

## Record of the updates done in the EU Skills Panorama database



Co-funded by the  
Erasmus+ Programme  
of the European Union

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# Summary report of the results

## 1. Abstract

Industry 4.0 is causing many changes and developments concerning all economic sectors, as well as aspects of life. The changes impact the technical field of companies such as products, services, processes as well as qualifications, organizational and life aspects (see EXAM 4.0 report on Most Relevant Trends for AM). As a result, the ongoing transformation process and digitization also affect competences and skills required of employees working in an advanced manufacturing environment. In the course of the research project EXAM4.0, a competence model was developed concerning future skills and competence requirements for employees. The Skills Panorama Database provides information and data about different occupational groups, including tasks and skill required in these occupations, influential factors and the resulting future skills (CEDEFOP, 2015). The research in this report focuses on comparing future skills requirements concerning ICT technicians, science & engineering technicians and technical managers provided on the platform of Cedefop's Skills Panorama Database to the EXAM4.0 Competence Model, taking into account influential factors of Industry 4.0, impacts the transformation process had and future trends concerning the automotive industry and advanced manufacturing sector (CEDEFOP, 2015).





## 2. Introduction

The Skills Panorama Platform is an initiative of the European Commission, Directorate-General for Employment, Social Affairs and Inclusion. It provides accurate and up-to-date intelligence based on labour market data. The platform offers insights into skills demands in the EU, covering all Member States, sectors as well as occupations (CEDEFOP, 2015). The website, powered by Cedefop, Centre for the Development of Vocational Training, was published in December 2015 as a lively and interesting platform. Cedefop's Skills Panorama pursues the aim to foster development and improvement of identifying skill demands and anticipated developments in Europe. The platform provides information about developments concerning education, training and employment issues for policy makers and experts as well as researchers and guidance practitioners. By publishing the data and comparing them to previous trends, the platform helps education & training centres to become more responsive to labour market needs and also contributes to diminish skills mismatch across the Member States (CEDEFOP, 2015). On the website, there are seven categories which provide different data and information for users. Skills Panorama enables users to search for respective information by indicating specific sectors, main occupational categories, countries, or topics, for example people & skills, future jobs, labour market context or skills matching. Analytical highlights provide a comprehensive outlook on skill related issues referring to countries, sectors and occupation. As pursuing the goal of presenting a lively platform, users are encouraged to participate and contribute to the website in forms of rating, identifying and sharing materials, tools or resources in order to maintain timely data on the Skills Panorama website (CEDEFOP, 2015).

## 3. Trends for the future

Industry 4.0 evokes many changes and developments in the world of employment. In fact, the progressing digitization has an impact on all sectors and working environments, leading to reshaping and changing occupations and skill needs in the future. To identify required skills and qualifications for employees in Industry 4.0, the KET study considers three distinctive and interrelated tiers, referring to the approach of the VDI White Paper of 2015. Starting with Tier 3 which covers factors that influence the future workforce. As a result, the influences portrayed in Tier 3 evoke changes in employee's tasks, presented in Tier 2. The developments concerning the future workforce and adjusted tasks jointly form the base to identify the required skills and qualifications of employees for Industry 4.0 (Tier 1) (PricewaterhouseCoopers EU Services EESV, 2020).

Tier 3 describes influential factors which have an impact on the workforce such as tools, technologies, organization, structure, working environment, intra-, and inter-organizational cooperation. Tools and technology as influential factors are expected to evoke a decreasing need for manual and routine tasks, active use of collaborative robotics as well as optimized human-machine interfaces that allow employees to decide competently. Furthermore, the tools and technologies of Industry 4.0 ensure workers of the future real-time information perform efficiently. In return, employees need to be able to control and monitor production processes based on analysis data. In Industry 4.0, job rotation and job enrichment are anticipated to facilitate as well as increased responsibility and decision-making power, due to organizational changes and transition towards a flat organizational structure. In addition, the working





environment is expected to improve for workers for example referring to the sector of the Advanced Manufacturing (AM), including active use of devices, assistance systems, and automation of challenging or dangerous tasks. Furthermore, the study forecasts the increasing importance of teamwork, communication, particularly between cyber-physical-systems, and cooperation with external partners such as research institutes (PricewaterhouseCoopers EU Services EESV, 2020).

As a result, the developments described in Tier 3 will induce changes in the associated tasks of employees of Industry 4.0, presented in Tier 2. Monotonous and challenging tasks are anticipated to decrease in Industry 4.0. However, the changes are anticipated to enable workers to execute a greater variety of job assignments and a transition towards tasks that will be predominantly performed through devices and assistance systems (PricewaterhouseCoopers EU Services EESV, 2020).

