



# Advanced Technologies for Industry

## Monitoring Skills Supply and Demand in Advanced Technologies in support of Industrial Transformation

Online policy seminar

25 November 2020, 9:30 – 12:30, webex

Organised on behalf of:

**European Commission DG GROW**

**Executive Agency for Small and Medium sized Enterprises, EASME**

by Technopolis Group

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The policy seminar on ‘*Monitoring Skills Supply and Demand in Advanced Technologies in support of the Industrial Transformation*’ was the second in a series of 8 policy seminars organised within the Advanced Technologies for Industry (ATI) project (<https://ati.ec.europa.eu>) commissioned by the Executive Agency for Small and Medium-Sized Enterprises and the European Commission DG GROW. The objective of this seminar was to shed more light on the supply of and demand for skills in advanced technologies, and to discuss the monitoring challenges. The framework of the event was provided by the European Skills Agenda presented by the European Commission. The webinar also demonstrated the latest results of recent studies of the ATI using LinkedIn data, Cedefop and the Estonian Qualifications Authority.

### Presentations and key points:

#### 1. **Introduction to the ‘Advanced Technologies for Industry’ project**

*Marta Batalla Masana, European Commission DG GROW*

- The Advanced Technology for Industry (ATI) project results from the merger of two former projects of the European Commission DG GROW: the KETs Observatory and the Digital Transformation Monitor. The ATI project provides policymakers, industry representatives and academia with statistical **data on the creation and use of advanced technologies**, analytical reports on technological trends, sectoral insights and products, analyses of policy measures and policy tools related to the uptake of advanced technologies, and analyses of technological trends in competing economies.
- The ATI Technology Centre Mapping presents an overview of the technology centres with expertise in advanced technologies in the EU.

#### 2. **EU Policies and Initiatives – Helping people and organisations acquire 21st century skills**

*André Richier, European Commission DG GROW*

- André Richier presented the European Skills Agenda and Pact for Skills.
- The reskilling revolution is a key topic of our times. In the past, reskilling used to happen at a much smaller scale. Today, the challenge is to **find ways to reskill a large share of the workforce**.



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- Businesses in particular are more and more interested to know what will happen in the future. This is why forecasting skills demand and supply is key, but beyond 2 to 5 years it is unrealistic to foresee what will happen. **Realistic timescales are needed to make credible foresight.**
- There is a large literature on the share of jobs that will be impacted by the digital revolution. **Every aspect of the economy will be transformed by technology**, even low-skilled activities with low salary.
- We are currently experiencing a polarisation of the labour market. **Middle skills activities are disappearing, while low-skilled and highly skilled jobs are gaining importance.** Despite differences between countries, the trend is occurring in all European countries and globally. As the European economy is based on middle class kind of jobs, this might create issues.
- The best way to address the skills challenge is to **put in place multi stakeholder partnerships** and governance with the private sector involving also recruiters, trainers.

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- The Covid-19 crisis, the transition to a low-carbon economy and the 4<sup>th</sup> Industrial Revolution create considerable stress on traditional sectors and labour market.
- At international level, there is a fierce competition for talent. In Europe, there is a shortage of 1 million IT specialists and it is estimated that 100 million of workers might need reskilling in the next five years.
- Large-scale initiatives are crucial to ensuring the successful transformation of industry, and that SMEs have access to the talent they need for the jobs of the future.
- It has never been more important to invest in people (both in technical and transversal skills) in an economic and social sense.
- There are good practices but they lack scale, visibility and impact.
- Raising to the challenge requires a shared vision with Member States, industry and social partners and a scalable and sustainable strategy.



