



Introduction to IO1

Common Framework and Definitions & Action Plan



INDEX

| | |
|-------------------------------------------------------------------------------|----|
| Introduction..... | 4 |
| Chapter 1 - The voice of Europe: “A New Skills Agenda for Europe”..... | 5 |
| Getting connected: focus on digital skills | 5 |
| Reaping the full benefits of digitalisation..... | 5 |
| Digital Europe: 2021-2027 | 6 |
| Chapter 2 - Digitalisation and digital skills gap in the EU workforce | 8 |
| ICT and digital skills to do the job | 8 |
| Digital transformation and high-tech skills | 12 |
| The role of training and education providers..... | 13 |
| Leading education providers | 14 |
| Dual-track education | 14 |
| Continuous education and retraining the labour force | 14 |
| Complementary Skills | 15 |
| A long-term strategy for education and training providers | 17 |
| Reaping the full benefits of digitalisation via online learning methods | 18 |
| Chapter 3 - DITA Definitions | 20 |
| Digital Transformation processes | 20 |
| The target group: Digital and non-digital Professionals..... | 21 |
| The skills: High Tech T - Shaped Skills | 23 |
| The Technological domains..... | 24 |
| Chapter 4 - Where do we start from: PPs Country Overview..... | 27 |
| Italy | 27 |
| Digital Transformation Scoreboard..... | 27 |
| Overview of main initiatives to develop digital skills | 27 |
| Impacts, challenges and perceptions | 28 |



| | |
|--------------------------------------------------------------|----|
| Austria | 29 |
| Digital Transformation Scoreboard..... | 29 |
| Overview of main initiatives to develop digital skills | 30 |
| Impacts, challenges and perceptions | 31 |
| Belgium | 33 |
| Digital Transformation Scoreboard..... | 33 |
| Overview of main initiatives to develop digital skills | 34 |
| Impacts, challenges and perceptions | 35 |
| Spain..... | 36 |
| Digital Transformation Scoreboard..... | 36 |
| Overview of main initiatives to develop digital skills | 37 |
| Impacts, challenges and perceptions | 38 |
| Portugal..... | 40 |
| Digital Transformation Scoreboard..... | 40 |
| Overview of main initiatives to develop digital skills | 41 |
| Impacts, challenges and perceptions | 42 |
| Germany | 44 |
| Digital Transformation Scoreboard..... | 44 |
| Overview of main initiatives to develop digital skills | 45 |
| Impacts, challenges and perceptions | 45 |
| Chapter 5 – An action based summary of this report..... | 47 |
| References | 48 |



Introduction

This document has been prepared to guide the partnership in the first activities of the DITA project.

Specifically, IO1 and IO2 aim at identifying and mapping training organizations and programs targeted and tailored to European SMEs workers who are facing digital transformation processes in their organizations.

Before starting, partners wanted to have a better understanding of

- Skill needs we are focusing on
- Which kind of organizations and training programs should we look for
- Who are the beneficiaries of the training initiatives we will map
- Potential synergies with national initiatives

This document wants to

- provide the partnership with validated definitions
- suggest an action plan for the next 2 months (until the end of 2019)

The document has been organized as follows:

- Chapter 1 summarizes the major EU goals to tackle the digital skills gap in European SMEs
- Chapter 2 provides an overview of the main evidences provided in terms of skill gaps and introduces the role of education and training providers
- Chapter 3 deals with the most relevant definitions we should agree on and a list of domains (technological and non-technological) that should be part of our mapping activity
- Chapter 4 summarizes the English written available evidences in terms of national initiatives to mind digital skills gaps
- Chapter 5 provides a summary of the document
- Chapter 6 provides an action plan until the end of December 2019



Chapter 1 - The voice of Europe: “A New

Skills Agenda for Europe”

Getting connected: focus on digital skills

The rapid digital transformation of the economy means that almost **all jobs now require some level of digital skills, as does participation in society at large**. The collaborative economy is changing business models, opening up opportunities and new routes into work, demanding different skill sets, and bringing challenges such as accessing upskilling opportunities. Robotisation and artificial intelligence are replacing routine jobs, not only on the factory floor, but in the office. Access to services, including e-services, is changing and requires that both users, providers and public administrations have sufficient digital skills. E-health, for instance, is transforming the way people access and receive healthcare.

The demand for digital technology professionals has grown by 4% annually in the last ten years. **Yet digital skills are lacking in Europe at all levels**. Despite continued strong employment growth, the number of unfilled vacancies for ICT professionals is expected to almost double to 756000 by 2020. Furthermore, almost half the EU population lacks basic digital skills; with around 20% of people having none at all. Member States, business and individuals need to rise to the challenge and invest more in digital skills formation (including coding / computer science) across the whole spectrum of education and training.

Europe **needs digitally smart people who are not only able to use but also to innovate and lead in using these technologies**. Without it Europe will not succeed in embracing this digital transformation. The acquisition of new skills is vital to keep pace with technological developments and industry is already introducing innovative training methods. Research and innovation hubs can also help develop and transfer such skills, acting as catalysers for investment and for business and job creation.¹

Reaping the full benefits of digitalisation

Remaining competitive in the global market arena thus requires consistent investment in higher-order ICT skills and their integration within educational curricula as a key competence,

¹ COM (2016) 381 final Communication from the Commission to the European Parliament, the Council, the European and Social Committee and the Committee of the Regions – “A New Skills Agenda for Europe”



since they are likely to become the norm in a wide(r) set of jobs in the future. Reinforcing the attractiveness of ICT-related subjects, and of STEM fields (science, technology, engineering, maths) in general, remains a critical issue of concern, given low levels of participation of young people in such subjects (European Commission, 2012). One way of accomplishing this is by exploiting the rising potential of new modes of online ICT education delivery, which can foster further private industry involvement in e-learning² and the award of new high-quality e-certificates and qualifications. Building stronger partnerships between education and training providers and employers, such as the European Commission's *Digital skills and jobs coalition*, is another. But the ESJ survey also highlights that a major part of the adjustment of humans to technological obsolescence will take place within workplaces, in the form of continuous and on-the-job learning. Ensuring the continuous adaptation of skills to new digital demands depends on the commitment of employers to human resource management practices that invest in people, not machines. It also needs significant reengineering of work methods and daily routines, especially in lower-skilled occupations and sectors. Only in this manner will the digital revolution translate into workplace evolution and continuous learning for the sizeable share of EU employees who, at the moment, do not require any ICT as part of their daily work. Finally, even though digitalisation has given rise to the new platform (or 'gig') economy, it will be critical for EU policy-makers and businesses to prevent rising marginalisation and job insecurity, ensuring that such new forms of work do not compromise the continuous skill development of individuals (Pouliakas, 2016).

Digital Europe: 2021-2027

To tackle the digital skills gap, significant investments are needed. In the new EU budget, the Commission proposes coherent and comprehensive support for building up the digital skills needed to support reskilling and upskilling in Europe for a successful digital transformation. Different funds will target different skills needs.

The new Digital Europe Programme with a budget of €700 million will expand the digital talent pool with around 256,000 people who will be able to deploy the latest technology in business throughout Europe. It will focus on three types of actions:

² Digital skills and competence, and digital and online learning, European Training Foundation, Turin, 2018



1. Master's Programmes in cutting-edge digital technologies developed together with EU excellence centres in artificial intelligence, cyber and high-performance computing. The aim is to offer 160 new master programmes training 80,000 digital specialists.
2. Short-term specialized training courses in advanced digital technologies for around 150,000 job seekers and employed people especially in SMEs. The aim is to equip them with the competences that will enable the deployment of digital technologies across all sectors of the economy.
3. 35,000 job placements in companies or research centres where advanced digital technologies are developed or used. The aim is to give people the opportunity to learn specialists' skills working with the latest available technologies.



€700 million for advanced digital skills to:



Support the design and delivery of short-term trainings and courses for entrepreneurs, small business leaders and the workforce



Support the design and delivery of long-term trainings and Master's courses for students, IT professionals and the workforce



Support on-the-job trainings and traineeships for students, young entrepreneurs and graduates



Chapter 2 - Digitalisation and digital

skills gap in the EU workforce

Cedefop, the European Centre for the Development of Vocational Training, has performed a set of studies in the area of digitalisation and digital skills. The most recent and comprehensive study, dated 2016, reveals that the future structural transformation of EU labour markets is tightly knit with a high demand for advanced digital skills. Indeed, a previous #ESJsurvey Insight (No 8) has shown that there is a **strong positive correlation between jobs that are anticipated to grow in employment in the next decade**, as extracted from Cedefop's skill forecasts, **and the importance of advanced digital skills** within such jobs, as derived on the basis of the ESJ survey (Cedefop, 2016)³.

Nevertheless, despite widespread acknowledgement of the importance of digital skills, there has been little information about the type of ICT skills required in EU workplaces and the extent to which employees are coping with such demands as part of their workplace tasks.

Cedefop's ESJ survey – cited in this document - partly fills this gap as it collected information on the highest level of ICT skills required by EU employees so that they can carry out their job tasks.

The main findings of this survey, which are relevant to the DITA project are summarized below.

ICT and digital skills to do the job

The first input refers to the jobs / positions that are most likely to be affected by digitalisation and, therefore, will require digital skills.

Figure 2⁴ shows that a remarkably high share of specific sub-groups of the EU workforce does not need any ICT skills at all to do their jobs, ranging from as much as 56% among those undertaking elementary occupations to 25% of service and market sales workers.

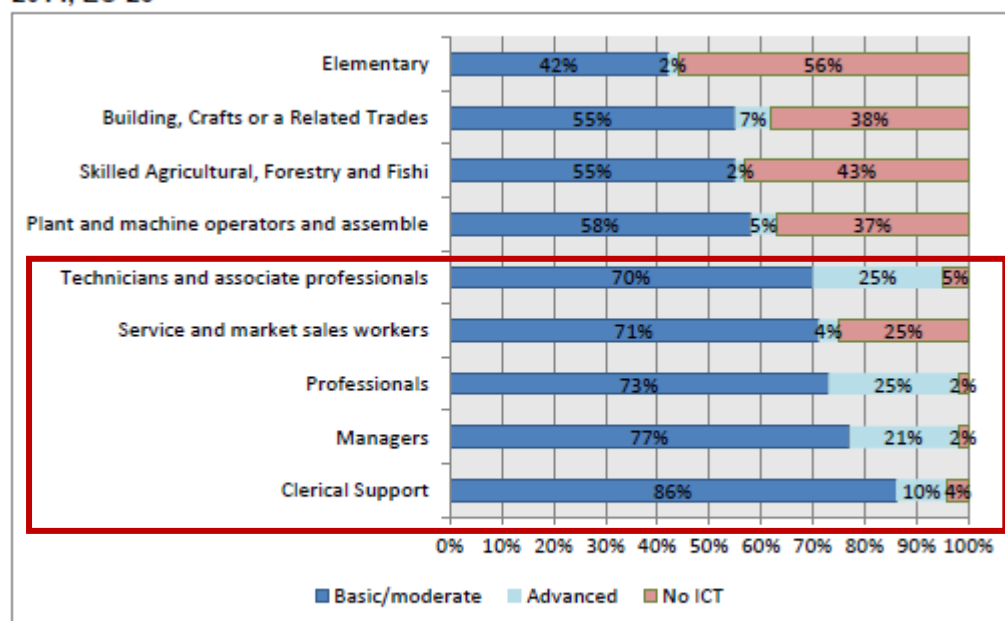
³ Cedefop (2016), 'The great divide: Digitalisation and digital skill gaps in the EU workforce, ESJsurvey Insights, N.9, Thessaloniki

⁴ The original numbering of figures and tables has been preserved in this document



As much as 33% of employees in the agricultural sector and 29% in the accommodation, catering and food services sector stated that they are in no need of ICT skills to perform their jobs. For these workers manual or other skills play a more important role (Figure 3).

