Digital Transformation & Competences in Europe: Industry & Technology Relevant Trends, Gaps and Ideal Training Synergies

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Index

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Introduction

The deployment stages of Intellectual Output 2 faced several “stops and go” due to the permanent learning process of the partnership during its interaction with stakeholders and “Sparring Partners”[1].

While IO2 had originally the main goal to identify specific available training resources in the partner countries, create some training benchmarks and activate the first connections. However, the significant amount of thematic digital skill gaps and the heterogeneous approaches adopted in each country and by each training organizations suggested to the DITA partnership, to design IO2 in a slightly different way.

Project Partners jointly decided to focus on industry specific trends and case studies to design a useful framework that will help to strategically guide the design of the DITA ATLAS (IO3). The framework is based on:

- **the identification of a country’s specific training assets in digital transformation processes**, which relies on the best available knowledge base in specific vertical digital domains,
- **a first screening of available educational methodologies of training programs** focused on specific vertical topics in the field of digital transformation / industry,
- **the identification and sharing a set of preconditions enabling transnational cooperation mechanisms**,
- **the possibility of learning outcomes recognition and the definition of learner’s mobility strategies** for transnational training cooperation work between organizations belonging to different countries.

Based on this, this digital publication has been divided into 3 main chapters, specifically:

- **Chapter 1: Digital Transformation in Europe – Country Specific Training Assets and their Transnational Value**
  The chapter provides an overview of digital transformation patterns in each involved country and identifies the industrial sectors which are driving economic growth and are positively impacted by digital transformation.
  Chapter 2: Digital Transformation Going “Vertical” – Cases Studies Linked to Specific Digital Industry Areas (Robotics, IoT, Data Management, etc.).

[1] Sparring partners – as described later – are selected training organizations which have been involved to focus on specific vertical topics, cooperation mechanisms and first co-design sessions of the DITA ATLAS.

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This chapter provides evidence of how digital transformation is having an impact on each identified industrial sector, where excellences in the identified DITA digital technology domains can be found and which gaps have to be minded.

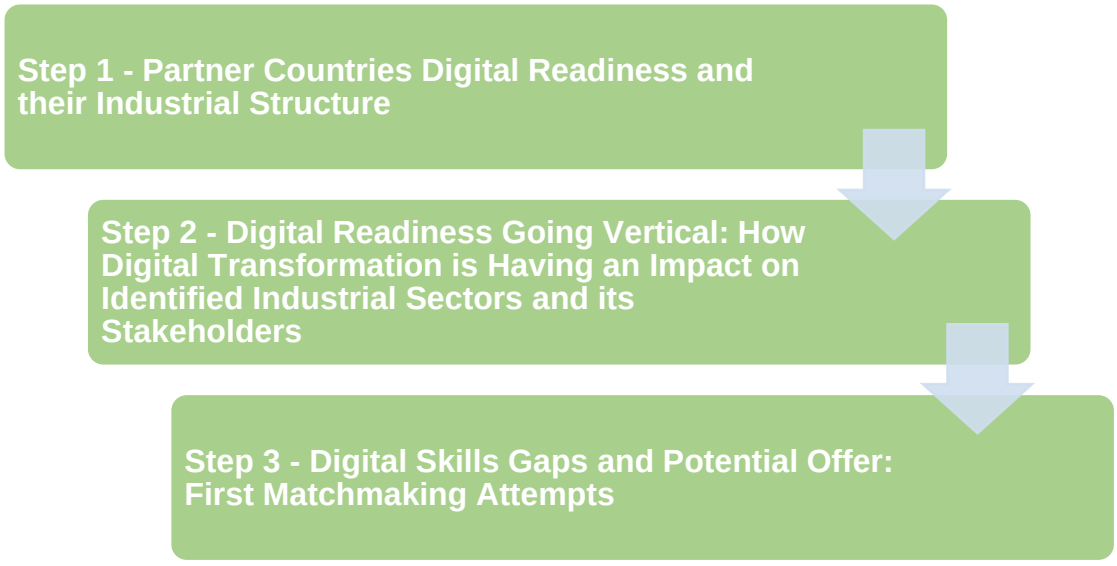
- **Chapter 3: Matching Gaps and Excellences & Recognition of Learning Outcomes**

  This last chapter provides evidence of the exchange that project partners had with their sparring partners. The focus is on a first matching between excellences (potential offer of training and competences) and the demand side, on possible cooperation mechanisms and the learning recognition mechanisms currently in use by sparring partners.

The Methodology

First of all, an analysis related to the digital readiness level has been elaborated and included, in order to understand the Digital Transformation rankings in the respective countries (Source: Digital Transformation Scoreboard 2018). This investigation has been carried out to understand the "status quo" of PPs' digital readiness and, when underlined, the industrial relevance of digital transformation.

Successively, PPs have been involved to collect real data following a step-by-step process, which has been designed by Intellimech with the support of the project leader Nerosubianco. The figure below provides an overview of the process that has been followed by project partners:



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Specifically:

1. **Step 1:** after having identified the core digital transformation trends in each partner country, a focus on industrial relevant sectors has been made**.** DITA Partners agreed, indeed, that the ATLAS (IO3) will have an impact if it will be linked to the economic & industrial strengths of the involved geographical areas and therefore it is essential to identify from where (sectors) the demand of digital skills will come. Partners have considered:
    a. industrial sectors that represent an excellence in the region/country,
    b. leading players in the identified sectors,
    c. clusters or intermediate organizations,
    d. S3 strategies related to the excellences,
    e. leading training organizations.
2. **Step 2**: project partners have focused on the **digital maturity** reached by the analysed industrial excellences and engaged stakeholders to identify gaps and priorities; subsequently they have identified **digital technology excellences** (which will be further used to classify the DITA ATLAS training catalogue)
3. **Step 3**: project partners have identified regional and national **digitalization leaders.** Who are the key players (i.e.: Digital Innovation Hubs, Competence Centres, thematic platforms, etc) and together with selected Sparring Partners identified priorities, possible cooperation approaches and a first matrix to mind the gap between digital skill gaps and offer.

The analysis has been supported by specific templates used to collect data and evidence by the partners (see Annexes), which have been consecutively analysed and merged by Intellimech in this final report:

- 1 template for Step 1 (Annex 1)
- 1 template for Steps 2.a and 2.b (Annex 2)
- 1 template for Step 3 (Annex 3)
- 1 Survey “Digital Industry Training Programs & Cooperation” (Annex 4)

Geographical Classification

PPs have agreed to focus the analysis on regional or national areas. Thus, the data collection is based on regional areas: Bavaria for Germany; Lombardy for Italy; Asturias, Castilla y Leon, Basque Country for Spain; and on national areas for Austria, Belgium and Portugal.

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Representative industries

Each partner has selected a maximum number of 4 emerging/trending representative industries, detailing the number of enterprises, employment rate and GDP for the particular geographic areas. The official data have been extracted from the most recent evidence listed below (the oldest data are published in 2018):

- *European Reports*
- *National Statistical Surveys*
- *Regional Industry Reports*
- *Results of Regional Specialization Surveys / Analysis*
- *Reports from Industry Associations / Observatories*
- *Data / Analysis / Studies delivered by Clusters*
- *National / Regional Digital Agenda or Roadmap*
- *Own studies / reports (stemming from recent projects, surveys, interviews, formal PHD thesis, etc.).*

Sparring Partners

Each project partner has identified at least 1 sparring partner to start a focused analysis on priorities, cooperation mechanisms among training organizations and learning outcomes recognition methods. Involved sparring partners are:

- H-FARM
- AFIL- Lombardy Intelligent Factory Cluster
- BERGAMO SVILUPPO
- FH Kufstein Tirol Bildungs GmbH
- My Academy GmbH
- Bemas
- HETEL
- Centro de Referencia Nacional en Desarrollo Informático y Comunicaciones (Comunidad de Madrid)
- SEAS,
- Estudios Superiores Abiertos
- DBServices Portugal
- ISQ Academy
- CENTIMFE
- Digitales Zukunftszentrum Allgäu-Oberschwaben

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Chapter 1: Digital Transformation in Europe – Country Specific Assets and their Transnational Value

The goal of this chapter is to identify **country's specific training assets in digital transformation processes**, in particular defining which has the better knowledge base than others in specific vertical digital domains.

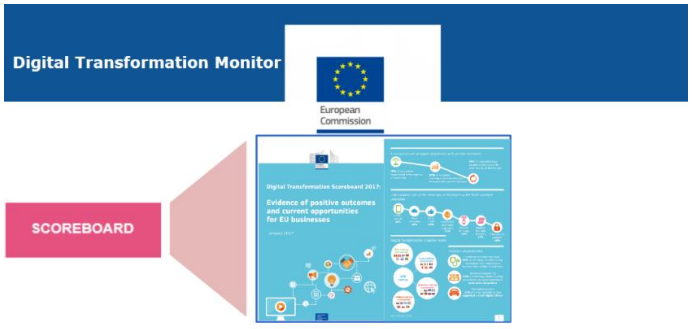
This chapter is based on the analysis of the "Industry focus", with a description of industrial excellences of target geographical areas.

Specifically, for each partner country this chapter provides evidence of:

- the level assessment of digital transformation in the respective country;
- the industry sectors that better represent the excellence in the target areas;
- the leading enterprises representing these sectors;
- the clusters or the intermediate organizations renown in the sectors;
- which S3 strategies reflect the excellences;
- which training organizations are well anchored to the sectors.

As mentioned in the first paragraph of the "Methodology" section, the Digital Transformation Scoreboard has been taken as a reference point for the "status quo" of the digital readiness at European level, and in particular in the PPs' countries. Therefore, the main observations are aligned with the qualitative analysis carried out among PPs.

The European Digital Transformation Index[2]



The Digital Transformation Scoreboard provides evidence on the extent of digital transformation in Europe and is based on a qualitative part, focusing on the survey results and a quantitative part based on indicators enabling to statistically monitor progress on the enabling conditions for digital transformation.

The first task that has been completed by project partners is to determine the **digital readiness** level of the involved partner countries.

For the purpose of the DITA project, the **Digital Transformation Scoreboard 2018** has been analysed and reviewed by project partners to have an overall appreciation of the digital readiness of each partner country. Additionally, this analysis has been used to identify some strategic

[2] Digital Transformation Scoreboard 2018: EU business go digital: Opportunities, outcomes and uptake, Publication Office of the European Union, 2018.

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Key Messages that will be considered during the development process of the DITA ATLAS (IO3).

Digital Readiness Level is increasing in almost all PP countries

Digital Tranformation Index

The report shows that more Member States perform considerably above the EU average in terms of digital technology integration. Northern and western EU Member States score highest in terms of digital transformation. Nevertheless, improvements are necessary for eastern and southern Member States, which are still lagging behind.

The Digital Transformation Scoreboard provides data and analysis on the adoption of digital technologies in businesses across the EU. To better inform and help policy makers and industry stakeholders to take steps ahead, 2018's Scoreboard surveyed EU companies of the food and construction sectors even though the screening of national policies, national data sourced from Eurostat, national statistics offices and international organisations contribute to generate a wider European cross-sectoral picture.

The Report shows that almost 2/3 of EU Member States have made the **digitisation of their industries a priority**, adopting large-scale policies and related initiatives to increase productivity and competitiveness and improve the digital skills of their workforce. Despite many commonalities, findings from analysing national initiatives across Europe reveal how diverse the tools developed and experiences gained really are. All policies have common goals but differ in many aspects like policy, design, funding approach, financial size and implementation strategies.[3]

To what concerns the conditions enabling digital transformation (DTEI) the leading Countries are: The Netherlands, Finland, Sweden, **Belgium**, and Luxembourg.

To what concerns comparison between the Digital Technology Integration Index (DTII) scores across Member States shows that the three highest-scoring economies are Denmark, Ireland, and Finland.

Key Message 1: the DITA ATLAS – especially under Intellectual Output 3 – will work to incorporate leading training providers from these countries to generate a robust catalogue of digital skills providers and try to establish connections with those areas.