- **Software and its business applications are fields that are very important for the EU**, because EU can have a comparative advantage. If the knowledge is limited to technical skills, there is a strong competition from other countries, e.g. India.
- There is a pyramidal segmentation of skills for occupations of different levels of complexity, where gaps exist at all levels.
- **Depending on the country, the level of sophistication of IT professions is very different:** it is more sophisticated in Northern Europe than in the South. Less sophistication means that the sector has more chances to be automated. It shows that it can be pointless to provide IT training if it results in automation and loss of jobs in a few years. Again, quantity is good, but quality is more important, especially in Europe where we can't compete on prices.
- The ICT sector in the EU is not as important as in other regions (US, Asia). It is essential to improve the development of new technologies in sectors where EU has a comparative advantage.
- The **European Skills Agenda** was adopted in July 2020. Building on existing initiatives it focuses on upskilling and reskilling (programmes of traineeships, apprenticeships). Supported by regional and national partnerships (clusters), it also aims at providing SMEs access to latest technologies.



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- The **Digital skills and Jobs Coalition** includes training for unemployed, training for the workforce, for IT specialists with a wide spectrum of activities. The Pledge viewer website (<https://pledgeviewer.eu/>) details the initiatives and best practices.
- The next funding period will enhance advanced and digital skills. Different programs that can contribute to this, including the **Recovery and Resilience Facility** that enhances upskilling and reskilling, and the **Digital Europe Programme** to which large amount of funding are allocated.
- **Blueprint for Sectoral Cooperation on Skills**. Stakeholders of specific sectors work together in sector-specific partnerships, called alliances for sectoral cooperation for skills, which develop best practices and implement strategies to address skills gaps in these sectors. The first five blueprint alliances began their work in January 2018 and since then there have been another 3 waves when further alliances were launched.
- **The European Pact for Skills** was adopted on the 10<sup>th</sup> of November 2020.

## Pact for Skills



### Questions from the audience

*What is the link between the Blueprint and the Pact for Skills?*

The Blueprint is a strategic instrument to facilitate skills partnerships to be established. The main focus is to link training with jobs, in other words to connect those who need certain skills to those who possess these skills. The objective is to avoid situations when people are trained but cannot find jobs.

*Is the focus of the Pact on cross country collaborations?*

It is indeed a key element for skills partnerships. Allows to share best practices and facilitates foresights.

*Is there a component of foresight on future skills?*

The idea is to measure robustly the impact of existing initiatives and scale those that work and terminate those that do not. The focus is put on anticipation and hence there is a need for people with experience in foresight.



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### 3. ATI project: monitoring advanced technological skills supply and demand based on LinkedIn data

*Kincsö Izsak and Paresa Markianidou, Technopolis Group*

#### General results

- With technological change, skills become outdated more quickly than in the past, and the need for new skills emerges at an unprecedented speed. Without awareness and anticipation, these fast changes in the skills requirements create a gap between the skills supply and demand.
- Technopolis Group relied on LinkedIn data to analyse skills supply and demand in advanced technologies. **The advantage is that LinkedIn allows for a level of granularity not available in other data sources.** LinkedIn is the largest professional network platform with rich information like profile summary, job title, job description and field of study. 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.

#### Key insights from the ATI analysis

- **AI is the most thought-after and fastest growing skill** both in the EU27 and US. AI skills have the highest growth in 2020, concentrated in Finland, Sweden and Germany.
  - The growth dynamics dropped in 2020 compared to 2019, however, the skills that witnessed stability/further growth include **Connectivity, Security, Cloud, Mobility and Photonics**. The **Covid crisis** is impacting the opportunities of tech professionals that has to be mitigated.
  - Professionals with advanced technology skills are concentrated in very specific sectors and **more needs to be done to support intersectoral talent mobility**.
  - There is a **job position challenge** and more needs to be done in terms of training professionals across all occupational levels.
  - Top skills of recent hires of tech startups include mostly tech skills but also business organisation and interpersonal skills and confirms the **importance of focusing not only on technological education but also on soft skills**.
  - EU countries that retain and **attract the most AT talents are Germany and Austria**. They have gained almost twice the number of talent that they have lost. Germany and Austria **attract predominantly AT talents from outside the EU**.
- The results of the analysis shed light on the distribution of advanced technology skilled human resources across industries and sectors in the EU27 and in the US. 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.
  - **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.
  - 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.