The developments and changes described in Tier 3 and Tier 2 jointly form the base of Tier 1, including skills and qualifications that are required in Industry 4.0. Key qualifications for employees in AM are forecasted to include both technical and non-technical skills. The study emphasizes increasing importance concerning data management skills, cybersecurity, decision-making-methodologies as well as computer programming, coding skills, and interdisciplinary understanding of processes, organization, and technologies. Non-technical competencies demanded in Industry 4.0 imply adaptability, flexibility, communication skills, teamwork skills, and self-management skills.

Moreover, employees of Industry 4.0 are expected to be willing to continuously improve and have a mindset towards lifelong learning. The results presented above can be proven by a recent study from Deloitte and The Manufacturing Institute (2018). In their study “2018 Deloitte and The Manufacturing Institute skills gap and future of work-study” the authors present similar results regarding future skill needs, supporting their conclusions by key outcomes of an online survey (PricewaterhouseCoopers EU Services EESV, 2020). The results imply skills such as technology and computing skills, digital skills, programming skills for robots and automation, ability to work with tools and technology, and critical thinking skills. Regarding technical skills required of employees in the AM, key outcomes of the survey emphasize the ability to interact with human-machine interfaces, data management skills, and specialized knowledge of technologies and processes. Non-technical skills described in the key outcomes of the survey also present similarities between the studies. According to the skills gap survey, skills concerning adaptability, flexibility, creativity, critical thinking as well as a general mindset towards lifelong learning are anticipated to increase.

With regard to the sector of automation industry, advancements and progressing automation also lead to developments and changes concerning jobs and skills within this sector. Occupations of the automation industry refer to innovative and research-oriented manufacturing and therefore are also affected by the influential factors of I4.0. According to the recent study by Skills Panorama, it is anticipated that technical applications as well as use of ICT will increase in the future (CEDEFOP, 2021). As a result, technical occupations such as in the field of production, design or engineering, will be highly requested on the labour market. Furthermore, highly skilled technical jobs are expected to increase whereas metalworkers or electrical engineering workers, referring to medium skilled technical occupations, will be less dominant. According to the study, employees working in highly skilled technical jobs are expected to present a wide range of transversal as well as technical skills. The top transversal skills imply adaptability, teamwork, languages, customer service, self-management, problem-solving, communication, creativity, analysis as well as leadership (CEDEFOP, 2021). Top technical skills listed in the study, include





skills such as manufacturing processes, quality standards, design, engineering, materials, electronics, mechanics, CNC, logistics as well as automation (CEDEFOP, 2021). In addition, digital skills as well as risk assessment skills will be important for future employees working in the automotive sector.

In comparison, both sectors, advanced manufacturing as well as automotive industry, emphasize the importance of both technical as well as non-technical skills. Furthermore, there are some similarities regarding the listed skills, for example communication skills, teamwork, adaptability, problem solving, creativity or leadership.

## 4. Competencies for Advanced manufacturing

In the course of the EXAM4.0 research project a competency model was developed concerning future skills and competence requirements for employees working in an advanced manufacturing environment. To develop the EXAM4.0 Competence Model, the structure and results of ESCO and PwC EU Services' KETs Initiative were taken into account. As the model presented below shows, the categories of competences for Key Enabling Technologies were maintained, although the categories were extended by competences of "The Industry 4.0 competency model". This latter model also referred to as Prifti Model, describes competences for employees of the AM, without defining skills for certain jobs or competences for certain companies. The hierarchically structured model displays an extensive list of competences concerning three occupational areas: information systems, computer science, and Engineering. The majority of the behavioural competencies are pertinent to all three occupational areas, whereas only a few competences refer to just one or two areas. Those few competences concern the competency dimension of "applying expertise and technology". As a result, the model demonstrates the development of working conditions in the future, which are expected to evoke an increase of an interdisciplinary approach and non-technical competences or soft-skills. The EXAM 4.0 Competence Model for employees in advanced manufacturing implies the same six categories as the KETs initiative including categories of competences regarding:

- Technical subjects
- Quality, risk, and safety
- Management & Entrepreneurship
- Communication
- Innovation
- Emotional Intelligence

The first category refers to the technical competences required of employees working in an advanced manufacturing environment. Similar to the KETs model, this category implies competences concerning design methods, systems analysis, modeling and simulation, ICT skills, computer skills, programming, coding as well as computational thinking. However, the EXAM 4.0 model does not include all listed competences although it summarizes certain competences and skills, for example, competences in STEM (science, technology, engineering, mathematics). The majority of competences are also listed in the Prifti model. Furthermore, this model indicates competences pertaining to Big Data, data analytics, and interpretation, which were added as "data management" competences. Moreover, in the competency dimension of applying expertise and technology, the Prifti model cites different technologies such as embedded





systems, sensors, mobile technology, Cloud Computing, robotics, and AI (Artificial Intelligence). The listed technologies refer to certain occupational areas. For this reason, the ability to interact with human-machine-interfaces was included in the EXAM 4.0 model.