Furthermore, the report also highlights that by the end of 2018 significant progress had been made across the EU in entrepreneurial culture (which measures the capacity of exploiting

[3] https://ec.europa.eu/growth/tools-databases/dem/monitor/scoreboard

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digital technologies to start new businesses), supply and demand of skills (which measures if the gaps are minded) and investments and access to finance (which measures the capacity to incorporate new technologies into daily businesses).

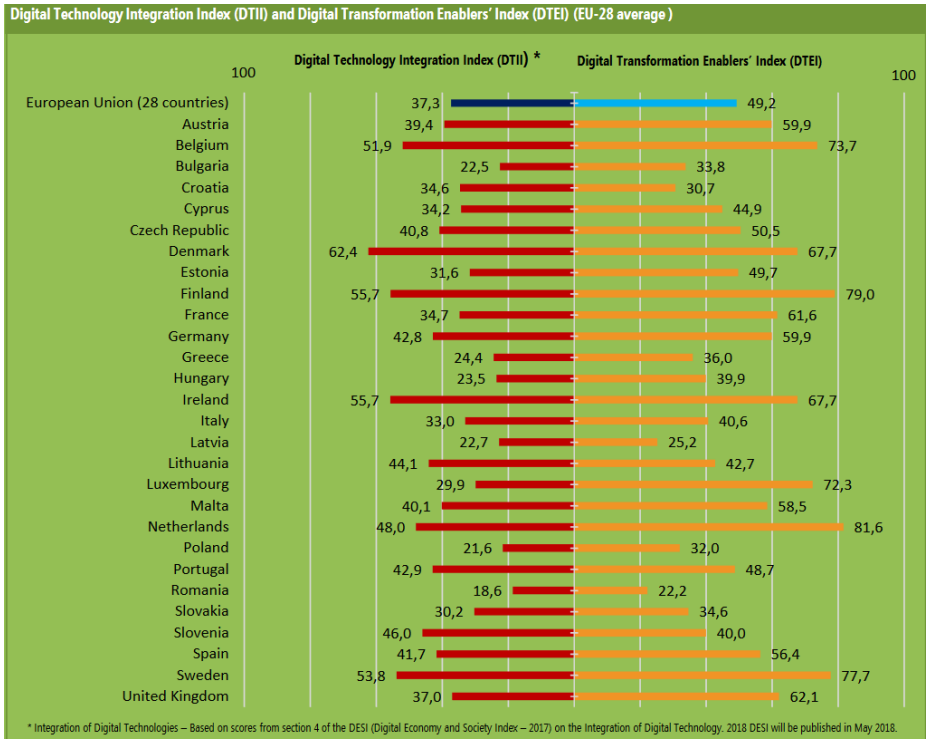

Figure 3 Integration of Digital Technologies, Digital Transformation Scoreboard 2018

As reported in Figure 3, in 2018 the starting position of the partners' countries were as follows:

- for the **Digital Technology Integration Index**: Austria, Belgium, Germany, Portugal and Spain were above the EU average score, as opposed to Italy that performed below in terms of digital technology integration,
- for the **Digital Transformation Enablers' Index**: Austria, Belgium, Germany and Spain are above the EU average score, as opposed to Italy and Portugal, which were lagging behind and where improvements were needed.[4]

The **methodological approaches** used to define the Digital Transformation Scoreboard, as explained below in Figure 4, are based on key enabling elements, such as "digital infrastructure, supply and demand of digital skills, entrepreneurial culture, investment and access to finance, e-leadership", and key output, such as "integration of digital technology, changes in the ICT start-up environment".

[4] A Digital Transformation Enablers' Index (DTEI) and a Digital Technology Integration Index (DTII) were established to identify the performance of Member States in terms of enabling conditions and transformation experienced by means of a positioning score comprised between 0 and 100. These scores allow the analysis of the way countries are distributed in terms of enabling and outcome conditions with respect to each other and with respect to the EU 28 average score, **EU DIGITAL TRANSFORMATION MONITOR**

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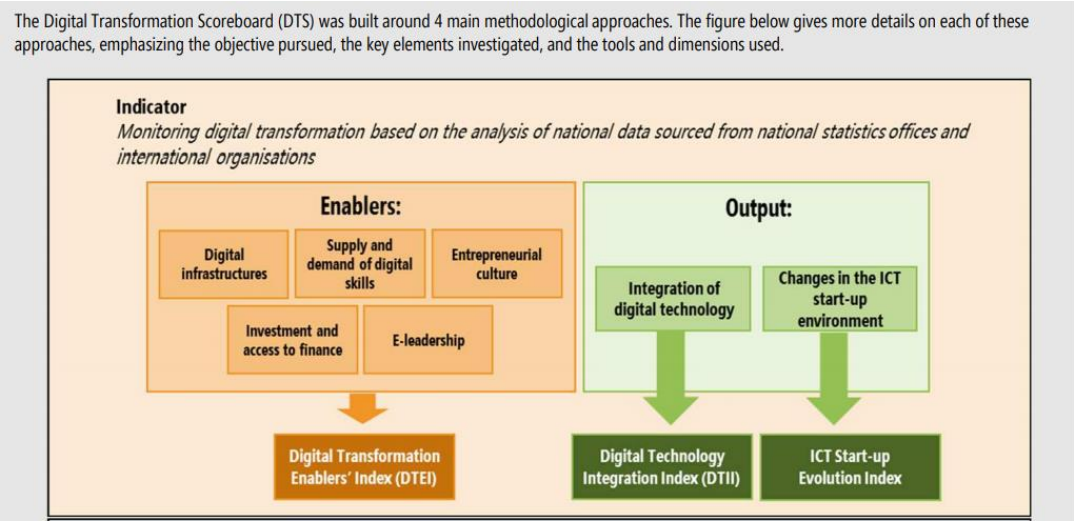

Figure 4 DTS Methodological Approach

The results of each approach adopted in Partners' Countries are shown in the Table n. 1 below, where strengths and weaknesses of each enabling force are visible.

Availability of digital skills and competences is still an issue

The last (still weak) enabler is the one that we have to consider for the purpose of the DITA project. This aspect is in line with the key characteristics of national policy initiatives highlighted by the "Digital Transformation Scoreboard 2018" Report, where Industry digitization policies show a strong tendency to focus on infrastructure and technology rather than on the development of skills. Even though skills are an important component of the examined initiatives, 70% of the initiatives are more focused on the other enablers mentioned before. This message has also been pointed out recently by the SME Digital Alliance with the following statement "despite its strength and innovativeness, Europe is at risk to fall behind in the global digital race. There is **a shocking lack of digitally skilled workforce across the continent**, resulting in an estimated digital skills gap of as many as 1,000,000 workers. Given that we are currently in the middle of the fourth industrial revolution, this gap is poised to grow ever more rapidly."[5]

In the following Table n. 1, it is possible to see the different scoreboards of "Digital Transformation enablers" per Project Partner' Country:

[5] https://www.digitalsme.eu/skills-home/

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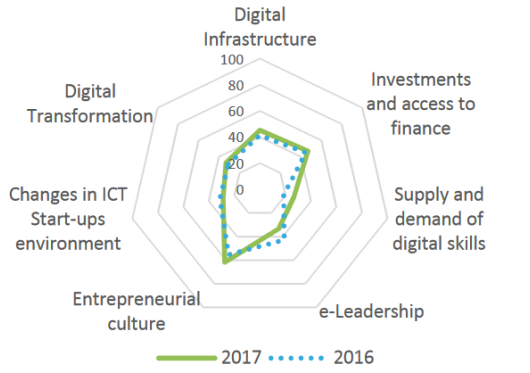
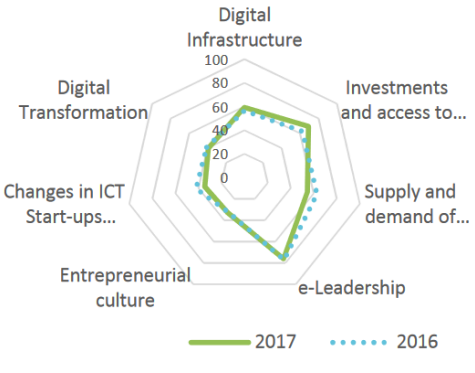
ITALY

Figure 9.29: Italy´s framework conditions for digital transformation



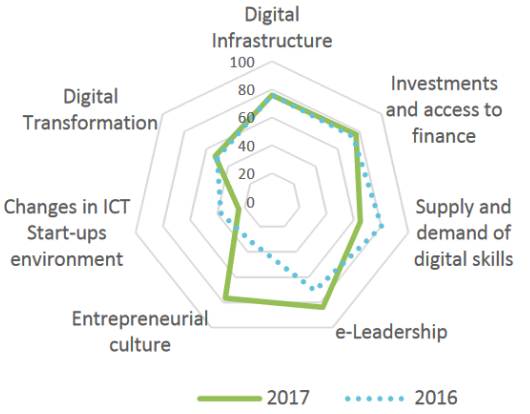
AUSTRIA

Figure 9.1: Austria´s framework conditions for digital transformation



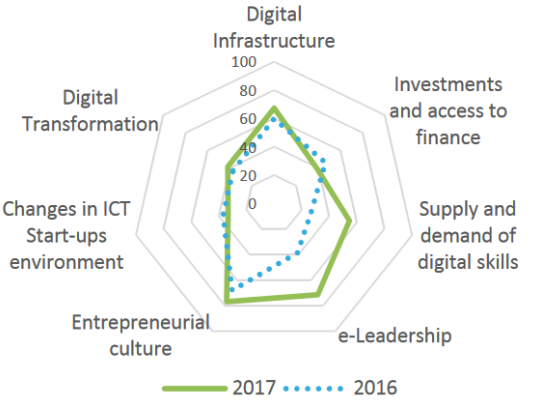
BELGIUM

Figure 9.3: Belgium´s framework conditions for digital transformation



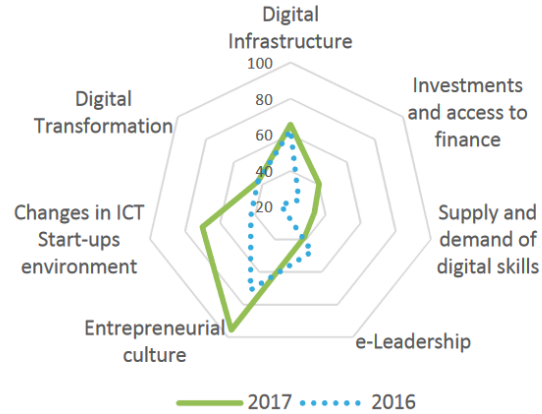
SPAIN

Figure 9.51: Spain´s framework conditions for digital transformation



PORTUGAL

Figure 9.43: Portugal´s framework conditions for digital transformati



GERMANY

Figure 9.21: Germany´s framework conditions for digital transformation

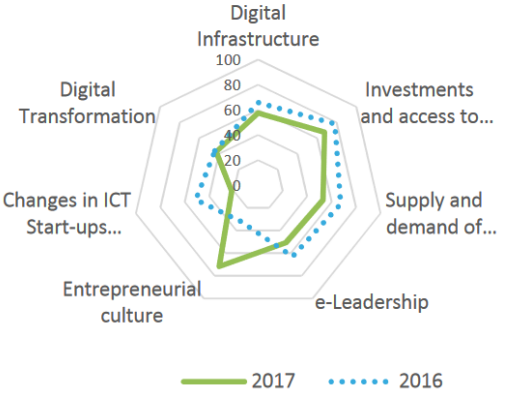


Table 1

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The graphics in Table n. 1 show the analysis reported in the "Digital Transformation Scoreboard 2018" Report, with the following evidences for the European Countries:

- **Digital Skills for the Digital Transformation**

There is significant progress in promoting enabling conditions (i.e., **Spain**) and several countries have also made significant progress, such as **Portugal,** Estonia and Cyprus. In terms of the top three performers in digital skills, Ireland, the Netherlands and Sweden lead the group, while Denmark and **Belgium** have moved slightly downwards. These top performers are closely followed by Finland, the UK, and Luxembourg, which are also leaders in the dimension with a performance well above the EU average.

