud ecosystem and interoperable data exchange. The system is expected to see various suppliers of cloud services linked up and serve European industries. It will also act as a repository for businesses looking for specific data services. According to the current setup, any cloud provider across the world can be part of GAIA-X as long as they follow a compatible architecture¹⁷.

On the other hand, uneven access to technology infrastructure and the resulting inequalities in terms of opportunities is a key issue that limits the diffusion of technologies. The ATI technology centre mapping analysis¹⁸ found that despite a wide offer of technological services in Europe, the support is not always used by industry. The technological offer throughout Europe is often only known and accessible to a narrow community, e.g. the local ecosystem of a pilot line, but not to geographically or thematically more distant organisations. A further problem is that the offer often addresses only one aspect of the innovation journey or one part of the value chain.

Global standards have an important role to play in supporting safer investment decisions and thus economic recovery strategies. Industrial success in fields such as hydrogen, batteries, medical devices or chemicals need international standards where the EU should remain in the driving seat. The above-mentioned Gaia-X is expected to provide common set of standards and rules for data storage and transfer for all cloud services.

¹³ <https://www.edsurge.com/news/2021-02-01-covid-19-has-widened-the-skills-gap-but-it-also-presents-an-opportunity-to-close-it>

¹⁴ <https://www.earto.eu/wp-content/uploads/EARTO-Paper-on-the-EU-Economic-Recovery-Package-19052020.pdf>

¹⁵ Final regulation proposal / agreement 2020 "European Cybersecurity Industrial, Technology and Research Competence Centre and the Network of National Coordination Centres"

¹⁶ Ibid

¹⁷ <https://techmonitor.ai/technology/cloud/what-is-gaia-x-eu-data-sovereignty>

¹⁸ ATI Recommendations for action to improve SMEs' access across Europe to Advanced Technology Centres, 2021 available at: <https://ati.ec.europa.eu/reports/eu-reports/recommendations-action-improve-smes-access-across-europe-advanced-technology>

Section 3

3. Policy strategies and policy measures

Key messages:

The 2020 EU Industrial Strategy was updated in May 2021 to reflect the new circumstances arising from the Covid-19 pandemic. The Strategy offers new measures to accelerate the twin green and digital transitions by investing in re- and upskilling and co-creating transition pathways in partnership with industry. The EU will be, however, challenged to defend its industrial values against global trends and do a balancing act to support industrial development, environmental and social responsibility and recreate/protect jobs.

Thinking ahead post-Covid-19, national governments in the EU27 (but also globally) are grappling with the problem of turning their industries more resilient against global shocks. Key policy discussions focus on digital transformation, sustainable industry and strengthening supply chains. A main part of the solution is seen in more accelerated technological transformation.

3.1 European policy context

The current European industry policy context is burdened not only by the Covid-19 pandemic, but other international policy challenges such as the US-China trade tensions including the competition for stronger tech and industrial supremacy but also the aftermath of Brexit. The US-China tensions give further motivation to the EU to develop its own digital capabilities¹⁹. Today, Europe's future resilience is seen "*in boosting an open strategic autonomy and building a fairer, climate-neutral and digitally sovereign future*".

A more interventionist approach towards industrial development has gained ground in some European and national policies already before the pandemic and amplified by the pandemic. Industrial and technological ambitions are in the centre of the recovery measures.

The 2020 **EU Industrial Strategy** was updated in May 2021 to reflect the new circumstances arising from the Covid-19 pandemic and the new needs resulting from the European industry. The updated Strategy reaffirms the priorities set out in the March 2020 Communication and takes into account the lessons learned from the crisis to boost the recovery and enhance the EU's 'open strategic autonomy'. It proposes new measures to strengthen the resilience of the Single Market, especially in times of crisis, including a Single Market Emergency Instrument and strengthening market surveillance of products. The updated strategy also addresses the need to better understand Europe's dependencies in key

strategic areas so it presents the results of six in-depth reviews (on raw materials, batteries, active pharmaceutical ingredients, hydrogen, semiconductors and cloud and edge technologies) providing further insights on the origin of strategic dependencies and their impact.

At the EU level, the **Industrial Forum**²⁰ was set up in January 2021 as a new mechanism to support the Commission in its analysis of industrial ecosystems and in assessing the related risks and needs of industry in facing the challenges of our times.

