



*October 2020*

# Advanced Technologies for Industry – Policy brief

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Meeting the sectoral skills challenge in advanced  
technologies

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## Section 1

### 1. Background

Skills and talent are key to enable the digital and technological transformation process and safeguard the competitiveness of European industry given the fact that innovation comes from the creativity and skills of individuals. While investment in new technologies offers the opportunity to re-shore manufacturing in Europe, a lack of skills can create bottlenecks in this process<sup>1</sup>.

With technological change, skills become outdated more quickly than in the past, and the need for new skills emerges at an unprecedented speed<sup>2</sup>. Without proper skill anticipation, these fast changes in the skills requirements create a gap between the skills supply, that is outdated, and the skills demand, for which not enough workers have the competences<sup>3</sup>. Europe is also facing a gender divide where women are not participating in digital society as much as men do.

Solving the skills gap requires to focus on skills development, but also on supporting the transition from education to work, and on matching skills supply with demand<sup>4</sup>. Regarding skills development, the existing gaps are less related to shortcomings in youth education than to the lack of lifelong learning at the workplace, a crucial element to allow the workforce to develop the adequate skills at the right time.

Nurturing a technological talent pool will need a stronger training strategy through master's programmes in cutting-edge digital technologies, training of digital specialists, short-term specialised training courses in advanced digital technologies and life long learning courses. Many of these are already addressed by the Digital Europe Programme<sup>5</sup>.

In addition to the labour market challenges caused by the global transformational trends, the COVID-19 pandemic has reinforced the climate of uncertainty related to the future of jobs<sup>6</sup>. The crisis has shifted the attention to the importance of having the right skills for strategic sectors to be able to adapt quickly to changing circumstances.

The growing awareness of our societies' vulnerability to external shocks and the coming

global recession will affect the European economy and push towards an accelerated transformation of the labour market. A disruption in EU jobs and skills is expected in the short and medium-term, notably due to the mandatory and voluntary social distancing practices<sup>7</sup>. More specifically, it is estimated that in the EU, 45 millions jobs (23% of the EU27 employment) are at very high risk of COVID-19 disruption<sup>8</sup>, but depending on their level of digitalisation and their possibilities of compliance with social distancing measures, all sectors will be affected differently.

A recent study<sup>9</sup> provides an assessment of the sectors that are the most at risk of disruption and finds that the most vulnerable industries are "accommodation and food services", followed by "wholesale and retail trade, sales, shop" and "social and personal services". The low digital intensity of these sectors is a key determinant in their exposure, which emphasises the importance of accelerating the digital transformation to strengthen the resilience of the economy.

Nevertheless, even a society ruled by advanced technologies such as Artificial Intelligence (AI) requires a revaluation of human soft skills. AI cannot replace interpersonal skills such as empathy or cooperation and talent for soft digital skills, such as user centricity and learning is also highly necessary<sup>10</sup>.

In this context, the objective of this analysis has been to:

- Analyse the skills challenge for advanced technologies in the EU and other global competitors in particular for six selected sectors,
- Review the European policy framework supporting advanced technology skills especially for sectors and provide examples for sectoral skills initiatives at national level.

This study is based on the analysis of LinkedIn data and a comprehensive desk research.

<sup>1</sup> [https://ec.europa.eu/growth/industry/policy/skills\\_en](https://ec.europa.eu/growth/industry/policy/skills_en)

<sup>2</sup> [https://www.cedefop.europa.eu/files/3083\\_en.pdf](https://www.cedefop.europa.eu/files/3083_en.pdf)

<sup>3</sup> <https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition>

<sup>4</sup> [https://www.cedefop.europa.eu/files/3080\\_en.pdf](https://www.cedefop.europa.eu/files/3080_en.pdf)

<sup>5</sup> <https://ec.europa.eu/digital-single-market/en/europe-investing-digital-digital-europe-programme>

<sup>6</sup> [https://www.cedefop.europa.eu/files/4186\\_en.pdf](https://www.cedefop.europa.eu/files/4186_en.pdf)

<sup>7</sup> [https://www.cedefop.europa.eu/files/3082\\_en.pdf](https://www.cedefop.europa.eu/files/3082_en.pdf)

<sup>8</sup> [https://www.cedefop.europa.eu/files/6201\\_en.pdf](https://www.cedefop.europa.eu/files/6201_en.pdf)

<sup>9</sup> *ibid*

<sup>10</sup> Cappellini (2017). The digital talent gap

## Section 2

### 2. European industry performance in advanced technology skills

The capacity of industrial sectors across countries differs a lot in terms of attracting and retaining talent with advanced technology skills. Within the manufacturing industry, it is the **Automotive and Electronics industries that currently attract most skills especially in advanced manufacturing, Internet of Things** but also other digital technologies such as Cloud and Artificial Intelligence.

The EU27 and US exhibit similar patterns, however, while **in the EU27 skills are more concentrated in some of the manufacturing sectors such as Automotive**, in the US advanced technology skilled professionals are **more distributed across sectors, which might also indicate a better penetration of technological skills** throughout the US economy and hence adoption.

A stronger effort to **hire digitally skilled professionals in sectors such as Medical devices and Chemicals** could unlock their potential and could help facing the fast move of tech firms into these areas.

The digital economy is transforming the workplace in all occupations. **Engineers and professional staff are the most equipped with skills in advanced digital technologies**, while managers and chief executives but also production workers are less knowledgeable in these fields.

**Talent mobility** across sectors is prominent where manufacturing industries are able to capture talents from several other sectors, but almost all face a competitor sector against which they lose talents.

Skills **inequality between genders** is an important challenge. In some countries such as Italy and Romania, the share of women employees with advanced technology skills is around 30%. On the other hand, Czechia displays the highest gender gap, with 81% of workers with advanced technology skills being men, closely followed by Germany.

High-tech and digital jobs are increasingly required in every industry and sector. Nevertheless, the capacity of industrial sectors differs a lot in terms of attracting and retaining talent with advanced technology skills. The gap between the workers' skills portfolio and market needs depends on numerous factors, including the country's economic situation, the ageing of the working population and technological trends<sup>11</sup>. The skills gap is a global industrial challenge and concerns workforce development both in the short and long-term.

In this section, we provide new evidence about the employment of skilled professionals across industries and countries at the level of individual advanced technologies<sup>12</sup> relying on data from the self-reported skills of professionals in LinkedIn, a widely used and accepted online job platform. We bring examples from six industries notably

automotive, agri-food, medical devices, chemicals, textiles and electronics<sup>13</sup>.

To harvest the data from LinkedIn, keywords capturing skills by advanced technology have been defined and queries have subsequently been constructed to filter the database by location and industry. LinkedIn represents a different sample of the workforce in Europe, across European countries and the US and as a result it needs a correction in order to confidently generalise to the total population and allow for comparison. The representativeness of the LinkedIn sample has been assessed against several criteria including the level of education, gender and the share of registered users in information and communications technology and science and engineering compared to the actual active population in these fields in each individual country resulting in a corrective weighting. The detailed methodology, the analysis of the

<sup>11</sup> European Commission Blueprint for Sectoral Cooperation on Skills: Towards a Common Vision on addressing SMEs skills needs in the automotive sector: strengthening the development of upskilling and reskilling strategies

<sup>12</sup> Advanced technologies are defined as recent or future technologies that are expected to substantially alter the business and social environment and include Advanced Materials, Advanced Manufacturing, Artificial Intelligence,

Augmented and Virtual Reality, Big Data, Blockchain, Cloud Technologies, Connectivity, Industrial Biotechnology, the Internet of Things, Micro and Nanoelectronics, Mobility, Nanotechnology, Photonics, Robotics and Security.