Figure 2 Level of ICT skills needed to do the job by occupation, adult employees, 2014, EU-28

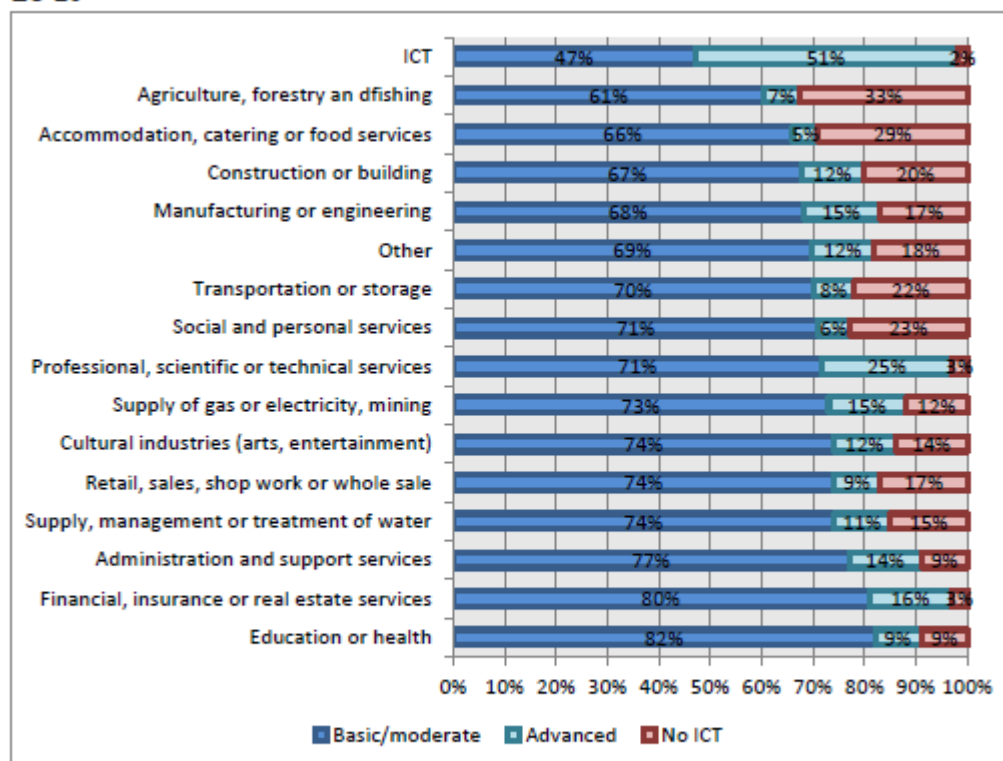


NB: Share of valid responses to the question: Which of the following best describes the highest level of information communication technology (ICT) skills required for doing your job?

Source: [Cedefop European skills and jobs survey](#).



Figure 3 Level of ICT skills needed to do the job by sector, adult employees, 2014, EU-28



NB: Share of valid responses to the question: Which of the following best describes the highest level of information communication technology (ICT) skills required for doing your job?

Source: [Cedefop European skills and jobs survey](#).



The Table below⁵ depicts **occupations that are mostly susceptible to technological skills obsolescence and those that exhibit a relatively stable skills profile that is least affected by technological change.**

It is evident that workers employed in **ICT, health and engineering-related occupations, together with managers**, are more likely to experience changing skills profiles in their jobs, whilst employees in the primary sector and in elementary or personal service occupations are relatively insulated from technological innovation.

| <i>Top occupational groups with changing skills profiles</i> | <i>Top occupational groups with stable skills profiles</i> |
|-----------------------------------------------------------------|------------------------------------------------------------|
| ⊕ ICT Associate Professionals | ⊖ Subsistence farmers, fishers or hunters |
| ⊕ ICT Professionals | ⊖ Cleaners or helpers |
| ⊕ Production or specialist services managers | ⊖ Food preparation assistants |
| ⊕ Electronic and electronic trades workers | ⊖ Personal services workers |
| ⊕ Teaching professionals | ⊖ Personal care workers |
| ⊕ Administrative or commercial managers | ⊖ Labourer in mining, construction, manufacturing |
| ⊕ Science and engineering professionals/associate professionals | ⊖ Driver or mobile plant operator |
| ⊕ Health professionals | ⊖ Agriculture, forestry and fishery labourer |
| | ⊖ Protective services worker |

NB: Ranking of occupations based on an index of skills stability, derived as the share of EU adult employees who experienced changes to the technologies (machinery, ICT systems) they used in the past five years and expect that their skills have a high likelihood of becoming outdated in the next five years.

Source: [Cedefop European skills and jobs survey](#).

There is a **group of professional profiles** that fits to DITA's target group, that will require changes in terms of skills due to the increasing introduction of digital technologies in the daily working processes.

⁵ Cedefop (2016), 'Rise of the machines: Technological skills obsolescence in the EU', #ESJsurvey Insights, No 8, Thessaloniki: Greece



Digital transformation and high-tech skills

A recent work published by PWC on behalf of the Executive Agency for Small and Medium-sized Enterprises (EASME)⁶ contributes to successfully shaping workforce transformation in the EU by developing a common vision of high-tech skills and future professionals and designing actions to foster them.

The skills requested by industry following the digital transformation of economy and industry are not merely technical.

Over the last decade, the notion of “T-shaped” skills has emerged, **referring to an individual worker having a combination of both general skills across multiple domains and specialist skills within one domain.** Future professionals are likely to be creative, innovative and entrepreneurial, and capable of building relationships, advancing research and strengthening their organisations. The breadth of the future professional reflects the individual’s willingness and ability to collaborate across industries, sectors and disciplines. The depth of the future professional refers to the depth of the industry-related and sectoral skills and knowledge that the individual possesses.

Behind current and future gaps lies a **changing demand for various skills.** Cedefop, the OECD and the World Economic Forum forecast that elementary work, manual and low-skilled jobs, and jobs consisting of routine tasks will decline, while non-manual and highly skilled jobs will increase. At the same time, reports show that demand for jobs that include programming is growing 50% faster than the job market overall, and workers with skills that fit hybrid jobs are particularly sought after.

As such, the report considers **high-tech T-shaped skills an imperative for the EU’s competitiveness now and in the future.** Our conceptualisation of high-tech T-shaped skills primarily focuses on programmes, projects and curricula that combine high-tech skills with specific complementary skills.

These complementary skills are:








- Technical skills in an adjacent technology domain or system of thought;
- Skills related to quality, risk and safety;
- Management, leadership and entrepreneurial skills;

⁶ Skills for Smart Industrial Specialisation and Digital Transformation, Interim Report (October 2018);



- Communication skills;

- Innovation skills;
- Emotional intelligence skills; and
- The ability to consider ethical implications.

| 1 Technical | 2 Quality, risk & safety | 3 Management & entrepreneurship | 4 Communication | 5 Innovation | 6 Emotional intelligence | 7 Ethics |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |
| competences related to practical subjects based on scientific principles (e.g. characterisation, systems integration, mathematical modelling and simulation, top-down fabrication etc.) | competences related to quality, risk & safety aspects (e.g. quality management, computer-aided quality assurance, emergency management and response, industrial hygiene, risk assessment etc.) | competences related to management, administration, IP and finance (e.g. strategic analysis, marketing, project management, IP management, deal negotiation skills etc.) | competences related to interpersonal communication (e.g. verbal communication, written communication, presentation skills, public communication, virtual collaboration etc.) | competences related to design and creation of new things (e.g. integration skills, complex problem solving, creativity, systems thinking) | ability to operate with own and other people's emotions, and to use emotional information to guide thinking and behaviour (e.g. leadership, cooperation, multi-cultural orientation, stress-tolerance, self-control etc.). | ability to consider the ethical impact of job tasks and new technologies and applications on society. |

The category of **technical skills** relevant to smart industrial specialisation and digital transformation covers the following technology domains, in line with recent publications on key enabling technologies and digital skills:

- Skills relevant to researching and developing production technologies (e.g. advanced manufacturing technologies, advanced materials and nanotechnologies, life-science technologies);
- Skills relevant to researching and developing digital technologies (e.g. micro-nano-electronics, photonics and artificial intelligence);
- Skills relevant to researching and developing cyber-technologies (e.g. digital security and connectivity);
- Basic digital technology skills (e.g. digital user skills, DigComp Framework⁷); and
- Advanced digital technology skills (e.g. skills relevant to IT professionals' occupations, European e-Competence Framework⁸).

The role of training and education providers

The same report focuses on 3 educational levels, which we consider relevant for the purpose of our project and describes the role that each level should play in supporting digital transformation processes, up and reskilling of EU workforce.



Leading education providers

Top **universities** play a crucial role in training tomorrow's technology leaders. In order to understand which academic institutions, dominate academic fields relevant to KETs and digital transformation, the report has connected KET-related and digital areas to the classification of technology domains used by the Times Higher Education, QS World University Ranking and Academic Ranking of World Universities rankings. The analysis shows that some elite universities score well in all KET-related areas. These include Oxford, Cambridge, Stanford, Harvard and MIT. Two Swiss universities consistently make the top 20 in engineering, natural sciences and computer science. Though Europe is very well represented in the top 500 of universities worldwide, Europe relies largely on UK universities to enter the top 20.

Dual-track education

The report describes also dual-track education and its relevance to the transversal nature of high-tech T-shaped skills. Dual-track education organises formal education in a way that **combines in-school classroom-based education with workplace experience and on-the-job learning**. Dual-track education leans on three concepts that are important for its functioning as a national or regional education system: integration, standardisation and recognition.

Continuous education and retraining the labour force

The report highlights the importance of **continuous education for working adults in an economy undergoing digital transformation** and pays attention to the empirical impact that continuous education can be said to have.

Digital transformation changes professions, occupations and job tasks throughout sectors and markets. Consequently, betting on upcoming graduates and prospective workers to fulfil labour demand in the coming years may not be enough. Considering the sheer numbers involved, retraining current workers may prove vital to preparing enough people for working both in new jobs and in new sectors. Subsequently, future-oriented education and training efforts will need to include current workers in the European labour force.

In broad strokes, something can be said of the cost of reskilling and upskilling workers, which appears popular, especially among high-skilled workers. Assuming that the speed at which technology domains change and develop would require a retraining programme every 3-5



years, the annual expenditure for regularly retraining a department of 100 workers would be EUR 240-400K.