In general, we can affirm that there is a significant speed of digital transformation and the size of the workforce, especially in Germany. Eastern and southern EU Member States lag behind in terms of digital skills, which is one of the most important factors to take into account to seize the benefits of digitisation across their industrial fabric.

- **Entrepreneurial culture and digital transformation**

An entrepreneurial culture spread widely across the majority of EU Member States. The Netherlands is now the best-performing Member State in the "entrepreneurial culture" dimension, closely followed by **Portugal**, Croatia and Romania. Further leaders in these enabling conditions are Cyprus, Latvia, and Lithuania, with a performance well above the EU average. It is interesting to note that two Member States, namely Slovenia and Czech Republic, have made significant progress in their entrepreneurial environment with a marked increase in their score. The high performance and net progression of Balkan and Baltic Member States, such as Romania, Croatia, Slovenia, Latvia and Lithuania, reflect the success of the recent active implementation of policies conducive to the creation of a business-friendly environment. Consequently, "entrepreneurial intentions and entrepreneurship" is a desirable career choice in these countries.

High-performing Member States in entrepreneurial culture with a high share of opportunity-driven entrepreneurs are more likely to adopt digital technologies than business friendly Member States with a higher share of necessity-driven entrepreneurs.

- **Investments and access to finance for digital transformation**

Finland, **Belgium** and Sweden are the top-performing Member States in "investments and access to finance" for businesses, which is regarded as one of the most important factors driving the digital transformation of the industry within business and academic communities.

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The top tier in this dimension also comprises **Germany, Austria** and the UK, which are also recognised as being business-friendly and perform well above EU average.

Member States are committed to a stable trajectory of factors relating to investment and its positive effects on digitization.

- **E-leadership for digital transformation**

Finland is the best-performing country in the "e-leadership" dimension. Good performances are also registered by Denmark and Sweden. Luxembourg and Ireland have entered the top three in terms of e-leadership. Moreover, it is important to highlight that **Belgium** and **Spain** have seen significant changes in their scores, indicating their growing strength in developing leadership within the digital economic paradigm.

The trend has moved upwards, indicating that e-leadership is bearing its fruit to help improve the digitisation of the industry. In addition, the gap between several Member States and this trend has narrowed, indicating that factors relating to e-leadership have gained in importance across the EU.

- **Digital infrastructure for digital transformation**

The Netherlands is the best-performing Member State in the "digital infrastructure" dimension, followed by Luxembourg, Denmark, Finland and **Belgium**. The distribution of scores shows that the majority of Member States perform above the EU average, indicating high availability of digital infrastructure across most of the EU.

The trend has moved upwards, showing an increased level of digital transformation, while the slope is slightly steeper, indicating an increase in the impact of digital infrastructure on the digitalisation of the industry.

- **Changes in the ICT start-up environment in relation to digital transformation**

The best performer in terms of the start-up environment is now Lithuania, followed by Sweden. Amongst the top tier of the ranking are countries that have seen a significant increase in scores in this specific dimension. For instance, Sweden, **Portugal**, Luxembourg and Romania have risen highly in their index scores. Some of the eastern EU Member States in the top tier were already among the top performers in terms of the start-up environment in 2017, indicating that their economic environment is favourable to the birth and growth of new digital businesses compared to other western EU Member States. **Germany, Belgium** and Greece are at the bottom of the ranking in 2018. These Member States are lagging behind with a performance level well below the EU average. **Italy,** the Netherlands and **Spain** are

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also at the bottom of the performance scale (slightly higher than the abovementioned Member States) with a performance about quarter lower than the EU average.

The "changes in ICT start-ups" dimension reflects the developments experienced by the ICT start-up environment in recent years. The best performers in this dimension are Member States in which the number of ICT start-ups has recently increased. On the other hand, low-performing Member States are ones in which the ICT start-up environment has stagnated in the last few years.

Horizontal Training Approaches in Digital Transformation (The Need for Technical and Soft Skills)

While the Digital Transformation Scoreboard tells us that digital skills are among the key enabling drivers if Europe's transformation, other surveys, like the one reported by "*Facing the Digital Transformation: are Digital Skills enough?*"[6], provide us with a more detailed insight about which "**skills and competences**" can be considered "horizontal key assets".

Science, technology, engineering and mathematics (STEM) skills, including ICT skills, are considered essential in driving innovation, and delivering knowledge-driven growth and productivity gains (Shapiro et al., 2015; Peri et al., 2015; Deming and Noray, 2018).

Demand for these skills has been growing since the early 2000s and growth is expected to continue – not only fuelled by the creation of new jobs requiring advanced technical skills, but also because of a strong anticipated replacement demand as a result of an ageing STEM workforce (Shapiro et al., 2015; EUSP, 2014a). **Perceptions on STEM skills shortages are further exacerbated by the fact that technological progress is so fast that STEM skills quickly become obsolete and new STEM skills are always scarce (Deming and Noray 2018**).

However, the demand for skills created by the digital transformation goes beyond STEM (including ICT) skills. Employers increasingly report the need for a broader set of cognitive and non-cognitive skills to cope with the demands of the digital transition. With increasing scope for automation of repetitive tasks, skills requirements are expected to shift gradually towards entrepreneurship, critical thinking and creativity and other skills used to carry out non-routine tasks in which workers hold a comparative advantage (Desjardins, 2018; Autor,

[6] https://ec.europa.eu/info/publications/facing-digital-transformation-are-digital-skills-enough_en

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2015). These also include people management skills, coordinating, collaborating and communicating with others, and emotional intelligence.

Recent evidence from the US suggests that high paying occupations increasingly require strong social skills (Deming, 2017; Deming and Kahn, 2018).[7]

EU firms call for horizontal technical & soft skills

As reported in the "Upskilling European industry: New operational tools wanted", although more than three-quarters (77%) of companies acknowledge that digital transformation has become a top strategic priority, companies do not expect it to be easy. This is especially the case for European firms. In the 2016 survey of The Economist Intelligence Unit, only 64% of European respondents expect their digital transformation objectives for 2016 to be met, compared with 78%in North America.[8]

Furthermore, several alliances and organizations provided lists of **vertical priorities** for the digital economy. The following priorities have been selected, due to the connection of DITA to some of the partners of Digital Skills Global (i.e.: Accenture, SAP, Deloitte)

1. Programming, Web and App Development

At the heart of any tech product or digital service is coding. The core languages that most programming and web and app development positions need include Bootstrap, jQuery, Angular, Code Igniter, PHP/JavaScript and MySQL. These skills are listed on a regular basis in the top 10 most in-demand by employers on LinkedIn.

Coding is also vital for emerging technologies such as augmented reality (AR) and virtual reality (VR). Coding will provide AR and VR Developers with the foundation skills needed to develop the next generation of AR and VR technologies.

2. Digital Business Analysis

Digital Business Analysis helps organizations to make the right choices by providing an independent and objective mind set and applying a range of proven analysis techniques to make a convincing business case for investment in a digital solution. As digital transformation is central to all organizations in the digital economy, digital business analysis skills are in high demand.

[7] Facing the Digital Transformation: are Digital Skills enough? European Economy Economic Briefs, 2020

[8] Upskilling European industry: New operational tools wanted, Recommendations of the Strategic Policy Forum on Digital Entrepreneurship, A forum established by DG Internal Market, Industry, Entrepreneurship and SMEs; Author: Strategic Policy Forum on Digital Entrepreneurship, 2016

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Digital Business Analysts are at the epicentre of digital transformation projects. They help organisations develop a digital ecosystem of technologies that will help drive digital transformation and business growth.

3. Digital Design and Data Visualization

Websites, Apps and Digital Services have one thing in common: a user interface. Any designer with experience creating effective, dynamic user experiences will be in high demand with most tech companies.

Designers can also visualize complex data to help management make vital business decisions. This skill is call data visualization. Data visualization is useful for senior leaders to gain valuable insights from data. Tools such as Tableau and Power BI are used by designers to analyse and visualize data.

4. Digital Project Management

Project management is by no means exclusively desirable to tech companies, but it is a vital part of developing digital products and services in a timely and cost-effective manner. An understanding of a range of methodologies such as SCRUM and AGILE are key skills.

Digital Project Managers need to have a holistic understanding of how digital projects are developed - from ideation to prototype to fully developed digital product or service.

5. Digital Product Management

Another skill that is not unique to software development but one that is particularly valuable nonetheless is Digital Product Management. Software services need to have a lifecycle management plan put in place. The continued growth of Software as a Service will make Product Management ever more integral to the tech sector.

6. Digital Marketing

To promote their products and services tech companies will look to digital marketing. Understanding of how to get the most value for money out of the broadest range of networks will be key here.

7. Social Media

Some of the best PR today is carried out almost exclusively through social media. Twitter, Facebook, Reddit, Instagram and countless other platforms give tech companies direct access to customers, thought leaders and evangelists. The best Tech PR managers are Social Media managers.

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8. Data Science and Data Analytics

Companies gather huge amounts of data that can be immensely valuable to them if they have a Big Data Analyst who can make sense of it all. Data Scientists are in-demand by employers across the world. Glassdoor constantly feature Data Scientists in their Best Jobs Listing. Not only is Data Science an excellent career path for professionals in the digital age, but demand far outweighs supply, making Data Scientists highly employable. A recent McKinsey report showed that "The United States alone faces a shortage of 140,000 to 190,000 people with analytical expertise and 1.5 million managers with skills to make decisions based on the analysis of big data." As data science becomes a minimum requirement for more and more manager level jobs, learning data science will help you position yourself ahead of the curve.

9. Decision Making for Leaders

Decision making is a critical for leaders in the digital age. According to the World Economic Forum, for those looking to future proof their careers, building competencies in areas that machines will be unlikely to tackle effectively (i.e., complex problem solving, creativity and problem solving) is likely the best recipe for success.

Key Message 2: the DITA ATLAS – especially under Intellectual Output 3 – should focus on connecting training providers with specific vertical technical programs that answer today's demand AND providers that also include "soft skill" related training programs thus enriching the overall quality of our catalogue.

Digital Transformation Enabling Skills and Competence: the EU2021-2027 Perspective

The European Commission is promoting various initiatives aimed at increasing training in digital skills for the workforce and for consumers; modernising education across the EU; harnessing digital technologies for learning and for the recognition and validation of skills; and anticipating and analysing skills needs.

The EU has a plan and calls for cooperation (in line with the goal of DITA ATLAS)

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 €600 million dedicated to advanced digital skills, will expand the digital talent pool with around 256,000 people who will be able

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to deploy the latest technology in business throughout Europe. It will focus on three types of actions:

- Master's Programmes in cutting-edge digital technologies developed together with EU excellence centres in artificial intelligence, cybersecurity and high-performance computing. The aim is to offer 160 new master programmes training 80,000 digital specialists.
- 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.
- 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 specialist skills working with the latest available technologies.

The European Social Fund Plus will support EU Member States to improve the quality, effectiveness and labour market relevance of national education and training systems to support the acquisition of key competences, including digital skills. It will also promote upskilling and reskilling opportunities for all, placing a particular emphasis on digital skills.

The European Global Adjustment Fund will support training, with a digital skills component, to help laid-off workers find another job or set up their own business.

Erasmus+ will support digital learning from early childhood to vocational education and university education. It will also continue to support the acquisition of digital skills through cross-border experiences.

Horizon Europe will finance grants for master, PhD and post-graduate research activities in all fields including digital through Marie Skłodowska-Curie actions as well as the European Institute of Innovation & Technology.

The Recovery and Resilience Facility strongly encourages Member States to include in their plan’s investment greater support to the development of digital skills.

The new **European Skills Agenda** underlines the importance of lifelong learning, lays down objectives for the skills for jobs in the digital and green transitions and it mobilises companies, social partners and organisations to take meaningful actions.

Making education and training fit for the digital age is the aim of the Digital Education Action Plan (2021-2027). It calls on Member States and stakeholders to work together to ensure a high-quality, inclusive and accessible digital education in Europe. The Action Plan has two long-term strategic priorities. The first focuses on supporting the development of a high-

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performing digital education ecosystem, by, for example, supporting Gigabit connectivity of schools and digital transformation plans at all levels of education and training. The second priority focuses on enhancing digital skills and competences, by, for example, developing guidelines for teachers to foster digital literacy and tackling disinformation as well as targeting advanced digital skills development through Digital Opportunity Traineeships.