The Strategy also supports new industrial alliances²¹ in strategic areas where such alliances are the best tool to accelerate activities that would not develop otherwise. The Commission is preparing the launch of the Alliance on processors and semiconductor technologies and the Alliance for Industrial Data, Edge and Cloud, and considering the preparation of an Alliance on Space Launchers as well as on Zero Emission Aviation.

In addition, the Industrial Strategy offers new measures to accelerate the twin green and digital transitions by investing in re- and upskilling and co-creating transition pathways in partnership with industry, public authorities and other stakeholders, starting with tourism. Finally, the updated Strategy also responds to calls to identify and monitor the main indicators of the competitiveness of the EU economy as a whole: single market integration, productivity growth,

¹⁹ See also: https://ecfr.eu/publication/europe_digital_sovereignty_rule_maker_superpower_age_us_china_rivalry/

²⁰ https://ec.europa.eu/growth/industry/policy/dialogue-expert-advice_en

²¹ Industrial alliances are already used as one of the delivery vehicles for existing EU strategies including in the fields of hydrogen, raw materials and plastics.

international competitiveness, public and private investment and R&D investment.

The SME dimension is considered by the Commission to be at the core of the updated Strategy with tailored financial support and measures to enable SMEs and innovative startups to embrace the twin transitions.

The major European funding programmes that support industrial recovery and transformation at the EU level are the Recovery and Resilience Facility, the Digital Europe Programme, the Horizon Europe programme, as well as recent actions announced under the Digital Decade Communication and the Action plan on synergies between civil, defence and space industries (including the EU Observatory of Critical Technologies). IPCEIs²² (Important Projects of Common European Interest) and industrial alliances can also play important roles in specific sectors, where proved well targeted, justified and efficient tools. The recent ATI Report on Technological trends and policies²³ presents a more detailed overview of each of these key EU programmes and initiatives.

3.2 National policies

Thinking ahead post-Covid-19, national governments in the EU27 (but also globally) are grappling with the problem of turning their industries more resilient against global shocks. A main part of the solution is seen in more accelerated technological transformation.

This section provides a broad and non-exhaustive overview of the types of policy support addressing the industrial recovery at national level. These range from tax incentives, credit guarantees, equity support to direct grants. The Recovery and Resilience Facility will be a major vehicle to fund national measures. Current plans allocate at least 20% of the funds on digital transformation. They also devote at least 37% of the total expenditure on reforms that support climate objectives and foster investment in low carbon and circular industrial technologies. Some of the relevant policies listed in the available national recovery plans are also mentioned.

The measures build on existing policy instruments and aim at accelerating in particular digital transformation trends. There are some common elements that are summarised below:

- Industrial recovery is placed in the context of enabling a **green, digital and social transition** of industry.

- One of the important goals of governments is the protection of jobs and recovery of key economic sectors. Industries that have been particularly troubled during the lockdown periods are beneficiaries of research and innovation measures such as automotive, aerospace, tourism or retail.
- **Reindustrialisation** is debated in many national policy circles in the context of further digitalising factories, increasing production capacities and relocating economic activity.
- **Enhancing the operational capacities of SMEs and midcaps** is among the core policy targets at the national level, in line with the spirit of the EU Industrial Strategy.

Short term measures fostered investment in research, development and innovation and helped to take some more steps towards digitalisation, however, the overall amounts per company have been limited. The impact of the recovery and resilience plans is still to be seen on industrial transformation.

France

The French government has mobilised its financial resources to support industrial recovery and transformation with the so-called 'third rectifying finance law' adopted in July 2020. This law enabled the implementation of several measures to support the industry not just in terms of recovery but also to **step up a gear to an ecological, digital and social transition**, make the economy more resilient and inclusive²⁴.

Digital acceleration measures are a key priority of the recently launched 'France Relance' strategy that represents a key opportunity with important subsidies targeting fields such as artificial intelligence, robotics, human-robot interaction, augmented and virtual reality, sensor networks, but also resource efficiency and low-carbon technologies. The French 'Future Industry Alliance' has promoted widely that "*investing massively in digital technology is the only way to move the country up a gear*". Creating industrial digital roadmaps is one of the actions being widely promoted.

