



REthinking
EDUcation COmpetencies.
Expertise, best practices
and teaching in Digital Era

IO1 - The European Perspective

Competence profiles update perspective and impacts for the future digital society

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IO1.A1.1 The European perspective

Foreword

This report is part of the first intellectual output of the RE-EDUCO project¹ “*Rethinking EDUcation COmpetencies. Expertise, best practices and teaching in Digital Era*”, an Erasmus+ - KA2 - Strategic Partnerships in the field of Education - project n. 2020-1-IT02-KA201-079433.

Rethinking EDUcation COmpetencies. Expertise, best practices and teaching in the Digital Era is an action research project aimed to create the best conditions for the exchange of best practices in order to produce innovation and cooperation *in* and *between* partners’ countries.

Moreover, RE-EDUCO encourages the production, the experimentation and the exchange of new approaches and training methods in the field of digital culture.

It enhances the role of digital culture improving the possibilities for growth and exchange, widening the choices for young people in private and professional life.

Considering this complex framework, the project was born from the need to produce and test, at a transnational level, a range of methodologies and best practices to improve the skills of students and teachers and encourage them to embrace digital innovation in their lives, career opportunities and educational environments.

With the aim to achieve these goals the project will:

- provide to Institutions, students and innovative sectors a framework to better understand the potentiality and risks of digital technologies;
- encourage the cooperation and strengthen the collaboration among training institutions, research centres and businesses;
- offer to students and teachers the opportunity to increase their digital skills, through the collaboration with digital companies and the participation in creative active learning paths;
- promote the development of new learning paths and pedagogical approaches amongst teachers;
- encourage the sharing of materials and ideas through the promotion of an international community of best practices;
- share best practices for the dissemination of digital culture and integrated new educational approaches;

¹ Web site: <http://re-educo.eu>

- provide policymakers with a framework of information and data, useful for leading their strategies and policies towards a more informed and human-centred and people-oriented digital culture.

With the goal to reach the above-mentioned objectives, the RE-EDUCO project has built a partnership among universities, research centres, training institutions, schools, associations, business accelerators and incubators, including different experiences, approaches and perspectives. The project includes several partners from different countries like:

- Italy: with the Link Campus University and the Digital Technologies Education & Society research centre (Applicant) and the Italian Digital Revolution Association;
- Greece: with the Hellenic Open University;
- Spain: with Insomnia, a Business Accelerator and Incubator;
- Cyprus: with the Cyprus Computer Society (CCS);
- Finland: with Omnia, the Joint Authority of Education in Espoo Region.

RE-EDUCO contributes also to the improvement of teaching processes related to digital skills by:

- understanding the digital transformation and emerging skills recorded by the world of work, offering important sources of information to students, teachers, families, policy and decision makers;
- improving teachers' strategic skills in the use of new methodologies and online environment in education and didactic activities;
- experimenting a new training model for students and teachers, which aims at contributing to the creation of digital competences in order to address the new questions of the knowledge and information society in relation to education, raising also the quality of teaching as required by all European documents.

The main activities will be developed, within 34 months, following a stepwise approach.

The **first step** consists in the definition of the entire detailed project design, which will be shared with all partners in order to define a common theoretical framework related to: the digital revolution and its effects on the labour market, employment and competences and the methodology, instruments and outputs that will be elaborated. With this step, RE-EDUCO will realize the first Intellectual Output *Active citizenship for digital society. Skills and Training Planning (IO1)*, which includes two important actions: A1 *Needs analysis* and A2 *Informative and training courses*.

A1 Needs analysis: Competence profiles update: perspective and impacts for the future digital society offers the general framework to better understand the potentialities offered by digital transformation in strengthening learning processes, fostering employment and professional growth, promoting new active citizenship.

To support these actions the Applicant, in strong cooperation with other Italian partners (LCU and AIDR), prepares a useful template for sharing a common theoretical frame, methodologies and tools for national research. Each country partner will elaborate a national research on the bases of local data set for secondary data extraction, **related to local labour markets trends**, focusing on:

- needs analysis and industry 4.0;
- new digital profile;
- new emerging skills for digital society;
- skills gaps in the digital field.

A2 Informative and training course: Empowering people and community Risks and opportunities of digitalization for life, learning and professions which offer a set of information, orientation and training activities for students to empower their digital skills.

An online environment provided by the Applicant will support all the blended training courses and project activity. All partners prepare and share training contents for students' seminars. The informative and training material produced by partner countries are available to the whole partnership to favour the maximum dissemination by international channel and networking.

In a **second step**, the RE-EDUCO project aims to develop the community of teachers to favour the sharing of best practices, following the model of Teaching Learning Centres, as requested by all European documents focused on the quality of learning issues.

IO2 Excellence in teaching, learning and skills development will realize by the creation and activation of an International Teachers Community of practice through two correlated actions:

- IO2.A1 - *Alliance 4 Digital challenge Community (All4DigCha)*;
- IO2.A2 - and training course for teachers.

The Hellenic Open University is the leading organization for this action and cooperates strictly with P6 (responsible for *Re-Educo Youtube channel IO5*).

In the **third step**, the RE-EDUCO project will organize a *School Contest: from the idea research to digital start up* (IO3), which are laboratories and digital start-ups for digital innovation. Insomnia Consulting is leader of this action which includes two correlated activities:

1. Orientation paths and transversal skills. Research and enhancement of talents.
2. Digital start-ups for digital innovation.

In the **fourth step**, by the leadership of CCS, the RE-EDUCO project will offer *Active Learning for digital innovation* (IO4) to reinforce students' digital skills. *The course will be articulated into two modules and one workshop:*

- 1 module on computer essentials and online essentials;
- 1 module on word processing, spreadsheets and presentation modules;
- 1 workshop on presentation skills.

During the **fifth step**, the RE-EDUCO project aims to review, update and release all the materials (analysis, methodologies, tools, suggestions, school contest, start up, community etc.) produced during the whole project.

The leading organization for this IO is OMNIA which will provide, in strong cooperation and under supervision of the Applicant:

- *Guidelines, recommendations and tool for non-formal learning methods* (IO5.A1)
- the *Re-Educo Youtube channel* (IO5.A2) to guarantee the maximum continuity,
- diffusion and sustainability.

The RE-EDUCO project will implement a session of *partners staff training* (C1) by the leadership of OMNIA, to guarantee participants with methodological knowledge and skills to promote a better quality of teaching *in and for* the digital environment.

Monitoring, ongoing evaluation, communication, awareness raising and dissemination activities will accompany the entire project by the involvement of all partners.

Introduction

A useful contribution for understanding how digital technologies can change organisational and production models was conducted by the World Economic Forum (Schwab, 2019), which outline three possible developmental alternatives.

1. *Automation as a channel of optimization.*

In this perspective, automation and artificial intelligence should benefit companies, their customers and their workforce. Khanna (2019) imagines this scenario based on the adherence to four standards applied to the transformation process:

- improvement of job conditions and opportunities instead of workforce replacement;
- improvement of the way companies act in the market;
- addition of customer value;
- improvement of data-use potential without violating privacy.

2. *Cooperation with machines, not automation.*

This perspective foresees the integration of the workforce with technology instead of recourse to replacement; something which may be pursued by involving workers in the adaptation of automation processes while avoiding alienation from them. The achievement of this goal would affect society at different levels (Heeks, 2020).

- It would have an impact upon policies that go beyond the logic of mere redistribution and welfare.
- The organisational aim would be to highlight the responsibility of the leadership and managerial systems.
- The industrial agreements would need to aim at promoting a different model of protection, by creating the essential conditions for the affirmation of a new social contract and development models where the use of digital technology would create renewed opportunities.

3. *Digital transformation and transformation of the workforce.*

This would be achieved by creating digital work designed to promote employment standards suited to the digital economy and avoid the explosion of social inequalities capable of destroying the already fragile social fabric.

The contributions made by the McKinsey Global Institute (Manyika, Chui, Miremadi, Bughin, George, Willmott, Dewhurst, 2017) move along the same lines, and sustain that about half of the

world's current jobs will disappear quite soon, partially offset by the birth of new jobs that do not exist as yet and cannot even be imagined.

The management of similar disruptive scenarios cannot be left either to chance or to self-regulating market mechanisms which, over a period of thirty years of uncontested development, have eloquently revealed their weaknesses in terms of: the depletion of collective resources; the failure in redistributing the enormous wealth produced; financial speculations, the widening of poverty brackets and the harshening of nationalistic, cultural and religious clashes at global scale etc.

As Toynbee (2004: 78) recalls, "the effects of the industrial revolution show that free competition can produce wealth without producing well-being". Despite all this, virtuous experiences can be found here and there in the world, even in Italy. These experiences strive to create critical mass and establish themselves as an alternative. The difference lies mainly in the ability of political and managerial leadership to foresee solutions to problems, but also in their ability to view the reality with awareness and intellectual honesty, without either alarmism or facile enthusiasm.

Recently, the European Commission launched a new *Pact for Skills* (European Commission, 2020), considering the digital skills gap one of the most important issues for the future of Europe. The analysis illustrates in this report (IO1.A1 - *Needs analysis. Competence profiles update perspective and impacts for the future digital society*) aims to offer a contribution in defining a European digital skills strategy and global trend in this disruptive innovation.

The IO1.A1 *The Needs analysis* is composed by three closely related sub-products:

- *IO1.A1.1 The European perspective*
- *IO1.A1.2 Annexes. Template for National on desk research*
- *IO1.A1.3 Needs analysis for national desk research elaborated by each country's partners (Cypro, Finland, Greece, Italy, Spain).*

The *European perspective* (IO1.A1.1) consists of two chapters.

Chapter one. *The theoretical framework for Digital Pattern innovation* illustrates the European vision related to the digital challenge for the future of the labour market; the digital transformation, explained by the development of new digital culture, pointing out new opportunities for competitiveness, labour (emerging profiles and digital skills) education, cultural sectors and society. The European policies and digital innovation pact represent the focus of this first chapter.

Chapter two offers an *international comparison of labour market trends and schools* created on the basis of documents, databases and data sets of a secondary nature with the intention of representing the following two issues:

1. the skilling and reskilling between innovation and transformation and
2. the digital skill for High Schools.

The *Annexes: Needs analysis for national on desk research (IO1.A1.2)* focuses on the theoretical-methodological guidelines to indicate to all partners how to process the research/analysis at national level, in order to:

- a) type and selection of sources;
- b) glossary;
- c) structure and main contents to elaborate national report
- d) index for writing national reports ensuring the comparison of data.

1. The theoretical framework for Digital Pattern innovation

With the theoretical framework for Digital Pattern innovation, we define the European vision related to the digital challenge for the future of the labour market and the development of new digital culture, pointing out new opportunities for competitiveness, labour, education, cultural sectors and society.

1.1 European policies and perspectives for digital culture

For about twenty years the labour market has been undergoing major transformations. The sudden and continuous changes due to technological innovation require an adequate, and equally fast, process of adaptation for those who have to enter it. The new jobs will increasingly ask to become "multidisciplinary architects of socio-technical systems", it will be necessary to be able to have a knowledge that ranges in different areas and the required tasks will probably no longer refer to the role of an individual, but will become more and more focus on the centrality of the team (Butera, 2017).

In this complex and dynamic scenario, it becomes necessary to acquire and develop adequate digital skills; in particular, the educational system is called to assume a leading role, as well as a great responsibility, in educating the ruling class and workers of the future, who will have to learn always and, in any context, in the Life Long Learning frame. Europe invests more and more in policies, strategies, practices and tools for education, training and the labour market. European investments include a particular focus on the education system, which plays a strategic and relevant role in lifelong learning to succeed in the world and in the 21st century workforce. Education plays a particular role in providing young people and adults with knowledge, soft and hard skills, offering an opportunity to develop skills in a knowledge-based and increasingly digitized economy.

The Council of the European Union, starting from the principles declared in European Social Law, according to which all citizens have the right to inclusive and quality education, training and lifelong learning, to participate actively in social life and to manage transitions in labour market, has defined a reference framework with the aim of identifying:

- the key competences needed to exercise the right of active citizenship, improve employability and personal fulfilment, health and social inclusion;
- support all interested parties involved;
- promote the development of skills in a lifelong learning perspective, at all levels.