<sup>13</sup> The choice of industries follows the availability of data at the time of writing this report but further sectors will be explored later on within the ATI project.

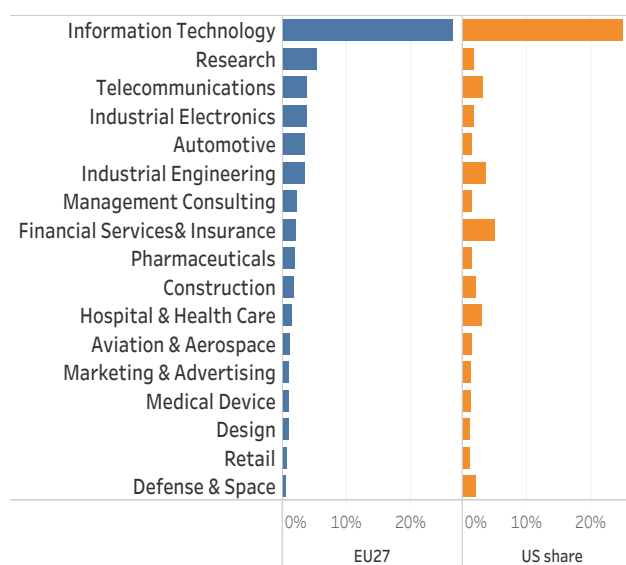
representativeness and the caveats in interpreting the data are further explained in the ATI methodological report available on the ATI website (ati.ec.europa.eu).

## 2.1 Professionals with advanced technology skills across sectors

To underpin the technological transformation journey of firms, employees need to be equipped with advanced technology skills. These technologies include digital technologies such as Artificial Intelligence or Cloud computing but also other enabling technologies such as Industrial Biotechnology or Nanotechnology.

Figure 1 shows the distribution of advanced technology skilled human resources across industries and sectors in the EU27 and in the US based on LinkedIn data. The results show that besides the ICT sector and research and academia, professionals with advanced technology skills have been employed most in the Telecommunication, Electronics and Automotive industries in the EU27 in the first semester of 2020. Sectors employing the lowest number of advanced technology talent include public policy, music, printing, furniture and farming.

Figure 1: Distribution of advanced technology skilled professionals across top sectors and industries in the EU27 and US, 2020



Source: Technopolis Group based on LinkedIn analysis

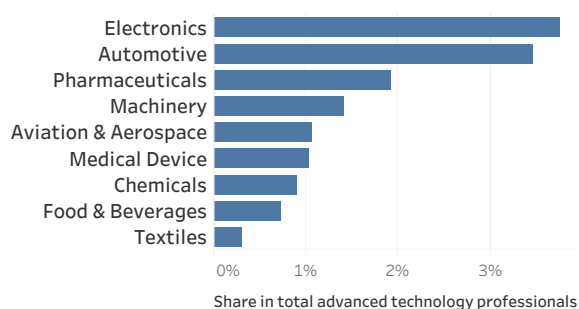
In the US, we observe similar patterns but Telecommunications is followed by Financial services and Insurance. Defense&Space is also among the sectors employing the highest share of these skills. In contrast, in the EU27 skills are more concentrated in some of the manufacturing

sectors such as Automotive or industrial Electronics.

Another difference between the two economic powers is that advanced technology skilled professionals are more distributed across sectors in the US than in the EU, which might indicate a better penetration of technological skills throughout the US economy and hence a stronger adoption of advanced technologies.

When looking at manufacturing industries (Figure 2), we find that it is the Electronics industry that employed the highest number of advanced technology skilled professionals followed by Automotive, Pharmaceuticals and Machinery in 2020.

Figure 2: Manufacturing sectors employing advanced technology skilled professionals in the EU27, 2020



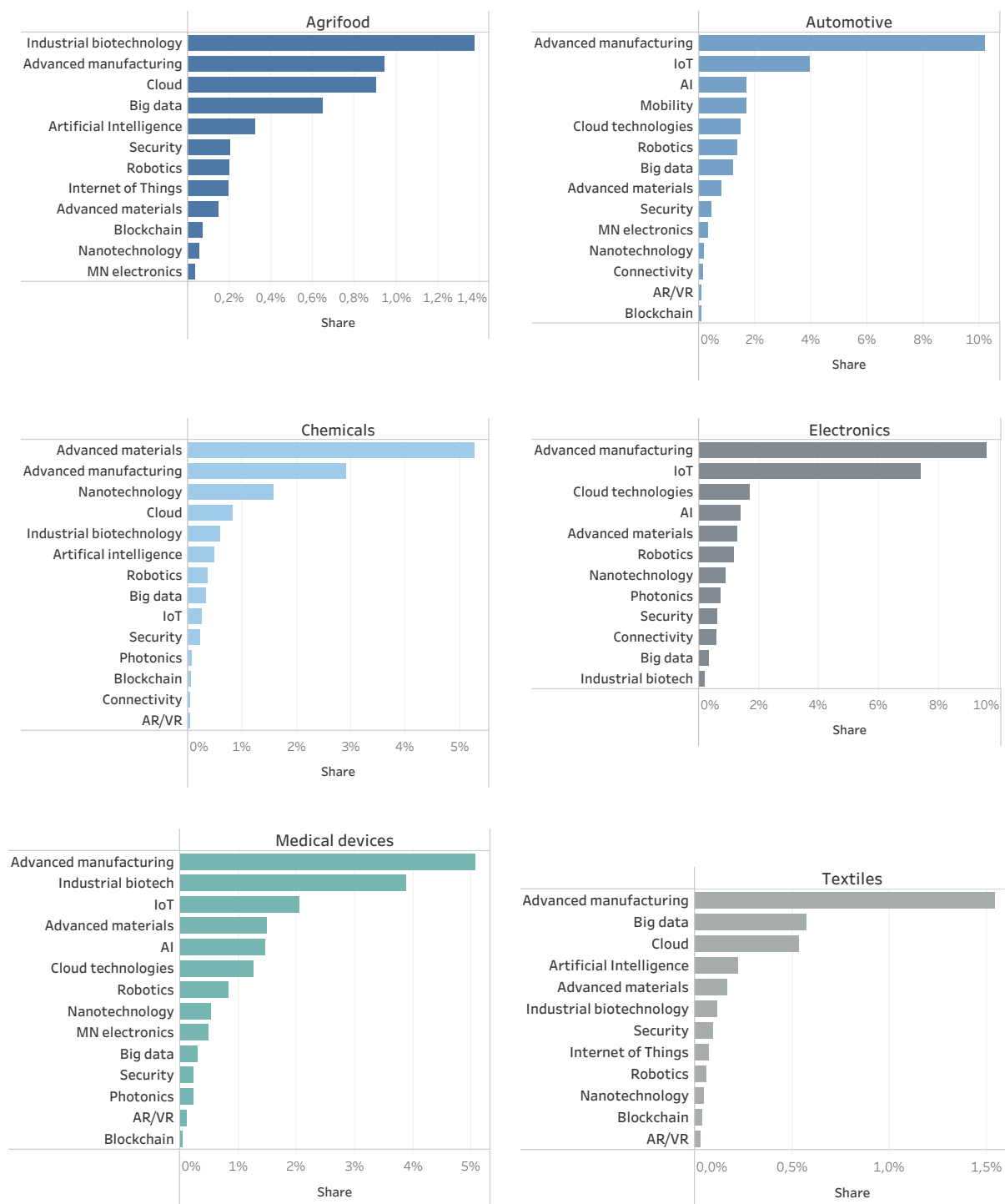
Source: Technopolis Group based on LinkedIn analysis

The differences are prominent among high-tech sectors and low tech ones, with Food manufacturing and Textiles industry taking only a low share of advanced technology professionals.