The category of quality, risk, and safety implies competences such as quality management, risk assessment, health and safety, industrial hygiene, equipment safety as well as emergency management and response. Furthermore, the competence concerning data security was also added to this category. The issue of data security becomes more important due to the increasing number of smart systems and technologies introduced in companies to save, provide and analyze information. To prevent internal information, competences concerning data security will be decisive in an advanced manufacturing environment.

Management and entrepreneurship present another category of competences required in Advanced Manufacturing. Similar to the KETs model, this category implies competences such as strategic analysis, technology strategy, teamwork skills, marketing, project as well as time and risk management. In addition, change management and customer orientation, both listed in the Prifti model, were also included.

The fourth category concerning communication competences of the PwC EU Service study already implies required competences regarding the interpersonal exchange of information. This category includes competences regarding verbal as well as written and public communication. Competences such as presentation skills and virtual collaboration demonstrate increasing importance. It is expected that the developments and changes caused by Industry 4.0 result in new forms and models of collaboration for employees. For example, working teams of the future are anticipated to be more interdisciplinary and will be working irrespective of location due to the ongoing globalisation and more complex problems referring to several departments.

Similar to competences for KETs, the category of innovation implies competences concerning integration, continuous experimentation, complex problem-solving as well as creativity. In the competency dimension of “Creating & Innovation”, the Prifti model also indicated the ability of critical thinking and abstraction.

The last category, emotional intelligence, implies competences such as adaptability, self-discipline, self-control, continuous improvement, attention to detail, leadership, cooperation as well as the ability to thrive through failures and decision making. Furthermore, several competences of the Prifti model were also integrated into this category, for example, work-life balance, responsibility, flexibility, self-management, and the ability to collaborate with others. Intercultural competences and the ability to work in an interdisciplinary environment, displayed in the Prifti model, substitute and complement the term of multicultural/global orientation, included in the KETs model.

Based on the results and structure of ESCO and KETs initiatives, the EXAM 4.0 model of required competences and skills for employees working in an advanced manufacturing environment also differentiates between general and specific competences. This differentiation concerns technical competences as well as competences in management and entrepreneurship. Regarding the category of technical subjects, general competences refer to all employees working in an advanced manufacturing environment independently of their job profiles, domains, or qualifications. Special competencies of this category refer to certain job profiles or domains, for example, lab skills, scalability, or life-cycle analysis. Furthermore, competences concerning

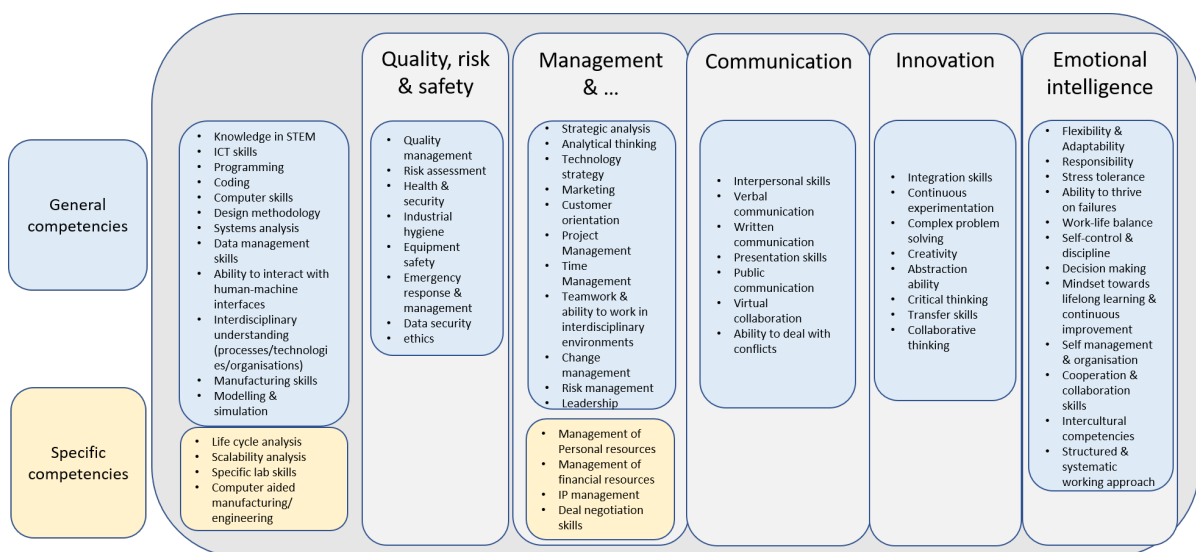






computer-aided-design (CAD) or -engineering (CAE) do not apply to all employees working in the AM. This software is predominantly used by engineers and professionals of specific domains and therefore classified as “special competence”.