The key competences identified are:

1. Literacy competence
2. Multilingual competence
3. Mathematical competence and competence in science, technology and engineering
4. Digital competence
5. Personal, social and learning to learn competence
6. Citizenship competence
7. Entrepreneurship competence
8. Cultural awareness and expression competence

The Council specifies that digital skills have to allow citizens an aware, safe, critical and responsible use of digital technologies at work, for learning, for participation in social life and for social inclusion. The acquisition of adequate digital skills has to enable citizens to use digital technologies to:

- understand and use information, media and data literacy;
- communication and collaboration;
- the creation of digital content;
- IT security;
- digital wellbeing;
- intellectual property;
- problem solving and
- development of critical thinking.

The EU recommendations, which underline the importance and usefulness of digital technologies, specify that the acquisition of adequate digital skills must also make possible to understand the limits and risks of technologies, so that they are used in a conscious, responsible and ethical way².

In response to the Council resolution on education and training of February 2020 which stressed that no action had yet been taken to address the problem of the digital skills gap, as urged by the *Annual Sustainable Growth Strategy 2020* and considering the importance of improving the digital literacy of people to thrive in the digital environment, on 30 September 2020, the Commission approved two initiatives involving the education and training sector: the creation of a European Education Area and a new Action Plan for digital education.

² Council Recommendation of 22 May 2018 on key competences for lifelong learning: [Council Recommendation on key competences for lifelong learning \(22 May 2018\)](#) (Last consultation 11-12-2020).

The intention to create a European education area was declared by the European Commission with a document dated 30 September 2020³.

In the statement, President von der Leyen argues that:

“Education is essential to the vitality of European society and economy. The European Education Area aims to bring to the education and training communities the support they need to fulfil their fundamental mission, in challenging and exciting times”⁴.

About this observation, it is committed to achieving the European Education Area by 2025, as the right to quality and inclusive education, training and lifelong learning are fundamental elements to redefine the strategy of growth of the Union, based on sustainability, green and digital transitions.

The creation of a European Education Area will be directly linked to the European Skills Agenda, VET policies and the European Research Area to exploit knowledge as a key element for a prosperous Europe based on the principles of inclusion, mobility and innovation. To achieve this, the Commission proposes to consolidate ongoing efforts and further develop the European Education Area along six dimensions⁵:

1. Quality
2. Inclusion and gender equality
3. Green and digital transitions
4. Teachers and trainers
5. Higher education
6. Geopolitical dimension

In order to ensure a prosperous future, the EU has decided to intervene, through policies and investments, on training and education oriented towards green and inclusive digital transitions, to facilitate the transition towards an economy environmentally sustainable, circular and climatically

³ Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions on achieving the European Education Area by 2025: https://ec.europa.eu/education/sites/education/files/document-library-docs/eea-communication-sept2020_en.pdf (Last consultation 11-12-2020).

⁴ Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions on achieving the European Education Area by 2025: https://ec.europa.eu/education/sites/education/files/document-library-docs/eea-communication-sept2020_en.pdf, pag.1) (Last consultation 11-12-2020).

⁵ On achieving the European Education Area by 2025: https://ec.europa.eu/education/sites/default/files/document-library-docs/eea-communication-sept2020_en.pdf (Last consultation 11-12-2020).

neutral. In fact, only with education and the acquisition of skills aimed at promoting the transition to a greener and more digital world, will there be significant social and employment impacts and Europe will be able to acquire global leadership. To foster transformation:

- Education systems and institutions need to start for capacity building for the green economy, as well as promoting new sustainable infrastructure for education, training and renovating existing buildings.
- We will need to invest in education and training so that there are professionals capable of defining and managing a climate-neutral and resource-efficient economy.
- *Effectively support sustainability transitions by integrating environmental sustainability perspectives between the natural and human sciences and supporting changes in skills, methods, processes and cultures⁶.*
- Promote the acquisition and development of digital, entrepreneurial skills and above all develop the ability to learn to learn in order to deal with a new labour market characterized by technological innovation.

“Digital literacy is a must, the more so in a post-Covid-19 world. Practically all further learning and jobs in all sectors will require some form of digital skills, yet on average two in five Europeans aged 16-74 are lacking these skills”⁷

The second initiative of the European Commission concerns the *“Digital Education Action Plan (2021-2027) - Resetting education and training for the digital age.”⁸* The Commission's goal is to promote quality, inclusive and accessible digital education in Europe. To achieve these goals, the EU defines two strategic priorities:

1. Fostering the development of a high-performing digital education ecosystem;
2. Enhancing digital skills and competences for the digital transformation.

⁶ On achieving the European Education Area by 2025: https://ec.europa.eu/education/sites/default/files/document-library-docs/eea-communication-sept2020_en.pdf pag. 9 (Last consultation 11-12-2020).

⁷ Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions on achieving the European Education Area by 2025: https://ec.europa.eu/education/sites/education/files/document-library-docs/eea-communication-sept2020_en.pdf, pag.8 (Last consultation 11-12-2020).

⁸ Digital Education Action Plan (2021-2027) - Resetting education and training for the digital age: https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en (Last consultation 11-12-2020).

In the first priority, the Commission intends to take the following initiatives:

- Encourage dialogue between member countries so that they create the conditions for defining a recommendation document of the European Council about online and distance learning.
- Elaboration of a European framework for the contents of digital education while respecting the cultural diversity and creativity of the different countries.
- Support the Gigabit connectivity of schools, as well as connectivity in schools, through European funding for Internet access and the purchase of digital equipment, applications and e-learning platforms.
- Support digital transformation projects at all levels of education and training;
- Support digital pedagogy through Erasmus projects, support teachers in the acquisition and development of digital skills. To encourage this last aspect, the creation of an online tool for self-assessment of teachers' digital skills called "Selfie for teachers" is planned.
- Establish ethical guidelines about artificial intelligence and the use of data in teaching/learning for educators, support research and innovation, under Horizon Europe⁹, in this area.

The second strategic priority: "Enhancing digital skills and competences for the digital transformation" aims to develop basic digital skills starting from early childhood and develop advanced digital skills capable of encouraging the increase of digital specialists and ensure equal gender representation in both studies and digital careers. To facilitate the achievement of the objectives identified, the Commission intends to adopt the following measures:

- develop common guidelines for teachers and teaching staff aimed at promoting digital literacy and tackling disinformation;
- update the European digital skills framework (DigComp)¹⁰ to include artificial intelligence and data-related skills;
- create a European Digital Skills Certificate (EDSC) recognized and used by stakeholders (governments, employers, etc.) of member countries;
- propose a Council recommendation for improving the provision of digital skills in education and training;

⁹ EU budget: Commission proposes most ambitious Research and Innovation programme yet: https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_18_4041/IP_18_4041_EN.pdf (Last consultation 11-12-2020).

¹⁰ The Digital Competence Framework for Citizens: [https://publications.jrc.ec.europa.eu/repository/bitstream/JRC106281/web-digcomp2.1pdf_\(online\).pdf](https://publications.jrc.ec.europa.eu/repository/bitstream/JRC106281/web-digcomp2.1pdf_(online).pdf) (Last consultation 11-12-2020).

- encourage member countries to increase participation in the International Computer and Information Literacy Study (ICILS)¹¹
- Promote the development of advanced digital skills through the extension of internships aimed at VET students and apprentices; create professional development opportunities for the staff of educational institutions for the acquisition of advanced digital skills (teachers, trainers and other staff involved in teaching).
- Take initiatives to encourage female participation in STEM courses (science, technology, engineering and mathematics) with the European Institute of Innovation and Technology (EIT)¹² and support the EU STEM Coalition¹³. Define university curricula able to attract and increase the presence of women in engineering and ICT courses based on the ‘STEAM’ approach.

In support of the decisions of the European Commission to adopt the aforementioned strategies, there are many data such as those that show that: many European families do not have a computer and/or are not reached by the broadband signal (Eurostat 2019)¹⁴; 44% of people between 16 and 74 (2019 data) do not have basic digital skills¹⁵; less than 40% of teachers in Europe feel ready to use digital technologies; these data also show a clear lack of homogeneity across Europe (OECD, 2018)¹⁶. The European Commission recognizes the need and indisputable benefits of digitization, but is aware that the process hides pitfalls, the risk of increasing the digital skills gap and, consequently, further accentuating regional and social divisions in the EU. On the other hand, the skills gaps also underline the differences in education levels, largely due to the socio-economic status. Therefore, it is necessary that the potential of digital technologies become a real advantage for the citizens of the European Union and this has not yet been realized.

¹¹ The 2018 International Computer and Information Literacy Study (ICILS): Main findings and implications for education policies in Europe: https://ec.europa.eu/education/resources-and-tools/document-library/the-2018-international-computer-and-information-literacy-study-icils-main-findings-and-implications-for-education-policies-in-europe_en (Last consultation 11-12-2020)

¹² The European Institute of Innovation and Technology (EIT): https://ec.europa.eu/education/policies/innovation-in-education/the-european-institute-of-innovation-and-technology-eit_en (Last consultation 11-12-2020).

¹³ Stemcoalition.eu: <https://www.stemcoalition.eu> (Last consultation 11-12-2020).

¹⁴ Digital economy and society statistics - households and individuals: https://ec.europa.eu/eurostat/statistics-explained/index.php/Digital_economy_and_society_statistics_-_households_and_individuals (Last consultation 11-12-2020).

¹⁵ European Skills Agenda for sustainable competitiveness, social fairness and resilience COM/2020/274 final. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0274> (Last consultation 11-12-2020).

¹⁶ OECD, TALIS 2018 Results (Volume I): <https://doi.org/10.1787/1d0bc92a-en> (Last consultation 11-12-2020).

1.1.1. Digital transformation

The main leverage of transformation within both public and private sector organizations is represented by exponential technologies, as defined in the following paragraphs, and their potential to generate process improvement and enable more effective, agile and faster ways of working.

The executive management of the company is called to lead this **digital transformation** by developing strategies that allow it to keep up with the continuous technological evolution and its **speed**. At the same time, public administrations are called upon to innovate their organizational models with a view to digital innovation, which is also a prerequisite for accessing the funds made available by European institutions in the new Next Generation recovery fund to address the pandemic crisis as an opportunity to revitalize the economies of Member States.

Due to their positive impact within organizations, technologies are used to improve the efficiency of operational; decision-making processes; productivity; customer service; cost efficiency, but also to develop new business models; design new services and products, generate new revenue streams that drive business performance.

Several studies confirm that companies sensitive to change, with a strong vision and a mature approach to digital transformation processes, are on average more profitable. Such companies generate higher revenues than those that have not been able to transform their core business through digital technology. Digital technologies create real opportunities for organizations of all sizes and in all sectors.

All this being said, i.e. having ascertained that digital transformation is not an option but a need for change, it is not so easy to define the phenomenon that embraces different and complex processes. Therefore, it seems more useful for the "defining" purpose to start from the objectives of digital transformation. The aim is to do business through a "vision" that leads to a new operating model based on the deep integration between digital platforms, people, places and tools, and which is characterised by the substantial rethinking of business processes, business models and the entire customer experience that becomes the main focus of the company. In this wake of change, it is necessary to be aware that innovation is not limited to the integration of technology in all areas of the company, but it required a significant cultural growth to overcome all the obstacles that generate resistance in the transformation process. These changes come out of the schemes adopted so far and rewrite the rules, starting with people, passing through processes, and then arriving at technologies.

Through digital transformation, we are witnessing the overwhelming growth of innovative start-up with a high technological content capable of changing the paradigm of work and the way of doing business. Some of them have become large, successful companies globally, transforming entire economic sectors through digital platforms: such as Uber in the mobility sector, Airbnb in tourism, Amazon and Alibaba for retail.

The ability of these start-ups has been to be able to exploit existing technologies in ways never imagined before applying them to innovative business models and successful strategies that traditional companies, too busy thinking about processes, had not approached with sufficient determination. In fact, large companies (the so-called incumbents, i.e. organizations traditionally present in a market often distinguished by near-monopoly position, thanks to their research and large investments have provided a base of revolutionary technologies (such as Internet, Cloud, Artificial Intelligence, blockchain) that successful start-ups have been able to exploit and use to create solutions for new targets.