Complementary Skills

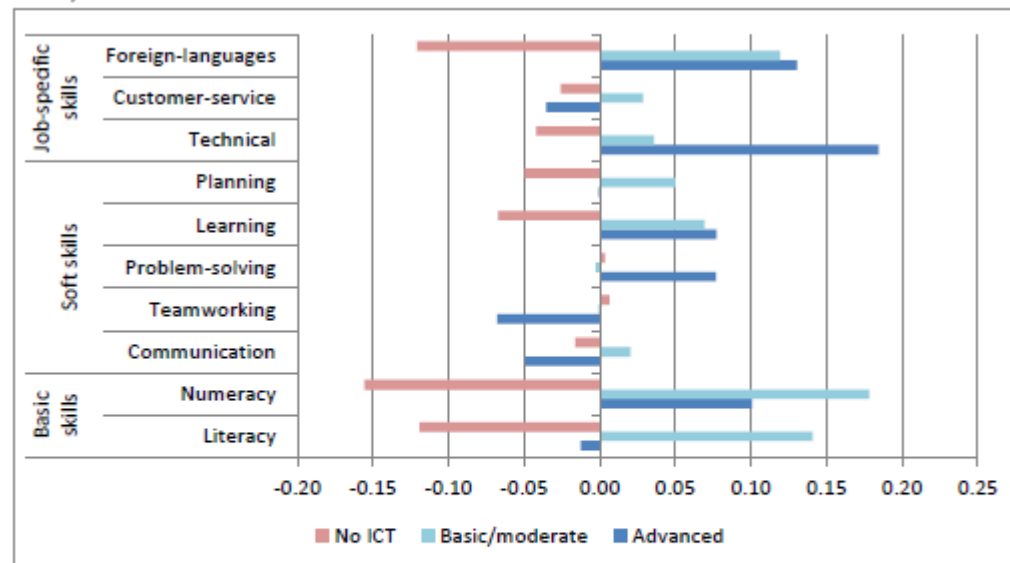
As already mentioned, the transformation spurred by the introduction of digital technologies in **workplaces does not only affect the demand for digital skills but also places a premium on other ICT-complementary skills.**

Figure 8 highlights that ICT users are, all other things being equal, more likely to be employed as a whole in more skill-intensive jobs. A unique exception is the fact that the jobs of advanced ICT users, in particular, are found to be less likely to rely on interpersonal (i.e. team-working and communication) and customer-service skills. Nonetheless, the jobs of ICT users are found to be unambiguously reliant on a higher level of cognitive skills (literacy, numeracy, problem-solving, learning to learn). **Specifically, adults who are employed in jobs that require a foundation level of ICT skills simultaneously require a strong level of foundation skills (literacy, numeracy) as well as planning and organisation skills.**

By comparison, it is important to have strong numerical and technical skills if employed in jobs dependent on advanced ICT usage. Such jobs are significantly dependent on the ability of individuals to think of solution to problems (problem-solving skills) as well as to learn, adapt and apply new methods and technologies at work (learning skills). Furthermore, there is a positive association between ICT usage and the need for a foreign language to perform one's job duties.



Figure 8 Complementarity between ICT and non-ICT skills at work, adult employees, 2014, EU-28



NB: Estimated probability (difference of the estimated odds ratios from the value of one) based on a logistics multivariate regression model. The dependent variable is the highest level of ICT skills needed for doing one's jobs and is regressed on a set of variables capturing the importance of non-ICT skills. The empirical specification accounts for gender, age, education level, occupation, economic sector and country dummies. Interpretation of graph: The job of an average worker that relies on foundation ICT skills has an 18% higher chance that numerical skills are also important, relative to that of a comparable worker that does not need ICT skills to do the job.

Source: [Cedefop European skills and jobs survey](#).

Furthermore, the World Economic Forum has identified Top 10 Skills which will be relevant in 2020 to cope with I4.0 transformation processes, which are:

- Complex problem solving
- Critical Thinking
- Creativity
- People Management
- Coordinating with Others
- Emotional Intelligence
- Judgement and Decision Making
- Service Orientation
- Negotiation
- Cognitive Flexibility



A long-term strategy for education and training

providers

The report highlights that “a longer-term common vision to develop high-tech skills for achieving smart industrial specialisation and digital transformation should be based on one core objective which is to reinforce the competitiveness of EU industry and to ensure its global leadership position among the rising competitors in the Fourth Industrial Revolution. This vision aims to support and help European industry to embrace new technological breakthroughs to upscale its initiatives, and thus leverage the opportunities that these technologies bring. **The key to capitalising on these new technical opportunities is a workforce that is capable and motivated to work intensively with them.** Thus, corporates, governments and territories need to implement skills strategies according to their contextual needs and circumstances, which will empower and ensure skills development for excellence, prosperity and personal development by pursuing the following objectives:

- Collaborative training programmes. Creating and supporting joint training programmes between universities and research institutions, vocational education and training (VET) and industry;
- World-class curriculum. Ensuring world-class, hands-on curricula to teach the skills required for upcoming technological advances;
- Smart education methodologies and technology-based tools. Increasing the effectiveness and efficiency of conventional training programmes with rising smart education methodologies; and
- Dual-track system. Fostering a dual-track training system in most industries, inspired by good practices that are established in Germany and elsewhere”.

Furthermore, current labour market changes and challenges, **the combination of technical (i.e. STEM based) and non-technical skills (i.e. quality, risk and safety assurance; management and entrepreneurship; communication; innovation related and emotional intelligence) - so called T-shaped skills** are expected to be in high demand to ensure sustainable knowledge-based economic development via the development and deployment of knowledge-intensive technologies that enable process, goods and service innovation through the deployment of KETs.



KETs have the capacity to develop entirely new industries while transforming existing industrial bases including the modernisation of manufacturing processes by reducing cost, raw materials, and energy consumption in addition to tackling waste and pollution¹⁹. All those advances taking place under advanced manufacturing processes are named as Industry 4.0 based on network-centric production using Advanced Manufacturing Technologies (AMT) and cyber-physical systems leveraging on KETs.

Thus, individuals have to engage in life-long learning not only to remain employable but also to achieve fulfilling and rewarding careers. Likewise, employers should not solely rely on new workers with the right ready-made skills **but invest in workforce up/re-skilling as a beneficial investment even in the absence of skills-shortages**. For policy makers, fostering continuous reskilling and lifelong learning across the economy is critical in order to maintain a labour force equipped with the right skills needed to boost sustainable, smart and inclusive economic growth. Additionally, the labour markets are not only influenced by automation but also by other factors such as globalisation, urbanisation, aging population, and the climate change that places sustainability high on the agenda. To stay competitive in this volatile and demanding industrial era, an **Educational and Skilling Revolution** aligned at regional, national and supra national levels is indispensable and represents a shared responsibility between public-private and public-citizen stakeholders as stated by the WEF⁷.

Reaping the full benefits of digitalisation via online learning methods

Remaining competitive in the global market arena thus requires consistent investment in technical and non-technical skills. One way of accomplishing this is by exploiting the **rising potential of new modes of online education delivery**, which can foster further private industry involvement in e-learning⁸ and the award of new high-quality e-certificates and qualifications. Building stronger partnerships between education and training providers and employers, such as the European Commission's *Digital skills and jobs coalition*, is another. But the ESJ survey also highlights that a major part of the adjustment of humans to technological obsolescence will take place within workplaces, in the form of continuous and

⁷ Towards a Reskilling Revolution: A Future of Jobs for All. WEF in collaboration with Boston Consulting, Jan 2018.

⁸ Digital skills and competence, and digital and online learning, European Training Foundation, Turin, 2018



on-the-job learning. Ensuring the continuous adaptation of skills to new digital demands depends on the commitment of employers to human resource management practices that invest in people. The use of online educational resources may be of help also in this case.



Chapter 3 - DITA Definitions

Current available reports also help us to share and agree on some common definitions which help us to direct the mapping activity. Specifically, we have been looking for common definitions for

- Digital Transformation processes
- The target group / beneficiaries of the Training Atlas:
 - o Digital professionals
 - o Non digital professionals
- The skills we want to focus on
 - o T shaped skills
- The technological domains
 - o KET 4.0 and digital transformation

Digital Transformation processes

Digital transformation is the profound and accelerating transformation of business activities, processes, competencies and models to fully leverage on the changes and opportunities of digital technologies and their impact across society in a strategic and prioritized way, with present and future shifts in mind.

Digital transformation in the integrated and connected sense requires, among others, the transformation of:

- Business activities/functions;
- Business processes;
- Business models;
- Business ecosystems;
- Business asset management;
- Organisational culture;
- Ecosystem and partnership models;
- Customer, worker and partner approaches.

These transformations have (and will have) an impact on all organizational areas of European SMEs.



The target group: Digital and non-digital

Professionals

The EU defines **digital professionals** as ICT professionals in all sectors of the economy: essentially, any person associated with the computer world in any form can be said to be an IT professional in layman terms. Specifically, it is usually associated with or more of the following – not exhaustive – list: Technical Support, Networking, Internet and website designing, Programming, Database creation, Software development.

For the purpose of our project, we can consider “non digital” professionals any other professional not working as an ICT professional in European SMEs. To avoid unnecessary initial filters, **the partnership has decided to consider both digital and non-digital professionals as an initial target group.**

The partnership will therefore consider any SME related professional (employee or consultant) who is directly (or may be directly) affected by digital technologies (and the digital transformation process) in its daily work (at management, operational, support or technical level). Under this perspective, any professional involved in one or more of the following departments may benefit from the Training Atlas⁹:

- 1) Human Resource
- 2) Finance & Accounting
- 3) Purchasing
- 4) IT
- 5) Business Development
- 6) Product Management
- 7) Process & Production
- 8) R&D
- 9) Sales & Marketing
- 10) Logistics
- 11) Customer Care

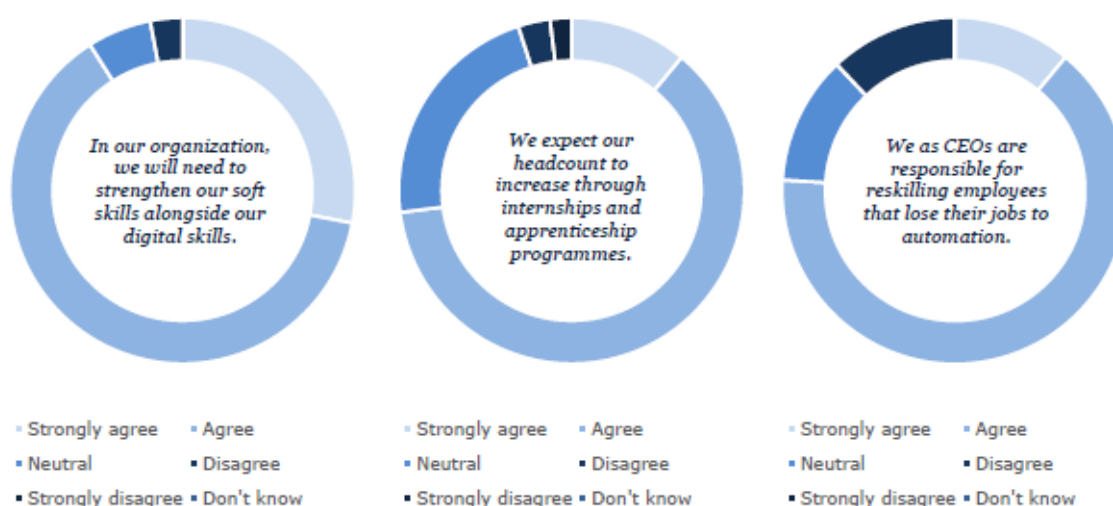
In other – EU compliant - terms, we will consider any professional profile that falls under one of the following categories:

⁹ This is an extended list if compared to page 64 of the Application Form



- Professionals with ICT practitioner skills: capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems
- Professionals with ICT user skills: capabilities required for the effective application of ICT systems and devices by the individual
- Professionals with potential E-leadership skills: capabilities required to accomplish of a goal that relies on ICT through the direction of human recourses and uses of ICT.