Besides analysing the distribution of skilled professionals in the economy, the share of advanced technology skilled human resources employed in six selected manufacturing industries have been also explored in order to gain more insights into the technological transformation of industries. These six sectors include the Automotive, Food and Beverage, Textiles, Industrial Electronics, Medical devices and Chemicals.

The six sectors display very different patterns (Figure 3). The Electronics and Automotive industry employed the highest share of advanced technology skilled professionals. The type of technologies most prominent include Advanced manufacturing technologies and the Internet of Things. Key skills which are highly demanded across these sectors also include Artificial Intelligence and Big data.

Figure 3: Professionals with advanced technology skills employed across sectors



Source: Technopolis Group based on LinkedIn analysis

Note: Occupations taken into account according to ILO ISCO08: managerial and supervisory, professional (including engineering) and technical, sales workers, occupations related to crafts, repair and operation of machinery; based on the corresponding skills and job title categories from LinkedIn

## 2.2 Advanced technology skills in different occupations

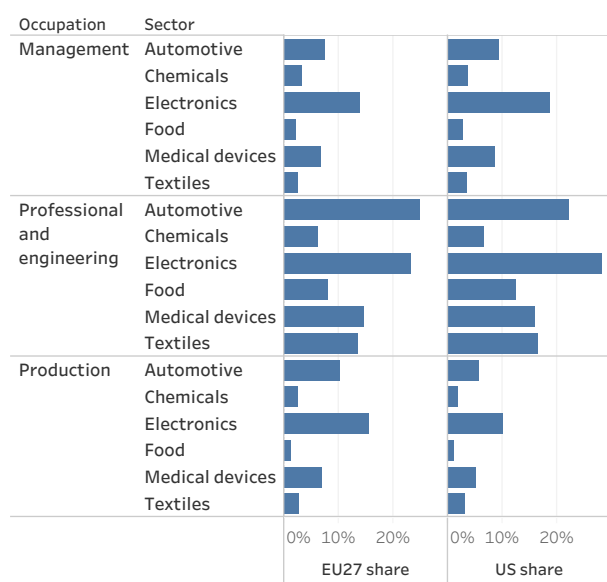
Advanced technology skills can be necessary for all types of jobs but still they have different relevance across occupations. Based on LinkedIn data, the skills profile of professionals employed in the six selected manufacturing industries has been investigated at various occupational levels including:

- in management and director positions,
- in professional and engineering jobs and
- working in production lines (e.g. technicians).

In this analysis, the following advanced technologies have been taken into account: Artificial Intelligence, AR/VR, Big Data, Blockchain, Cloud computing, Connectivity, Cybersecurity, Internet of Things, Mobility (understood in the context of autonomous driving and electric vehicles) and Robotics.

The results indicate that advanced digital skills are the most common in professional support and engineering related occupations. A lower share of people working in management positions have such skills and production workers and technicians have the lowest overall share. We find diverse patterns across sectors. Engineers in the Automotive and Electronics sectors are the most likely to possess advanced digital skills. Employees in the Textiles and Food&Beverage are the least skilled across all occupations.

Figure 4: Share of advanced digital technology skilled professionals per occupation type



Source: Technopolis Group based on LinkedIn analysis

The EU 27 and US show similar patterns, however, the sectoral differences are again confirmed for instance European Automotive industry performing better in terms of advanced digital skills, while Chemicals lagging behind compared to the US.

## 2.3 Talent mobility: talents lost and talent gained in the EU

In order to build a solid workforce with knowledge in advanced technologies, it is essential for the EU and its Member States to retain and to attract talents with the corresponding skills. Figure 5 illustrates the performance of each Member State in terms of talent mobility related to advanced technology skills<sup>14</sup>.

It can be observed that the performance of EU Member States in terms of talent mobility varies a lot. In general, European countries manage to retain and attract talents with skills in advanced technologies to a satisfactory extent. Indeed, most of countries display a ratio above 1, indicating a net gain of talents. However, four countries suffer from a net loss of talents: Romania, Greece, Croatia, Latvia. The larger share of these countries' highly-skilled nationals emigrate to the United Kingdom and Germany. They also display a particularly negative talent mobility ratio for specific countries, in particular Switzerland, Belgium and Luxembourg. Malta and Estonia seem to be an emigration destination for nationals from Greece and Latvia respectively.

On the other hand, EU countries that retain and attract the most talents are Germany and Austria with respective ratio of 1.94 and 1.79. In other words they have gained almost twice the number of talent that they have lost. Germany and Austria attract predominantly talents from outside the EU. The largest amount of immigrants in absolute terms come from the United Kingdom and United States, but the highest ratio of talent mobility are displayed by developing countries such as Iran, Egypt and Brazil for both, and India, Pakistan and Tunisia for Germany. It is also interesting to note that there is an important talent mobility between Austria and Germany, at the advantage of Austria.

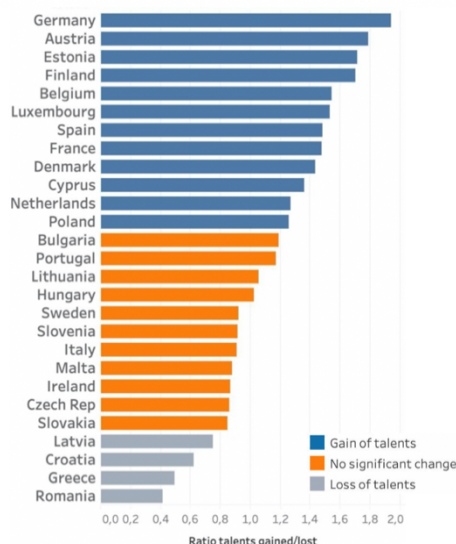
An international comparison (see Figure 6) shows that the best European players have similar talent mobility ratios as the United States (1.9). The United States attract mainly highly skilled from India and China, and one can also observe a very positive ratio for Brazil, Pakistan and Iran. As a consequence of its source position for Germany, Austria and the US, Brazil displays a very low ratio

<sup>14</sup> Talent mobility is computed as the ratio between the number of talents gained and the number of talent lost, by country. The advantage of using this measure is double. First, as a ratio it makes the results comparable for all countries, regardless of a country size and of the popularity of LinkedIn within the population, which is not the case with absolute numbers. Second, by taking into account both the

losses of talents and the gain of talents, it indicates the net gain from talent mobility, which is positive when the ratio is larger than 1 and negative (loss) when the ratio is smaller than 1. Talent mobility takes into account all the professionals' changes of countries, including from and to countries outside the European Union, for the last 12 months.

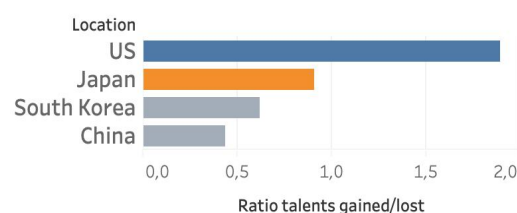
(0.29), indicating an important loss of talents. It has a lower talent mobility ratio than any European countries. Regarding South Korea, it also suffers from a net loss of talents as it displays a ratio of 0.62, a score similar to Croatia.