The **Digital Skills and Jobs Coalition** contributes fully to the objectives of both the Skills Agenda and the Digital Education Action Plan and will continue to play a vital role in mobilising the community and bridging the digital skills gap in Europe. The forthcoming Digital Skills and Jobs Platform will be a one-stop-shop for digital skills trainings and resources in Europe. It will also link the national coalitions together.

Key Message 3: the DITA ATLAS – especially under Intellectual Output 3 – should also visualize the connections with providers and initiatives which derive from EU granted initiatives, thus exploiting all efforts aimed at increasing the quality and availability of strategic skills and competences. From a strategic perspective, DITA ATLAS has to be anchored to the most relevant European initiatives.

The role of the industry

On 18 April 2016 the European Commission published a Communication on Digitising European Industry, which introduced a set of coherent policy measures as part of a Digital Single Market (DSM) technologies and public services modernisation package. A part of the Communication is dedicated to digital skills. In particular, it **calls for a human capital ready for the digital transformation with the necessary skills**.

The digital transformation is structurally changing the labour market and the nature of work. There are concerns that these changes may affect employment conditions, levels and income distribution. Alongside investment in technology, we need investment in skills and knowledge, to be ready for the future. The need for new multidisciplinary digital skills is exploding.

Together with all stakeholders, such as Member States, industry, social partners and education and training providers, the Commission will:

- address these challenges as part of a comprehensive dialogue on the social aspects of digitisation that engages all stakeholders involved in all aspects of work, education and training.
- reinforce the role of industry and research organisations in the Grand Coalition and stimulate further commitment from industry to take action.
- improve the understanding of skills requirements for new technologies;

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- promote the development of digital skills;
- stimulate partnerships for skills within the framework of the New Skills Agenda for Europe;
- engage Digital Innovation Hubs (DIH) in skills for mid-caps and SMEs.

Key Message 4: the DITA ATLAS – especially under Intellectual Output 3 – should permanently engage industries to validate the ATLAS, ensure that the offer meets the demand AND permanently connect to the demand (and training offer) of Digital Innovation Hubs. Furthermore, DITA and the ATLAS have been conceived to be a synergic tool with the catalogue and other DIHs related initiatives.

Due to the relevance of industry players (enterprises but also cluster and other forms of associations), partners have been working on analysing their strategic sectors, their digital positioning and how they can contribute to the overall mission of the project and broader EU strategies.

The Impact of Digital Transformation for Industrial Sectors

Project Partners have jointly been working to understand if and how Digital Transformation is affecting industrial sectors and identify key players and policy relevant connections that will be anchored to the DITA ATLAS at a later time.

For the purpose of this task, project partners have identified (as reported in the following Table “Selected Industry Sectors”) **6 main industrial sectors** which are strong economic drivers in their regions / countries and which provide evidence about how digital transformation is having an impact (and, on the other hand, putting pressure on the demand for digitally qualified professionals):

1) Machinery Manufacturing Industry
2) Chemical Industry
3) Wood & Paper Industry
4) Agri-food Industry
5) Mobility & Transport Industry
6) Life Science Industry

Details about the identified industry sectors in each Partners Country are resumed in Table n. 2 below:

ITALY	AUSTRIA
• **Manufacturing of machinery and equipment**	• **Wood and wood products** • **Agriculture and forestry**

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• **Manufacturing of fabricated metal products, except machinery and equipment** • **Manufacture of chemicals and chemical products**	• **Mobility (the figures show transport on road, rail, aviation, shipping)** • **Life science industry (biotechnology, pharma or the medical devices business)**
BELGIUM	**SPAIN**
• **Chemical Industry** • **Food** • **Pharma Industry** • **Machine Builders**	• **Metallurgical and mechanical industry** • **Food and beverage** • **Automobile and transport** • **Capital goods**
PORTUGAL	**GERMANY**
• **Agri-food** • **Automotive** • **Health** • **Paper manufacturers**	• **Manufacturing of wood and products of wood** • **Manufacture of machinery and equipment** • **Land transport (mobility)** • **Manufacturing of paper and paper products**

Table 2

All these industries are already dealing with relevant digital transformation processes and some major effects can summarized in short.

There are some major digital trends that are having a strong impact on processes, products and skills

Digital technologies and advanced manufacturing. Technological advances applied to manufacturing systems (advanced manufacturing supported by integrated machinery, sensors, robots, distributed software applications) and other key enabling technologies including nanotechnology and advanced materials are fundamentally **transforming existing industries and creating new ones**. They carry both opportunities and risks for established and new companies. Yet, their impact remains uncertain as technology develops over time in an unpredictable fashion.

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Big Data and AI. Large data sets ("big data") and algorithms, assisting in analysis and decision-making, are the new superpower fuel of the economy of the future. In both **manufacturing and service sectors**, they will bring enormous benefits to European enterprises, for example in terms of cost reductions. In the **automotive sector**, driverless vehicles will become a game changer in the coming years. Autonomous vehicles use artificial intelligence, sensors and satellite navigation systems and therefore transfer several hundred megabytes per second communicating with external platforms and back-ends. Partially and fully autonomous vehicles could reach 20% of new vehicle sales in 2025[9].

Innovative materials and related digital products. Composites materials and plastic electronics are other technological advances that show great promise for a variety of sectors such as **healthcare, mobility and media**. Composite materials find their way into hundreds of new applications each year, ranging from suitcases, golf clubs and cars to aerospace components and orthopaedic surgery. In the automotive industry for example, thermoplastic composites offer excellent crash performance compared with traditional steels as they increase the strength and stiffness of the materials used. Bio-composites, which represents 15% of the total European composite market,[10] are also widely used in the automotive industry (e.g., trims for doors, trunks and dashboards). In this sector alone, their production and use are expected to grow from 150,000 tonnes today to 600,000 tonnes in 2020[11]. The technology behind plastic electronics opens the door to a new generation of innovative products such as e-readers, illuminated jackets and glucose strips for people suffering from diabetes. Future electronic products will be more flexible, thinner, lighter and more environmentally friendly. It is estimated that the total market for printed, flexible and organic electronics will grow from EUR 14.2bn in 2013 to EUR 68bn in 2023[12]. Much of the growth will be in conductive ink and organic light-emitting diode (OLED) displays which will increasingly supplant LCD displays in e.g., mobile phones.

The ICT sector is increasingly providing new job opportunities in Europe. The European ICT workforce has been growing at an average annual rate of 4.26%[13]. Recent forecasts predict that over 750,000 jobs could emerge by 2020 if the right digital skills are available.[14]

[9] Upskilling European industry: New operational tools wanted, Recommendations of the Strategic Policy Forum on Digital Entrepreneurship, A forum established by DG Internal Market, Industry, Entrepreneurship and SMEs
[10] Idem
[11] Idem
[12] Idem
[13] Idem
[14] Idem

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Where can these changes be observed?

Keeping this evidence in mind, the partners have been looking for **key players** involved in exploiting and supporting digital transformation in their countries partner countries within the identified industry sectors.

First, a group of **leading enterprises** has been identified. They can be considered like accelerators of digital transformation processes as well as those who strongly demand for new competences and skills. The goal was not to be exhaustive but to identify enterprises that might be engaged either **as beneficiaries of the ATLAS or target group** of **exploitation** and **dissemination** strategies.

ITALY	AUSTRIA
• **Manufacturing of machinery and equipment:** *Same- SDF Group; Evoca Group* • **Manufacturing of fabricated metal products, except machinery and equipment:** *Itemed Group; Gualini* • **Manufacture of chemicals and chemical products:** *Siad*	• **Wood and wood products**: *Hasslacher Norica Timber; Weitzer Pakett* • **Agriculture and forestry:** *Skyability GmbH* • **Mobility**: *Twins GmbH* • **Life science industry**: *Tyromotion GmbH*
BELGIUM	**SPAIN**
• **Chemical Industry**: *BASF* • **Food:** *AB-Inbev* • **Pharma Industry**: *Pfizer* • **Machine Builders**: *Atlas Copco; Bekaert*	• **Metallurgical and mechanical industry**: *ArcelorMittal; Asturiana de Zinc, S.A.* • **Food and beverage**: *Capsa Food* • **Automobile and transport:** *Grupo Antolín; Groupe Renault; Daimler Vitoria* • **Capital goods**: *Gestamp Bizkaia Sociedad Anónima*
PORTUGAL	**GERMANY**

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• **Agri-food**: *Fábricas Lusitana - Produtos Alimentares, S.A.; Schreiber Foods Portugal SA; Centauro Internacional - Trocadores de calor, Lda; Beira Baga, Fruits of Portugal; Frigosto - Industria de Transformação e Preparação de Produtos Congelados, Lda* • **Automotive**: *Yazaki Saltano; Renault Cacia SA; Simoldes Plásticos SA; Epedal; AAPICO* • **Health:** *CHUC, E.P.E.; Plural - Cooperativa Farmacêutica, S.A.; Empifarma - Produtos Farmacêuticos, S.A.; Instituto Português Oncologia de Coimbra Francisco Gentil, E.P.E; Bluepharma - Indústria Farmacêutica, S.A.* • **Paper manufacturers:** *Celulose Beira Industrial (CELBI), S.A.; Navigator Paper Figueira, S.A.; DS Smith; Altri Florestal, S.A.*	• **Manufacturing of wood and products of wood:** *Brack Wintergarten; Otto Martin* • **Manufacture of machinery and equipment**: *Grob* • **Land transport (mobility):** *Mona Kempten* • **Manufacturing of paper and paper products:** *Vangenechten Kempten*

Table 3

Additionally, partners have identified **cluster organizations** linked to the selected industries, which might be also involved at a later stage either as synergic partners of the ATLAS (e.g., training providers), beneficiaries or reviewers.

ITALY	AUSTRIA
• **Manufacturing Industry:** *AFIL; DIH Lombardia*	• **Wood and wood products:** *Holzcluster Steiermark GmbH* • **Agriculture and forestry:** *Green Tech Cluster Styria GmbH* • **Life science industry**: *AAL AUSTRIA*

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BELGIUM	SPAIN
• **Chemical Industry**: *Catalisti* • **Pharma Industry**: *Flanders BIO;*	• **Metallurgical and mechanical industry**: *MetaIndustry4* • **Food and beverage**: *ASINCAR* • **Automobile and transport**: *FaCyL; ACICAE* • **Capital goods**: *IK4-Tekniker*
PORTUGAL	**GERMANY**
• **Agri-food:** *InovCluster* • **Automotive:** *Mobinov* • **Health:** *Health Cluster Portugal* • **Paper manufacturers:** *CELPA*	• **Manufacturing of wood and products of wood**: *Cluster Forst und Holz Bayern* • **Manufacture of machinery and equipment**: *IHK Bayern* • **Land transport (mobility):** *Cluster Automitive Bayern Innovativ*; *IHK Bayern* • **Manufacturing of paper and paper products:** *IHK Bayern*

Table 4

Are these changes in line with the regional smart specialization strategies?

As an additional step, partners have also check consistency between the identified industries and the **Smart Specialization Strategies of each region**. This will help later on to connect the ATLAS to running regional projects and initiatives, provide regions with a service (the ATLAS) that can support digitalization strategies and – ideally – help the coordinators of the ATLAS to identify regional granting schemes that will support the further deployment and anchoring of this tool to regional training policies.