As mentioned below, the project will try to prepare the ground for so called “hybrid jobs”. Hybrid jobs require employees to possess heterogeneous and complementary skills like programming as well as skills in design, marketing and data analysis. Hybrid jobs are a clear example of jobs created by technological innovations. **While the hybrid jobs are high in demand, the training system to empower students with this variety of skills are often weak and scarce.** However, accelerated training programs can often provide entry-level skills needed for a hybrid job since these skills are not hard to access and relatively easy to learn.

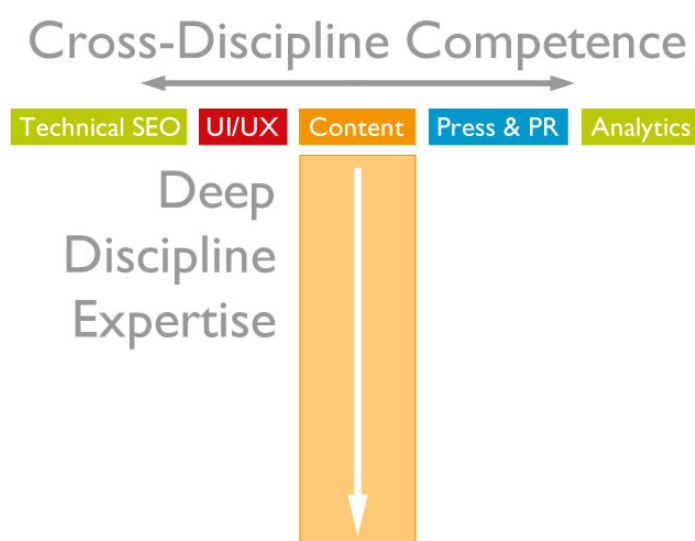




The skills: High Tech T - Shaped Skills

The notion of high-tech T-shaped skills pertains to the versatile combination of generalistic skills across multiple domains and specialised skills within one domain, present within one individual worker.

T-shaped skills describe specific attributes of desirable workers. The vertical bar of the T refers to expert knowledge and experience in a particular area, while the top of the T refers to an ability to collaborate with experts in other disciplines and a willingness to use the knowledge gained from this collaboration.



The importance of T-shaped individuals. Workers engaged in managing digital transformation processes will need to process information from multiple and diverse sources, to build, maintain and strengthen professional relationships across organisational boundaries, to drive innovation through organisational practices, and to communicate with impact and

empathy across social, cultural, economic and disciplinary divides.

The urgency of training T-shaped professionals. Experts think that T-shaped professionals will be able to increase competitiveness (which in Europe is still under strain) while addressing and engaging the social and economic opportunities and challenges brought in by digital transformation.

The necessity of engaging a broad array of stakeholders. The training of T-shaped professionals will require the engagement and commitment of actors from industry, academia, governments, foundations, professional bodies, and other stakeholders that can help shape and implement the educational models needed to generate T-shaped professionals through formal education and through on-the-job training

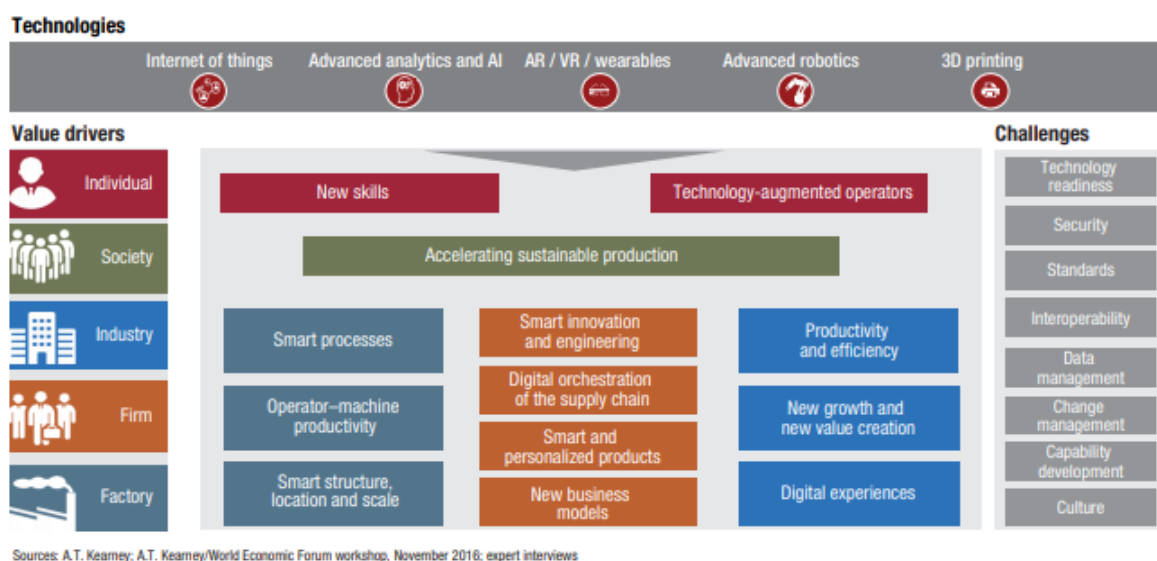


The Technological domains

Key Enabling Technologies are technology domains with the potential to strengthen the industrial and innovation capacities of the EU. In 2009¹⁰, the EC has identified six technologies as Key Enabling Technologies (KETs) which are Advanced manufacturing technologies, Advanced materials, Industrial biotechnology, Micro and Nanoelectronics, Nanotechnology and Photonics.

As stated in the white paper released by WEF in 2017 on 'Technology and Innovation for the Future of Production', **five key technologies** that **lever on KETs** (i.e. **Internet of Things, Artificial Intelligence, Advanced Robotics, Wearables** including **augmented and virtual reality, and 3D printing**) stand out by their broad applications and impact in countries, industries and value chains and have unleashed competition within **production systems**, forcing companies to rethink and retool everything that they do internally and support workforce in re and upskilling accordingly.

Combined and connected, these five key technologies are opening up opportunities and changing decades-old mechanisms for creating and distributing value in 13 important ways as shown in below Figure.



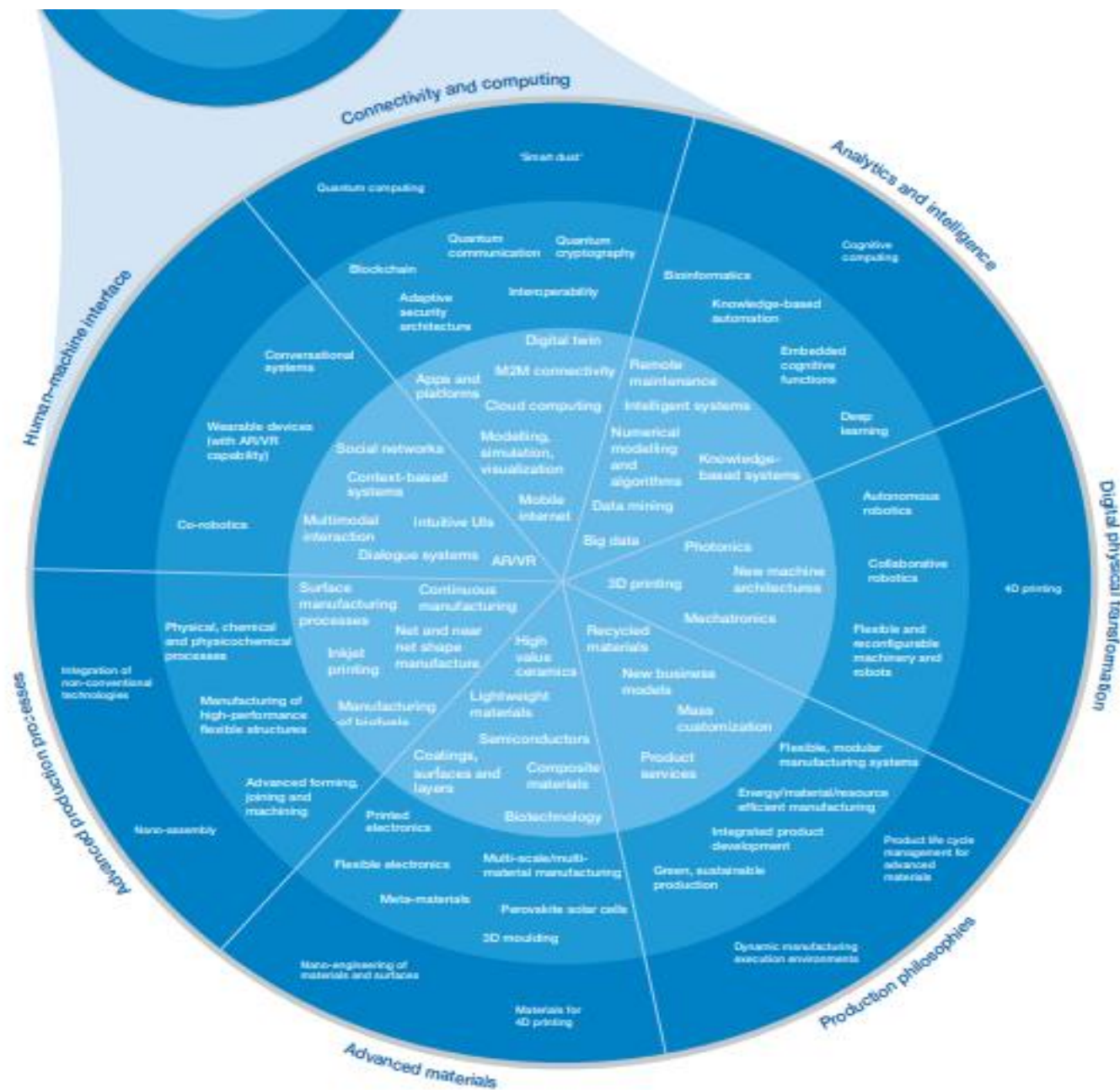
¹⁰ COM (2009) 512 Final: Preparing for our future: Developing a common strategy for key enabling technologies in the EU



The '**Production Technology Radar**' developed by the WEF provides a guide to business leaders and policy-makers on taking an action through vast range of mainstream, maturing and emerging technologies and philosophies impacting production systems as shown in below figure. A graphical representation of all relevant digital (and digital related) technologies having an impact on European SMEs has been published recently.