These technologies, therefore, have provided the backbone for innovation and growth of newcomers who have been able to focus exclusively on identifying problems and creating solutions without having to build the technological foundations on which to base their existence. These start-ups have been able to interpret the socio-cultural change and the innovations taking place in an agile and timely manner by adopting business models previously considered not applicable because they are not economically sustainable, such as sharing and the gig economy (and on the sidelines any criticism on the negative effects with respect to specific market areas and competition).

In practice, we have moved from a company where the main asset was the capital in order to have economies of scale to one based on data, so called "Data Driven", thanks to new technologies able to transfer huge amounts of data in almost real time. In fact, access to information is the main element that now makes new business models possible. The availability of tools with considerable computing power and access to all possible information has allowed anyone to try to create a start-up, with ever lower initial creation costs.

Once understood the level of change and the speed with which it is happening, it is clear that the digital transformation is a colossal opportunity to increase the productivity of companies, absolutely not to be wasted, which will allow from the point of view of growth to create new products and services, to enter new markets, new niches, creating value for the distribution model we have today.

It is understood that this opportunity must be supported by context policies that, on the one hand, do not limit innovation and, on the other hand, protect the positions of private individuals - first and foremost from a data privacy perspective; small companies that must turn to incumbents to acquire

the knowledge assets that only they possess and, more generally, the unfolding of a fair competition. In fact, as it will be better explained in the following paragraphs, it is no coincidence that the Commission has been working for some time now on the so-called **digital services package**, finally proposed with the Digital Services Act and Digital Markets Act on December 2020, and the **reform of the competition rules** for the creation of a new competition tool also in support of the Green Deal and the technological transition (and in the same direction to a redefinition of the Notice on the relevant markets to adequately consider the impact of technologies on them as traditionally interpreted).

1.2 New technologies, emerging profiles and digital skills

The new technologies in every process of digitization of a company or public administration, are primarily related to artificial intelligence, cloud, robotics and artificial intelligence, 3-D printing, augmented reality, virtual reality, blockchain and smart contracts ready to use for creating development and enable new ways of interaction in the ecosystem and make it accessible to new subjects and attractive for new investments.

Today more than ever, emerging technologies, often called **exponential**, can represent the core of the transformation and innovation of operational models in various fields, both personal and professional. To grasp their value, it is enough to think of their applications in the health, financial or manufacturing fields. For example, with 3D printing, it is possible to quickly produce not only complex parts of mechanical assemblies, but also prostheses and even organs and tissues. With collaborative robotics, on the other hand, in addition to production support, technology can now also be used in the surgical and diagnostic fields. The same applies to artificial intelligence applied to medical imaging or genomic sequencing, useful to develop predictive insights and enable increasingly accurate autonomous systems. Further examples of the disruptive and innovative capacity of emerging technologies can be found in the financial field when we talk about "fintech", a term that - in its widest meaning - refers to a wide variety of services and technologies for companies and individuals, introducing a set of innovations related to banking and financial products and services. Think of: electronic payments (cashless), online platforms for peer-to-peer lending or investment in innovative projects (crowdfunding), automated trading (algo-trading), automated consulting (robo-advice). In the financial field, obviously, the most disruptive novelty is represented by the creation of the so-called cryptocurrency, i.e. a digital representation of value based on cryptography. The most famous is the Bitcoin, which introduced us to the knowledge of blockchain, a technology that ensures security and uniqueness of data through a protection system that its creators define as unassailable, through a series of complex calculations.

The inviolability of the protocol is actually central to the success of cryptocurrency, however, due to the lack of a central bank that ensures its stability, it is struggling to take off. Similar impact has been seen in the insurance sector, where insure-tech is being discussed and, on the one hand, new technologies are being applied to traditional management methods (e.g. the development of so-called online comparators) and, on the other hand, new insurance risk management systems are being created.

Having said this, in order to better understand the phenomenon to which the digital universe tends, it is necessary to look at a wide range of exponential technologies that share the same mission: simplifying and improving people's lives, as well as innovating the way companies do business. It seems therefore useful to offer a brief overview of these technologies and their possible applications.

In the common vision is expected a significant growth in the adoption of Smart Devices, i.e. those intelligent and connected devices that we generally call the **Internet of Things** (IoT). These devices make it possible to collect data from virtually any device (cars, buildings, airplane engines, cars, people, etc..) for the most diverse applications: health, energy efficiency, predictive maintenance, mobility to name the best-known examples. For those involved in marketing, the amount of data that can be collected on customers and their behaviour is particularly useful to improve the **Customer Experience** and ensure customer loyalty. **Big Data & Analytics**, in fact, is an equally important trend that, on the one hand, allows the development of new business models already defined as data driven and, on the other, to offer tailor-made products based on the needs and preferences of the consumer. The fact that it is supported by Machine Learning ensures that data analysis is fast and effective and supports all those organizations that have made their fortune on the survey and examination of data by developing successful strategies in offering products and services. **Artificial Intelligence and Machine Learning** are innovative technologies that use prolific data to fuel the intelligence revolution to customize services for customers, reduce human error and increase productivity. Think of **collaborative robotics**, (*co-bot*) or a new mode that provides close collaboration between humans and robots in the production process or **RPA** systems that allow us to perform repetitive tasks automatically imitating human behaviour. The Iper-automation linked to Big Data and Artificial Intelligence has as main objective to free "man", the most precious resource for a company, from manual and repetitive tasks, from heavy and dangerous tasks, thus increasing the productivity and competitiveness of the organization.

Indeed, for the sake of completeness, while advantages technology has brought into the workplace are non-rebuttable and makes its use crucial in today workplace, there are instances where

technology offers disadvantages such as related costs for setting up and maintenance, poor performance reviews, lack of “personal communication”, increase of inequality¹⁷.

Finally, among the main technological trends, we should not overlook the potential of cloud computing, through which it is possible to offer innovative services such as SaaS (software-as-a-service)¹⁸, IaaS (infrastructure as service)¹⁹ and PaaS (platform-as-a-service)²⁰. This marks the beginning of the XaaS (*servitization* - everything as a service)²¹ era, i.e. the transition from offering goods to providing integrated systems services.

The emergence of these and new technologies requires not only the adaptation of organizational models but also the emergence of **new professional profiles** and the need to adopt a **new set of skills**. The concerns expressed about the negative impact of new technologies on the economy and the world of work cannot be overlooked. The main ones are summarized in the *Global Risks Perception Survey* (“**GRPS**”) of 2018, conducted by the World Economic Forum²², which highlights - as the most frequently cited risk interconnection - the association between technological progress and unemployment.

In other words, technological innovations could generate unemployment on a large scale, difficult to heal, with obvious significant social and political impacts, including a possible increase in social inequalities and their negative effects on cohesion. In fact, others believe that technology can generate a new era of prosperity with the creation of new professions that will be able to “accommodate” workers employed in jobs made obsolete by technology. In this regard, a recent international analysis of PwC shows that despite the disruptive impact of automation on the work

¹⁷ For a complete overview please see European Parliament “The impact of new technologies on the labour market and the social economy available at:

[https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614539/EPRS_STU\(2018\)614539_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614539/EPRS_STU(2018)614539_EN.pdf)

¹⁸ SaaS is a software distribution model in which a service provider hosts applications for customers and makes them available to these customers via the internet. For more details and example please see: <https://www.infoworld.com/article/3226386/what-is-saas-software-as-a-service-defined.html>

¹⁹ Infrastructure as a Service (IaaS) is a cloud computing service where enterprises rent or lease servers for compute and storage in the cloud. For more details and example please see: <https://avinetworks.com/glossary/infrastructure-as-a-service-iaas/>

²⁰ Platform as a Service (PaaS) is a complete development environment that is hosted in the cloud and enables application developers to create apps quickly and easily. It usually includes an OS, web server, tools, programming language, database, network, servers, storage, and more. The PaaS provider hosts and maintains the system and often builds a solution tailored to the unique needs of the customer. The customer maintains control of its applications. Many providers offer pay-as-you-go and other online pricing models. For more details and example please see: <https://www.hpe.com/it/it/what-is/paas.html>

²¹ Everything-as-a-Service (XaaS) simply denotes the increasing servitization of technology. Also known as anything-as-a-service, XaaS originated with the SaaS deployment model and now includes IaaS, PaaS, and even more functionally-specific models, such as storage-as-a-service, desktop-as-a-service (DaaS), and disaster-recovery-as-a-service (DRaaS). For more details and example please see: <https://gomindsight.com/insights/blog/everything-as-a-service/>

²² The *Global Risks Report 2018*. 13th Edition, World Economic Forum Global Challenge Insight Report, pag. 8-17: http://www3.weforum.org/docs/WEF_GRR18_Report.pdf (Last consultation 11-12-2020).

of the future, it is plausible that if new technologies can make some more routine and repetitive tasks disappear, they can also lead to the creation of new types of work, also due to the effect of the transformation of many professions and industrial activities from which new activities/professions will emerge, for example: smart working architect, online event manager, SEO analyst, AI (artificial intelligence) specialist, data analyst, chief transformation manager, digital marketing expert, e-commerce manager, customer success manager. Such a trend in the US led to a significant increase in creating jobs. Indeed, in 2016, the digital economy employed 5.9 million workers, representing 3.9 percent of total employment and from 2011 to 2016, employment in the digital economy grew at an average annual rate of 3.7 percent compared to an average annual rate of 1.7 percent for the overall economy²³.

Today, and especially tomorrow, most of the work will be characterized by a dual focus on the theme of skills: on the one hand, the growing demand for solid knowledge and technical-scientific skills, on the other, an application of soft skills, and attitudes (flexibility, sharing, ability to react to change) whose needs are expanded precisely by digital transformation. Jobs will be less and less linked to specific tasks and will require interconnected skills. Hence, the emerging need to support the development of skills suitable for the professions of the future that (or rather of the workers of the future) will inevitably intertwine with the unstoppable technological and digital evolution.

Similarly, the World Bank (2019), in its *World Development Report 2019: Changes in the world of work*²⁴ highlights how, although in some advanced economies and middle-income countries, the advent of robots is causing job losses in the manufacturing sector, and professions that rely on easily "codable" routine tasks are more subject to automation, technology offers opportunities to create new jobs, increase productivity and provide more efficient public services. Just think that through innovation, technology generates new areas such as video communications, entertainment, e-commerce, home automation, Internet of Things applications and vehicle telematics. New digital skills, instead, include advanced cognitive skills (problem-solving skills such as sustained attention, selective attention, divided attention, long-term memory, working memory, logic and reasoning, auditory processing, visual processing, processing speed²⁵), socio-behavioural skills (attitude to teamwork), and a concomitance of skills, such as logical reasoning and self-efficacy, which make human resources versatile and adaptable to the context.

²³ Barefoot, D., Curtis, W. J., Nicholson, J. R., & Omohundro, R. (2018). *Defining and Measuring the Digital Economy*. Retrieved from <https://www.bea.gov/system/files/papers/WP2018-4.pdf>

²⁴ World Development Report 2019: Changes in the world of work: <https://openknowledge.worldbank.org/handle/10986/30435> pag. 11, 17. (Last consultation 11-12-2020).

²⁵ See: <https://www.indeed.com/career-advice/career-development/cognitive-skills-how-to-improve-them>.

In any case, what is noted is that, beyond the pervasiveness of digital culture, the impact will be diversified with respect to sectors and countries, also considering the so-called mega-trend of globalization.

In fact, with regard to **the structure of the effects of change**, there is talk of polarization and de-industrialization of the labour market (OECD, 2017). Polarization means the circumstance in which the average level of skills will leave room for highly paid jobs with high skills respectively or, conversely, minimum wage jobs with a demand for low skills. This is a change in the world of work already underway and also driven by skill-based technological change (i.e. that favours skilled versus unskilled labour), a process in which technological change is mainly to the advantage of workers with higher skills. Italy, in reality, is (together with Ireland) in contrast to the trend resulting in a country of low polarization with a decrease in medium-high skills jobs and an increase in low skills jobs only. Also in this sense, however, it can be assumed already in the coming months, an alignment to the phenomenon forced by the pandemic and driven by what will be the guidelines provided by the **recovery plan** that, already in its guidelines, provides a series of programmatic indications on the digital transition whose effects are expected primarily in the world of work.