Besides some of the key sectors such as automotive, aerospace and transportation, the majority of the subsidy is aimed at helping SMEs and also mid-sized companies. As part of the recovery plan, the government is mobilising €140 m in 2021 to support investment dynamics. The support is channeled through existing initiatives such as for instance the **French Fab**²⁵ that will provide €45 m in loans to promote

²² E.g. the IPCEI on Microelectronics <https://www.ipcei-me.eu/what-is/>

²³ <https://ati.ec.europa.eu/reports/eu-reports/eu-report-technological-trends-and-policies>

²⁴ France Relance (2021). Les dispositifs à destination des entreprises industrielles

²⁵ <https://www.lafrenchfab.fr/>

industrial investment. Established in 2017, the French Fab brings together the French industry with a vision for a digital and technology-driven future. Another example is the '**Aid for transformative investment in the industry of the future**' measure that aims to support industrial SMEs and midcaps in adopting digital and other new technologies (additive manufacturing, robotics, virtual or augmented reality, design software, non-destructive testing, etc.). The aid takes the form of a subsidy for the acquisition of a property recorded as a fixed asset and assigned to an industrial activity on French territory.²⁶ '**AI Booster**' is an innovative measure to support SMEs and midcaps in their digital transformation using artificial intelligence technologies. Companies are supported throughout their transformation process, from the audit phase to the choice of the solution and its implementation, by integrating a reflection on the evolution of workstations, trades and skills.

The action '**Structuring research and development projects for competitiveness**'²⁷ has a budget of €70 m to support collaborations between industrial and academic actors. The objective is to strengthen the position of French companies in growth markets and support industrial research and experimental development. To be eligible, projects must be collaborative (at least one public research organisation and two companies), led by a company carrying out R&D work and have as their objective the development of one or more products, processes or services, not available on the market and with a high innovative content.

In February 2021 the French government has also launched the roadmap called '**Digital and environment**'²⁸. The objectives of this roadmap are manifold. It aims to improve knowledge about the impact of digital technology on the environment, support a more responsible digital environment and to use the potential of digital technology for an ecological transition.

Poland

The Polish economy has been relatively resilient and managed to minimise the economic impact of the pandemic²⁹. The National Recovery and Resilience Plan amounts to approximately €60 bn for Poland³⁰. The plan addresses three thematic objectives notably green energy and sustainable mobility, strengthening the quality of the healthcare system and resilient and competitive

economy and digital transformation. Horizontal measures such as digitalisation, green transition, cybersecurity, reindustrialisation and a modern society are complemented with sectoral specific measures.

As part of the works related to the National Recovery and Resilience Plan, the Ministry of Economic Development has prepared 86 projects in dialogue with representatives of Treasury companies, companies, experts and voivodeship authorities. The projects prepared by the Ministry of Economic Development relate to the following areas:

- microelectronics,
- support for the production of medicinal products and establishing a biotechnological hub,
- construction of a network of cognitive factories,
- development of the space sector and earth observation,
- development of prosumer energy and wind farms,
- construction and energy efficiency of buildings,
- support for health resort cities and
- establishing facilities for the construction of offshore farms.³¹

The support planned includes a range of tax and regulatory simplifications to help attract investments to Poland and to support domestic business.

Germany

The German government has established a €2 bn fund for startups and a €130 bn stimulus package, including additional loans and support for SMEs through public venture capital investments. The policy objective is to ensure that highly innovative and promising startups and small businesses continue their growth by providing venture capital funds with additional public funding to enable investors to finance highly innovative and promising startups even during the Covid pandemic.

The Federal Ministry for Economic Affairs and Energy (BMWi) supports small and medium-sized enterprises (SMEs) with the 'Digital Now -

²⁶<https://www.economie.gouv.fr/plan-de-relance/profils/entreprises/aide-investissement-industrie-du-futur>

²⁷ France Relance (2021). Les dispositifs a destination des entreprises industrielles

²⁸ <https://www.economie.gouv.fr/environnement-numerique-feuille-de-route-gouvernement#>

²⁹

https://ec.europa.eu/economy_finance/forecasts/2020/summer/ecfin_forecast_summer_2020_pl_en.pdf

³⁰ <https://www.gov.pl/web/planodbudowy>

³¹ <https://www.gov.pl/web/development-labour-technology/the-national-recovery-and-resilience-plan-amounts-to-approximately-60-billion-for-poland>

Investment Funding for SMEs³² programme so that medium-sized companies can exploit the economic potential of digitalisation. The programme offers financial grants and aims to encourage companies to invest more in digital technologies and in the qualification of their employees.