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- 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.

## Representativeness analysis

- LinkedIn data is insightful and has a good coverage but has to be interpreted with caution. Technopolis Group performed a detailed representativeness analysis.
- LinkedIn is a dynamic database and it is continuously updated. To account for this volatility, data extractions are made regularly.
- **Technopolis Group assessed the representativeness of the LinkedIn sample against several criteria** at the level of country:
  - Population: active population
  - Gender: male and female
  - Sector: ICT and science and engineering
  - Education: Tertiary educated and less than primary/primary and lower secondary education
- Technopolis applied a corrective method to account for the under or overrepresented groups in the population using a post stratification technique by dividing the LinkedIn sample into post-strata and compute a post-stratification weight.
- The LinkedIn platform is not designed for statistical analyses. It is a self-selection database sample. The utility of joining LinkedIn varies among the EU population. LinkedIn is more representative in Western countries than in Eastern countries, but also more representative in higher education than among blue-collar workers, and more representative for the professionals in ICT than in more traditional sectors.
- Weaknesses of LinkedIn:
  - Skills do not distinguish between academic knowledge and practical knowledge.
  - Skills are based on a self-assessment, which questions honesty of users.
  - Missing points. No information on all for all users.
- The advantages and opportunities of LinkedIn are:
  - Single most comprehensive source currently available for the construction of technology-specific skills related indicators
  - Unique source for the level of granularity required for AT indicators
  - Most cost-effective alternative considering not just the cost of running the analysis once but also the potential to run the analysis at regular intervals and on demand
  - Allows skills supply analysis by industry i.e. professionals currently employed in the sector in focus
  - Multi level geographical coverage



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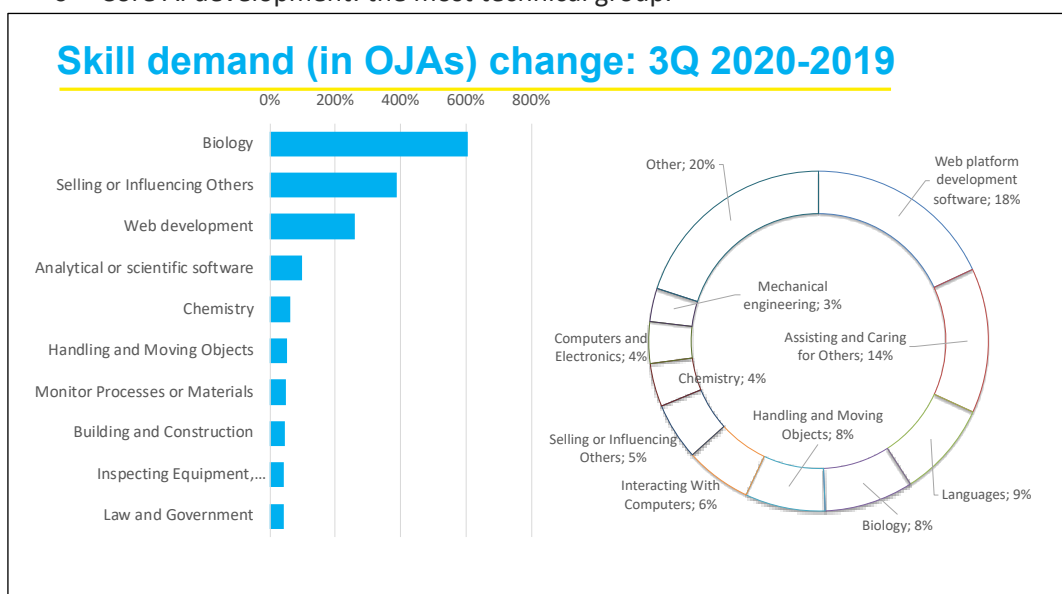
## 4. Skills for Advanced Technologies