Deindustrialization, on the other hand, represents the transition from a typical manufacturing employment to that of services, a sector in which the diffusion of technologies has contributed to transform the methods of access and use.

Confirming the pervasiveness of these phenomena, the demand for digital skills for today's and tomorrow's professions can be seen not only in the specialized "core" sectors, but also in the more traditional ones. In Europe, 9 out of 10 jobs will require digital skills but at the same time 169 million Europeans between 16 and 74 years old (44%) do not have basic digital skills. In fact, the greatest criticality of the world of work today is represented by the difficulties of companies to find resources with professionalism aligned to the needs of competition in global markets that by their nature are characterized by a high rate of technology.

Blockchain and artificial intelligence expert, Big-data analyst/architect, 3D printer specialist, Robot Process Automation expert, e-commerce expert, APP designer, Social-media manager, Digital marketing specialist, iOS programmer and Android are just some of the most requested professionals that, however, are scarcely available. These criticalities are exacerbated by the fact that **trends change almost monthly** and large scenarios change annually.

Moreover, as mentioned in the previous paragraphs, there is a further professional need across all sectors and directly related to new technologies: the growing demand for solid knowledge and technical-scientific skills is accompanied by the need for soft skills and attitudes (flexibility, sharing, ability to react to change) whose needs are expanded by the digital transformation. With respect to this second profile, the "professions of the future" will be less and less linked to specific tasks and will require interconnected skills modelled on technological and digital evolution. The 84% of managers interviewed for the report *Future of Jobs 2020* of the World Economic Forum push for the digitization of work, with an important expansion of remote work, which could involve up to 44% of the workforce, to be accompanied by some corrective measures necessary to respond to the risk of a drop in productivity and which are precisely related to the soft skills and attitudes that must accompany the transition to the new professions. At the same time, as the OECD²⁶ observed, the world of education and training is facing the growing demand/need to prepare students for rapid economic development, environmental and social changes, jobs that have not yet been created, technologies that have not yet been invented, even to solve social problems that have not yet emerged or have not been anticipated. Indeed, the World Economic Forum, albeit with a projection not supported by data for obvious reasons, claims that 65% of the children who go to school today, once graduated, will do the jobs that do not yet exist. For the *Institute for the Future* ("IFTF") the figure is even 85%.

1.3 ICDL - The Digital Skills Standard

Well known for many years as ECDL (European Computer Driving Licence) and managed by the ECDL Foundation, the leading digital skills certification body was recently renamed to ICDL²⁷ (International Computer Driving Licence) and is managed by ICDL Europe.

ICDL is the international digital skills standard. Across the world, education and training institutions, and public and private sector employers, use ICDL to provide the current and future workforce with the digital skills necessary to perform effectively in the modern workplace.

ICDL is made up of several programmes: ICDL Workforce, ICDL Professional, ICDL Insights, ICDL Digital Student and ICDL Digital Citizen. Within each programme, a range of modules cover skills for work and life.

²⁶ The future of education and skills: education 2030: the future we want:
[https://www.oecd.org/education/2030/E2030%20Position%20Paper%20\(05.04.2018\).pdf](https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf) (Last consultation 11-12-2020).

²⁷ ICDL Europe - www.icdleurope.org

ICDL Programmes²⁸

ICDL Workforce is designed to build the digital skills of the modern workplace. ICDL Workforce modules help employees and candidates demonstrate their effective use of technology with skills and knowledge that can be further developed by progressing to the ICDL Professional modules and beyond.

ICDL Professional is designed to meet the needs of modern professionals in a range of sectors and develops an advanced level of skills for those with technology reliant roles. From the use of business applications to the fundamentals of advanced technologies, these skills allow them to manage different types of work-load as well as collaborate with technical teams. ICDL Professional contains a range of modules which can be combined in any way to create a unique ICDL Profile. The syllabus content of each module is supported by learning materials that mirror day-to-day tasks and responsibilities typical of a role in the sector or industry.

ICDL Insights contains a range of modules which can be combined with other ICDL modules to create a unique ICDL Profile. The syllabus content of each module is supported by high-quality eLearning materials that establish core concepts, give practical examples of implementation, and provide opportunities for reflection. Together with a short certification test, this learning can provide an excellent opportunity either to develop relevant competences for future career development, or to contribute to continuous professional development.

Schools around the world use ICDL. **ICDL Digital Student** offers both flexibility and a range of levels, along with an up-to-date offering that is kept to rigorously high standards around the world. Students can benefit from an internationally recognised certification that is mapped to a number of qualifications, frameworks and standards, and which integrates with curricula in several countries.

ICDL Digital Citizen is specially developed to cater for those with no experience whatsoever of computers and the Internet. ICDL Digital Citizen helps to remove the fear of using a computer for complete novices by using a simple, non-threatening approach to educating individuals in the basic skills of using a computer, email and the internet.

ICDL Profile

The set of modules a candidate has successfully completed is referred to as their ICDL Profile. Attaining an ICDL Profile is a continual process. It can be built on over time, as the candidate's needs change, or as technology evolves and more modules are developed. In this way, the ICDL Profile

²⁸ <https://www.icdleurope.org/icdl-programmes/>

grows with the candidate: it shows their commitment to lifelong learning and the continuous upgrading of their digital skill set.

International Recognition of ICDL

ICDL is mapped to a number of international frameworks, including DigComp and national qualifications frameworks in Europe. There are also recognitions of the ICDL programme in various countries in Europe and beyond, including Poland, Italy, Portugal, Ireland, Romania, France, and Malta.

ICDL and DigComp

The ECDL Foundation has been involved in DigComp for a number of years. Through engagement with the development of DigComp, it has contributed insights from its experience in certifying digital skills. Primarily the ECDL Foundation brings an employability and work-related skills perspective to DigComp and have developed a number of its own programmes in line with competences featured in DigComp.

The high degree to which ICDL covers the DigComp framework has been independently validated. A 2018 study carried out by the UNESCO Institute for Statistics indicated that ICDL covered DigComp more comprehensively than 8 other international digital literacy frameworks or schemes.

UNICEF published a paper on digital literacy for children that argued that the UN agency should use the DigComp framework to develop its own digital literacy strategy for children. The paper also noted that ICDL has been used in 31 countries as a competence framework, and highlights that both the DigComp framework and the Digital Kids Asia-Pacific framework are compatible with ICDL.

The experience of ECDL Poland in using ICDL to cover DigComp competences in a practical skills development project has been highlighted in the JRC's 'DigComp in Action' publication.

Other Recognitions and References²⁹

France: ECDL is mapped to France's National Register of Professional Qualifications (CPF). ECDL has been mapped to the French National Qualification framework. The mapping to the National Register of Professional Qualifications means that ECDL candidates in France can access funding to build their digital skills under the *Compte Personnel de Formation* (CPF), an initiative that is open to millions of French employees and job seekers. ECDL is mapped as a transversal qualification - it is not restricted

²⁹ <https://www.icdleurope.org/policy-and-publications/recognitions/>

to a specific domain or subdomain, but covers all areas of professional activity. All training that is funded by the initiative must be registered on the National Register of Professional Qualifications. The recognition opens the opportunity to take ECDL under the CPF to workers and job seekers from all professional sectors and in all regions of France. The number of CPF hours are assigned to French employees based on years of employment and allow them to acquire any approved professional training for free.

Romania: ECDL recognised by Romanian Ministry of Education as equivalent to the Bacalaureate for Digital Literacy. Since 2010, ECDL has been recognised by the Romanian Ministry of Education as equivalent to the Bacalaureate test in digital literacy. Students have the choice to pass the traditional state exam at school or benefit from the opportunity of having ECDL an international qualification. Since 2010, over 50,000 high school students validated the digital literacy exam at the Bacalaureate by obtaining the ECDL Certificate.

Cyprus: The ECDL programme has been introduced in the public schools of secondary education. Since 2016, the ECDL has been introduced in the public schools of Cyprus following an agreement of the Ministry of Education, Culture, Sports and Youth with the Cyprus Computer Society, the national operator of ECDL in Cyprus. The agreement allows students in secondary education in grades 7 through 9 to undertake four ECDL modules for free and the cost is financed by the Government of Cyprus. The curriculum for those grades has also been aligned to map with the ECDL curriculum in those four modules. To date, thousands of secondary education students are developing and certifying their digital skills in Cyprus based on the ECDL standard.

More information about the ICDL programme, references and recognitions of the ICDL programme can be found at:

<https://www.icdleurope.org/icdl-programmes/>

<https://www.icdleurope.org/policy-and-publications/recognitions/>

1.4 European digital innovation pact

The European Commission, aware of the difficulties of many companies to know the technologies on which to invest and how to ensure transfers for their digital transformation, has proposed the creation of the first "digital Europe" programme that will invest €9.2 billion to align the next long-term budget of the EU 2021-2027 with the growing digital challenges.²⁰

In this context, on 5 May 2020, the Commission published a working document in which it outlined, together with the Member States, how the so-called European Digital Innovation Hubs ("EDIHs"), i.e. European innovation poles should be implemented. These are one-stop-shops that must help

companies to become more competitive in their business/production processes, products or services using digital technologies. EDIHs should provide access to technical expertise and experimentation, so that companies can "test before they invest". They will also provide innovation services, such as financial advice, training and development of the skills needed for successful digital transformation. Under this programme, grant opportunities will focus on improving hub structures and staff employment to enable EDIHs to provide services that stimulate a wide diffusion of Artificial Intelligence, HPC and Cybersecurity, both in sectors (especially SMEs and midcap) and in public sector organizations. According to the Commission, the selections of EDIHs will follow a two-step process: in the first, Member States will designate potential hubs and in the second, the Commission will launch a call for proposals limited to these hubs pre-selected by Member States³⁰.

Furthermore, depending on the current configuration and future needs of the local industry or public sector, each EDIH should have or should develop a dedicated focus on a **specific sector or technology**. What the Commission aims to do is to ensure complementarity between EDIHs that will be free to define their own organization and governance structure. In fact, in addition to their specific expertise, they must ensure links with the business world. With the currently proposed budget of between 500,000 and 1 million euros, it is expected to support between 130 and 260 Hubs across Europe.

It is worth pointing out that in Europe the digital transformation will not only be supported by the Digital Europe programme, which focuses on investments in digital capabilities. In fact, Horizon Europe will continue to finance research and innovation activities also in the experimentation of innovative digital solutions, while the European Regional Development Fund will support the evolution of HEIBs by supporting them - for example - to provide services to small and medium enterprises and public administrations or in the purchase of equipment, infrastructure and software. InvestEU, instead, will mobilize private investments with financial instruments dedicated to the support of digital transformation.

In September, work started on the *"European Digital skills and job platforms"*³¹ with the aim of developing and managing a key tool, the so-called core service platform, to strengthen digital skills in Europe - offering information, resources, an overview of training and funding opportunities and a community space for networking and collaboration at both European and national level. The Digital Skills and Jobs Coalition, which brings together Member States, companies, social partners,

³⁰ Cfr. European Commission Directorate-General for communications networks content and technology. European Digital Innovation Hubs in Digital Europe Programme Draft working document 05-05-2020: https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=62936 (Last consultation 11-12-2020).

³¹ Skills and Jobs Platform: project team starts work: <https://ec.europa.eu/digital-single-market/en/news/european-digital-skills-and-jobs-platform-project-team-starts-work> (Last consultation 11-12-2020).

non-profit organizations and academics, acting to address the lack of digital skills in Europe, had already been established.

On November 10, during the Professional Skills Week 2020, the Commission launched the new "Pact for skills", an initiative involving several stakeholders to support the systematic and global training and retraining of European countries. DIGITAL SME ³² was the first to join the Pact underlining the need for a public-private partnership at European level in the Strategy 2030.

The Pact, public-private and preceded by a similar initiative by Digital SME, aims to improve and retrain European citizens and businesses starting from their skills.

³² The Digital DIGITAL SME Alliance is a community of small and medium-sized ICT companies. Its members are national sectoral associations of digital SMEs in 30 countries and regions in the EU and neighboring countries, all associated with over 20,000 SMEs..