The high-level categories selected for the graphical representation is mainly based on **information and communication technology (ICT)-enabled technologies** such as connectivity and computing, analytics and intelligence, human machine interface and digital physical transformation.

The additional topics covered on this radar are **advanced materials** (encompassing various branches of both nanotechnology and biotechnology); **advanced manufacturing processes**; **manufacturing philosophies**, which would include things such as design approaches and mindsets geared towards sustainability.





Chapter 4 - Where do we start from: PPs

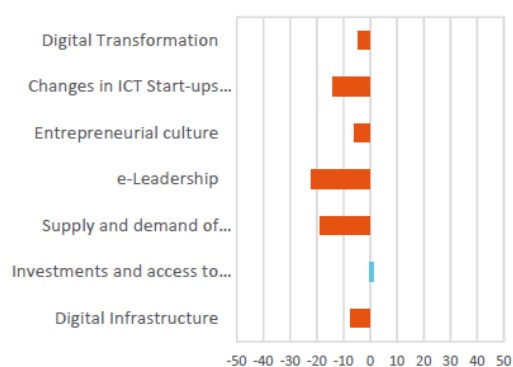
Country Overview

Italy

Digital Transformation Scoreboard

C Comparison with other EU Member States

Figure 9.30: Italy's performance vs. EU average



Note: Based on the average of the difference of the latest three imputed values. Where no data was available, the EU average was used

Italy scores above the EU average in one out of seven dimensions: investments and access to finance, but even here, it scores only 2% above the EU average.

In terms of digital transformation and entrepreneurial culture, the country scores somewhat lower, leaving room for further improvement.

Italy's core challenges lie in the fields of e-leadership, digital skills and changes in the ICT start-up environment. The country performs 22%, 19% and 14% below the EU average respectively in these three areas.

Overview of main initiatives to develop digital skills

| Name | Innovation Manager Voucher | Tax Credit for training | Strengthening of technical schools (ITS) |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | Voucher | Subsidy for staff training | Digital skills certificate |
| Starting date | 2019 | 2017 | 2017 |
| Objective | Sustain the digitisation of small and medium sized enterprises. | Stimulate staff training in the use of those technologies relevant for the digital transformation of enterprises. | Main goal is to train the next generation in accordance to the demand of skills in the labour market. |
| Short description | Innovation manager vouchers are lines of credit provided by the government to SMEs. Small and medium sized enterprises are thus supported in the purchase of the services provided by a specialist consultant able to guide the firm and digitise the business. | Tax credit of 40% on staff training related expenditure. The measure addresses enterprises/non-commercial entities resident in Italy, companies doing business abroad but with permanent establishment in Italy. | Technical schools are the only alternative to tertiary education. With their dedicated focus on technologies, the employability rate of young graduates is very high. The strengthening of such schools aims at promoting the occupational integration of young professionals by increasing their level of digital skills. |
| Granting organisation | MISE | MISE | MiUR |
| Participating organisations | | | |
| Sectors targeted | All, with a focus on the manufacturing sector. | All, with a focus on the manufacturing sector. | All, with a focus on the manufacturing sector. |
| Funding (split by private/public national/EU), period/annual funding | National EUR 25 million | National 2017 and 2018: EUR 250 million/year | National and regional 2017 and 2018: EUR 33 million/year |
| Current status of initiatives | To be implemented from 2019. | Measure has been confirmed by the latest Budget law. Nonetheless the tax credit is no longer fixed but varies according to the dimension of the company: 50% for small enterprises, 40% for medium enterprises, 30% for big enterprises. | |



Impacts, challenges and perceptions

The **Tax Credit for training** is an initiative by the Ministry of Economic Development aimed at the development of digital skills among the workforce. Although being well-calibrated towards the needs of companies, at present times the measure has not spurred the know-how of workers yet. Given the below EU-average level of Individuals with basic or above basic digital skills (in 2017, 48% in Italy vs 57% in Europe), and as confirmed by some of the stakeholders from the industrial sector, the measure should become structural to achieve better results.

The **Strengthening of Technical Schools** (ITS) is instead a measure influencing the offer of tertiary education paths in the country. Its main goal is to provide vocational trainings with a strict focus on digital skills in order to spread knowledge about digital processes⁴¹. Although – according to the perception of stakeholders – several are the ITS focused on the provision of digital skills, the measure alone cannot cope with the digital skills gap between Italy and Europe. The number of science and technology graduates is below the EU average in Italy. Furthermore, similarly to the tax credit for training, the measure has not been made structural yet. It is, however, assessed positively by most stakeholders interviewed (4 in a scale 1-5).

Another way in which the Italian government is planning to address the catch up on small and medium sized enterprises in the digital sector, is by implementing the **Innovation Manager Voucher**, an initiative part of PNI 4.0 and launched in 2019. It allows SMEs to cover labour costs of managers and consultants in digital transformation processes. More specifically, the benefit consists of a non-repayable grant (voucher) fixed between 30% and 50% to help cover expenses for consulting firm or consultants (which have to be registered in a specific list set up by a Decree of the Minister of Economic Development) for their advice on digital and technology topics; the annual maximum amount is fixed between EUR 25,000 and EUR 80,000 depending on the beneficiary business qualification⁴³.

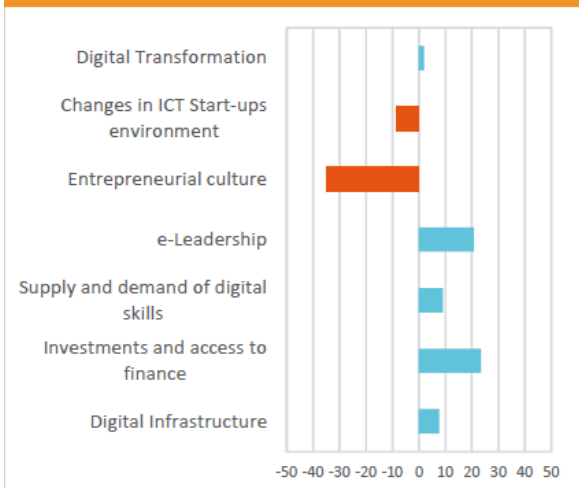


Austria

Digital Transformation Scoreboard

C Comparison with other EU Member States

Figure 9.2: Austria's performance vs. EU average



Note: Based on the average of the difference of the latest three imputed values.
Where no data was available, the EU average was used.

Austria performs above the EU average in five out of seven dimensions.

Austria's strongest asset is investments and access to finance, followed closely by e-leadership. In these two dimensions, the country scores around 15% and 12% higher than the EU average respectively.

Furthermore, Austria provides a solid digital infrastructure. It also scores relatively well in the supply and demand of digital skills and digital transformation. The dimensions in which Austria scores below the EU average are ICT start-up environment and entrepreneurial culture – in the latter, its performance is around 35 % lower than the EU average.

The improvement of the entrepreneurial culture would also provide motivation for an ICT start-up-friendly environment to be established, to further assist the Austrian economy in its digital transformation process. Plattform Industrie 4.0, described below, is a good step in this direction.



Overview of main initiatives to develop digital skills

| Name | Fit4Internet | Digital Bootcamps | Schule 4.0 (School 4.0) | Endowed professorship (Stiftungsprofessuren) |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | Training centres/courses | Financial grants for training | Others | Support for research competence |
| Starting date | 2018 | Start: 2018, implementation: 2019 | 2017 | N/A |
| Objective | To provide basic digital skills for older employees. | To provide applied rapid and in-depth up-skilling of already digitally skilled workers in companies. | To ensure the integration of digital basic education in all Austrian schools by integrating it into curricula and supporting the digitalisation of teaching. | Addressed goals: <ul style="list-style-type: none"> • Development of research competence and capacity in strategically important fields of research • Strengthening human capital • Extending and deepening cooperation relations between science and industry |
| Short description | Fit4Internet provides courses to spread basic digital skills for employees aged above 45 years. The main instrument used is the issuing of digital competence certificates. The courses focus on basic skills of older employees and workers. | The programme supports the up-skilling of specialists from SMEs in cooperation with a university through a nine-week intensive training courses on topics such as: artificial intelligence, big data, data engineering, blockchain, etc. | The initiative includes 4 pillars: <ul style="list-style-type: none"> • Basic digital education (including media education); • Digitally competent teachers (acquisition of digital skills and digital didactics; training opportunities at educational colleges); • Infrastructure and IT equipment (broadband initiative, expansion of IT infrastructure in schools); and • Digital education media (e-books; Eduthek; game-based learning approaches). | By awarding the "Endowed Professorship", the Federal Ministry of Transport, Innovation and Technology (BMVIT) supports important areas of knowledge for Austria as an innovation location and contributes to the further development of cooperation between science and industry. Endowed professorships are intended to bring outstanding researchers to Austria. The funding period is limited to a maximum of five years and includes the establishment of new topics in the Austrian research landscape. |
| Granting organisation | <ul style="list-style-type: none"> • BMDW • Companies | <ul style="list-style-type: none"> • BMDW | <ul style="list-style-type: none"> • Federal Ministry of Education, Science and Research (BMBWF) | <ul style="list-style-type: none"> • Federal Ministry of Transport, Innovation and Technology (BMVIT) |
| Participating organisations | <ul style="list-style-type: none"> • BMDW • Companies • Association fit4internet | <ul style="list-style-type: none"> • BMDW • FFG | <ul style="list-style-type: none"> • Schools | <ul style="list-style-type: none"> • N/A |
| Sectors targeted | All | All | All | All |
| Funding | Public funding constitutes 80% of total funding. In 2018, the budget amounts to ca. EUR 1 million. | Budget of the BMDW (public), funding per project: max. EUR 500,000 | Programme of the national government | N/A |
| Current status of initiatives | Until the end of 2018, 50 courses are planned to be organised in Austria as part of the programme. | First projects will be implemented in 2019. | A new Master Plan for Digitisation, announced in September 2018, builds on actions under the previous digitalisation strategy, 'School 4.0'. Under the latter various actions have already been implemented: (1) a new subject 'basic digital education' was introduced at lower secondary level this year, (2) a pilot project started in primary school providing an initial programming experience, (3) a modular teacher training on digital skills and digital didactics ('digi.folio') was set up combined with peer learning in 400 schools on the use of tablets while the school development network 'eEducation' was expanded, (4) | N/A |



| | | | |
|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| | | teacher training is reinforced through the setting up of 'Education Innovation Centers' as virtual learning areas in teacher training colleges, and (5) digital text books in secondary school became e-books. The new Master Plan for Digitisation in education has three areas of intervention. Under 'Software – pedagogy, teaching and learning content' digitalisation will be introduced into all subject areas and systematically incorporated into revised curricula. Second, infrastructure and availability of mobile end devices is brought up to a unified and comparable standard allowing nationwide use in schools. And, thirdly, under 'Teachers - training and further education', e-content and innovation is systematically introduced into teacher training | |
|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

Impacts, challenges and perceptions

The initiatives presented above have all been launched very recently. The Fit4Internet and the Digital Bootcamps initiatives are somewhat complementary: the previous initiative focuses on teaching basic digital skills whereas the latter initiative focuses on training IT experts on the latest technological innovations.