Figure 5: Ratio of talents gained and lost for each Member State



Source: Technopolis Group based on LinkedIn analysis

Figure 6: Ratio of talents gained and lost for selected non-EU countries



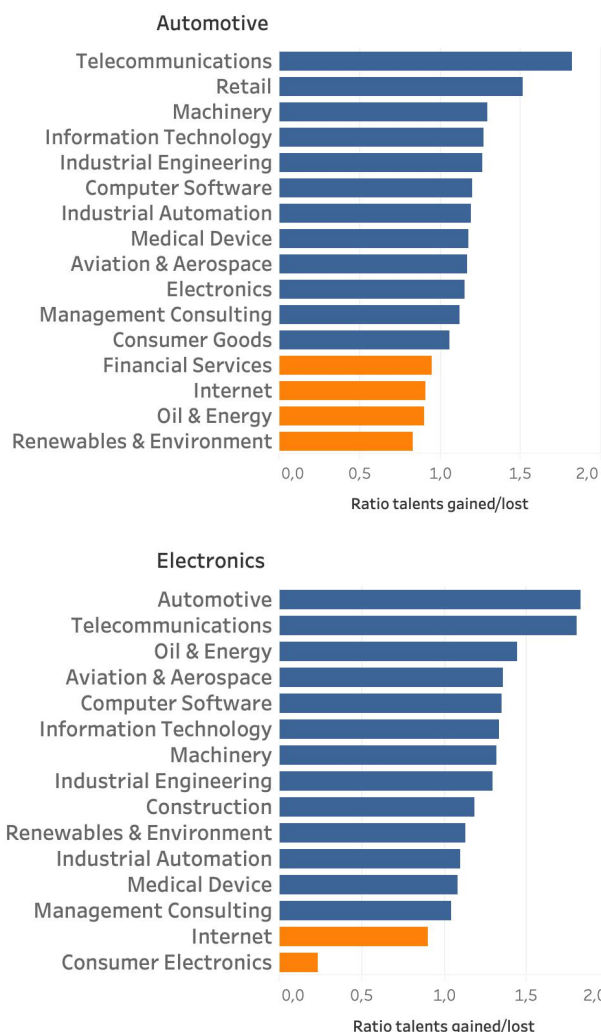
Source: Technopolis Group based on LinkedIn analysis

Talent mobility can also be investigated from a sectoral point of view. As highlighted previously, workers with advanced technology skills are demanded in various sectors. Hence industries have to compete to retain their talents and to attract talents from other sectors. Figure 7 illustrates the talent mobility dynamics between selected industries, and more specifically the flow of talents between one industry and its competitors<sup>15</sup>.

In general, the 6 selected industries are able to capture talents from several other industries as they display ratios larger than one, but almost all have to face a competitor sector against which

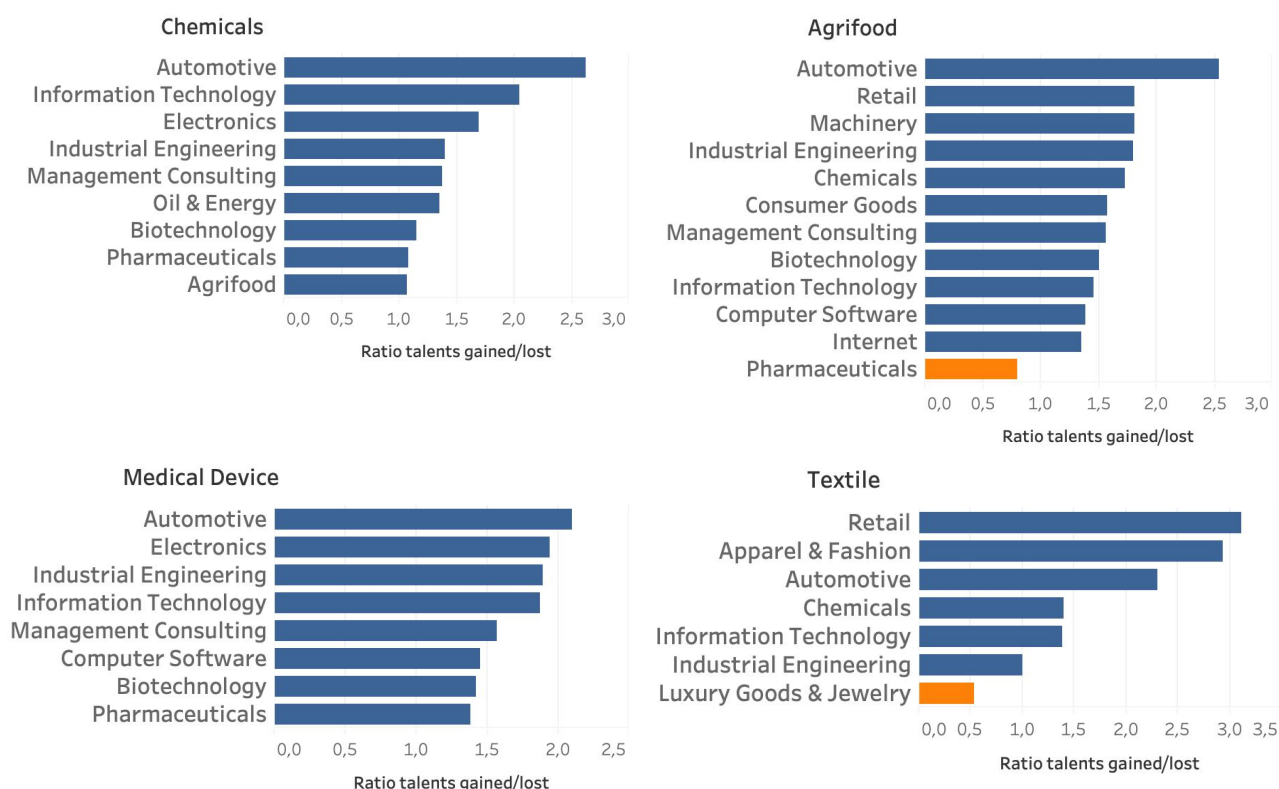
they lose talents (ratio smaller than one). For example, the Industrial Electronics industry is gaining talents from most of the displayed sectors, but is losing talents towards the Internet and Consumer Electronics industries. One can observe that the six manufacturing industries represented in Figure 7 all capture talents from the Telecommunications and Information Technology & Services sectors (all have a ratio larger than one for these sectors), which might indicate that ICT workers tend to leave the ICT sector to move into manufacturing.

Figure 7: Ratio of talents with advanced technology skills gained and lost across sectors



<sup>15</sup> Talent mobility is expressed as the ratio between talents gained and talents lost, with a figure larger than 1 indicating a positive talent flow, i.e. a gain of highly skilled workers for the industry in focus, and a figure smaller than 1 indicating a loss of talents. The measurement of talent mobility between sectors is based on the shifts of industries by workers with advanced technology skills in the EU27. The sectors that are displayed for each selected industry

corresponds to those where the largest talent flows take place (regardless of its direction), hence the figures do not display shifts of industries that are marginal. For textile and medical device, the talent flows recorded on LinkedIn are limited, hence less sectors are displayed on their respective figures.