2. International comparison of labour market trends and schools for digital transformation

2.1 The European approach

The European Commission realized the ESCO project³³ (European Skills, Competences and Occupation) with the aim to support job mobility across Europe promoting the adoption of a common language for different stakeholders about occupations and skills.

ESCO is the European multilingual classification of Skills, Competences and Occupations. It represents a sort of dictionary, describing, identifying and classifying professional occupations and skills considered significant for the EU labour market and education and training.

ESCO provides descriptions of 2942 occupations and 13.485 skills linked to these occupations. It is translated into 27 languages.

ESCO intends to be a bridge between the labour market and education/training system. It is part of the Europe 2020 strategy and the New Skills Agenda for Europe. ESCO is one concrete implementation of the digital labour market policies put in place by the Commission at European level to oppose disruptive changes or digital revolution and market labour.

It's important to outline that there are other international and European classifications systems and frameworks also for this reason, to promote a system vision of labour market transformation, the EU tried to develop ESCO free online platform with the intent to define frequently expression and a systemic approach by the integration of some elements from these different classification tools.

It could be useful to summarize, briefly, the variety of these frameworks to clarify the complexity on the basis of each study focused on the labour market.

International Standard Classification of Occupations (ISCO)³⁴

The International Standard Classification of Occupations (ISCO) is a four-level classification of occupation groups managed by the International Labour Organisation (ILO). Its structure follows a grouping by education level. The two latest versions of ISCO are ISCO-88 (dating from 1988) and ISCO-08 (dating from 2008).

³³ For further information see: European Commission - ESCO: <https://ec.europa.eu/esco/portal/>

³⁴ European Commission - International Standard Classification of Occupations (ISCO): https://ec.europa.eu/esco/portal/escopedia/International_Standard_Classification_of_Occupations_40_ISCO_41

In ESCO, each occupation is mapped to exactly one ISCO-08 code. ISCO-08 can therefore be used as a hierarchical structure for the occupations pillar. ISCO-08 provides the top four levels for the occupations pillar.

NACE³⁵

NACE is a Statistical Classification of Economic Activities in the European Community. It is part of the international integrated system of economic classifications, based on classifications of the UN Statistical Commission (UNSTAT), Eurostat as well as national classifications.

In ESCO, NACE revision 2 was used to organise the development of occupational profiles by 27 sectors of economic activities.

EQF³⁶

The European Qualifications Framework (EQF) provides a common reference framework which assists in comparing the national qualifications systems, frameworks and their levels. It makes qualifications more readable and understandable across different countries and systems in Europe. The qualifications pillar of ESCO is developed in a way that is consistent with the EQF. This will allow building on the results achieved during the work on the EQF. National qualification databases will be a valuable source for ESCO.

ISCED-F³⁷

The International Standard Classification of Education: Fields of Education and Training 2013 (ISCED-F) is a classification which is related to the International Standard Classification of Education (ISCED). Both are maintained by the UNESCO Institute for Statistics.

In ESCO, ISCED-F is used as metadata for **qualifications** in the **qualifications pillar**.

³⁵ European Commission - Statistical classification of economic activities in the European Community (NACE): https://ec.europa.eu/esco/portal/escopedia/Statistical_classification_of_economic_activities_in_the_European_Community_40_NACE_41

³⁶ EQF: [https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32017H0615\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32017H0615(01)&from=EN) (Last consultation 11-12-2020).

³⁷ ISCED-F - UNESCO Institute for Statistics: International Standard Classification of Education and Training: <http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-fields-of-education-and-training-2013-detailed-field-descriptions-2015-en.pdf> (Last consultation 11-12-2020).

e-CF³⁸

The European e-Competence Framework (e-CF) classifies 40 competences for the ICT professionals. It establishes a common language for competences, skills and proficiency levels across Europe. Competences in the e-CF are organised according to five ICT business areas and related to the European Qualifications Framework (EQF).

The e-CF is an important source for developing ESCO and in particular has been used by the Sectoral Reference Group ICT service activities.

Specifically, e-CF - The *European e-Competence Framework* - is not based on job profiles but rather on competences. Its purpose is to provide general and comprehensive e-Competences specified at five proficiency levels that can be adapted and customised into different contexts from ICT business and stakeholders' application perspectives. The 41 competences of the framework are classified according to five main ICT business areas and relate to the *European Qualifications Framework* as summarized in Fig. 1

³⁸ European e-Competence Framework: <https://www.ecompetences.eu/>

Figure 1: European e-Competence Framework

Dimension 1 5 e-CF areas	Dimension 2 41 e-Competences identified	Dimension 3 5 e-Competence proficiency levels				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. Information Systems and Business Strategy Alignment					
	A.2. Service Level Management					
	A.3. Business Plan Development					
	A.4. Product/Service Planning					
	A.5. Architecture Design					
	A.6. Application Design					
	A.7. Technology Trend Monitoring					
	A.8. Sustainability Management					
	A.9. Innovating					
	A.10. User Experience					
B. BUILD	B.1. Application Development					
	B.2. Component Integration					
	B.3. Testing					
	B.4. Solution Deployment					
	B.5. Documentation Production					
	B.6. ICT Systems Engineering					
C. RUN	C.1. User Support					
	C.2. Change Support					
	C.3. Service Delivery					
	C.4. Problem Management					
	C.5. Systems Management					
D. ENABLE	D.1. Information Security Strategy Development					
	D.2. ICT Quality Strategy Development					
	D.3. Education and Training Provision					
	D.4. Purchasing					
	D.5. Sales Development					
	D.6. Digital Marketing					
	D.7. Data Science and Analytics					
	D.8. Contract Management					
	D.9. Personnel Development					
	D.10. Information and Knowledge Management					
	D.11. Needs Identification					
E. MANAGE	E.1. Forecast Development					
	E.2. Project and Portfolio Management					
	E.3. Risk Management					
	E.4. Relationship Management					
	E.5. Process Improvement					
	E.6. ICT Quality Management					
	E.7. Business Change Management					
	E.8. Information Security Management					
	E.9. Information Systems Governance					

Source: E-QF

2.2 Type and selection of sources

Information and communication technology (ICT) professionals research, plan, design, write, test, advise, and improve computer systems, hardware, software, and are responsible for developing specific applications. They also handle documentation. They design, develop, monitor, maintain, and support databases and other information systems to ensure optimal performance, integrity, and security of processed data.

International experiences, with respect to the detection of tasks, skills and professional and training needs in the ICT field, are fragmented and often incomplete. The data collected and disseminated by the various European countries are very inhomogeneous, have a limited set of metadata and, in cases where they are collected through statistical surveys, are included in broader contexts in which the object of the survey is not ICT skills but the labour market or skills, in the most general sense of the term.

The reconnaissance of sources allowed us to identify the experience that we consider most relevant. We mention here in particular the research conducted and published in 2019 by the OECD *Measuring the digital transformation: a roadmap for the future* that analyses, comparing the situation in OECD countries, the Mismatch of digital skills at work in 2018.

Another source considered was Eurostat. In this case, we learned in the *Methodological Manual for statistics on the Information Society* the incidence of ICT specialist skills is inferred indirectly by measuring whether companies employ ICT specialists.

According to Cedefop's *European Skills and Jobs Survey* (ESJS³⁹), the five key competencies for ICT professionals are advanced ICT skills, problem solving, moderate ICT skills, learning, and job-specific skills. These skills could benefit employees to meet future ICT skills challenges to acquire as well.

For the reconnaissance of labour market trends at the European level, with regard to the transformations induced by the digital revolution, we chose to refer to the following international sources OECD (2019), CEDEFOP (2019), EUROSTAT (2020). In view of the accelerating processes of obsolescence of skills in these areas, it was chosen not to use older sources of information.

³⁹ Cedefop: <https://www.cedefop.europa.eu/en/events-and-projects/projects/assisting-eu-countries-skills-matching>

2.3 Skilling and reskilling between and transformation

For the on-desk analysis presented in this project report, documents summarizing ICT labour market trends were considered. In particular, from CEDEFOP, we will consider forecasts for the outlook for labour market trends from 2018 onward.

Skills Panorama (CEDEFOP, 2019) is a site for interactive consultation⁴⁰ of European labour market trends. The service is offered by the European Commission, Directorate-General for Employment, Social Affairs and Inclusion and promoted by Cedefop, European Centre for the Development of Vocational Training.

The document *ICT professionals: skills opportunities and challenges* (2019 update)⁴¹ for 2018 indicates that about 3.5 million people in Europe were employed as ICT professionals. Cedefop, between 2018 and 2030, assumes an 11% growth in jobs due to the creation of 395,000 new jobs (Chart 1). To this figure, due to the exit from the market of workers who will retire or otherwise leave their jobs, 1.6 million ICT professional jobs will have to be added that will have to be filled with the entry of new people (Chart 2). CEDEFOP's assessment is that the increase in employment will affect mainly highly qualified ICT professionals with high levels of education.

According to this survey, half of ICT professionals work in the ICT services sector and the other in all sectors of the economy, particularly manufacturing, professional services, and financial and insurance services.

Following the CEDEFOP (2019) analysis:

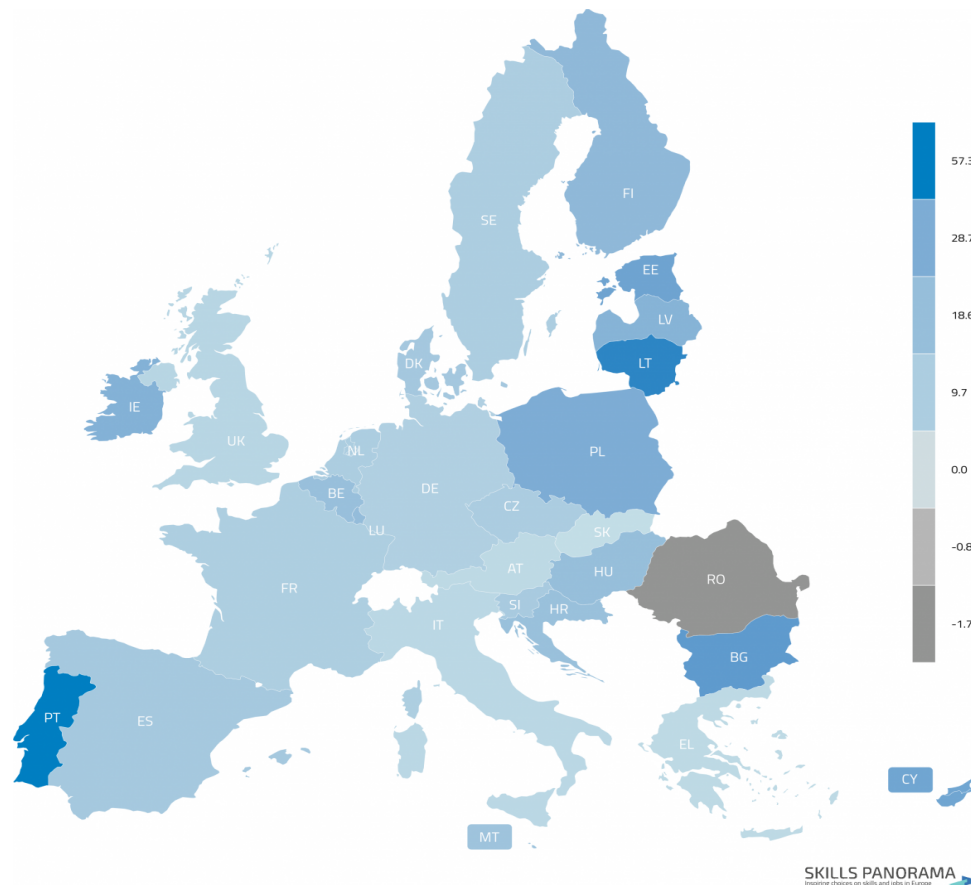
“ICT technicians may differ according to the sector they work for. Despite these dissimilarities, common drivers of change can be identified in relation to development of new business models and processes both in IT and its user sectors. Most ICT technicians hold either medium- or high-level qualifications (49 per cent and 43 per cent, respectively, in 2018). Between 2018 and 2030, these proportions are expected to change, as those with medium level qualifications will represent 40 per cent of the workforce in 2030, whereas those with high level qualifications will represent 54 per cent.