In addition, the 'Go Digital' initiative helps small and medium-sized companies access IT consultancy services. With its three modules 'Digitised Business Processes', 'Digital Market Development' and 'IT Security', 'Go Digital' is aimed specifically at SMEs in the commercial sector and the skilled trades. The programme offers practical consulting services to keep pace with technological and social developments in the field of online trading, the digitisation of everyday

business and the increasing need for security in digital networking.

Furthermore, under its 'development of digital technologies' portfolio, the Federal Ministry for Economic Affairs and Energy provides funding for pre-commercial research and development projects. The aim of this work is to pick up on key ICT trends at an early stage and to accelerate the process of transferring scientific findings into marketable state-of-the-art technology with high-level potential for practical applications.³³

Finally, the draft German Recovery and Resilience Plan³⁴ mentions a number of measures planning to promote the digitalisation of the economy as presented in Table 1.

Table 1: Measures promoting the digitalisation of the economy in Germany (€t = in thousand €)

Title of measure	Volume in €t	Climate	Digital	Reform	CSR	EU flagship
Investment programme for vehicle manufacturers/supplier industry	1.898.500	✓	✓	✓	Investments in alternative drive systems, digitalisation and automation, particularly research and innovation, education, digital skills	6. Scale-up
Federal programme "Development of skills alliances"	40.000		✓	✓	Investment in education, the digital transition, particularly digital skills, skill levels of disadvantaged groups, conditions for higher wage growth	7. Reskill and upskill
Bundeswehr Digitalisation and Technology Research Centre (DTEC.Bw)	700.000		✓		Investment in the digital transition, particularly research and innovation	
Promotion of digitalisation of the railways through replacement of conventional signal boxes/ fast-track programme to accelerate the roll-out of "Digital Rail Germany"	500.000	✓	✓		Investment in the digital transition, particularly sustainable transport; bringing forward public investments	

Source: draft German Recovery and Resilience Plan, 2021

Note: CSR= country-specific recommendations issued in the context of the European Semester, EU flagships = The European Commission encouraged Member States to include in their plans investment and reforms in seven flagship areas: 1. Power up, 2. Renovate, 3. Recharge and Refuel, 4. Connect, 5. Modernise, 6. Scale-up, and 7. Reskill & Upskill.

Finland

In Finland as in other countries key policy discussions focus on digital transformation, 'antifragile' and sustainable industry and stronger supply chains. A current policy question highly debated is how to reindustrialise Finland and the local production. More manufacturing is strictly linked to environmentally friendly practices, re-and de-manufacturing, leading to less waste and reduced emissions³⁵.

The objective to turn into an Industry 6.0 mode is defined as "ubiquitous, customer-driven, virtualised, antifragile manufacturing that is characterised on one hand by customer-centric, highly customised thinking, on the other hand by hyper-connected factories, with dynamic supply chains, where data flows across domains".

Policy measures have been put in place to foster innovation during the Covid crisis, but mostly through existing instruments.

³² <https://www.bmwi.de/Redaktion/DE/Dossier/digital-jetzt.html>

³³ <https://www.bmwi.de/Redaktion/EN/Dossier/digitisation.html>

³⁴ https://www.bundesfinanzministerium.de/Content/EN/Downloads/2021-01-13-german-recovery-and-resilience-plan.pdf?__blob=publicationFile&v=

³⁵ Business Finland (2021)

The two instruments specifically designed to mitigate the negative impacts of the Covid pandemic on businesses were the following:

- De-minimis based funding available until June 2020³⁶
- Temporary loan available until October 2021³⁷

The temporary research, development, and innovation loan launched by Business Finland has been intended for limited liability (private and publicly listed) SMEs and midcap-companies employing at least six people and operating in Finland and for foundations and associations doing significant business. Eligible for funding were those companies, foundations and associations that are through development seeking new means of coping with the disruptive circumstances in their businesses³⁸.

It is worth noting that these measures were criticised for not addressing the real problems caused by the Covid crisis and the most affected sectors. The average support per company was also relatively small at the end.