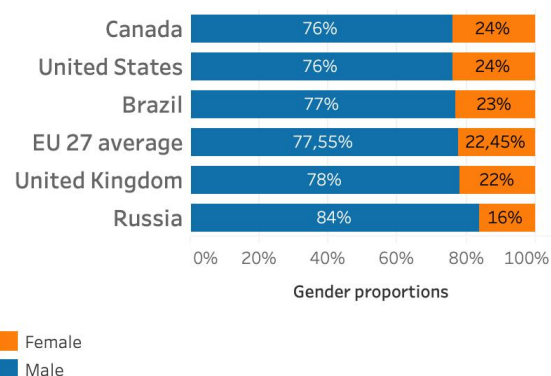
Source: Technopolis Group based on LinkedIn analysis

## 2.4 The gender gap

Technological inequality with regard to gender is an important challenge. Although digital technologies are recognised as having the potential to promote women's empowerment, a digital gender divide has been identified, whereby women access and use ICTs less than men, which can exacerbate gender inequalities<sup>16</sup>.

The LinkedIn data confirms the well-known gender gap trend. Figure 8 displays the prevalence of men and women among LinkedIn users who have skills in advanced technologies. It shows that women are largely underrepresented among these high-skilled workers and that this trend occurs in all regions studied<sup>17</sup>. The depth of the gender gap is similar in most of the regions studied, with a share of women oscillating between 22 and 24% in 5 out of the 6 countries. Only Russia stands out by displaying an even more marked gender gap: 84% of Russian workers with advanced technology skills are men, while only 16% are women.

Figure 8: Gender gap in advanced technologies skilled workers



Source: Technopolis Group based on LinkedIn analysis

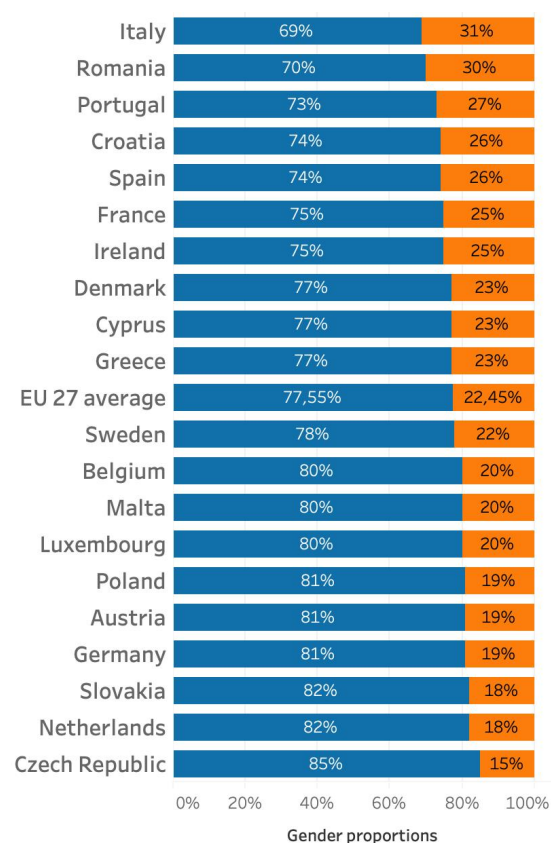
Nevertheless, when looking at EU figures across countries or sectors, different trends can be observed, as illustrated in Figure 9. Although no country shows a good gender balance in advanced technologies, some countries' share of women is considerably higher. This is the case of Italy and Romania, where the percentage of women is 31 and 30%, respectively. On the other hand, Czechia displays the highest gender gap, with 81% of workers with advanced technology skills being men, closely followed by Germany.

<sup>16</sup> [https://www.europarl.europa.eu/RegData/etudes/STUD/2018/604940/IPOL\\_STU\(2018\)604940\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2018/604940/IPOL_STU(2018)604940_EN.pdf)

<sup>17</sup> Data on the gender proportions of the workforce is not available for Japan, South Korea and China. Similarly, the

gender proportions are missing for some European countries (Finland, Hungary, Bulgaria, Slovenia, Lithuania, Latvia, Estonia) which are therefore not taken into account in the EU 27 average.

Figure 9: Gender gap in advanced technology skills across EU27 countries

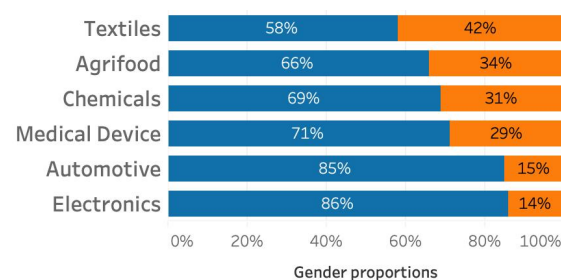


Female  
Male

Source: Technopolis Group based on LinkedIn analysis

However, the gender gap among workers with skills in advanced technologies is not the same in all industries. Figure 10 shows the proportions of men and women with advanced technology skills in selected six industries in the EU27. The industries where the gender gap is the most important are Electronics and Automotive, while Textile is an industry that has the highest share of women with advanced technology skills (42%). Nevertheless, none of the industries in focus reaches an optimal gender balance.

Figure 10: Gender gap in advanced technology skills across EU 27 sectors



Female  
Male

Source: Technopolis Group based on LinkedIn analysis

## Section 3

### 3. Skills policy for advanced technologies and sectors

The new European Skills Agenda published in July 2020 provides a **renewed framework for developing skills in advanced and digital technologies**. Various key actions address upskilling and reskilling not just for technologies but for industrial ecosystems and specific sectors.

The European '**Blueprint for sectoral cooperation on skills**' supports skills development in 21 sectors/themes and will play an instrumental role to promote advanced technology skills for industry in the upcoming years.

**National Industry 4.0 initiatives provide a framework** for skills development in advanced technologies and they are fostering digital and technological transformation of key EU industries. National industrial associations play a key role in fostering advanced technology skills among European businesses including especially SMEs.

Nevertheless, sectoral initiatives could better address the skills challenge in different occupations and positions and focus on the upskilling workers in all relevant job profiles.

Beyond putting the emphasis on key sectors, it will be important to diffuse talent into a broader set of sectors and **promote transformation of low-tech sectors** as well for a more balanced and equal economic development.

#### 3.1 European policy initiatives

In response to the disruptive technological transformation that is affecting industries and employment at a global level, the EU is aiming at upskilling the European workforce in advanced technologies. The EU has launched several initiatives aimed at improving European competitiveness on the global talent scene for specific sectors and industrial value chains.

On July 1<sup>st</sup> 2020 the European Commission presented its **new European Skills Agenda**<sup>18</sup> and has reaffirmed its ambition to invest in skills as a core industrial policy element in order to foster upskilling and reskilling within the next 5 years. It combines a European Pact for Skills which brings together all stakeholders with an increased EU budget. The EU wants to ensure the right to training and lifelong learning, provide the skills required to master the digital and green transitions, and to invest in a sustainable recovery after the coronavirus pandemic. To implement the actions and meet the objectives of the Skills Agenda, the **NextGenerationEU** initiative provides significant resources as part of a major budgetary initiative to tackle the economic and social consequences of the crisis. These funds will

also act as a catalyst for investing in people's skills.

The agenda promotes the education of young people, and especially women, in the field of **Science, Technology, Engineering and Maths**, but also the acquisition of transversal skills like cooperation and critical thinking all very relevant for underpinning the development of advanced technologies.

Other actions included in the new Agenda will foster several up- and reskilling strategies (at national, regional and sectoral levels), the availability of online information on skills demand and on learning opportunities, new approaches for online training and vocational education, and the development of adult learning.