ITALY	AUSTRIA
• Advanced manufacturing	• Quality of life (mobility)

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	• Bio-Economy and Sustainability • Material sciences and intelligent manufacturing • Life Sciences
BELGIUM	**SPAIN**
• Manufacturing & industry • Key Enabling Technologies • Sustainable innovation	• Asturias industrial steel pole • Food and beverage markets • Productive efficiency in transport sectors such as Automotive and Aeronautical • Advanced manufacturing
PORTUGAL	**GERMANY**
• Production technologies and Process Industries (application of new technologies to make processes more efficient and sustainable, especially in petrochemical, pulp and paper, textiles, paint and varnish) • Automotive, aeronautics and space (specialisation in automotive spare parts and aeronautic maintenance) • ICTs as transversal economic and social enablers • Health (translational medicine, health tourism, ageing) • Agri-food (link between food and health, organisation of the rural territory, agro-engineering and new technologies, wine, links with blue growth and tourism)	• Life sciences (biotech & systems biology); Innovative technology-based services; Clean technologies; New and intelligent materials, nano- and micro-technology • Efficient production technologies, mechatronics, automatization and robotics; ICT (Cyber-security, big data, cloud computing, industry 4.0, e-Commerce, craftsmanship 4.0, robotics for automation), connected mobility, e-Health, digital care, precision medicine and tele-medicine, smart energy, digital media, e-Tourism, e-Finance, smart construction, digital agriculture for resource efficiency and transparency, e-Environment and environmental protection

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The "*Final report of the Industry 2030 high level industrial roundtable*", underlines how the automation and digitization process of manufacturing, products and data-driven services will successfully transform European industry, driving change at a pace never seen before. Progress in Artificial Intelligence, Internet of Things, robotics, automation, biotechnology or 3D printing will bring about technology-led transformations across all European industries.[15]

Changes are facilitated by the support provided by training organizations.

Last but not least, partners have identified **training organizations** which are already playing a relevant role in providing industry specific training and which, again, may become strategic partners as soon as the ATLAS will be launched.

ITALY	AUSTRIA
• **Manufacturing Industry**: *Bergamo Sviluppo; Experis Academy*	• **Wood and wood products:** *MY ACADEMY GmbH* • **Agriculture and forestry**: *CAMPUS 02 Fachhochschule der Wirtschaft GmbH* • **Mobility**: Fachhochschule
BELGIUM	**SPAIN**
• **Chemical Industry**: *Verhaert, Drone College* • **Pharma Industry**: *Helisacademy*	• **Metallurgical and mechanical industry**: *Fundación Metal; Department of Education of the Principality of Asturias; HETEL* • **Food and beverage**: *Department of Education of the Principality of Asturias; HETEL* • **Automobile and transport**: *Department of Education of the Principality of Asturias; HETEL*

[15] https://op.europa.eu/it/publication-detail/-/publication/339d0a1b-bcab-11e9-9d01-01aa75ed71a1

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	• **Capital goods:** *Department of Education of the Principality of Asturias; HETEL*
PORTUGAL	**GERMANY**
• **Agri-food**: *ISQ; COTEC* • **Automotive**: *ISQ* • **Health:** *SPMS*	• **Manufacturing of wood and products of wood**: *Kompetenzzentrum - Digitales Handwerk; Hochschule Kempten; Digitales Zukunftszentrum Oberallgäu* • **Manufacture of machinery and equipment**: *Kompetenzzentrum - Digitales Handwerk; Hochschule Kempten; Digitales Zukunftszentrum Oberallgäu* • **Land transport (mobility):** *Digitales Zukunftszentrum Oberallgäu* • **Manufacturing of paper and paper products:** *Digitales Zukunftszentrum Oberallgäu*

Key Message 5: the strategy behind the DITA ATLAS – especially under Intellectual Output 3 – has to be based on fruitful connections with leading enterprises, clusters, policy departments and training organizations. This will help to 1) fully validate its structure and content, 2) attract the demand-side interest and possible new providers, 3) be linked to regional policies.

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Chapter 2: Digital Transformation going "vertical" – Cases Studies

Introduction

Digital Transformation is having a tremendous impact on the European Industry, changing the way companies are developing their products and processes. Furthermore, digital technologies are powerful tools that can have a transformational effect on the SDGs, according to "Digital with Purpose: Delivering a SMARTer 2030," a new report by the Global Enabling Sustainability Initiative (GeSI) and Deloitte, supported by the EIT Climate-KIC. The report analysis of a broad range of SDG targets finds that further deployment of existing digital technologies will, on average, help accelerate progress toward the Sustainable Development Goals by 22% and mitigate downward trends by 23%.[16]

Furthermore, this assumption is also confirmed by the **Pact for Skills** launched by the European Commission. The Pact is a shared engagement model for skills development in Europe which involves companies, workers, national, regional and local authorities, social partners, cross-industry and sectoral organisations, education and training providers, chambers of commerce and employment services. The Pact for Skills supports a fair and resilient recovery and delivers on the ambitions of **the green and digital transitions and of the EU Industrial and SME Strategies**, inviting public and private organisations to join forces and take concrete action to upskill and reskill people in Europe.[17]

Chapter 2 is dedicated to a more in-depth description of the digital maturity index of the identified sectors, starting from the analysis and interaction among the identified players by PPs:

- Machinery Manufacturing;
- Chemical;
- Wood & Paper;
- Agri-food;
- Mobility & Transport;
- Life Science.

The work of the partners has been focused on identifying:

- **The Digital Maturity of each industry:** regional or national evidences have been collected to measure the digital maturity and examples of how this is happening have been provided;

[16] https://www.climate-kic.org/press-releases/new-report-outlines-growing-potential-for-digital-technology-to-help-solve-climate-change-challenges/
[17] https://ec.europa.eu/social/main.jsp?catId=1517&langId=en

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- **Digital Technology Excellences**: evidence of excellences in one or more digital technology areas among those that have been selected for the purpose of the DITA ATLAS. These evidences are very useful to prioritize the cooperation networks that should be established by the DITA ATLAS.

Digital Maturity of identified industries

Digital Technologies & Machinery (Manufacturing)

Italy

In 2019, 8,4% of all Italian companies had already invested in I4.0 technologies. Northern Italy has the highest share (9,2%).

Belgium

Robots and industry 4.0 are highly integrated in the manufacturing industry. A study from Flanders make & PWC mentions that 50% of the leading industrial companies in Belgium has implemented industry 4.0 digital systems and more than 90% believe that industry 4.0 is transforming the manufacturing future.[18]

Germany

Future topics for machine tool manufacturers: Domestic sourcing and sustainability, new business models, digitization, safety for machines and cyber-physical systems, automation, adapting the product portfolio to user requirements, technologies for new drive concepts[19].

Driving forward the networking of machines, a particular example being the Umati (Universal Machine Tool Interface) communication interface, which the VDW is continuously developing together with the German Engineering Federation (VDMA) and machine manufacturers[20].

Trends in mechanical and plant engineering will have a major impact in the coming years, external changes will be more important than internal ones: increasing demand for customer-specific system and integration solutions (74 %), shifting of demand to non-European countries (70 %), growing importance of after-sales and service (60 %), increasing competition from new market participants (47 %), increasing importance of Germany as a business location (45 %)[21].

[18] https://www.pwc.be/en/documents/20170322-industry-4.0-hype-or-reality.pdf
[19] https://www.produktion.de/trends-innovationen/das-sind-die-zentralen-trends-der-werkzeugmaschinen-branche-113.html
[20] https://www.vdi-nachrichten.com/technik/werkzeugmaschinen-hersteller-setzen-auf-weiterentwicklungen/
[21] https://www.wlw.de/de/inside-business/branchen-insights/maschinen-anlagen/maschinenbau-zukunftsaussichten-trends

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Two aspects are of prime importance: the digitalisation or virtualisation of machine tools and their networking.

The Machinery Manufacturing is one of the most positively impacted sectors by Digital Transformation. National investment policies following the German Industrie 4.0 initiative are boosting investments with good results in terms of innovation of production processes.

Digital Technologies & Chemical Industry

Italy

In 2019, 8,4% of all Italian companies had already invested in I4.0 technologies. Northern Italy has the highest share (9,2%).

Belgium

BASF is using drones and smart technologies to inspect the infrastructure. They are also investing in technology projects.[22]

"The Digital Transformation requires the involvement of an ecosystem, in particular in the traditional industry, such as the chemical one, that has so far been slower to embrace new digital technologies".[23] The chemical industry is indeed affected by this transformation, and as reported on a study published by Deloitte, the chemical industry is focusing on novel technologies like additive manufacturing for new materials, reducing the consumption of traditional chemicals and materials; new digital technologies like blockchain and predictive analytics can be readily integrated with existing Internet of Things (IoT) infrastructure to enable track-and-trace capabilities.[24]

Digital Technologies & Wood and Paper Industry

Austria

Looking at the following three sectors of the wood industry, (1) sawing and further processing, (2) prefabricated building and (3) furniture construction in Austria, the following can be observed:

[22] https://www.youtube.com/watch?v=FHlu2IT1eO8
https://www.basf.com/be/nl/who-we-are/Group-Companies/BASF-Antwerpen/Projects/Smart-tooling.html
[23] https://www.forbes.com/sites/marcoannunziata/2020/01/22/it-takes-an-ecosystem-digital-transformation-in-the-chemical-industry/?sh=30d1bae015b3
[24] https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/future-of-digitalization-in-the-chemical-industry.html

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All three woodworking industries are on the verge of the technical transition from the third (Automation) to the fourth (Industry 4. 0) industrial revolution.

In the (3) furniture industry there is high automation and flexibility of the systems used up to batch size one. In the other two areas (1 and 2) there are still large differences between individual processes within a production. Cloud-based control systems are generally not yet available, and there are some hurdles and restrictions for the systematic use of industrial robots. The evaluation in the areas of ICT infrastructure, human-machine communication and efficiency for small batch sizes is low (here are the greatest potentials). The challenge for flexible design in the sense of a smart factory lies in increasing the flexibility of the technical plants and systems. This requires an increase in data continuity between the departments as well as between production development and subsequent areas of production, assembly and service. To achieve this, an interdisciplinary collaboration is required with special demands on teaching and research.

Germany

Digitization projects were initiated in this sector. The research and development project aims to support forest stakeholders in Bavaria with a focus on small private forests in developing a conversion strategy for the optimal use of digital tools. Digital tools are used by the associations in particular for business process management, member support and land management. The aim is to increase resource efficiency and market orientation[25].

Structure of process flows requires rethinking, including investments in machinery compatible with new technologies and digital requirements must be well thought out and feasible[26].

The Charter for Wood 2.0 as a milestone in the Climate Protection Plan 2050, the Federal Ministry of Food and Agriculture (BMEL) is implementing the Federal Government's decision to "strengthen the contribution of sustainable wood use to achieving the climate protection goals"[27].

The Working Group on Raw Wood is committed to optimising processes and further advancing the digitisation of the sector. Projects such as ELDATsmart, ELDATsmart Go! and DRMdat demonstrate this commitment[28].

A procedure has been developed to transfer complex data sets containing precise information on the geometry of components directly from a planning software to a machine[29].

[25] https://www.cluster-forstholzbayern.de/de/projekte/digitalisierung-forstzusammenschluesse
[26] https://www.pressebox.de/inaktiv/wirtschaftsfoerderung-zukunftsregion-nordschwarzwald-gmbh/Digitalisierung-in-der-Holzbranche-als-Herausforderung-und-Chance/boxid/979374
[27] https://www.charta-fuer-holz.de/fileadmin/charta-fuer-holz/dateien/service/mediathek/WEB_FNRC_0090_Statusbericht.pdf
[28] https://www.ag-rohholz.de/themen/digitalisierung
[29] https://www.greenbuilding-magazin.de/news/news-detail/24984-digitalisierung-im-holzbau/

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The Fraunhofer Institute for Material Flow and Logistics (IML) predicts an increase in digital printing; packaging, as an important component of every value-added chain, will become an information carrier in the future and at the same time generate new information itself. Tomorrow's transport packaging will monitor its contents, make its way to the recipient without the influence of people, communicate with each other across all stages of the supply chain and make target-oriented decisions in the process (2) 4 important drivers:

1) Segmentation: Branded companies are increasingly diversifying their products according to their individual target groups. In practice, this means that the total volume remains the same, but segmentation continues to increase. Constantly shorter delivery times require acceleration of processes.
2) Variability: Brand protection is becoming increasingly important.
3) Cost reduction by reducing warehouses: "Packaging on Demand".
4) Print quality: The brand color must not be approximate, but rather must fit exactly

The future lies in smart and intelligent packaging, fully automated packaging lines and digital value chains.