The Finnish Recovery and Resilience Plan³⁹ was published on 26 May 2021 as part of the Sustainable Growth Programme for Finland. The plan is very well aligned with the EU priorities and focuses on 4 main areas (the estimated volumes are a total amount of €2.1 bn for the period 2021-26):

- 1) Green transition will support the structural adjustment of the economy and underpin a carbon-neutral welfare society (approx. €825 m)
- 2) Digitalisation and a digital economy will support the digital transition (approx. €234 m)
- 3) Raising the employment rate and skill levels (approx. €638 m)
- 4) Access to health and social services (approx. €405m)

Italy

In Italy the **Impresa 4.0** National Plan⁴⁰ is the foundation on which the country's Recovery Plan is based. It comprises a number of comprehensive measures promoting investment in innovation and competitiveness of companies by supporting private investments, the digitalisation of industrial processes, improvement in workers' productivity, as well as the development of new skills, new products and new processes. Among the specific policy instruments there are mostly tax incentives and credit guarantees:

- **Tax credits** for investments in capital goods (replacing the previous super-amortisation and hyper-amortisation) ranging from 6 to 40%.⁴¹ There are new tax incentives also for research and development activities (12% tax credit up to investments of €3 million), ecological transition (10%) and technological innovation (6% on a maximum investment of €1.5 million).
- **Tax credit for Training 4.0** to support the expenditure on employee training in technology areas envisaged by the National Plan Impresa 4.0 and to fill the skills gap.
- **Tax break for investment in startups** (a 30% break on personal income tax for investments up to €1 m, or a 30% deduction from corporate income tax basis, up to €1.8 m) for innovative startups and SMEs.
- **Guarantee fund for SMEs** supporting businesses and professionals who have difficulty accessing bank loans because they do not have sufficient collateral.
- **Nuova Sabatini** (contribution for interest payments for bank loans) supporting businesses requesting bank loans to invest in new capital goods, machinery, factory equipment and digital technologies (hardware and software).

The table below (extract from Italy's Recovery Plan) shows the lines of intervention the country has planned in the area of '**Digitalisation, Innovation and Competitiveness of the production system**'.

³⁶ <https://www.businessfinland.fi/en/for-finnish-customers/services/funding/disruptive-situations-funding-and>

³⁷ <https://www.businessfinland.fi/en/for-finnish-customers/services/funding/rdi-loans-in-disruptive-circumstances>

³⁸ <https://www.businessfinland.fi/en/whats-new/calls/2021/business-finland-introduces-new-temporary-rdi-loans-for-large-employers-to-overcome-the-effects-of-the-coronavirus-crisis>

temporary-rdi-loans-for-large-employers-to-overcome-the-effects-of-the-coronavirus-crisis

³⁹ <https://vm.fi/en/finlands-recovery-and-resilience-plan>

⁴⁰ <https://www.mise.gov.it/index.php/it/transizione40>

⁴¹ <https://www.esa-automation.com/en/industry-4-0-and-new-italian-tax-incentives-in-2020/>

Table 2: Lines of intervention in the area of digitalisation and competitiveness in Italy

M1C2 – Digitisation, innovation and competitiveness of the production system	Resources (EUR/billion)				
	Existing (a)	New (b)	Total (c) = (a)+(b)	REACT-EU (d)	TOTAL NGEU (c) + (d)
'Transition 4.0'	3.10	15.70	18.80	-	18.80
Innovation and technology of microprocessors	-	0.75	0.75	-	0.75
SME digitisation and Guarantee Fund *	-	-	-	0.80	0.80
Broadband, 5G and satellite monitoring	1.10	3.10	4.20	-	4.20
Fast Connections	1.10	2.20	3.30	-	3.30
Satellite constellation and National Institute of Earth Observation	-	0.90	0.90	-	0.90
Industrial policies for the supply chain and internationalization**	-	2.00	2.00	-	2.00
TOTAL	4.20	21.55	25.75	0.80	26.55

* Financing with React-EU.

** Includes leveraged intervention lines.

Source: Italy's Recovery Plan, 2021 available at <https://www.mef.gov.it/en/focus/The-Recovery-and-Resilience-Plan-Next-Generation-Italia/>

Notes: MIC2 refers to the number of the mission addressed by the plan, REACT-EU refers to Recovery Assistance for Cohesion and the Territories of Europe, NGEU refers to NextGenerationEU

Section 4

4. Policy considerations

The Covid crisis has forced European policymakers and industry stakeholders to take new measures that can help industrial restructuring and the adaptation to the changing realities. Current national recovery and resilience plans are bold and aim at fostering digitalisation, protecting the climate or supporting resource efficiency. The success of implementing these plans will depend on several factors. This policy brief wants to raise the following points for policy considerations:

Sustained financing will be essential to reach the necessary transformational effects and stimulate a technology-based industrial recovery. Building on the successful mobilisation of public and private efforts to tackle the Covid-19 outbreak, the industrial recovery is expected to accelerate the digital and ecological transformation of our societies, with a particular focus on the European Green Deal (as the new European Growth Strategy) and giving a clear signal to industry, investors and consumers. According to the OECD Green Recovery Database green recovery measures are still a relatively small component of overall stimulus packages - while the €373 bn of environmentally positive recovery measures⁴² (including the Next Generation EU fund) is clearly a significant investment in driving a more sustainable recovery.⁴³

Nonetheless, funding alone will be not enough. Smart political decisions are needed to foster new partnerships. The digital transition is expected to happen faster since companies might not have a choice, while the green transition will need more political boost. Nevertheless, **creating the right networks around leading companies** (both large and key digital/circular startups and scaleups) **will be critical to help diffusing advanced technological solutions**. The green transition will need to be speeded up by concrete political measures and not only plans. Large-scale single investments will have longer lead times, hence the urgency of these measures are even more pertinent.

Besides focusing on industrial technologies, a successful recovery and transformation will depend also on new business models and service

innovation. Recovery programmes will need to put these objectives back on their agenda more explicitly.

Industrial alliances and public-private partnerships will need to avoid institutionalising current structures that might make industries less resilient to further external shocks. They should remain continuously open to new partners with a longer term focus (on radical innovation for next generation solutions instead of incremental innovation to improve current solutions only). The external dynamics should be also monitored and the partnerships be adapted whenever necessary with strong requirement for exit planning. Industrial alliances should be complemented by periodical launch of new alliances (some may be based on previous alliances, but with new partners and new focus).

Policy will need to balance short-term measures that address urgent problems **and long-term actions** that help a positive industrial transition. Policy measures that aim at protecting existing industries can lead to safeguard sectors and companies, which in longer term will inevitably fail, thus preventing resources to be moved to emerging and other sectors with better growth potential. This might slow down the inevitable and necessary 'creative destruction' process that is needed for transforming the local industry and economy.

Policymakers will need to ensure better alignment across policies at various levels and over time. There is a clear need to ensure alignment between the short-term objectives of boosting income, jobs and growth with long-term environmental commitments (for example with net-zero emissions goals) and enhancing resilience. Policy responses should not contribute to locking in existing industrial structures or going back to business-as-usual. In addition, **synergies between funding programmes** should be sought and the **EU industrial and research, development and innovation policies should be linked together**. For example, the target of the new EU Economic Recovery Package in terms of technology deployment and industry creation should be aligned with the funding measures of

⁴² https://ec.europa.eu/info/strategy/recovery-plan-europe_en

⁴³ <https://www.oecd.org/coronavirus/policy-responses/the-oecd-green-recovery-database-47ae0f0d/>



Horizon Europe. The EU has already made steps in the right direction by consolidating and streamlining funding programmes and objectives under the New Multiannual Financial Framework.

The skills challenge and the need for transforming education systems is well-known. As part of the industrial recovery, policymakers will need first to **manage the accelerated pace of change and short-term structural unemployment issues**. Current measures to retrain and upskill staff and support life-long learning will work in the long

term, but the faster the current changes happen, the more severe the structural mismatches in labour supply and demand will be in the coming years.



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About the 'Advanced Technologies for Industry' project

The EU's industrial policy strategy promotes the creation of a competitive European industry. In order to properly support the implementation of policies and initiatives, a systematic monitoring of technological trends and reliable, up-to-date data on advanced technologies is needed. To this end, the Advanced Technologies for Industry (ATI) project has been set up. The project provides policymakers, industry representatives and academia with:

- Statistical data on the production and use of advanced technologies including enabling conditions such as skills, investment or entrepreneurship;
- Analytical reports such as on technological trends, sectoral insights and products;
- Analyses of policy measures and policy tools related to the uptake of advanced technologies;
- Analysis of technological trends in competing economies such as in the US, China or Japan;
- Access to technology centres and innovation hubs across EU countries.

You may find more information about the 16 technologies here: <https://ati.ec.europa.eu>.

The project is undertaken on behalf of the European Commission, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs and the European Innovation Council and SMEs Executive Agency (EISMEA) by IDC, Technopolis Group, Capgemini, Fraunhofer, IDEA Consult and NESTA.