The Commission will support digital skills in particular through the following initiatives:

- the Digital Education Action Plan;
- EU ICT-Jump-Start training to provide short-term intensive training to tackle ICT skills shortages, with a focus on gender-balanced participation
- Digital Crash Courses for SMEs and "digital volunteers" programme to upskill the current

<sup>18</sup> European Commission (2020). European Skills Agenda for sustainable competitiveness, social fairness and resilience

workforce in digital areas, as already announced in the EU SME strategy.

Developing the necessary skills base in advanced technologies in European industry is directly linked to education, and therefore implies rolling out European education programmes, such as the **European Universities Initiative**<sup>19</sup>. The European Universities Initiative aims at creating a network of transnational alliances with the ambition to become the universities of the future that will revolutionise the quality and competitiveness of European education.

### Sectoral cooperation on skills

To be launched in November 2020, the Pact for Skills is the first flagship measure of the new European Skills Agenda and refers to sectoral skills. It is a new engagement and governance model for skills that will mobilise all relevant stakeholders. Industry, public and private employers, social partners, chambers of commerce, education and training providers and employment agencies will be invited to work together and to create a shared vision and action. The Pact for Skills will facilitate public-private cooperation through **large-scale partnerships, including at regional and local level, in strategic industrial ecosystems**. Initially, it will focus on those industrial ecosystems heavily affected by the current crisis and the priority areas identified in the European Green Deal, for which ambitious up- and reskilling strategies will be essential such as healthcare, automotive or tourism. In the concerned sectors, the large scale partnerships are expected to unblock concrete investments in upskilling opportunities for employees in companies and in a whole value or supply chain<sup>20</sup>.

Under the European Skills Agenda, the initiative called '**Blueprint for sectoral cooperation on skills**'<sup>21</sup> aims at addressing skills shortages and unemployment, including advanced technologies at sectoral level. As part of the Blueprint and through a selective process, so-called "*alliances for sectoral cooperation on skills*" have been set up that are composed of different relevant sector stakeholders such as businesses, trade unions, research institutions, education and training institutions and public authorities. The alliances are supported by the Erasmus+ framework in order to address the skills challenges faced by the European labour market.

The objective of the alliances is to develop and implement a strategy to address the skills gaps in their specific sector to ensure growth, competitiveness and employment in the sector. By assessing the global, societal, technological, environmental factors that affect their sectors, the partners identify priorities and develop a sectoral skills strategy that targets skills shortages. To supplement the development of the sector skills strategy, concrete solutions are developed, notably the design of vocational programmes and qualifications. Furthermore, the alliances frame a long term actions plan to be rolled out at the regional and national levels, based on the EU achievements.

Figure 11: Blueprint for sectoral cooperation on skills



Source: European Commission

The Blueprint is supported by different EU tools, that are promoted by the alliances in their specific sector. Notably, the **European Qualification Framework** (EQF) is a comprehensive reference framework for qualifications covering all education and training levels that acts as a bridge between the different national and educational systems<sup>22</sup>.

<sup>19</sup> [https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative\\_en](https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative_en)

<sup>20</sup> [https://www.clustercollaboration.eu/sites/default/files/WYSIWYG\\_uploads/pact\\_for\\_skills\\_-\\_overview\\_10-07-2020\\_0.pdf](https://www.clustercollaboration.eu/sites/default/files/WYSIWYG_uploads/pact_for_skills_-_overview_10-07-2020_0.pdf)

<sup>21</sup> <https://ec.europa.eu/social/main.jsp?catId=1415&langId=en>

<sup>22</sup> <https://www.cedefop.europa.eu/en/events-and-projects/projects/european-qualifications-framework-efq>

Similarly, the **European Skills/Competences, Qualifications and Occupations (ESCO)**<sup>23</sup> provides a common reference terminology and classification of skills, competences, qualifications and occupations for EU and non-EU languages. Both tools boost the accordance of skills and help making the European labour market more integrated.

Under the new Skills Agenda, the Blueprint will also help **define sectoral skills intelligence**, map key occupation needs, define occupational profiles and roll-out training programmes. Finally, the work of the alliances will also feed the European Skills Panorama with internal information and data for their specific sector. The Skill Panorama is an initiative of the European Commission that aims at increasing the transparency of the European labour market and provides free online resources, including data, related to skills, workforce and jobs outlook<sup>24</sup>.

#### Lessons from the sectoral skills alliances:

Building a solid alliance is a complex task and its governance requires significant resources.

Importance of soft skills, such as adaptability, learning to learn, having the right mindset needs to be recognised and addressed.

Not just engineers, but also production managers, particularly those in SMEs, have a need for higher qualifications and “Industry 4.0” skills.

Reviewing the existing education and training programmes for the sectors in Europe is necessary in order to avoid under-exploitation of results, replication of already implemented activities.

*Source: based on the review of sectoral alliance reports<sup>25</sup>*

The Blueprint for sectoral cooperation on skills will be expanded within the Pact for Skills of the Updated Skills Agenda 2020 and opened to more sectors. The existing blueprint alliances are the following:

- automotive
- maritime technology
- space - geo information
- textile, clothing, leather and footwear
- tourism
- additive manufacturing

- construction
- maritime shipping
- steel industry
- bioeconomy, new technologies and innovation in agriculture
- green technology and renewable energy
- paper-based value chain
- batteries for electro-mobility
- defence technologies
- energy value chain – digitalisation
- energy-intensive industries/industrial symbiosis
- microelectronic manufacturing & design

The next six sectors eligible for funding under Erasmus+ are:

- blockchain
- cultural heritage
- cybersecurity
- rail supply and transport industries
- work integration social enterprises
- software services.

#### Promoting advanced manufacturing skills

The **European Advanced Manufacturing Support Centre (ADMA)**<sup>26</sup>, another initiative of the European Commission aims to help SMEs assess the possibility of adopting both advanced manufacturing solutions as well as social innovation strategies and transforming their organisation towards next-generation factories.

ADMA supports skills development by facilitating peer learning, but also through dedicated train-the-trainer sessions and workshops focusing on advanced manufacturing skills.

#### Promoting digital skills

Significant investment is necessary to tackle the digital skills gap, hence different funds are existing, coping with the different challenges related to skills<sup>27</sup>.

In particular, some funding programmes support reskilling by providing trainings with a digital aspect to unemployed citizens in order to kick off their career (**European Globalisation Adjustment Fund**). Other funds target the improvement of the quality, effectiveness of national education and training systems to

<sup>23</sup> <https://ec.europa.eu/social/main.jsp?catId=1326&langId=en>

<sup>24</sup> [https://skillspanorama.cedefop.europa.eu/en/useful\\_resources/including-sectoral-skills-evidence-skills-panorama-practical-framework](https://skillspanorama.cedefop.europa.eu/en/useful_resources/including-sectoral-skills-evidence-skills-panorama-practical-framework)

<sup>25</sup> Blueprint for sectoral cooperation on skills – Tourism, Automotive, Space (Geo information), Steel, Textile/Clothing/Leather/Footwear, Additive Manufacturing  
<sup>26</sup> <http://adma.ec/>

<sup>27</sup> <https://ec.europa.eu/digital-single-market/en/policies/digital-skills>

incorporate digital competences (**European Social Fund Plus**).

The **Digital Europe Programme**<sup>28</sup> is dedicated among others to advanced technological skills and to develop a European digital talent pool ready to apply the latest technologies across the economy. The Digital Europe Programme includes the EU digital talent pool with around 256 000 people. €700 m is allocated for advanced digital skills. Two actions are focused on the labour force: the support of short-term specialised training courses in advanced digital technologies for around 150 000 job seekers and employed people and the support of 35 000 job placements in companies or research centres where advanced digital technologies are developed or used.