Digital Transformation is affecting the wood sector and the pulp & paper industry in different ways: a) thanks to the implementation of industry 4.0, enterprises are setting up more efficient and sustainable processes; b) the need of new materials and sustainable packaging solutions is one of the driving forces of the R&D paper projects and digital technologies are playing a relevant role in designing sustainable processes and the design of new products.

Digital Technologies & Agri-food Industry

Austria

Digital technologies are already used in Austria, both in arable farming and in animal husbandry. Approximately six percent of all Austrian farms are using precision farming systems and already thirteen percent of all arable land is managed using GPS-controlled technologies.

A line exists throughout Austria for the implementation of digitization at all levels of agriculture. In Austria, there is still a considerable lack of technical infrastructure in rural regions. In particular, the development of broadband Internet and cooperation and exchange between digital experts in local authorities would be urgently needed to be able to use 4.0 technologies in the long term, safely and sustainable.

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The focus of the application area is on seed, fertilizer or plant protection cards as well as on parallel-track facilities. For the reason that agriculture in Austria is small in structure and often diversified, it has very specific conditions and requirements for digitalization.

Individual investments in modern technologies often do not pay off for small businesses. Although the number of partially or fully automated work steps is increasing even in small companies, the number of possible partial or complete systems is large and the compatibility is low due to the lack of enforcement of data standards. Increasing the ability of farmers to make decisions towards 4.0 technologies requires targeted, individual farm advice as well as high-quality training and continuous training of farmers, as well as teachers and staff in the service sector (trade, specialist workshops). Therefore, the most important fields of action are:

The opening of standardized interfaces for automated data exchange. Example: API interface to eAMA for automatic transfer of the field pieces (Shape-Files) or animal lists. The availability of data also for small businesses, which do not generate data themselves.

Flexible training concepts must be developed, considering the resulting social changes in agriculture and forestry.

Belgium

Barry Callebaut launched the first chocolate 3D printing studio to create unseen chocolate experiences for his customers.[30]

Spain

CAPSA food is a highly digitalized company and is at the top of the sector in this field. However, the rest of the sector, and especially SME, are facing the strategic challenge of introducing digital technologies into their business model.

Digital Transformation is cross-cutting phenomenon the Agri-food sector, affecting the whole value-chain. The impact of digital transformation starts from the production line (i.e., innovative machinery in the agriculture sector based on bigdata) and ends up with the final products (i.e., circular and green food packaging).

[30] https://www.barry-callebaut.com/en/group/media/news-stories/barry-callebaut-opens-worlds-first-3d-printing-studio-craft-unseen

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Austria

In 2011, the strategy for the implementation of an Intelligent Transport System in Austria identified six areas for action[31]:

- Basics: Requirements for intermodal, harmonized services in the intelligent transport system, creation of the legal framework or the establishment of standards.
- Traffic management: tasks of traffic management by the infrastructure managers to optimize traffic flows within the framework of the existing structural infrastructure.
- Informed road users: services and measures that provide traffic information to individual road users and offer booking and billing services.
- Freight transport and logistics: services offered to carriers of transport logistics and freight transport, ranging from route information to reservation and payment systems to logistics support, for example by monitoring goods.
- Vehicles: measures to improve on-board systems that enable road users to be safer, more comfortable or reduce emissions.
- New mobility concepts: New concepts that can have a positive impact on the long-term mobility of transport users, such as cooperative systems based on vehicle-to-vehicle communication or new, sustainable drive systems.
    - Electromobility:
        - E-cars: The number of electric cars and electric hybrid cars on offer in Austria has been increasing strongly for years. Annual growth rates of between 31% and 128% for electric cars (BEV) were observed between 2013 and 2017[32] . The share of electric vehicles (incl. Hybrid) is 2% in July 2020.[33].
        - Public transport: More than 80% of ÖBB's rail infrastructure is electrified and a large proportion of the traffic is also handled electrically in the conurbations. For some time now, the use of trams, trolleybuses and underground trains throughout Austria has also been supplemented by the use of particularly environmentally friendly electric buses operated by Wiener Linien[34].

[31] Federal Ministry for Transport, Innovation and Technology
[32] Austria Mobile Power
[33] Statistik Austria
[34] Austrian Mobile Power

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- Electric bicycles: The increasing sales of electric bicycles are increasingly noticeable on Austria's roads. In 2018, 457,000 bicycles were sold, including 150,000 e-bikes. A record since 2010. If in 2015 one in five bikes were still an e-bike, in 2018 one in three bikes is already electrically supported.[35].

- Hydrogen propulsion:
  - Buses: In 2019, ÖBB Postbus GmbH will test hydrogen buses for one week in Graz and three weeks between Schwechat Airport and Vienna. The Wiener Linien will start a test in 2020, and ten hydrogen buses will be put out to tender in 2030 (12a VCOE).
  - Trucks: In Austria, the Tyrolean supermarket chain MPreis is already planning a complete switch to hydrogen. In 2020, the first three trucks and all 42 trucks in the fleet will be converted by 2027. A dedicated electrolysis plant for "green" hydrogen is planned for 2020 (12a VCOE).
- Railways: In September 2020, the ÖBB launched the multi-week test of the "Coradia iLint" hydrogen train. Until 26. In November, the train will be in scheduled operation with passengers on the way. The train has to prove itself especially on subways that are not intended for electrification (12b OEBB). With Austrian know-how, the HyTrain climate fund lighthouse project will bring the world's first hydrogen-powered narrow-track train to market maturity. On the Zillertalbahn in Switzerland, the project enters the implementation phase. This includes the development of the hydrogen drivetrain and the plant for refuelling the train with green hydrogen. Through the Climate and Energy Fund, the Austrian Ministry for Climate Protection is funding the development of the H2 narrow-track train in the Zillertal with 3.1 million euros (12c BMK Infothek).

Spain

The Study of the 4.0 Trends in a Global Context with Impact on the Automotive Sector (Junta de Castilla y León) considers the situation in the sector to be positive.

However, it demands higher collaboration between sectors (basically, software or IT experts with industrial or manufacturing engineering experts).

[35] Federal Ministry Republic of Austria Climate Action, Environment, Energy, Mobility, Innovation and Technology

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Germany

In 2017, 23% of the population use the Smartphones to buy tickets, about 68% for timetable information[36], and a total of 2018 million mobile phone tickets were booked[37]. In about 100 projects, public transport is driving digitization[38]. Speech to text technologies will be integrated in the future[39]. Although Länder and municipalities are responsible for public transport, the federal government provides an additional 9.5 billion euros annually to ensure accessibility to central and regional centers[40]. The BMVI provides special support with the establishment of the National Platform Future of Mobility (NPM)[41]. Existing best practices should form a basis from which standards must be developed in the course of the process[42]. By 2030, 7 to 10.5 million electric vehicles should be on German roads[43]. A real-life laboratory in Hamburg is testing and trialing innovative mobility offers in ten sub-projects, ranging from mobility platforms and autonomous driving to the use of micro-depots to reduce logistics traffic and on-demand shuttles[44]. Megatrend: Independence and work life blending: the lifestyles of families, young urbanites and internationally networked high potentials already require effective time and mobility management[45]. Growth in mobility styles: immobility vs. deceleration, Forever youngsters, Global Jetsetter, High frequency Commuter[46]. In order to promote ideas for digital mobility, the BMVI is providing 200 million euros in funding under the mFUND[47]. The aim is to double the number of passengers' kilometers travelled annually by bus, tram and underground railway from 46.2 to 92.4 billion[48].

The mobility and transport industry will be deeply modified by the digital transformation technologies, thanks to the adoption of new products (i.e., e-car, e-bike, etc.) which will also transform the business models behind (a sharing model versus the owning one). The data analysis and AI will allow the implementation of new products and processes, meeting the consumers' needs faster.

[36] https://de.statista.com/statistik/daten/studie/713742/umfrage/nutzung-des-smartphones-fuer-informationen-ticket-erwerb-im-oepnv-in-deutschland/
[37] https://de.statista.com/statistik/daten/studie/951254/umfrage/anzahl-handytickets-deutsche-bahn/
[38] https://intelligente-welt.de/digitalisierung-im-oepnv-100-projekte-im-ganzen-land-bringen-bus-und-bahn-nach-vorn/
[39] https://digitalemobilitaet.nrw/massnahmen/information-und-datenqualitaet/mobilnrw-alexa-pilot-sprachassistenz-systeme-amazon-alexa-skill.html
[40] https://www.bmvi.de/SharedDocs/DE/Publikationen/G/ressortbericht-nachhaltigkeit.pdf?__blob=publicationFile
[41] https://www.bmvi.de/SharedDocs/DE/Publikationen/G/ressortbericht-nachhaltigkeit.pdf?__blob=publicationFile
[42] https://www.plattform-zukunft-mobilitaet.de/wp-content/uploads/2020/07/NPM-AG-3-Plattformbasierte-intermodale-Mobilit%C3%A4t-und-Handlungsempfehlungen-zu-Daten-und-Sicherheit.pdf
[43] https://www.plattform-zukunft-mobilitaet.de/wp-content/uploads/2020/07/NPM-AG5-Netzintegration-von-Elektromobilit%C3%A4t-Basis-f%C3%BCr-eine-Erfolgreiche-Sektorkopplung-Eine-Definition.pdf
[44] https://www.bmvi.de/SharedDocs/DE/Artikel/DG/reallabor-digitale-mobilitaet-hamburg.html
[45] https://www.adac.de/verkehr/standpunkte-studien/mobilitaets-trends/mobilitaet-2040/motive-beduerfnisse/flexibilitaet-unabhaengikeit/
[46] https://www.adac.de/verkehr/standpunkte-studien/mobilitaets-trends/mobilitaet-2040/mobile-lifestyles-2040/
[47] https://www.bmvi.de/SharedDocs/DE/Publikationen/DG/mfund_flyer.pdf?__blob=publicationFile
[48] https://www.nimo.eu/media/archive1/Wissensdatenbank.txt/EndberichtStudiemobilitBSLWeichenstellungenVerkehrswendePNV.pdf

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Digital Technologies & Life Science Industry

Austria

In 2016, as a result of a national strategic process involving all relevant life science stakeholders, the federal government published a new life science strategy ("Zukunfts-strategie Life Sciences und Pharmastandort Österreich"). It aims at further developing and strengthening the domestic science, research and business landscape along the whole innovation value chain from early research to market uptake. Fields of action of the strategy: Basic Research, Research Infrastructure, Big Data, Personalized Medicine, Clinical Research, Science-Economic Cooperation and Translation, Business, Production and Market, Dialogue Science and Society

A special focus is put on activities to improve translation, to foster science business partnerships, to enable international cooperation, to facilitate the founding of new life science ventures and to help establish platforms in which stakeholders can interact and public and private investors can match their experiences most efficiently.

One of the key national projects in the upcoming years will be to set up a new Translational Research Center (TRC), providing perfect conditions to bring basic life science research results into application and towards the patients. The TRC aims at further strengthening the innovative power of the Austrian life science community and is supported by the whole community. Another important strategic focus will be to leverage the potential of digitalization for science, industry and society. Due to its high potential for tackling societal challenges, the government has committed itself to strongly support activities in this area. The federal government is also aware of further improving conditions for research-intensive companies. In 2018, the research premium for R&D companies has been lifted to 14%. In addition, further measures are planned to reduce bureaucratic loads and to lower corporation taxes and fees. On the European level, the Austrian government supports intellectual property rights and incentives for innovative drugs (AWS Austria Wirtschaftsservice / Life Science Report 2018).

Belgium

Pfizer announced in September 2019 the launch of a global network of digital research hubs to leverage AI and bigdata to be used in the production of medicine and vaccines. They also

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installed a blockchain centre of excellence to enhance the tracking of clinical trial supply chain and experimental drugs.[49]

In the Life Science Industry, including Health digital technologies will allow the achievement of better conditions for citizens as well as faster medicines and vaccines, thanks to the usage of data collected from research.