These are only exemplary initiatives. In 2017, the working group of the industry 4.0 platform presented a “result paper”, called “qualification and competences in the industry 4.0”. 81 recommendations were developed in seven action areas. These were:

- Combining new and old learning methods;
- Diversity of learning places;
- Promoting access to learning;
- Optimising framework conditions;
- Supporting co-operations;
- Breaking stereotype role models; and
- Pursuing a strategy.



Two out of three industry associations interviewed knew the working group. The usefulness of its work is perceived as very positive, especially that the working group enables a multi-stakeholder dialogue across the division employer/employee and allows for a common strive for setting objectives. However, the political implementation of the proposals made by the working group is seen as a remaining challenge.

Industry associations reported that a high number of their members are faced with a digital skills gap. At the same time, the digital skills of the workforce are only considered having improved to a limited extent since 2015 (2.67 on a scale from 1 to 5). According to the industry associations surveyed as part of this study, only some companies have adopted a general strategy on how to improve digital skills of their employees.

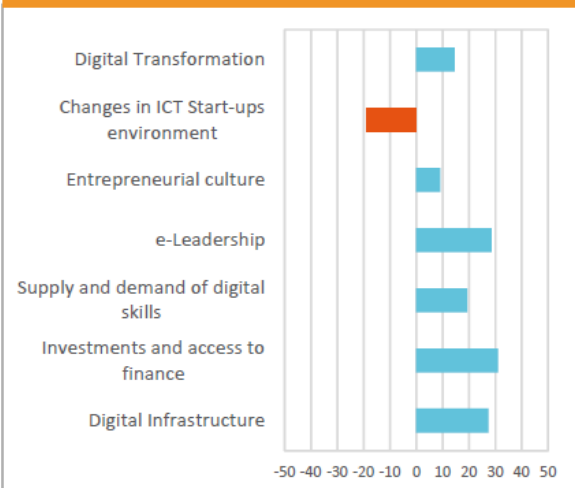


Belgium

Digital Transformation Scoreboard

C Comparison with other EU Member States

Figure 9.4: Belgium's performance vs. EU average



Note: Based on the average of the difference of the latest three imputed values. Where no data was available, the EU average was used.

Belgium is well advanced in its digital transformation in comparison to other EU Member States. It scores above the EU average in six out of seven dimensions. Belgium performs particularly well (more than 20% higher than the EU average) in investments and access to finance, e-leadership, digital infrastructure and digital transformation.

In addition, Belgium's performance in entrepreneurial culture is around 10% higher than in the EU average.

Nevertheless, the country performs below the EU average concerning its ICT start-up environment, representing the country's main weakness.

In summary, Belgium significantly outperforms in comparison to the EU average, and hence can be considered one of the EU's digital front runners. However, further support for business creation in the ICT sector is needed to catch up with the average EU performance.



Overview of main initiatives to develop digital skills

| Name | Digital Skills Belgium Fund (federal) | DigitalChampions .be (federal) | Action plan ICT & Digitalisation VDAB (Flanders) | Digital School (Ecole Numérique) (Wallonia) | WallCode.be (Wallonia) | Fablab Mobile (Brussels) | BeCentral (Federal) |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | Training centres, counselling centres, workshops | Training and certification programmes | Coordinated action on job skills | Training | Training, workshops | Training, workshops | Training centre |
| Starting date | 2017 | 2015 | 2018 | 2011 | 2016 | 2018 | 2017 |
| Objective | The main aim is to use digital skills to increase integration chances of vulnerable groups (vulnerable children, young people and young adults.) | The aim is to strengthen digital skills of citizens of all ages. | Support job seekers, employees, employers and partners at the educational level in acquiring labour market-oriented skills in the field of ICT and digitalisation | Reach Wallonia's strategic objectives "Equip schools with cutting-edge facilities and infrastructures" and "Ensure that all Walloons acquire digital skills at every step of their life and education/career path"). | Initiation of youngsters and training of teachers to digital skills, in particular computer science, algorithmic logic and programming languages. | The aim is to introduce ICT to young people. | BeCentral will play a major role in bridging the digital divide and in helping to accelerate Belgium's Digital Transformation. |
| Short description | The Fund provides financial support for projects that aim to improve the digital skills of socially vulnerable youth and (young) adults. They may also be initiatives related to short, medium or long | Following the Grand Coalition on ICT jobs at European level, Belgium has set up the Belgian National Coalition "DigitalChampions.be". DigitalChampions.be is an alliance bringing together stakeholders from | - Jobmatching and career development - Good coordination between supply and demand through proactive cooperation with employers - Increase the changes of | The action aims to support 500 projects every year in order to speed up and intensify digital use in all schools by pupils and current/future teachers. Projects can cover an "autonomous" | Wallonia has launched the operation WallCode.be to introduce youngsters from a very young age to computer science, algorithmic logic and programming languages. WallCode has | Six Brussels-based fablabs created a consortium called FabLab Mobile, funded by Innoviris. The Fablab mobile functions as a TechTruck in which young people (aged 10 to 18) are able to | BeCentral is a new digital campus where children, young people and adults can upgrade their digital skills. BeCentral is hosting digital schools, workshops and events in an entrepreneurial |
| | type courses. These initiatives promote their chances of social inclusion and economic autonomy. | various governments, education and the private sector. It undertakes initiatives so that all citizens, irrespective of their age and background, are given the opportunity to strengthen their digital skills. | matching and sustainable employment by strengthening the competences of citizens - Increase the impact of VDAB as a director through better cooperation with partners and a complementary approach to the market. Increase the reach in the digital future by promoting and educating digital tools and promoting digital job matching as a means. | project from a school/college, a tandem between a teaching training college and a school to develop resources and strategies of digital use, "advanced" schools willing to use technologies not covered by the catalogue ¹⁰⁰ . | two main actions: 1-Introducing youngsters, so that they can hone their skills and explore different areas of digital technology, via introductory activities 2-Raising awareness and training teachers and future teachers. Not forgetting Algo-Bot, a free video game introducing players to programming languages. | get familiar with digital technologies and learn about coding, lasers, or even 3D printers. They will then be able to learn even more and develop their own projects with educational kits carried on a delivery bicycle. | ecosystem. More than 30 initiatives are available every day including coding schools, cybersecurity program, NGO's and start-ups. |
| Granting organisation | Federal government | Federal government | Government of Flanders / VDAB (Flemish Office for Employment and Vocational Training) | Walloon region | Digital Wallonia | Brussels Region through Innoviris | Cofounded & backed-up by more than 40 entrepreneurs |
| Participating organisations | Minister of the Digital Agenda, Telecommunications and Post | Stakeholders from various governments, NGOs, education and employment | VDAB and subcontractors | Walloon region, service providers | About 40 partners | OpenFab, IMAL, Fabal'ke, CoderDojo, Micro Factory, Fabal' ULB | 200+ residents |



| | | | | | | | |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------|
| | | institutions, social partners and the private sector | | | | | |
| Sectors targeted | All | All | All | All | All | ICT | All |
| Funding (split by private/public and national/EU), state period/annual funding | Funding from the Federal government programme. Total budget of EUR 18 million for 2016-2018 (around EUR 5.6 million each year). | N/A | N/A | EUR 62.7 million allocated for the 2014-2022 period (regional public funding) | 100% public funding from Digital Wallonia, promoting also private initiatives. Budget of EUR 87,000 in 2016, EUR 190,000 in 2017, EUR 900,000 in 2018. | EUR 600,000 (2018-2019) from regional public funding | N/A |
| Current status of initiatives | 41 projects funded in 2017, 37 in 2018. | Two Digital Skills Fairs in May 2017 and May 2018, and a range of initiatives available. | N/A | The 2019 call for projects was launched in February 2019. | About 3,500 students involved in 2016 and 5,000 in 2017. | The project is running for 2018 and 2019. | BeCentral will provide at least 10,000 people with digital skills starting from end of 2017. |

Impacts, challenges and perceptions

DigitalChampions.be, BeCentral and the Digital Belgium Skills Funds have been implemented in the framework of the Digital Belgium strategy. Awareness of the different initiatives varied across stakeholders interviewed and their usefulness was considered moderate (average score of 3.3 on a 1-5 scale where 1 is low and 5 is high), for instance because training is not always tailored to the target group. To complement training programmes, contests such as the Digital Wallonia Champions are considered useful to stimulate companies to become the next champions. To assess digital skill gaps, national authorities mentioned using certification tools such as Pix and Tosa.

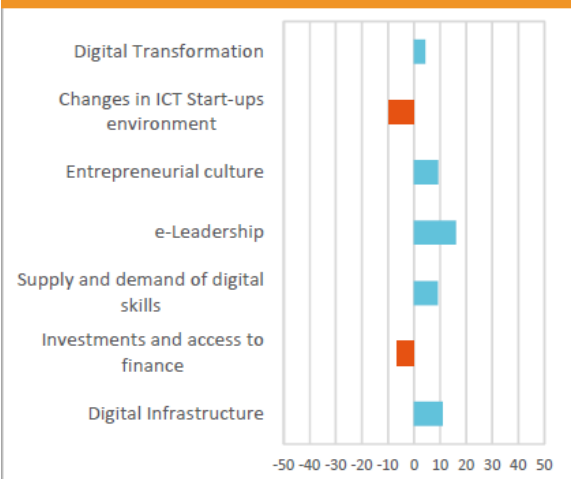
According to Eurostat data, the share of Belgian enterprises providing training to their personnel to develop/upgrade their ICT skills increased from 32% in 2015 to 35% in 2017. In the meantime, the share of individuals with basic or above basic digital skills only slightly increased from 60% to 61% between 2015 and 2017. Stakeholders interviewed did not notice a significant improvement of digital skills of the workforce since 2015 (average score of 2.75 on a 1-5 scale where 1 is no improvement and 5 is maximum improvement).



Digital Transformation Scoreboard

C Comparison with other EU Member States

Figure 9.52: Spain's performance vs. EU average



Note: Based on the average of the difference of the latest three imputed values. Where no data was available, the EU average was used.

Spain performs above the EU average in five out of seven dimensions. Its strongest assets are e-leadership and digital infrastructure. In both cases, the country scores more than 10% above the EU average.

E-leadership is the area that shows the biggest improvement compared to last year's results.

The presence of changes in ICT start-up environment is significantly weak compared to its EU partners, as it scores 10% lower than the EU average. The level of investments and access to finance is also low compared with other EU Member States.

The country continues to perform well in the fields of entrepreneurial culture and digital skills, scoring around 9% higher than the EU average. Lastly, its score in digital transformation is marginally above the EU average.