**Upskilling pathways**<sup>29</sup> focuses on providing training related to literacy and numeracy, calculation and digital proficiency to low-skilled adults without upper-secondary education. The adults that lack these basic skills and have a low level of education are at high risk of unemployment, poverty and social exclusion and the ongoing technological disruption of the industry will only worsen their exposure. “Upskilling pathways” aims at upskilling this vulnerable share of the workforce by offering them access to lifelong learning and allowing them to deepen a broader set of skills that fit the needs of the industry<sup>30</sup>. The programme is composed of a skill assessment that enables adults to identify their strengths and weaknesses in terms of skills, the learning process itself that is based on existing local training structures and the validation and recognition of the skills acquired.

**DigComp**<sup>31</sup> - European Digital Competence Framework - is a reference framework formulating what it means to be digitally competent. DigComp provides a tool that is facilitating the understanding of digital competences. By supporting the development of essential skills in Europe, the framework of DigComp directly help addressing the challenges of skills shortages and upskilling.

The **EU Codeweek**<sup>32</sup> is a grassroots movement that strives to improve digital skills, such as coding and computational thinking, for the youth. In 2019 an estimated 4.2 million people participated in the EU Codeweek worldwide.

### 3.2 Policy initiatives at national and regional levels

A key element of the new European Skills Agenda is **to catalyse Member States and private actors to invest in skills**.

The **Digital Skills & Jobs Coalition** provides a forum for EU countries to reduce the skills gap and share good practices about how to reskill the European workforce. By the end of 2020, the Coalition expects to train over 1 million young people for vacant digital jobs, help SME's in attracting and retaining digital talent, modernise education and provide teachers as well as students with digital tools, and to raise awareness of the importance of digital skills for employability. The Coalition specifically focuses on digital skills. EU Member States have been also developing their own national digital skills strategies underpinning industrial transformation.

Beyond the digital skills strategies, the national **Industry 4.0 initiatives** of EU Member States provide a policy framework for skills development in advanced technologies. Upskilling and reskilling especially for the manufacturing industries is one of the main objectives of the current national Industry 4.0 strategies in general.

France's programme '**Industrie du Futur**'<sup>33</sup> was launched in 2015 with the ambition to support the use of digital technologies, modernise production tools and transform business models. “Industrie du Futur” is based on 5 pillars including one that focuses specifically on the upskilling of the workforce. The upskilling objective is pursued by working closely with labour unions to develop a common vision that encompasses them and by developing training programmes designed to train the industry's employees in order to create a workforce that is apt to cope with Industry 4.0<sup>34</sup>. Tackling the skill shortage allows to facilitate the diffusion of new technologies in the industry and to foster France's competitiveness.

“Industria 4.0”<sup>35</sup> is the Portuguese strategy to develop its digital industry by focusing on 3 axes: digitalisation, innovation and training. The first pillar of “Industria 4.0” is **human qualification**, and more specifically a requalification of the labour force in line with the labour demand. In this regard, one of the priorities of the plan is to adapt the education system to match industry future needs by integrating digital skills in the education curriculum. In addition, the plan also focuses on

<sup>28</sup> <https://ec.europa.eu/digital-single-market/en/europe-investing-digital-digital-europe-programme>

<sup>29</sup> <https://ec.europa.eu/social/main.jsp?catId=1224&langId=en>

<sup>30</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016H1224\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016H1224(01)&from=EN)

<sup>31</sup> <https://ec.europa.eu/social/main.jsp?catId=1315&langId=en>

<sup>32</sup> <https://codeweek.eu>

<sup>33</sup> <http://www.industrie-dufutur.org/>

<sup>34</sup> <https://www.economie.gouv.fr/lancement-seconde-phase-nouvelle-france-industrielle>

<sup>35</sup> [https://www.compete2020.gov.pt/destaques/detalhe/Industria\\_4ponto0](https://www.compete2020.gov.pt/destaques/detalhe/Industria_4ponto0)

lifelong learning by encouraging employees training and continuous training through extra-curricular activities. The approach is very bottom-up and actively involves multinationals that play a key role in the implementation of initiatives addressing the skills shortages, both in terms of upskilling and in terms of reskilling. The objective of the government is that 200 000 workers get trained in topics related to ICT and digital competences.

The '**Digital Skills Bridge**'<sup>36</sup> programme in Luxembourg has been a pilot project that was carried out from May 2018 to November 2019 and aimed at anticipating the impacts of technological change on jobs and at supporting companies and their employees to transition to new work, jobs and skills. The programme was implemented in volunteer companies, who started by going through a consultative and audit phase to assess their future skills-needs. Based on external and internal factors, the programme then identified the companies' employees at high risk of a potential job loss and diagnosed their skill gap in regard to a relevant job transition. They were accordingly offered specific training and coaching, which was aimed at creating new mobility possibilities, either within the same company or externally. The whole process is based on preventive and proactive upskilling. It has allowed to develop an ecosystem of relevant assessment of potential skill gap and to develop a unique upskilling approach to cope with digital disruption.

**National education and training policies** provide a further framework for advanced technology skills promotion.

An example is the Federal Ministry of Education and Research of Germany that is implementing a policy to foster continuing training and lifelong learning at the national level: the **National**

**Training Strategy**<sup>37</sup>. The main focus of the policy are to improve transparency on the training offer and to offer personalised advice for interested individuals and companies. A measure to address these challenges is the implementation of digital education rooms that connect people with precise education offer thanks to an algorithm which allow an individual and adaptive learning in the digital space. The programme also aims at better recognising the acquired skills, as well as the informal competences, and at issuing education certificates digitally. In the same vein, improved statistics on the prevalence of training are to be developed. In the context of the "National Training Strategy", the Federal Ministry of Education and Research has launched in April 2020 INVITE<sup>38</sup>, its digital platform for vocational training which aims to create an innovative digital and secure educational space for continuous training.

**National industrial associations play a key role in fostering advanced technology skills** development for specific sectors and in particular for SMEs.

For instance, France Chemicals has partnered up with Accenture to support firms in their digital transformation journey<sup>39</sup>. The partnership develops a series of use cases focused on digital transformation for their members, consolidating industry good practices. Training modules are also available to enable chemical industry businesses to address the fundamentals of digital technology (connectivity and mobility, cybersecurity and on-premises cloud infrastructure), as well as the most relevant solutions to increase efficiency and effectiveness.

In the Table below, further sectoral policy initiatives are presented that aim at promoting advanced technology skills development in specific industries.