⁴⁰ Skills Panorama: <https://skillspanorama.cedefop.europa.eu/en> (Last consultation 11-12-2020).

⁴¹ Future employment growth of ICT professionals in European countries, Skills Panorama. Available at: https://skillspanorama.cedefop.europa.eu/en/analytical_highlights/ict-professionals-skills-opportunities-and-challenges-2019-update#_what_are_the_trends_for_the_future_2 (Last consultation 11-12-2020).

The share of low qualified workers is expected to decrease from 8 in 2018 to 6 per cent in 2030. Another key characteristic of the occupation is that skills are particularly vulnerable to the swift and constant technological advancements across sectors. In the workplace, using ICT, being autonomous, gathering and evaluating information are the most important tasks of ICT technicians”.

Graph. 1: Future employment growth of ICT professionals in European countries (2018-2030, in %)

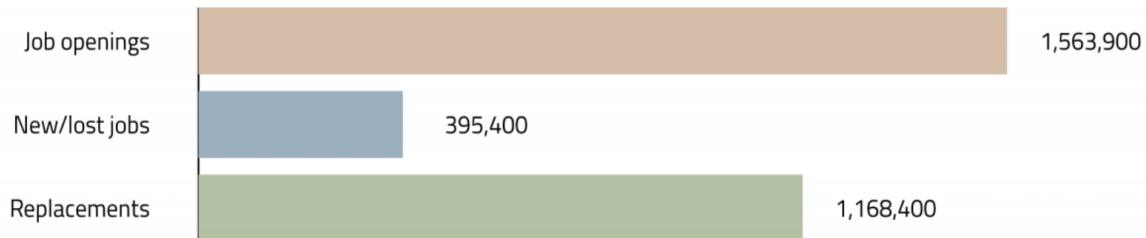


SKILLS PANORAMA
 Inspiring choices on skills and jobs in Europe

Source: Cedefop, 2019⁴²

⁴² ICT technicians: skills opportunities and challenges (2019 update) - What are the trends for the future? https://skillspanorama.cedefop.europa.eu/en/analytical_highlights/ict-professionals-skills-opportunities-and-challenges-2019-update#_what_are_the_trends_for_the_future_2 (Last consultation: 12-07-2020)

Graph. 2: Future job openings of ICT professionals (2018-2030)



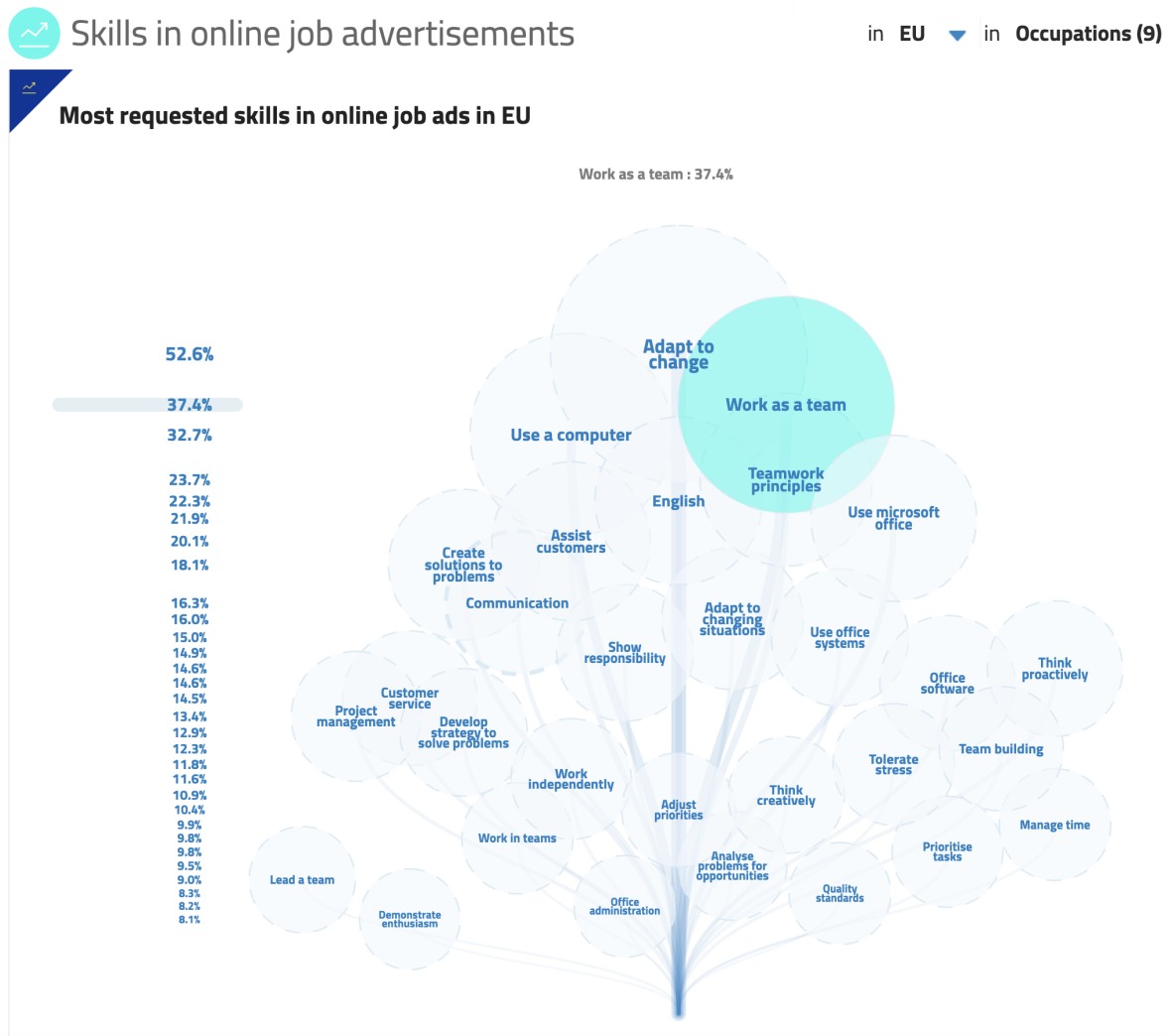
Source: Cedefop, 2019⁴³

Skills Panorama brings insights on jobs and Skill requested in online job advertisements. Based on an ongoing Cedefop project, these insights now cover 28 European countries. More than 67 millions of online job ads were collected and analysed, covering the period of July 2018 till December 2019. The analysis provides information on most required occupations and skills across European countries and regions based on established international classifications: ISCO-08 for occupations, NUTS-2 for regions, ESCO for skills and NACE rev. 2 for Sector⁴⁴

⁴³ ICT technicians: skills opportunities and challenges (2019 update) - What are the trends for the future? https://skillspanorama.cedefop.europa.eu/en/analytical_highlights/ict-professionals-skills-opportunities-and-challenges-2019-update#_what_are_the_trends_for_the_future_2 (Last consultation: 12-07-2020)

⁴⁴ Skills in online job advertisements: <https://skillspanorama.cedefop.europa.eu/en/dashboard/skills-online-job-advertisements?country=EU&occupation=#1> (Last access: 11-12-2020)

Fig. 2: Most requested skills in online job ads in EU



Source: Cedefop, 2019

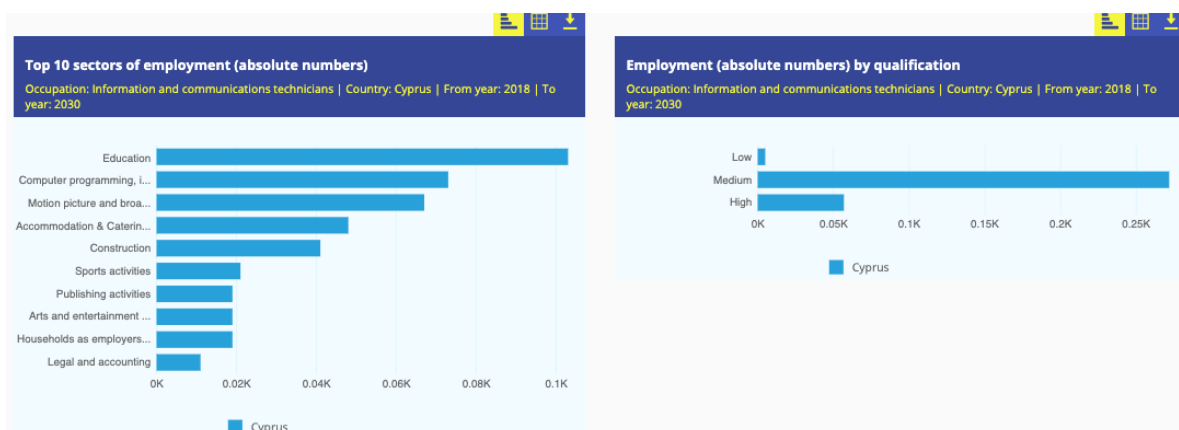
In the partner countries of the Erasmus plus RE-EDUCO project the employment growth in ICT between 2018 and 2030 is proposed by the CEDEFOP website in graphical form in the analysis Future employment growth (in %).

The following charts for the RE-EDUCO project partner countries present estimates of future employment, future job openings, and replacement needs for the specific occupation "Information and communications technicians." The graphs present the top 10 employment sectors and employment by skill in absolute numbers for the selected occupation. As for future job openings

and replacement needs, their change in absolute numbers is illustrated. Information and communications technicians (ICT technicians) find employment in a wide range of sub-occupations ranging from network systems technicians to telecommunications engineering technicians. Because of the wide penetration of information and communication technologies throughout the economy, they work in a wide range of industries including ICT, manufacturing, telecommunications, and services. It is important to remember that the predictions reported here were developed prior to the advent of the pandemic by Covid-19.

As can be seen (Graph 3), as far as Cyprus is concerned, employment in the Information and communications technology sector will concern mainly medium-level qualifications, less so higher qualifications and there will be little increase in low-level qualifications.

Graph. 3: Future employment growth (in %) Cyprus

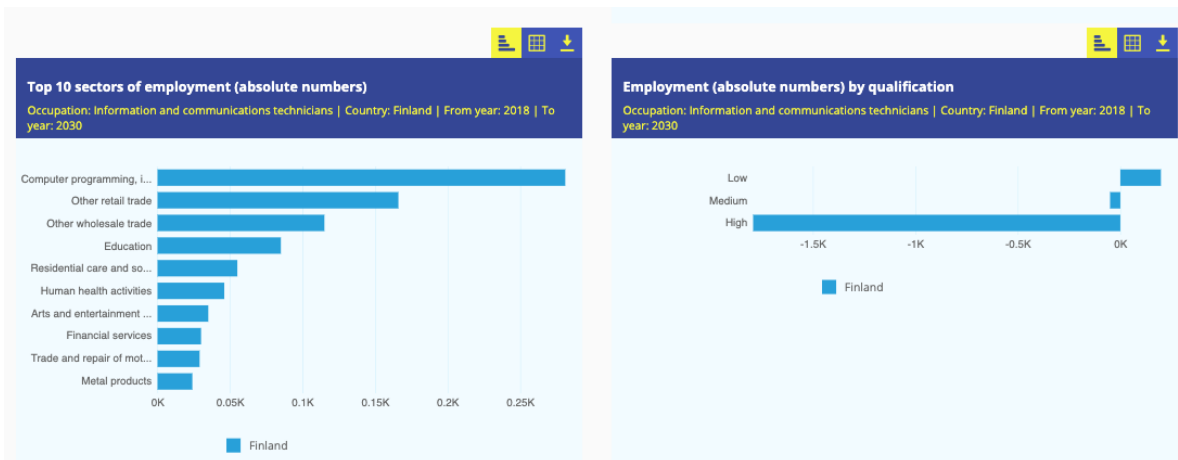


Source: Cedefop, 2019⁴⁵

As far as Finland is concerned, the analysis produced by CEDEFOP (Graph 4) shows that employment in the Information and Communications Technology sector will show growth only in relation to low qualifications, while there will be a small reduction in employment for medium qualifications and a notable reduction for high qualifications.