Jiri Branka, Cedefop

- 4 main areas of work include: **matching skills demand and supply, best career paths for young people, skills development in school and in life, and European mobility of skills.**
- Links to the work of Cedefop on measuring employment in advanced technologies, and in particular on employment in high-tech:
  - In the high-tech economy: <https://bit.ly/3pATReR>
  - In the high-tech occupations in manufacturing: <https://bit.ly/3f9Zc7X>

The share of high-tech employment is different in the whole economy and in manufacturing. The countries that are the leaders are not the same. Northern countries and France have value-added activities in manufacturing sectors.

- **In ICT, there is a slow but significant shift from medium skilled to high skilled ICT jobs, from technicians to professionals.** One of the reasons of this shift can be the efforts of ICT companies to make their products and software more sophisticated and to develop things without the needs of ICT technicians.
- Cedefop has been specialised in collecting data on skills needs from job ads website across Europe. 100 million jobs ads have been processed. The sources of data are job search engine, public employment services, recruitment agency, online newspapers. The prevalence of each depends on the country.
- European regions are very heterogenous in terms of the skills needs in the job ads. In particular, in terms of the share of job ads related to ICT, R&D and engineering that can be up to 25% in some regions (10% being the EU average).
- **The size of demand for Artificial Intelligence (AI) is small: under 1% in US, 0,5% in EU.** AI skills are divided in a few major areas:
  - Automation and robotics,
  - Artificial Intelligence – wider use: the largest group,
  - Core AI development: the most technical group.



Note: OJA refers to online job advertisements





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Most skills in Artificial Intelligence are also used in other sectors (e.g. Python). Occupations that require AI are diverse. AI is slowly penetrating all sectors and type of jobs, not only ICT (biologists, etc.).

- Impact of the pandemic in the skills that have risen in demand. The fastest rising skill is biology, but other skills that have risen in the pandemic are web platform development software, assisting and caring for others, e-commerce.

## Questions from the audience

*Do you include Monster and Indeed data?*

The data is provided via API so there is no need to scrap their website. It is hard to maintain these agreements along time.

*Have you tested the representativeness at regional or city level?*

Not at the city level. At the national level, it was tested but it is hard to compare the data of Cedefop to something similar. At the regional level it is simply not possible. Nevertheless, the data is still reasonably robust. It consists more in indications of trends than in statistical analyses.

*Are you considering allowing the user to define the skills to query your database?*

Cedefop is developing a tool called data lab, that is hosted by Eurostat, with who they cooperate.

*How can you use the data to anticipate future demand?*

Data is not yet used for this purpose.

*Do you observe soft skills combined with digital skills in demand?*

It is indeed an observed trend.

## 5. Monitoring skills supply and demand in Estonia – the case of mechatronics

Ave Ungro, Estonian Qualifications Authority

- Mechatronics is a complex field that encompasses many future needs. It includes interesting aspects for all skill monitoring activities and combines several fields: computing, electronic systems, mechanical systems, control systems. It has a large scope of application.
- OSKA is a programme in Estonia that has been launched with the objective to anticipate and monitor labour skills and demand. It addresses questions such as: How many people are needed? Which skills are needed? Where and how to acquire these skills? Initially, the initiative was focused on the educational system, but now it is leading towards labour force training.
- OSKA has been implemented for 5 years now and has covered all Estonia's economic fields. A field analysis consists in **combining quantitative and qualitative data with the involvement of experts (employees, representatives, policy makers, etc) to evaluate the results.**
- The pilot of OSKA consists in using AI to monitor skills, mechatronics being a case study of this pilot. AI has been used to monitor skills needs in Finland already for years and they try to adopt a similar method for Estonia.