Key Message 6: all identified core industries of the partner countries are positively affected by digital transformation. Private investments and public initiatives are launching promising challenges that will require adequate skills and competences at all levels.

The next paragraph focuses on which technology areas are currently well ranked in terms of competences and experience which gives us a first overview about "where" knowledge, competences and skills are.

49 https://www.businesswire.com/news/home/20200512005379/en/2020-Insights-into-Pfizer---Enterprise-Tech-Ecosystem-Series---ResearchAndMarkets.com

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Digital Maturity & Technology Excellences: relevance of DITA ATLAS domains

ITALY	AUSTRIA
• CPS • Cybersecurity • Cloud Computing • Robotics • Machine Vision • IoT	• CPS • Artificial Intelligence and Cognitive Systems • Laser based manufacturing • Robotics and autonomous systems • Simulation and modelling • ICT management, logistics and business systems • IoT • Interaction technologies • Internet services • Additive manufacturing (3D printing) • Location based technologies • Advanced or High-Performance Computing • Data Mining, Big Data, Database Management • Cloud Computing

While the previous paragraph confirms the relevance of digital transformation for all selected industries, this one focuses **on the prevalence of digital maturity and technology excellences in all the identified industrial sectors and in each involved geographical area**. This helps to describe how each regional or national area is creating the preconditions to face the innovation challenges of digital transformation processes.

BELGIUM	SPAIN
• Use of big data • Drones • Smart sensors • Robots • 3D printing • Machine learning • Blockchain	• ICT Management • Logistics and business systems • Sensors • IoT

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• AI • IoT	
PORTUGAL	**GERMANY**
• Sensors, actuators, MEMS, NEMS, RF • Photonics, electronic and optical functional mater. • Screens and display technologies • Cyber physical systems • Robotics and autonomous systems • IoT • AI and cognitive systems • Interaction technologies • Cyber security • Augmented and virtual reality, visualization • Gamification • Additive Manufacturing • Laser based manufacturing • ICT management, logistics and business systems • Internet services • New Media technologies	• Sensors, actuators, MEMS, NEMS, RF • Photonics, electronic and optical functional mater. • Robotics and autonomous systems • IoT • AI and cognitive systems • Interaction technologies • Cyber security • Augmented and virtual reality, visualization • Gamification • Additive Manufacturing • ICT management, logistics and business systems • Internet services • Data Mining, Big Data, Database Management • Cloud Computing

Key Message 7: This additional analysis confirms that the identified technology areas (that derive from the technology domains of the European Catalogue of Digital Innovation Hubs) are in line with the main digital technology trends of the involved partner countries.

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Digital Transformation: Relevant Benchmarks

Project Partners have identified relevant stakeholders in each identified industrial area, which can be referred to as benchmarks. In other terms, these actors are good determiners to concretely understand how the different industrial areas are dealing with digital transformation in terms of applications, required skills, attempts to mind the skills and competence gaps, etc. These players will be further considered during the project to add potential training providers to the DITA ATLAS (IO3), disseminate it and eventually validate the quality of the training organizations and programs that will be published.

ITALY	AUSTRIA
MOBILITY: E-Novia ✔ *E-mobility* ✔ *Smart Manufacturing applications* ✔ *Smart cities and Smart factory* ***MOBILITY, LIFE SCIENCE, MACHINERY MANUFACTURING***: Kilometro Rosso ✔ *Digital technologies* ✔ *Digital economy* ***ALL SECTORS***: Sorint Tek (Advanced Analytics and Machine Learning Solutions) ✔ *Digital application for Cyber* ✔ *Data Security*	**MOBILITY**: Digital Innovation Hub West (DIH West) represented by FH Kufstein ✔ *Digital Transformation and Innovation* ✔ *Industry 4.0* ✔ *e-Services* ✔ *Artificial Intelligence* ✔ *Security* **LIFE SCIENCE**: Know-Center GmbH, Research Center for Data-Driven Business & Big Data Analytics ✔ *Industrial measurement technology and measuring station automation* ✔ *Virtual methods and simulation in development* ✔ *Process optimization with SPS, mobile devices and RFID (Radio Frequency Identification)* ✔ *Energy optimization Development of prototypes and demonstrators* **AGRI-FOOD**:

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	CAMPUS 02 Fachhochschule der Wirtschaft GmbH ✔ *Industrial measurement technology and measuring station automation* ✔ *Virtual methods and simulation in development* ✔ *Process optimization with SPS, mobile devices and RFID (Radio Frequency Identification)* ✔ *Energy optimization Development of prototypes and demonstrators*
BELGIUM	**SPAIN**
MACHINERY MANUFACTURING: Flanders Make ✔ *Cyber physical systems* **MACHINERY MANUFACTURING, MOBILITY, LIFE SCIENCE**: IMEC ✔ *Industry 4.0* ✔ *Smart cities* ✔ *Industries* ✔ *Health* ✔ *AI* ✔ *Smart products* ✔ *IOT* **LIFE SCIENCE**: Flanders BIO ✔ *Big data and AI*	**MACHINERY MANUFACTURING, AGRI-FOOD, LIFE SCIENCE:** ✔ *AsDIH Asturias Digital Innovation Hub* **MOBILITY:** ✔ *DIHBU Burgos Digital Innovation Hub* **ALL SECTORS:** ✔ *Tecnalia*

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PORTUGAL	GERMANY
LIFE SCIENCE, MOBILITY, MOBILITY: ✔ ISQ **ALL SECTORS:** ✔ COTEC ✔ IAPMEI	**Digital Product School** ✔ *IoT, Artificial intelligence and cognitive systems* ✔ *Location based technologies* ✔ *Interaction technologies, Augmented and virtual reality, visualization, Additive Manufacturing, Internet services* **LIFE SCIENCE, MOBILITY, Industry 4.0, Energy** **Technologie Transferzentren Kfb, Sf, IFM, Professional Business School** ✔ *Artificial intelligence and cognitive system,* ✔ *Simulation and modelling* ✔ *Cloud infrastructure, e.g. Kafka* ✔ *Data mining, big data, database management*

Table 5

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Digital Skills & Competence Gaps: First Insights

ITALY

There are at least 5 main domains where there is a lack of digital skills and competences, specifically: IoT systems, Data Analytics, Virtual Reality, Automation, Cloud Computing.

AUSTRIA

Austria ranks 13th out of 28 EU Member States in the Digital Economy and Society Index (DESI) 2020.

Austrian companies still do not take full advantage of the use of digital technologies such as cloud services or big data, but there was a substantial increase in the percentage of companies using social media and selling online. A threat seen is that the regulatory framework in Austria still needs to be better adapted to the digital age. Many of the pillar-specific initiatives have been launched only within the recent past and their real impact still needs to be seen.

BELGIUM

There is a lack of training facilities specialized in digital skills in Flanders

SPAIN

As reported by a survey carried out by the National Institute of Statistics (Spain), there are different indicators on the presence of the digital element in companies, depending on the territory and type of industry.

PORTUGAL

No specific domain where we can provide evidence of digital skills or competences gap. Based on the current demand for technical profiles we can assume that there is a general gap that has to be minded in almost all industries (this refers both to very technical skills and competences as well as to soft skills applied to digital transformation).

GERMANY

Identification of total tool chain for digitization, starting with sensorization, data transfer, Data infrastructure, and data banks. Especially sophisticated data analysis tools based on AI for individual problems are necessary.

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Digital Skills & Competence Gaps: Approaches to Mind the Gap

The interactions so far between project partners, representatives of the use cases and digitalization leaders (see Chapter 3) have not identified if there are already available benchmarks that can be used to design effective training programs in most of the digital technology areas that have been identified.

The current discussion hypothesizes that the answer is not in a specific tool but in “changing the game continuously”. Using new tools depending on the topic and the demand for training might have the most positive effect on learning.

This is a short list of the identified methods that could be taken into consideration when it comes to creating a catalogue:

- Short technical lectures: traditional, short lectures covering complex technical matters, still represent an effective teaching method. It is important to enable students to interact with the lecturer. Direct questions and discussions are sometimes possible (depends on the teaching culture), but we have found clicker systems more effective. Nowadays these systems are purely software-based, running in tablets, smartphones and laptops. The lecturer gains important and broad feedback from the students and knows how to proceed, while students from all cultural and technical backgrounds are encouraged and enabled to participate easily. In-class open discussions: technical content has important effects on society and personality. For example, data privacy and security are an ongoing debate, especially in the context of pervasive systems like IoT. These topics need to be discussed in class and an open discussion between groups of students is important. In-class assignments and tests are very favourable to deeper understand subjects. Longer lectures should be interrupted regularly with exercises, processed and discussed immediately. Again, clicker software is beneficial in allowing all students to respond and for the teacher to access the learning process. Exercises can be individual or in small groups. Tests are very practical in the beginning of classes to “tune in” the students to the topic.
- Peer review exercises are slightly different from usual exercises. Students are asked to first individually work on an exercise and submit their results (e.g., through clicker software or any other multiple-choice real-time test system). Without revealing the results, the students are then asked to work in teams on the same problem and to submit their results once more. Both results are shown and discussed.
- Poster sessions are very useful for processing and reflecting on scientific publications or technical standards. Rather than lectures with content, the students are given reading exercises, which are summarized and presented in a poster session. The

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resulting posters can be used very well to show the progress of the class to a broader audience. Lab exercises are very important for teaching complex digital technologies and go beyond normal in-class exercises. Usually, the teachers prepare a hardware/ software setup, which enables the students to quickly test and make their own small modifications.

- Projects are well suited for summarizing and combining all new knowledge from longer periods of time. Conducted in groups, projects also practise team management and presentation skills. The project topics can be designed in a way to produce demonstrations to show to a broader audience.
- Blended learning, such as online videos and exercises, is an emerging trend, gaining more and more interest. The approach is extremely useful to address particular challenges, such as time and place flexibility of students. Many students nowadays work part-time and study in full-day programmes. Blended learning minimizes the time required to be spent in school and at the same time maximizes the learning outcome.
- On-line training creates new channels for learning independently, outside the traditional institutional environments for education as laboratories and classrooms in general. Overall, digital technologies define a new, broader ecosystem for learning, where learning takes place in both physical and virtual environments, through both formal and informal processes

Key Message 8: interaction with leading organizations, as well as some further analysis based on recent research papers, show that a wide set of training tools and methods can contribute to increase the availability and quality of digital industry related skills and competences.

Based on this, DITA ATLAS will have to look for complementary training partners as well as complementary training methods.

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Chapter 3: Recognition of learning outcomes

Introduction

The last chapter is based on the interaction between project partners and Sparring Partners, leading training organizations which will also be involved in co-designing the ATLAS (IO3) and in identifying the first possible matching options of the catalogue.

Specifically, partners have

- identified training key players (i.e.: Digital Innovation Hubs, Competence Centres, thematic platforms, etc.).
- discussed together about
  - their training priorities
  - learning outcomes recognition mechanisms

DITA Sparring Partners

ITALY	AUSTRIA
H-FARM AFIL- Lombardy Intelligent Factory Cluster BERGAMO SVILUPPO	FH Kufstein Tirol Bildungs GmbH My Academy GmbH
BELGIUM	**SPAIN**
Bemas	HETEL Centro de Referencia Nacional en Desarrollo Informático y Comunicaciones (Comunidad de Madrid) SEAS, Estudios Superiores Abiertos
PORTUGAL	**GERMANY**
DBServices Portugal ISQ Academy CENTIMFE	Digitales Zukunftszentrum Allgäu-Oberschwaben

Vertical specializations

The following figures show the relation level between thematic areas and current training programs, based on the answers collected by the Sparring Partners.