⁴⁵ Skills Forecast: <https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/skills-forecast> (Last consultation 11-12-2020).

Graph. 4: Future employment growth (in %) Finland



Source: Cedefop, 2019⁴⁶

Continuing with the examination of Greece, it can be seen that employment in the Information and Communications Technologies sector will expand in part in relation to low qualifications and, above all, to higher qualifications. On the other hand, there will be a reduction in employment in relation to medium-level qualifications (see Graph 5).

Graph. 5: Future employment growth (in %) Greece



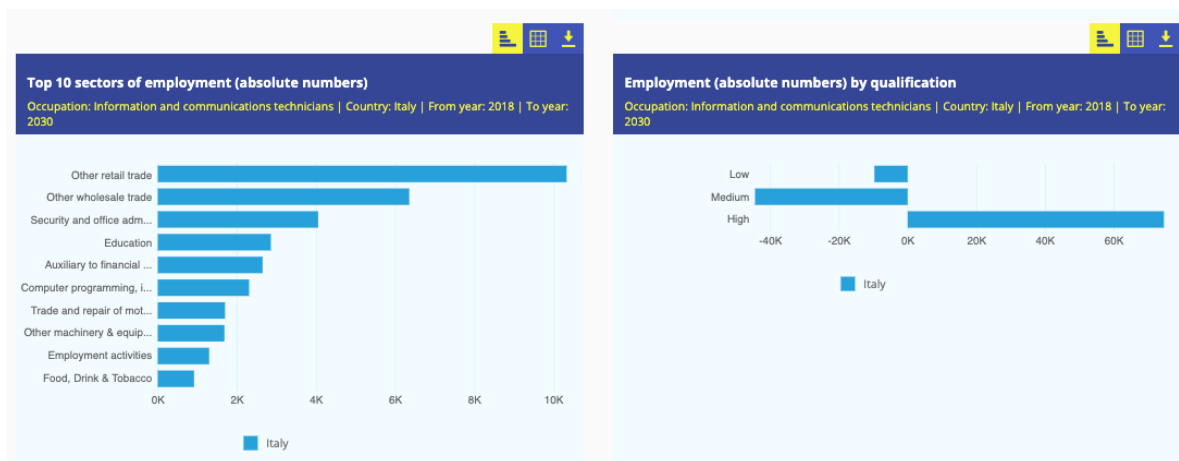
Source: Cedefop, 2019⁴⁷

⁴⁶ Skills Forecast: <https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/skills-forecast> (Last consultation 11-12-2020).

⁴⁷ Skills Forecast: <https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/skills-forecast> (Last consultation 11-12-2020).

Examination of the data for Italy (see Graph 6) shows that employment in the Information and Communications Technology sector will see a significant expansion of employment in relation to high-level qualifications, while there will be a significant contraction in the employment of medium-level qualifications and, to a slight extent, also low-level qualifications.

Graph. 6: Future employment growth (in %) Italy

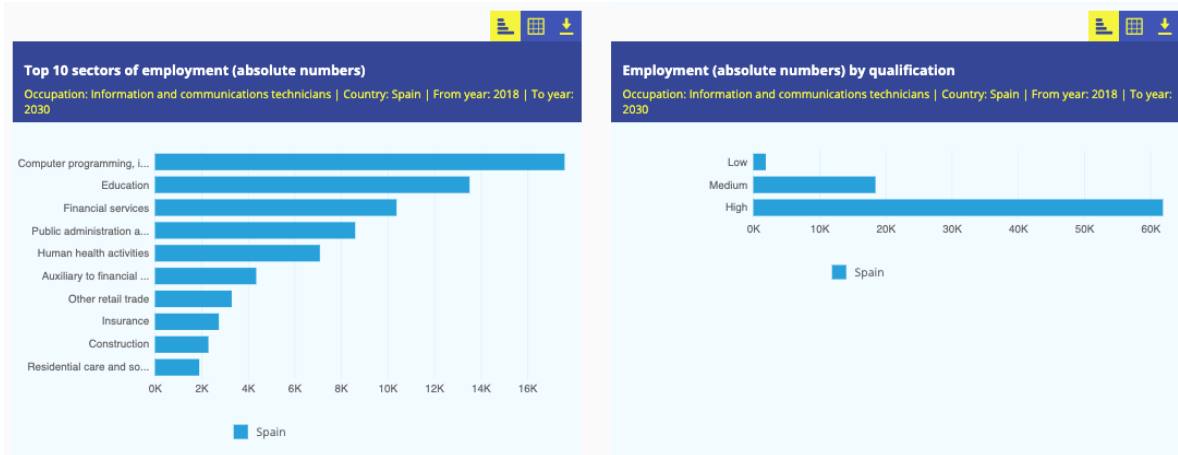


Source: Cedefop, 2019⁴⁸

Finally, looking at Graph 7, with reference to Spain, it emerges that employment in the Information and Communications Technicians sector will mainly concern high qualifications, less so medium qualifications and only very partially low qualifications.

⁴⁸ Skills Forecast: <https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/skills-forecast> (Last Access:11-12-2020).

Graph. 7: Future employment growth (in %) Spain

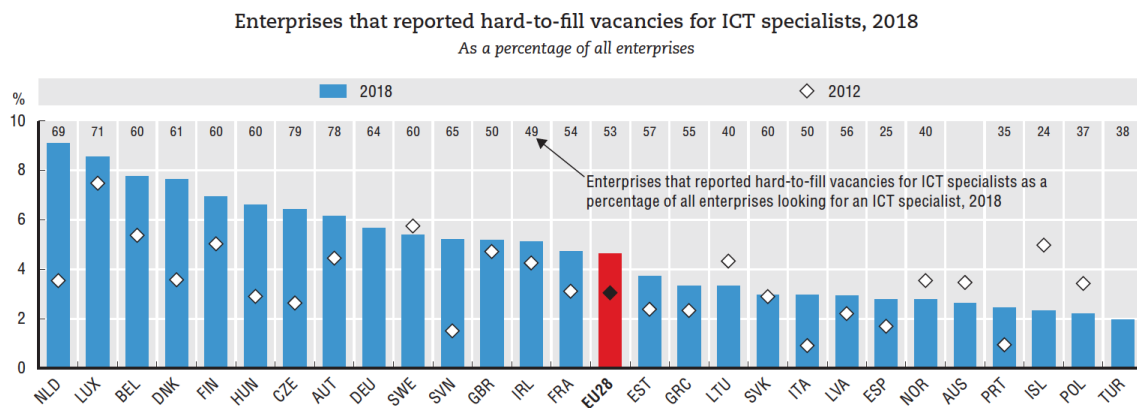


Source: Cedefop, 2019⁴⁹

To complete the analysis of ICT employment trends, reference can also be made to *Measuring the Digital Transformation, a roadmap for the future* (OECD, 2019).

The former relates to: Firms reporting 2018 ICT specialist vacancies that are difficult to fill (Chart 8).

Graph. 8: ICT profiles difficult to cover



Source: OECD, ICT Access and Usage by Businesses Database, <http://oe.cd/bus>, December 2018. See chapter notes. StatLink contains more data.

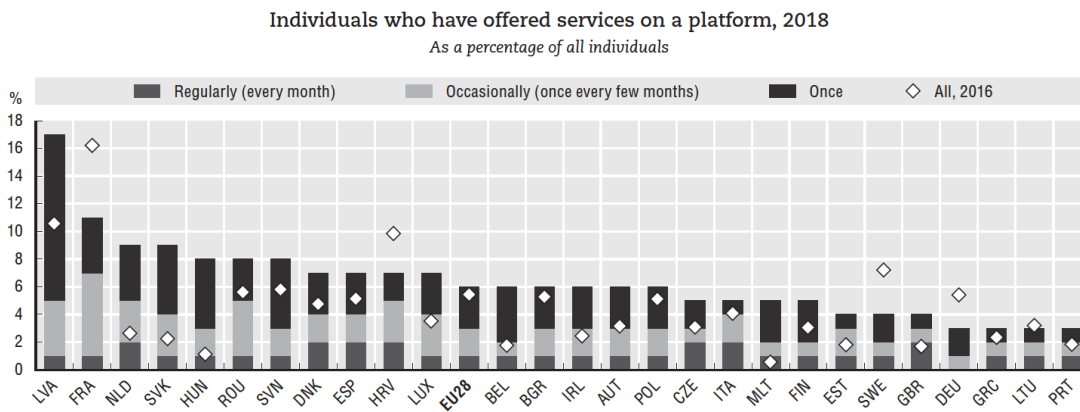
StatLink  <https://doi.org/10.1787/888933930611>

Source: OECD, 2019

⁴⁹ Skills Forecast: <https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/skills-forecast> (Last Access:11-12-2020).

A second graph illustrates the situation regarding online activities, i.e. services related to the development of Apps and activities linked to the creation and updating of websites (Graph 9).

Graph. 9: Individuals who have offered services on a platform (App o WEB) nel 2018



Source: European Commission (2018). See chapter notes.

StatLink <https://doi.org/10.1787/888933930801>

Source: OECD, 2019

ICT professionals perform narrowly defined categories of work that require a wide range of skills, some general, some specific, and many change over time. As jobs change, so do the skills workers must possess to perform them. To analyse this, the OECD text *Measuring the Digital Transformation, a Roadmap for the Future* references online job postings from Burning Glass Technologies that highlight the types of skills in demand and how the skill profiles of occupations change over time.

Chart 10 shows an analysis of 1.8 million U.S. job ads in 2018 for four computer-related occupations. The survey shows the types of skills most in demand for each occupation and the types of skills for which demand grew rapidly between 2012 and 2018.



Graph. 10: Top-demanded skills in computer-related jobs, United States, 2018



Note: The word clouds display the top 30 skills demanded in each of the occupational categories considered. The size of the words mirrors the relative frequency with which words appear. Words appearing in more than 2% of the cases in the category considered are displayed in blue.

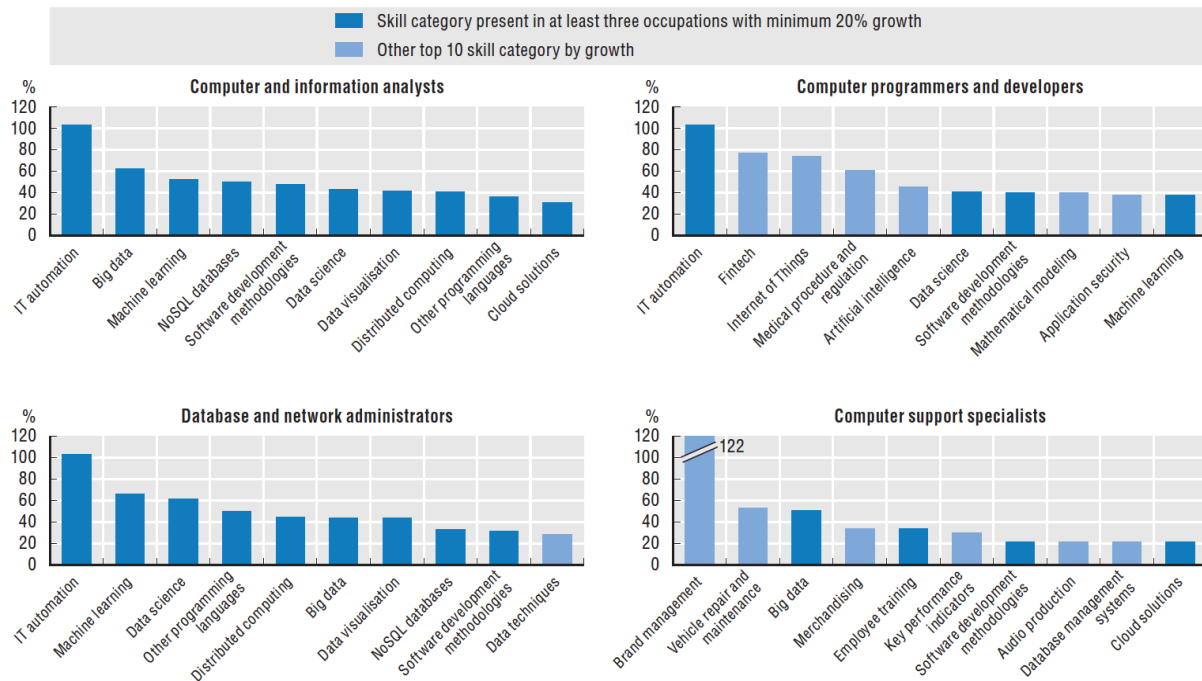
Source: OECD calculations based on Burning Glass Technologies, www.burning-glass.com, January 2019. See chapter notes.