Overview of main initiatives to develop digital skills

| Name | Red.es: Digital Professionals | EOI: Young employment initiative | EOI: DigitalXBorder | EOI: National reference centre for e-commerce and digital marketing in the context of professional training |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | Series of support programmes | Training programmes | Training programme | Training programmes |
| Starting date | 2014 | n/a | n/a | n/a |
| Objective | It aims at enabling the acquisition of digital skills throughout all the steps in one's professional development. | Offer unemployed young people the knowledge, skills, and attitudes necessary for their immersion as professionals in a labour market marked by digital transformation. It also aims at providing the understanding of the meaning and scope of what digital transformation means in the professional world. It also provides the knowledge on the main areas of experience that the digital sector is developing in the company and what professional profiles are associated with the Digital Sector in order to adapt the professional profile to what the labour market demands. | <ul style="list-style-type: none"> Train SMEs in order to make the right decision regarding digital issues. Help international sales of products and services, via Internet and cloud tools. Boost SME growing by increasing commercial opportunities that come from multi-market sales. Improve the digitalization index of Spanish SMEs in the Digital Economy and Society Index (DESI), published by the European Commission (Spain in ranked 14th on the list, out of 28). | There are three main activities: <ol style="list-style-type: none"> Technical improvement courses for vocational training teachers: develop technical capacity of the teachers of vocational education, to improve their teaching skills and increase their professionalism in areas linked to the area of commerce and marketing. Design of innovative VET courses for the unemployed: provide students with a training offer that increases their possibilities to enter the labour market in areas linked to the sectors of commerce and marketing by focusing on topics related with the creation of businesses online and business models and transformation of digital business. Innovation and experimentation On-VET |
| Short description | This initiative consists of a mix of actions including scholarships for students or financial support for enterprises and entities with training programmes within the area of ICT. The initiative includes six action lines: <ul style="list-style-type: none"> Young employment Postgraduate training MOOC's Reference centre Continuous training | The initiative consists of two phases: <ul style="list-style-type: none"> Phase 1: Google MOOC's, online courses of 40 hours Phase 2: personalised mentoring that students can follow in their own city. The strategy also provides financial support to companies that hire participants of the online course (up to 5,000 EUR and up to 160 participants). | The programme is aimed at CEOs whose strategic priorities include the growth of their company and its international competitiveness. It is focused on SMEs with international experience and digital presence, with a preferred yearly turnover of more than EUR 5 million. The programme consists of a course of 56 hours running 7 consecutive Thursdays focused on 7 areas: <ul style="list-style-type: none"> Ecosystem; Marketing; Marketplaces; Operations; Innovation and legal affairs; Data economy; and Agenda of the CEO. | 1. Technical improvement courses for vocational training teachers through various courses: <ul style="list-style-type: none"> Marketing and digital search engine; Experience of the digital client; Competitive intelligence in the internet; Big Data analysis. 2. Design of innovative VET courses for the unemployed: <ul style="list-style-type: none"> Course of creation of digital business (220 hours) Course of business models and transformation of digital business (100 hours) |
| Granting organisation | Red.es, public entity under the Ministry for Economy and Enterprises | EOI | EOI | EOI |
| Participating organisations | Various, including the Autonomous Communities and educational institutions | Google | ICEX and ADIGITAL | Red.es |
| Sectors targeted | Academic and professional sectors. | | It mainly targets SMEs with international experience and a digital presence. | <ol style="list-style-type: none"> Technical improvement of vocational training teachers: <ul style="list-style-type: none"> Courses directed towards employed workers: teachers and experts in professional training and professors for vocational training. The main target group include: unemployed people with a focus |



| | | | | |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | | on women, young people under 30 years, people with disabilities, victims and other people affected by terrorism, victims of gender violence, long-term unemployed, people above 45 years and people in risk of social exclusion. |
| Funding (split by private/public and national/EU), state period/annual funding | <p>This is co-financed between the Spanish government and the European Union. A large sum of the funding comes from the ESF.</p> <p>Some of the action lines provide an overall budget for the period 2014-2020:</p> <ul style="list-style-type: none"> • Young employment: EUR 19.95 million; • Postgraduate training (2014-2015): EUR 890,000 (2014) and EUR 733,894 (2015); • MOOC's: no budget information available; • Reference centre: no budget information available; • Continuous training: EUR 10,925,000; | National financed with a budget of around EUR 39 million: Budget EUR 1,392,000: EUR 751,568 for training and EUR 640,320 for supporting companies for hiring. | The programme is co-financed between the Spanish government and the EU – a ratio of the funding comes from the ESF. The total budget amounts EUR 658,850. | The total budget for the three activities was EUR 300,000 (2018-2019). |
| | <ul style="list-style-type: none"> • Create future: EUR 3.69 million | | | |
| Current status of initiatives | Running | | The programme has already been implemented in Alicante, Málaga, Zaragoza and Murcia and it is in the process of being established in Valladolid and Barcelona. In the next two years, the programme will expand to further 19 Spanish cities. | |

Impacts, challenges and perceptions

The Digital Agenda for Spain also had a focus on digital inclusion and employability, established in 2013 and taken onwards by CI4.0 with other action lines. The focus was to increase accessibility, digital inclusion, equality and employability. The first and only evaluation was conducted in 2014, which indicated progress with the targets but had little detailed information about the overall plan of digital inclusion due to the high number and dispersion of participants. However, the EOI has trained more than 80,000 professionals and has contributed to the creation and modernisation more than 50,000 SMEs in Spain over the past 60 years. So far, today, 57.653 students have registered in the MOOC, of which 6,557 have already completed their training and have received their joint EOI-Google diploma.



Regarding phase 2, almost 300 unemployed young people between 16 and 30 are receiving individual tutorials.

In the years 2015-2017, the percentage of the population with at least basic digital skills increased. In 2017, over half of the population possesses at least basic skills. Nevertheless, Spain lags the EU average regarding the Human Capital among EU countries. One area Spain performs highly above average is the number of graduates holding a STEM degree. The usefulness of the initiatives was rated rather low (2 in a 1-5 scale) by industry stakeholders and the improvement of the digital skills was seen as moderate (3 in a 1-5 scale).

In Spain, the ESF is crucial for inclusive growth and convergence. In particular, the funds provide crucial support to SME competitiveness, strengthening of digital skills and vocational training, as well as women's labour market participation.

Overall, Spain counted shortages in ICT specialist occupations in 2016.⁴³ While currently, the number of STEM graduates is a strong factor for the country, the overall level of digital skills lags the EU average. The initiatives implemented by Spain, however, have received very positive feedback in various instances, e.g. CEDEFOP.

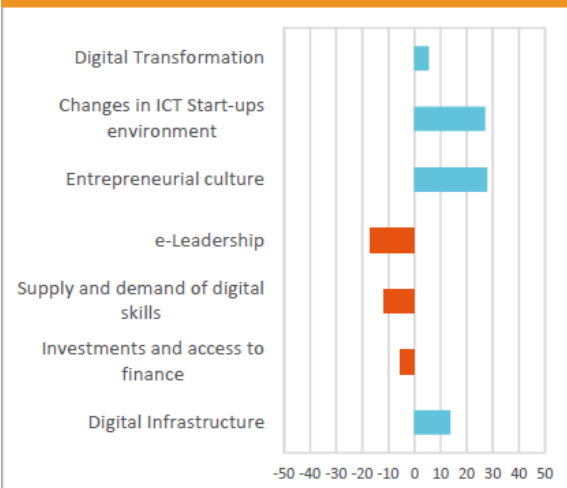


Portugal

Digital Transformation Scoreboard

C Comparison with other EU Member States

Figure 9.44: Portugal's performance vs. EU average



Note: Based on the average of the difference of the latest three imputed values. Where no data was available, the EU average was used.

Portugal performs above the EU average in four out of seven dimensions. In particular, it stands out in entrepreneurial culture and the ICT start-up environment, scoring nearly 28% higher than the EU average.

Compared to last year's data, there has been a trend change in the score of ICT start-ups, which is now far above the EU average. Meanwhile, the country continues to perform well in digital infrastructure and digital transformation in comparison to its European partners.

The data indicates that Portugal's greatest challenges are in e-leadership, where it scores nearly 19% below the EU average. Similar challenges persist in the supply and demand of digital skills and investments and access to finance, in which Portugal could equally improve.



Overview of main initiatives to develop digital skills

| Name | INCoDe.2030 ³⁷ | Code for All de (Academia Código) ³⁸ | Tourism Digital Academy ³⁹ | Technical Courses i4.0 (Cursos técnicos i4.0) ⁴⁰ | Digital Atelier ⁴¹ | Industry-Action Programmes ⁴² |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | National coalition | Coding training | Training courses | Training courses | Training courses | Training courses |
| Starting date | 2017 | N/A | 2018 | N/A | 2016 | 2017 |
| Objective | Raising/enhancing digital competences of all Portuguese citizens to respond to the challenges of digital society. | To provide unemployed youth opportunities to find employment in the IT sector as well as teaching children basic programming skills. | Develop training courses in the digital area of tourism, support R&D and international cooperation. | Revise professional technical courses focusing on the specific needs relating to the digitalisation of the economy. | To train and enable citizens with the competences and tools needed to succeed in the digital economy. | Adapt training offers with double certification to each industry's needs and to the needs of each region. |
| Short description | INCoDe.2030 is the Portuguese Digital Skills Initiative involving a broad range of stakeholders. | Code for all organises bootcamps for unemployed youth that last 14 weeks (650+ hours) after which participants are able to find employment in the IT sector. Additionally, there is a platform for children that serves as an introduction into programming language and provides them with basic programming skills. | In partnership with tourism educational institutions, the Academy prepares training courses for human resources in tourism in the digital area as well as launches innovation challenges and competitions. There is a partnership with clusters in the tourism area to develop action plans, international projects in the area of tourism R&D, innovation promotion in tourism. | The Technical Courses i4.0 initiative will create interface moments between schools and the industry and will promote the resourcing of qualified workers as well as the utilisation of companies' equipment to support academic activities. | Google in partnership with Higher Education Institutions will create a platform with free training and tools. Offline training, for example, through a Digital Marketing Course is also foreseen in cooperation with public universities that would include modules on Social Media, Digital Marketing Planning or Internationalisation. | This programme inserts itself in the system of investment incentives for companies. By applying Action-Training methodology to the reality of the SMEs, competences can be enhanced and significant improvements to the functioning, organisation and competitiveness obtained. |
| Granting organisation | Foundation for Science and Technology | Code for All | Tourism of Portugal | Ministry of Education, ANQEP | Google | Ministry of Economy, Ministry of Education, Ministry of Work, Solidarity and Social Security |
| Participating organisations | Government entities, sectorial associations, companies, Higher Education and other educational institutions, municipalities, foundations, vocational institutions, other private entities | Unemployed youth, children | Tourism educational institutions, government entities, sectorial associations and institutions | Ministry of Work, Solidarity and Social Security | Ministry of Science, Technology and Higher Education, Coordinating Council of Polytechnics, Universities | SME Academy of IAPMEI |
| Sectors targeted | Private and public social sector institutions, Industry and services, Education, R&D | Education, ICT | Tourism | Education | Education | Education |
| Funding (split by private/public and national/EU), state period/annual funding | Funding unknown, possible mix of public and private funding | Funding unknown, possible mix of public and private funding | Funding unknown, possible mix of public and private funding | Funding unknown | Funding unknown | Funding unknown |
| Current status of initiatives | In implementation Creation of 10 Creative Communities for Digital Inclusion reaching close to 1,000 direct beneficiaries. Extension of ICT from 5th to 9th school years and many ICT and robotics Labs in secondary education. Special focus on ICT in qualification and training | In implementation Between 2016 and 2018 the aim was to provide the course to 200 youth. All participants found employment within 2 months of finishing the bootcamp. | In implementation | In implementation From the 2017/18 and 2018/19 academic years, close to 107,000 students enrolled in technical courses i4.0. It also resulted in 39 non-high-level qualifications | Concluded This initiative educated over 40,000 people through 23 online training modules made available on the platform. | Concluded During the course of the programme 21 actions were developed, conducted by 7 business associations and the SME Academy of IAPMEI. |



| | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--------------------------|--|--|
| centres and requalification of degree holders (both active and unemployed) in ICT, the target being 1,500. More than 8,000 higher education degrees awarded in ICT, per year. Several TeSP courses (higher education vocational courses — 2 years) in direct cooperation between Polytechnic Schools and companies. Creation of MAAC high performance computing centre in U. Minho and launching the Portuguese AI Initiative. | | | with dual certification. | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--------------------------|--|--|