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- There is a lack of knowledge about mechatronics. Despite the precise descriptions of 3 positions in mechatronics in terms of skills by ESCO, employers often refer as “mechatronics skills” as a whole or get confused and use it as a synonym of electrical or digital.
- **The difficulties encountered during the mechatronics pilot were linked to the match between mechatronic curricula as the concepts related to mechatronics** are very wide in the curricula. They had to teach the tool to recognise the skills concept better, because at first it was indicating that the demand for mechatronics was very low. It shows that Artificial Intelligence cannot be used as the main source of data, not only in the field of mechatronics but in skills demand in general. Another related question is the level of details needed in the description of skills.

### Questions from the audience

*How do you see the technology skills supply in mechatronics?*

The AI project shows that it is advancing well. Schools are putting forward their effort to supply the skills that are needed in industry. A challenge is that certain industrial sectors might need certain skills, but some of the workers with these skills do not go into these industries.

*Are you monitoring the availability of AI professionals?*

Partially

*Maybe an approach going beyond the job ads would be to look at mechatronics profiles hired by companies?*

Absolutely. They thought about it and the possibility to use LinkedIn, it has to be discussed further.

*In which way will you use the current data from the AI tool?*

They want to develop the best version of the AI tool, and to develop it such that they can use not only for mechatronics (pilot) but for all skills. The pilot is a way to test the platform and identify the problems, but they will make it better next time. Hence, they will not use the current data because it is not robust and coherent enough. Unless if schools want to access the data to improve their program.

*Have you considered to inform employers about the fact that AI has been used to monitor the skills demand?*

OSKA is in constant contact with employers and associations from different fields. All the results are constantly shared. Employers are very important partners. They want them to benefit from the work of OSKA. They have an active and direct contact with employers, notably through expert communities, seminars, etc.

*In Slovenia activities like OSKA is performing, was inspired by S4 – Slovenian Smart Specialisation Strategy implementation within its 9 priority areas, where development of skills was already embedded from the beginning in 2016. Beside the essential stakeholder’s involvement and ownership we find of crucial importance active involvement and cooperation of at least 3 main E ministries – (i) Economy, (ii) Employment and (iii) Education what is not always an easy task)*

OSKA is currently closing the first round of surveys and doing the analysis of the results. It has taken 5 years to OSKA to analyse all sectors of Estonia’s economy, and now they are starting a new round.





# Advanced Technologies for Industry

## 6. Interactive session based on the Mural board

- The uptake of new technologies by companies going through transformative trends has been explored by Technopolis Group using LinkedIn data. It can be observed that companies that hire profiles hire very different AT skills, which makes it an interesting proxy. Another approach would be to use Twitter. For example, it is possible to isolate the companies within Twitter to see the language they use to describe transformative trends. These methods could provide good alternatives to more traditional ways – surveys and all their issues.
- Regarding the various data sources, the question is how different sources capturing different information on skills and job demand can be combined. Each source provides one piece of the puzzle. It is also important to note that during the pandemic the demand for these platforms has increased a lot. In general, recruitment is moving to platforms.
- With regard to emerging monitoring needs, OSKA is conducting a special research on the Covid-19 influence. It has mainly been sectoral. The influence of Covid has been fast, in particular on ICT skills. Hence, the need for reskilling becomes even stronger. Several other areas (connectivity, mobility) are very much impacted. They combine different methods together to have a sectoral overview. The work of Cedefop on the influence of Covid was shared: <https://www.cedefop.europa.eu/en/news-and-press/news/coronavirus-and-european-job-market-where-pandemic-hit-hardest-spring-2020>.
- While there is a discussion of refining indicators, we must be careful with the risk of “paralysis by analysis”. At the same time as we identify the needs, we must identify the solutions. Questions that should be asked include: what is the cost? the time needed? how could it be implemented? We must make sure that the logistics and resources in terms of people, funding and content are there. Hence, the activities of organisations that focus on detailed analyses must be embedded with those who develop the solutions, for instance curricula and training. Strong partnerships between both are needed to deliver impactful solutions.