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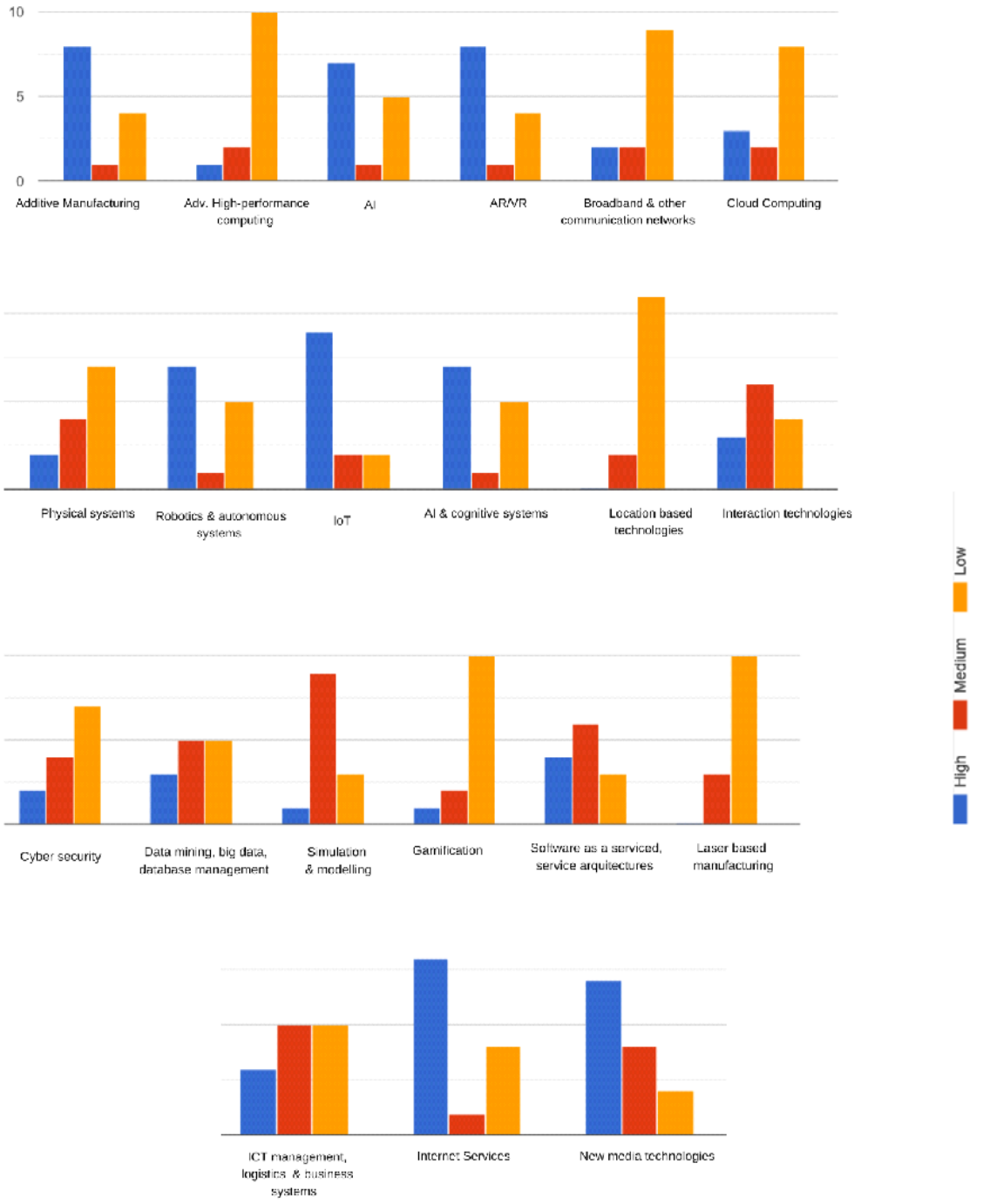

Figure 4 Sparring Partner Feedback on DITA Technology Domains Relevance to Training Priorities

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Current Priorities: Specific Technological Training Assets (STTA)

ITALY

- **STTA: Data Management, Machine Vision, AR/VR**
  - develop training programs
  - raising awareness on R&I in these areas
  - support policy makers in defining policies.

AUSTRIA

- **STTA: Robotic, additive manufacturing, IoT, Internet Services**
  - added value for organizations and students from shared lab infrastructure, exchange of staff and students, internships, knowledge transfer
- **STTA: Robotic, Artificial Intelligence, New Media**
  - benefit for Organizations and Students (including their companies) and additionally high impact for involved regions

BELGIUM

- **STTA: Technologies that can be applied to asset management and maintenance**
  - organization of high-quality training courses, conferences, seminars, study evenings, company visits and trade fair visits related to asset management and maintenance
  - encourage young people to choose an education and a profession in maintenance
  - maintain relationships with similar organizations at home and abroad and setting up activities together with them;

SPAIN

- **STTA: Robotics, IOT, VR/AR, cloud computing and big data.**
  - exchange and development of competences, digital tools and methodologies.
  - training and exchange of VET trainers/students
  - detection of training needs and professional profiles most in demand by companies in the technology sector
  - improve training offer with new ideas, shared with potential partners
  - increase the number of students, courses offer and quality of contents

PORTUGAL

- **STTA: Not specifically linked to 1 technology domain:**
  - provide complementary tech skills

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- new training content, materials, innovative methodologies and international certifications
- practices and knowledge sharing

GERMANY

- **STTA: AI, VR AR, Cybersecurity, IOT**
  - professional exchange,
  - provide participants in training programmes with a broader insight,
  - deliver stronger training,
  - support business development

Topics to be considered for the establishment of effective cooperation among complementary training providers:

- the demand for complementary courses, thematic / technology domains are relevant but there are also some additional criteria that may be appealing such as:
  - language
  - reputation of trainers, speakers, training organization
  - labour market linked to training organizations
- interest on behalf of the trainers / educational staff
- concrete possibility to enable exchanges (even from an administrative perspective)

Key Message 9: DITA ATLAS can play a role to meet current challenges and priorities of the identified Sparring Partners especially in the following areas: 1) expand the range of accessible training programmes in specific technology domains; 2) support the set-up of exchanges and more formal connected training schemes; 3) facilitate the "learning process" of training organizations that can learn from other providers.

The table below has been designed to do a first possible matching between DITA excellences and DITA "digital skills & competence gaps" priorities.

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Matching desired CVs, excellences and regional / national priorities

CVs	Programming, Web and App development	Digital Business Analysis	Digital Design and Data Visualization	Digital Project Management	Digital Product Management	Digital Marketing	Social Media	Data Science and Data Analytics	Decision Making for Leaders
DITA EXCELLENCES	Cybersecurity (IT, PT) Cloud Computing (IT) Blockchain (BE) Big Data (BE) AI (BE, PT)	CPS (IT, AT, PT) IoT (IT, BE, ES, PT) Gamification (PT) Sensors (BE, ES, PT) AI (BE, PT) Big Data (BE)	Additive Man. and 3D printing (PT) Interaction Technologies (PT) Gamification (PT) Augmented and VR (PT)	CPS (IT, AT, PT) ICT Management, Logistics and business systems (ES, PT)	CPS (IT, AT, PT) Machine Vision (IT) Machine Learning (BE) IoT (IT, BE, ES, PT) Sensors (BE, ES, PT) Robotics (IT, BE, PT)	Internet services (PT) New Media (PT) Gamification (PT) Sensors (BE, ES, PT)	Internet services (PT) New Media (PT) Gamification (PT)	CPS (IT, AT, PT) IoT (IT, BE, ES, PT) ICT Management, Logistics and business systems (ES, PT) Sensors (BE, ES, PT) AI (BE, PT) Big Data (BE)	CPS (IT, AT, PT) IoT (IT, BE, ES, PT) ICT Management, Logistics and business systems (ES, PT) Gamification (PT) Sensors (BE, ES, PT) AI (BE, PT) Big Data (BE)
REGIONAL AND NATIONAL PRIORITIES									

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IT		Data Management	AR/VR		Machine Vision			Data Management	Data Management
AT		IoT, AI	Additive M		IoT, Robotics	Internet Services	New Media		
BE		AI applied to maintenance		ICT Management, Logistics				AI applied to maintenance	ICT Management, Logistics
ES	Big Data, Cloud Computing	Big Data, IoT	AR/VR		IoT			Big Data, IoT	Big Data, IoT
PT	Blockchain, Cloud Computing	IoT			IoT			IoT	IoT
DE	AI, Cybersecurity	AI, IoT	AR/VR		IoT			AI, IoT	AI, IoT

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Recognition of learning outcomes

Current schemes

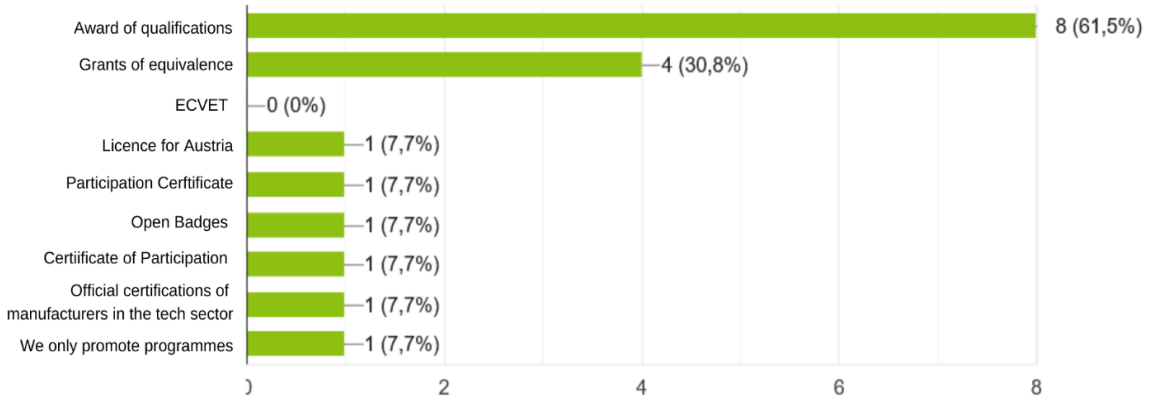

Figure 5 Results of Sparring Partner Survey on Qualifications

From the survey it appears that the ECVET Toolkit is not used among Sparring Partners, while on the other hand other certificates and learning credits are used (i.e., Open Badges, etc.). During IO3 we will collect inputs from all participants in order to define a common recognition strategy at European level, and promote, where relevant, the use of the ECVET Toolkit.

Interest in creating joint recognition mechanisms

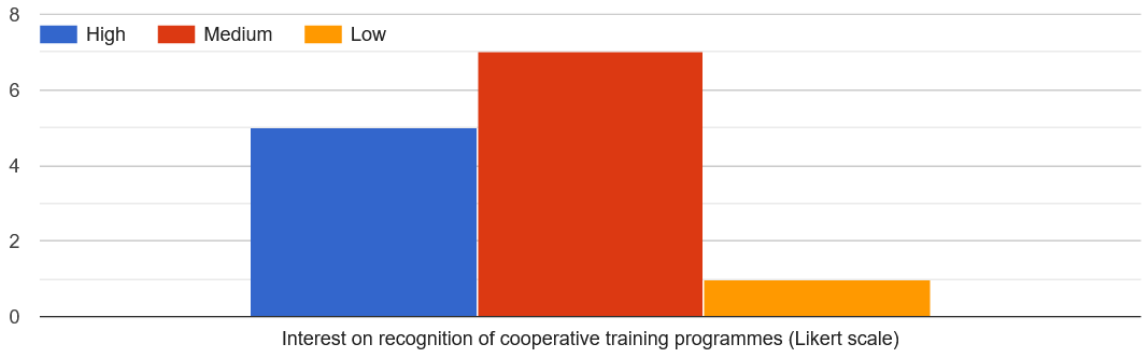

Figure 6 Results of Sparring Partner Survey on Joint Recognition Mechanisms

Sparring Partners declared there is a common interest in finding a shared way of learning outcomes recognition. This will allow students to select potential cooperative training programmes, with the aim of achieving different specific skills in the technological domains of expertise underlined before. Furthermore, this can increase the overall quality of the training offer by adding new courses delivered by third parties.

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ANNEX 1: IO2 Step 1 Industry Focus

ANNEX 2: IO2 Step 2 Digital Maturity & Technology Excellences of the identified Industries

ANNEX 3: IO2 Step 3 Leading the Digital Process

ANNEX 4: DITA IO2 Interview Template for Sparring Partners

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