Table 1: Examples of sectoral skills policy initiatives at national level

Country	Sector	Title	Description	Budget
Belgium	Agrifood	Skills Center FormAlim <sup>40</sup>	FormAlim is a Skills Center specialised in skills related to the agrifood industry in Wallonia. Thanks to their high-end infrastructure and position in the economic development poles, the Walloon Skills Centers are actors of the training and awareness-raising of workers, unemployed citizens, students and industries' actors <sup>41</sup> . FormAlim supports the reskilling and upskilling of the agrofood workforce as it organises short-term training and long-term qualifying curriculum based on the technologies specific to the agrifood sector and on the needs of the industry. This vocational training is available for anyone with the will to acquire new	na

<sup>36</sup> <https://adem.public.lu/en/employeurs/futureskills/projet-pilote.html>

<sup>37</sup> <https://www.bmbf.de/de/nationale-weiterbildungsstrategie-8853.html>

<sup>38</sup> <https://www.bibb.de/de/120851.php>

<sup>39</sup> <https://www.info-chimie.fr/la-chimie-accelere-sa-transition-digitale,93113>

<sup>40</sup> <https://www.formation-formalim.be/>

<sup>41</sup> <https://www.leforem.be/centres-de-competence.html>

Country	Sector	Title	Description	Budget
			agrifood competences, either as lifelong learning for employees of the industry, or as insertion training for the youth.	
Estonia	ICT	ICT Development Programme <sup>42</sup>	The ICT Development Programme is a sectoral initiative of the Ministry of Economic Affairs and Communications. It aims at enhancing the development of e-Estonia by solving the challenges faced by the IT sector, and by fostering the digitalisation of the economy. It is based on 3 measures: first, alleviating the labour shortage in the ICT sector by involving external labour force and supporting ICT higher education, second, supporting the digitisation of the industry, third, supporting the visibility of e-Estonia. Both the first and the second measures require actions that involve upskilling and reskilling of the Estonian workforce.	€8 m
France	Chemicals Tourism Automotive	Employment and Skills Agreement (EDEC) for the Automotive sector <sup>43</sup>	The Employment and Skills Agreement for the chemicals sector is a programme developed by the Federal French State in collaboration with the actors and social partners of the chemicals sectors. It is taking place from June 2018 to December 2020 and focuses on supporting the small and medium enterprises on two axes. First, it supports the environmental, energy and digital transformations of enterprises in chemicals as a way to maintain and develop their activities, and second, it accompanies the identification of their skills needs in order to secure the careers of their employees. Concrete actions that correspond to the challenges of the French chemicals sector have been implemented, notably the inclusion of digital in the professional qualifications of the chemical industry, the identification of the minimum digital requirements in the chemical professional environment, the improvement of work-based training.	€2.4 m (including €800 000 from the State)
Germany	Textile	Making provisions for the shortage of specialists – recruiting specialists in the EU <sup>44</sup>	The German Federal Employment Agency, the Confederation of the German Textile and Fashion Industry and the regional associations of the Textile Industry have initiated the project called “ <i>Making provisions for the shortage of specialists – recruiting specialists in the EU</i> ”. The large variety of usages of the textiles and composite materials raises the labour demand of the German garment industry. The competitiveness of an important number of sectors depends heavily on textiles: energy and environmental technology, aircraft, cars and ships, streets materials and landscaping, aeronautics and aerospace technology, home and household textiles, garments and fashion, and the healthcare sector that depends on textile medical products, from implants to wound treatment products to organ replacements.	na
Ireland	Biopharmaceutical	Laboratory Apprenticeships <sup>45</sup>	Two new apprenticeship schemes were launched in 2018 by the Irish Minister for Communications, Climate Action and Environment to address the identified skills shortages in the biopharmaceutical sector. These new	

<sup>42</sup> [https://ec.europa.eu/information\\_society/newsroom/image/document/2019-32/country\\_report\\_-\\_estonia\\_-\\_final\\_2019\\_OD302D02-B893-2A15-1643CC2948ACF8F1\\_61203.pdf](https://ec.europa.eu/information_society/newsroom/image/document/2019-32/country_report_-_estonia_-_final_2019_OD302D02-B893-2A15-1643CC2948ACF8F1_61203.pdf)

<sup>43</sup> <https://travail-emploi.gouv.fr/IMG/pdf/accord-cadreedec-filieeaautomobile.pdf>

<sup>44</sup> <https://textil-mode.de/en/themen/education/>

<sup>45</sup> <https://biopharmachemireland.ie/IBEC/Press/Publications/doclib3.nsf/wvBPCINewsByTitle/laboratory-apprenticeships-launched-by-minister-bruton-02-11-2018?OpenDocument>

Country	Sector	Title	Description	Budget
			apprenticeships are part of the government's wider strategy on future skills needs. The programmes were developed by the industry, and in particular by BioPharmaChem Ireland, a business group representing the sector, in cooperation with the leading academic provider (Institute of Technology Tallaght). As the demand for experienced laboratory personnel has increased in the recent years in Ireland, the apprenticeships will contribute to provide to companies the skilled workforce they need.	
Lithuania	Metal-working	4Change : Empowering Metalworkers For Smart Factories Of The Future <sup>46</sup>	Launched in 2016 by Linpra and still ongoing, the 4Change project has the ambitions of tackling the skills gap of metalworkers. The project partners have identified the profession-specific skills needs as advanced technology and digital skills, robotics and CNC operation skills, and social/entrepreneurial skills. The programme is based on two axes: designing and delivering a new targeted VET programme based on the current and future skills needs identified, and developing a self-adaptive work-based learning system in combination with coaching for motivation and innovation.	€1.17 m (EU funds)
Poland	Automotive	Automotive Sector Competence Council <sup>47</sup>	The Automotive Sector Competence Council (including electromobility) is a nationwide platform for the exchange of experience between formal and non-formal education and business. In this way, businesses can influence providers of educational and development services related to both formal and non-formal education. The aim of the project is to come up with solutions and align the education system to the needs of the automotive sector by engaging with business, educational and administration representatives, and by drawing from their experience, research results and feedback. The development of these solutions for the sector will be handled by the established Competence Council for the automotive sector (including electromobility). The activities of the Council will involve a group of stakeholders from all over the country.	na
Portugal	Tourism	Tourism Digital Academy <sup>48</sup>	The Tourism Digital Academy is an initiative launched by "Tourism for Portugal" with the approval of the Ministry of Finance. It aims at driving the transformation of the tourism sector in Portugal, by promoting innovation and research in tourism, and at supporting companies that develop a creative vision of tourism. The academy will be hosted by the Center for Tourism Innovation in collaboration with tourism educational institutions. One of its key actions is therefore to develop training in the digital area for the tourism human resources. It will also launch innovation challenges and competitions, and establish partnerships with clusters in the tourism area.	na

Source: Technopolis Group, 2020

<sup>46</sup> <http://metindustry.eu/projects/linpra/>, [https://ec.europa.eu/information\\_society/newsroom/image/document/2019-32/country\\_report\\_-\\_lithuania\\_-\\_final\\_2019\\_OD30BFFC-E624-3200-70B376999BBBC75E\\_61212.pdf](https://ec.europa.eu/information_society/newsroom/image/document/2019-32/country_report_-_lithuania_-_final_2019_OD30BFFC-E624-3200-70B376999BBBC75E_61212.pdf)

<sup>47</sup> <https://www.silesia-automotive.pl/rada-ds-kompetencji-w-sektorze-motoryzacyjnym-z-uwzglednieniem-elektromobilnosci-2271>

<sup>48</sup> <https://www.ambitur.pt/centro-de-inovacao-do-turismo-operacional-no-1-o-semester/>, [https://ec.europa.eu/information\\_society/newsroom/image/document/2019-32/country\\_report\\_-\\_portugal\\_-\\_final\\_2019\\_OD313AC4-9C8E-F45B-AA1BFF19CC713C17\\_61218.pdf](https://ec.europa.eu/information_society/newsroom/image/document/2019-32/country_report_-_portugal_-_final_2019_OD313AC4-9C8E-F45B-AA1BFF19CC713C17_61218.pdf)

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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 Executive Agency for Small and Medium-sized Enterprises (EASME) by IDC, Technopolis Group, Capgemini, Fraunhofer, IDEA Consult and NESTA.