StatLink  <https://doi.org/10.1787/888933928806>

Source: OECD, 2019

Graph 11 shows that the most in-demand ICT skills are common to all computer-related occupations and include "IT automation skills," "machine learning" and "big data" or "software development methodologies." The growth in demand for these technical skills is often combined with an increase in demand for complementary skills, such as the ability to train employees or industry-specific skills, for example, "fintech," "medical procedure and regulation," or "brand management".

Graph. 11: Top 10 skills in high demand for computer-related jobs, United States, 2012-18



Note: Only skills categories which were present in more than 2 000 vacancies in each eight-digit Standard Occupational Classification (SOC) 2010 occupation were analysed, so as to minimise the probability that a few large employers drive the resulting growth rate. Growth is calculated over the entire period.

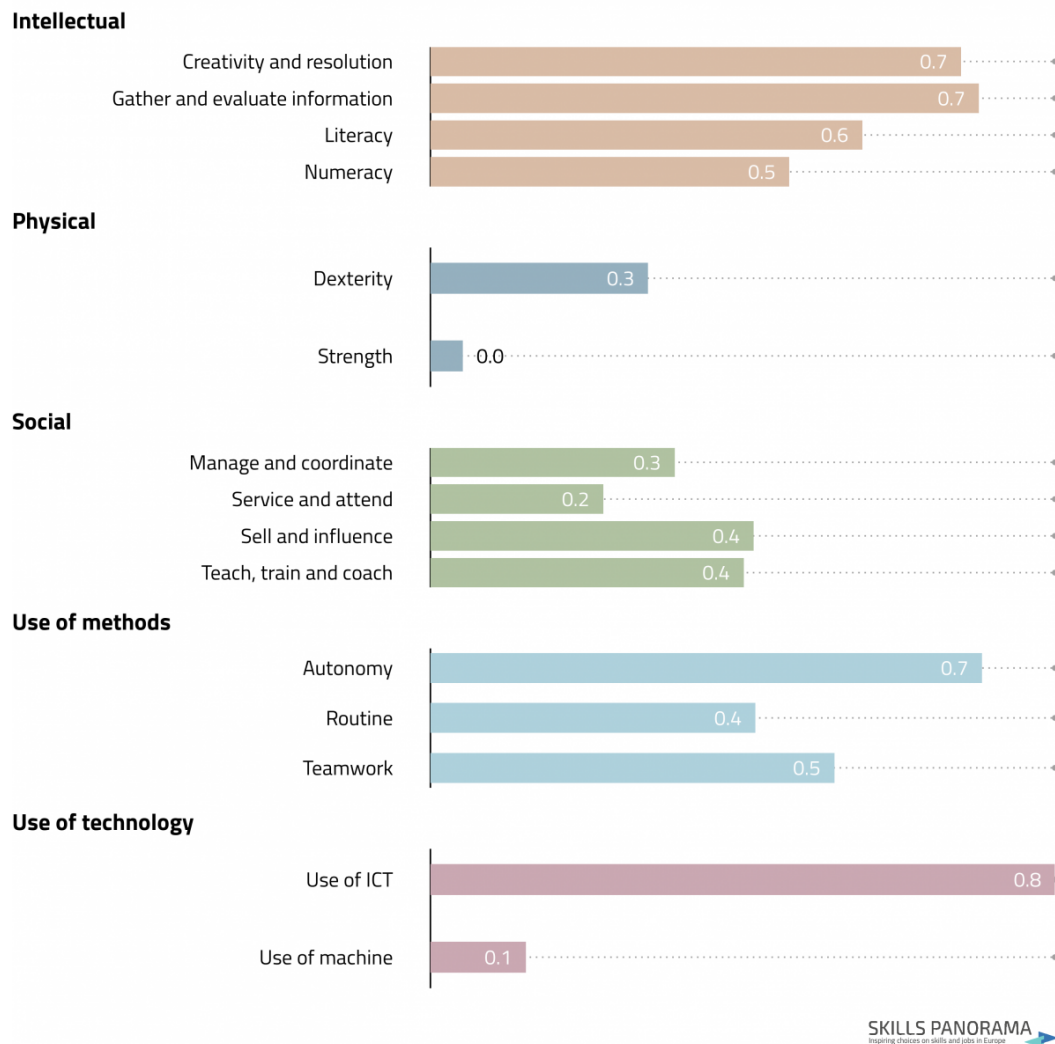
Source: OECD calculations based on Burning Glass Technologies, www.burning-glass.com, January 2019. See chapter notes.

StatLink <https://doi.org/10.1787/888933928825>

Source: OECD, 2019

Interestingly, the growth in demand for complementary skills can also be found in CEDEFOP "[...]According to the Eurofound Job Monitor, ICT use, autonomy, information gathering and evaluation, and others are the most important tasks of ICT professionals," as summarized well in Graph 12.

Graph. 12: Importance of tasks of ICT professionals



Source: CEDEFOP, 2019⁵⁰

From CEDEFOP document: “[...] the share of computer science graduates has increased in ICT recruitment over the last decade; yet other graduates, from mathematics, natural sciences, engineering or social sciences that possess the IT skills demanded fill ICT positions that would otherwise remain vacant. As ICT professionals very often come from non-pure IT studies, enriching curricula across specialisation of studies with STEM and other ICT-pertinent skills can support people’s transition to ICT professional jobs, regardless of their educational background.

⁵⁰ ICT professionals: skills opportunities and challenges (2019 update) - Tasks and skills: https://skillspanorama.cedefop.europa.eu/en/analytical_highlights/ict-professionals-skills-opportunities-and-challenges-2019-update#_tasks_and_skills (Last consultation 11-12-2020).



As continuous vocational education is indispensable for career progression, there are several professional certifications that ICT professionals could pursue through private providers and academic institutions. Certifications are designed to keep the knowledge and skills of the workforce updated. The e-skills quality study⁵¹ shows that certification has become essential for ICT practitioners across all backgrounds. Not surprisingly, about half of them reportedly hold at least one certification.”⁵²

⁵¹ European Commission - Towards a European Quality label for ICT industry training and certification: <https://www.eskills-quality.eu/index.php?id=854> (Last consultation 11-12-2020).

⁵² ICT professionals: skills opportunities and challenges (2019 update) - “How can these skill needs be met?”: https://skillspanorama.cedefop.europa.eu/en/analytical_highlights/ict-professionals-skills-opportunities-and-challenges-2019-update#_how_can_these_skill_needs_be_met_ (Last consultation 11-12-2020).

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Annexes

Template for National on desk research

“Needs analysis Competence profiles update perspective
and impacts for the future digital society”

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IO1.A1.2 Annexes

Forward

This Annex illustrates the recommendations for *IO1.A1.3 National Needs analysis Competence profiles update perspective and impacts for the future digital society*.

The Annex presents the theoretical-methodological guidelines that each country partner has to carry out at local level. The template aims:

- To be a reference for all national equips;
- To give a common grid for collecting information;
- To present general guidelines to write and to present the national reports;
- To offer a proposal for the national research index.

It addresses the first step of the on-desk research process, contributing to the delivery of the following outputs, with special reference to the *IO1 "A training scheme for Active citizenship for digital society. Skills and Formative Planning"*, realized on the basis of national *needs analysis* (IO1.A2), conducted by each country's partner.

National reports have to be very concrete tools for identifying, at local level, actions targeted to the introduction, in the educational system, of training models and successful methodologies, to favour the empowerment of digital culture and digital competences into high school.

The template constitutes guidelines for the national research, as project syntax, trying to present, in a synthetic way, the research drawing. It should be followed in order to show it in a conclusive report, with the objective to assure the comparability of all the gathered information on the basis of the same criteria; but a flexible approach is suggested to achieve the objectives.

Objective of the national researches - *IO1.A1.3 National Needs analysis Competence profiles update perspective and impacts for the future digital society* - is to explore the effects of the digital revolution on the local labour market, to promote:

- the innovation in organizational and educational processes to reduce the mismatch in job offer-demand in a digital era;
- the promotion of excellence in teaching and skills development;
- the dissemination of a broader digital culture useful to manage responsibly digital technologies.

Reaching this goal, each national report presents, at least:

- type and selection of sources adopted for national desk analysis explaining the type of sources used (institutional, structured, occasional, etc.) and the way in which the surveys are conducted to identify emerging competence profiles;
- For all national reports sources and research from the last three years will be examined;
- the type of sources used must be made explicit, also in relation to the kind of survey adopted;
- a reconstruction of the national scenario in relation to the digital challenges and national market labour trends on the bases of selected sources (i.e. emerging profiles, emerging competences, mismatch in job offer/demand; new emerging skills for digital society; skills gaps in the digital field etc.);
- glossary and F.A.Q. for common and/or specific terms;
- the identification of local good practices if useful.

For this analysis, each country partner will use sources and **data of a secondary nature accessible locally**.

The on-desk analysis at national level on secondary sources will be carried out in January. Following the project design **deadlines will be:**

- end of January first draft of the report
- mid-February second draft of the report
- end of February delivery of the final report in English to the Applicant

Based on these assumptions, each national report must be articulated as follows, strictly respecting the shared methodological indications:

Introduction

First part:

- reconstruction of the national scenario in relation to the digital challenges in the market labour and education system
- type and selection of sources

Second part:



- the results of the on-desk research in terms of emerging profiles, emerging competences, mismatch in job offer/demand
- strengths, weaknesses, risks, threats and opportunities of digital revolution in local market labour

Conclusions

Annexes

- Glossary
- F.A.Q.

Index template

Introduction

The introduction of the national research presents the main characteristics of the national report and clear reference to the Erasmus Project.

National desk research. The impact of digital transformation in (name of the country)

The **first part** of the national report elaborated by on desk research focuses on transformation introduced at local level by digital revolution. This section will have two chapters.

The first chapter explains:

- national framework for the adoption and the development of ICTs in market labour (specific laws, decrees, acts, contributions);
- financing programs of specific projects to implement digital technologies at local context also considering the global pandemic;
- national framework to support the incorporation of digital technologies in education, with specific attention to high school.

The second chapter concerns the reconstruction of:

- type and selection of sources adopted for national need analysis on digital revolution and its effects on the labour market;
- Clarify how the professional units are defined at national level;
- Clarify what kind of sources are used for national needs analysis (institutional sources, open data, structured sources, chambers of commerce, employment services, direct research, other sources, etc.)

Description of national research

The **second part** summarize effectively the desk analysis focusing on:

- the main results emerging by the on-desk research, illustrating:
 - trends of national market labour with specific reference to digital revolution (industry 4.0);
 - professional development and emerging profiles;
 - emerging competences and digital competences wanted;
 - mismatch between job supply and demand;
 - problems for educational institutions;
 - other useful consideration for local analysis.

- graphs and tables will be used to make the presentation of data more effective. Graphs and tables must be accompanied by a short explanatory caption and must also strictly comply with the editorial standards and the project template in use.
- Tables and graphs always clearly explaining the sources adopted and the date of consultation.

The main aim of the second part is to clear:

- strengths, weaknesses, risks, threats and opportunities of digital revolution in local market labour and high school
- needs and perspectives for improving;
- the most important problems detected at local level and possible solutions.

Conclusions

Conclusions summarizes:

- the main and the most relevant results of the national research;
- the emerging key elements of the national context;
- the most important information to inform IO1.A2 related to “Empowering people and community. Risks and opportunities of digitalization for life”, that is information, orientation, training sessions for students and teachers aiming at spreading the comprehension of potentialities of digital competences.

References

Sitography

Annexes

The Annex includes:

- Glossary, considering
 - the translation in national languages of common and shared glossary
 - new essential term/word adopted at local level to explain digital revolution and its effect in the market labour and education sector
- F.A.Q
Specific rules that define local market labour and education sector.