Impacts, challenges and perceptions

The measures proposed in the national strategy for digitalisation under the axis 'Training and development of human resources' were outlined based on the gaps identified by the Digital Economy & Society Index (DESI) in 2016 regarding educational offer in the area of ICT. The aim of the measures is to encourage children and younger generations to pursue education in ICT, digitisation and automation, to restructure higher education to reinforce topics associated with ICT and innovation in content and activities with a goal to prepare students for the current challenges of the labour market. Further, some of the measures are aimed at promoting transversal initiatives targeted at digital skills and competences of the Portuguese active population. The aim is to also increase the attractiveness of the national industrial sector, focusing on awareness of entrepreneurs and other involved parties of innovation within industry 4.0.

In line with the national strategy, the national digital coalition InCoDe.2030 aims to raise digital competences of all Portuguese citizens by 2030. For example, by 2030, all households are expected to have internet access and the number of frequent users should be above 90% of the population. These are quite ambitious targets given that in 2017, according to Eurostat, only 50% of the population had basic or above basic digital skills. Nonetheless, to address the challenges and goals identified, the initiative's activities focus around five main axes of interest – inclusion, education, qualification, specialisation and research. The progress made since its creation in 2017 has been presented at the 2nd Permanent Forum for Digital Competences⁴³, and includes for example, a pilot project of e-learning training course for unemployed with 545 successful participants (2017), 12,586 successful participants in improvement training courses that integrate online content and services (including modular



training, life-long training and inclusion training), 40 courses with 649 successful participants focusing on programming, information security, data science, digital marketing and others.

The industry sees INCoDe as an important tool for digital transformation, however, it cannot do it on its own. Involvement of all levels of government and society are needed, particularly in connection with digital literacy. However, more time is needed to be able to observe the medium- and long-term impacts and improvements.

As mentioned, the national strategy in the area of AI, 'AI Portugal 2030', has been developed within the digital coalition, therefore, the aim is to improve the AI capacity hand-in-hand with skills development. One of the key objectives of the Initiative AI Portugal 2030 is fostering and providing visibility to AI specific training at all levels, from early education to PhD level, including lifelong learning. The Portuguese Universities and Polytechnics have been actively providing post-graduate courses on AI related topics and the offer is increasing rapidly. Several Portuguese companies have also been offering themselves specialised training on AI and Data Science.

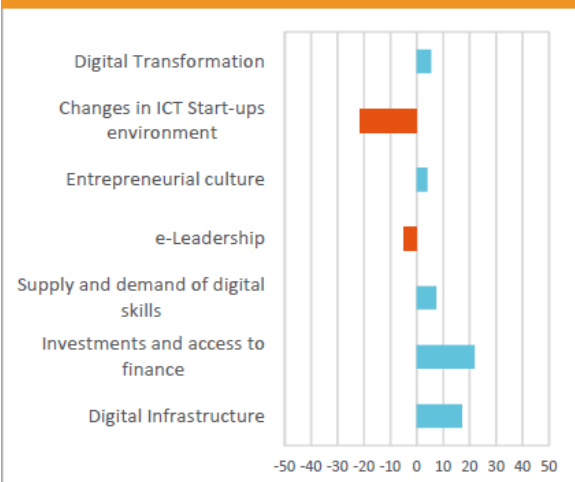


Germany

Digital Transformation Scoreboard

C Comparison with other EU Member States

Figure 9.22: Germany's performance vs. EU average



Note: Based on the average of the difference of the latest three imputed values.
Where no data was available, the EU average was used.

Germany scores above the EU average in five out of seven dimensions. Outperforming the EU average by almost 22% and 18%, Germany is among the EU's leaders in the dimensions of investments and access to finance and digital infrastructure.

Moreover, Germany performs above the EU average in supply and demand of digital skills and digital transformation. Meanwhile, in the field of entrepreneurial culture, Germany only scores marginally above the EU average.

Finally, the dimension in which Germany performs below the EU average are the ICT start-up environment (-21%) and e-leadership (-5%).

Compared to 2017, Germany has strengthened its entrepreneurial culture, while a decline was experienced in all other fields.



Overview of main initiatives to develop digital skills

| Name | Mittelstand Digital Competence Centres | Vocational Training 4.0 | Future of the German Mittelstand |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | Competence Centres | Training Program | Action Program |
| Starting date | 2015 | 2016 | 2017 |
| Objective | The Federal Ministry for Economic Affairs and Energy has the goal to strengthen the competitiveness of small and medium sized enterprises. The mix of regional centres and thematic centres includes all divisions and industries. | To develop new measures for a future - oriented, attractive and competitive vocational training and to connect them with other BMBF initiatives on digitisation. The initiative also supports the Digital Agenda of the Federal Government. | To promote the spirit of entrepreneurship, to strengthen the financing of start-ups and tackle skills shortage. Besides, the Action Plan aims to strengthen innovative capacities and SMEs in structurally weak regions. |
| Short description | Mittelstand 4.0 competence centres throughout Germany help with expert knowledge, demonstration centres, networks for the exchange of experience, events and practical examples. The Federal Ministry for Economic Affairs and Energy enables the free use of all offers of Mittelstand-Digital. | The activities of VET 4.0 include the BMBF Program "Digital Media in Vocational Education". This will contribute to the modernisation and strengthening of VET. Innovative, digitally supported education, communication and information solutions are developed to meet the requirements for learning and working in the digital society. Accompanying this is the development of concepts to strengthen the media literacy of employees and organisations in order to optimally use learning with digital media. In addition to the target group of learners, the focus is also on the specific qualification of pedagogical specialists. Nationwide, at least 1,200 trainers are trained in the company training context. | To ensure that the German Mittelstand can remain healthy, strong and innovative in the face of the challenges sketched out above, the Economic Affairs Ministry, which is responsible in the Federal Government for SME policy, is implementing measures in ten fields. |
| Granting organisation | The Federal Ministry for Economic Affairs and Energy | The Federal Ministry of Education and Research, Federal Institute for Vocational Education and Training | The Federal Ministry for Economic Affairs and Energy |
| Participating organisations | Actors from companies, associations, unions, science and politics | N/A | N/A |
| Sectors targeted | Industry | Industry | Industry |
| Funding | EUR 1 billion available until 2018 | N/A | EUR 14 million |
| Current status of initiatives | Ongoing | Ongoing | Ongoing |

Impacts, challenges and perceptions

Based on industry perception, the availability of digital skills as moderate (4 on a scale from 1 to 5). German adults are in the top tier when it comes to digital skills, with 37% of people scoring at an intermediate level in problem-solving in technology-rich environments, which comes with a low digital skills gap. By contrast, Germany is facing high risk of job automation, with a total of 54.2% of jobs at risk of automation. The relatively low share of workers with computer-based jobs does limit the job stress and worries about work when not working associated with digital jobs. The exposure to disinformation is one of the lowest in OECD countries (9%).

According to the OECD, improving opportunities for life-long learning and better anticipating skills needs is critical to Germany's ability to seize the digital transformation. Germany is among the countries with a higher-than-average share of jobs at high risk of automation and, like the rest of the OECD, has experienced job polarization. While overall participation in adult learning is average, the participation gap in adult learning between high-skilled and low-skilled adults is much larger in Germany than in most OECD countries. Tackling skills at



multiple entry points will be essential – from ensuring the education system equips students with solid literacy, numeracy and problem-solving abilities, as well as basic ICT skills and soft skills, through to anticipating changing skills needs to adapt curricula and guide students' choices, to improving the effectiveness of lifelong learning and training for adults.



Chapter 5 – An action based summary of

this report

The partnership will focus on digital up and reskilling of employees working in SMEs in different technical domains / professional groups (Pg.9 & 10) and departments (Pg. 19).

We will consider digital and non-digital professionals (Pg. 19) and their needs in terms of technical and non-technical skills.

For the technical skills we will consider a wide range of technologies that may need to be understood (Pg.23).

For non-technical skills we may consider

- Complex problem solving
- Critical Thinking
- Creativity
- People Management
- Coordinating with Others
- Emotional Intelligence
- Judgement and Decision Making
- Service Orientation
- Negotiation
- Cognitive Flexibility

This means that when it will come to connect different training organizations, we may also consider the option of connecting entities with different technological and non-technological focus (for instance: in an ideal world we might be able to connect a training organization providing short modules on technical insights of Artificial Intelligence and another one delivering a short module on Critical Thinking).

To start the mapping process, partners may leverage on the national initiatives that have been briefly described in Chapter 4. Please note that these initiatives have been taken from EU surveys and may not represent the whole spectrum of available or effective options for the DITA project.



References

- Monitoring progress in national initiatives on digitising industry, SMART 2018/0002 - Interim Report, 15 July 2019 and Country Reports
- Digital Transformation Scoreboard 2018 - EU businesses go digital: Opportunities, outcomes and uptake; Digital Entrepreneurship Monitor - EASME/COSME/2014/004; Publications Office of the European Union, 2018
- Cedefop (2016), 'The great divide: Digitalisation and digital skill gaps in the EU workforce, ESJsurvey Insights, N.9, Thessaloniki
- Cedefop (2016), 'Rise of the machines: Technological skills obsolescence in the EU', #ESJsurvey Insights, No 8, Thessaloniki: Greece
- Brussels, 10.6.2016 COM(2016) 381 final Communication from the Commission to the European Parliament, the Council, the European and Social Committee and the Committee of the Regions – “A New Skills Agenda for Europe”
- Skills for Smart Industrial Specialisation and Digital Transformation, Interim Report (October 2018); PWC - Executive Agency for Small and Medium-sized Enterprise (EASME) EASME/COSME/2016/034
- Towards a Reskilling Revolution: A Future of Jobs for All. WEF in collaboration with Boston Consulting, Jan 2018
- COM (2009) 512 Final: Preparing for our future: Developing a common strategy for key enabling technologies in the EU
- Report of the Task Force on advanced manufacturing for clean production: Advancing manufacturing – advancing Europe. Brussels (2014)
- Digital skills and competence, and digital and online learning, European Training Foundation, Turin, 2018