Concerning competences pertaining management and entrepreneurship, the differentiation does not refer to specific domains rather qualifications. Special competences imply management of personal or financial resources as well as deal negotiation skills and management of intellectual property. As a result, employees with an EQF level of six or higher, usually working in middle or higher management and presenting managerial responsibility, are required to occupy certain special competences whereas employees without management function (EQF level of four) do not have to present specific but general competences of management and entrepreneurship.



## 5. Occupational field examples

On Cedefops Skills Panorama website, the platform provides information about occupational groups. The data firstly include an overview of the respective occupational group and key facts about employment figures, work places and occupational fields. The data also includes information about trends of the future e.g., regarding employment development, drivers of change affecting skill needs and how skill demands can be met. Furthermore, Skills Panorama provides information about tasks that are typically carried out in the respective occupational group and skills that will be necessary. There are different categories of tasks and skills distinctive for the occupational groups. The categories are intellectual skills and tasks, physical, social, use of methods and use of technology. However, the presented table does not differentiate between tasks and skills (CEDEFOP a, 2019). Regarding future skill demands there are changes within the occupational groups which will lead to further competences. For example, regarding the professional group of science and engineering technicians, this group includes a wide range of of fields and disciplines and refers to medium-level qualification. Typical tasks and skill needs imply gathering and evaluating data, creativity, resolution, autonomy, literacy, numeracy, dexterity, strength, management & coordination, service & attend, sell & influence, teamwork ,





use of ICT and machines as well as skills concerning teach, train & coach (CEDEFOP a, 2019). Listed tasks such as evaluating and gathering information can be compared to skills like data management skills, service and attend implies the skills of customer orientation, as well as a typical task of sell and influence equates to marketing skills. Skills Panorama also displays the task to manage and coordinate. In the EXAM4.0 Competence Model, management and entrepreneurship presents a category of their own implying different skills associated to management and entrepreneurialism. The task 'manage and coordinate' can be used in a broad sense, including skills like project, risk, time or change management as well as strategic analysis or leadership. Another typical task for employees of this occupational group represents the use of machines, comparing to skills of handling human-machine-interfaces. As a result, employees of this category require a wide variety of technical as well as non-technical skills. In comparison to the identified skills for employees working in the AM, there are some skills missing especially regarding soft skills. According to Skills Panorama data, skills referring to competence categories such as emotional intelligence, quality, risk & safety, communication or innovation except for creativity are not displayed in the future skills for the respective occupational group. However, communication skills, as well as data security, quality assurance, integration, equipment safety, analytical thinking, abstraction ability, continuous experimentation, complex problem solving or critical thinking present key skills for employees working in an advanced manufacturing environment which also include occupations related to science & engineering technicians. Moreover, there are further skills that are not distinctly presented in the EXAM4.0 Competence Model. For example, literacy, dexterity, strength or numeracy, whereas numeracy is included in STEM skills. In addition, tasks like teaching, training and coaching employees or staff members referring to skills of instructors and educators are also not included in the model (CEDEFOP a, 2019).

A similar observation can be made regarding ICT technicians and specialists. Employees referring to this occupational group present a medium to high qualification (CEDEFOP b, 2019). According to Skills Panorama, in occupations with high demand and use of ICT skills, social tasks appear to be less important, however, depending on the respective occupation. With regard to required skills in this occupational group, similar skills were listed to be important, for example creativity, resolution, gather & evaluate information, literacy, numeracy, dexterity, management & coordination, service & attend, sell & influence, autonomy, teamwork, and the use of ICT (CEDEFOP b, 2019). Skills pertaining competence categories such as quality, risk & safety, communication, emotional intelligence as well as innovation are also not included in the Skills Panorama data of this professional group.

Technical managers present another occupational group, referring to high-level qualification (CEDEFOP c, 2019). The skills required for this group displayed on the platform implies further skills. For example, skills that will be necessary for employees working in the field of technical managers imply IP management, detailed planning, quality assurance, managing & controlling budgets & costs, training & performance of staff, autonomy, creativity, resolution, use of ICT, numeracy, literacy, management & coordination, teamwork, leadership as well as emotional intelligence skills (CEDEFOP c, 2019). As described in the previous chapter, within the EXAM4.0 Competence Model there is a differentiation between general and specific competences, some of the latter concerning higher qualification levels. Employees referring to an EQF-level of six or higher represent managerial responsibilities and tasks. Therefore, they are required to occupy





further specific skills pertaining the competence category of management & entrepreneurship. The occupational group of technical managers on the platform include the specific skills displayed in the framework, e.g., IP management, management of financial and personal resources as well as deal negotiation skills in the task of representing organization in negotiations (CEDEFOP c, 2019). However, other key skills especially social skills are not presented on the platform for the respective professional group. Skills such as data security, risk assessment, health & security, industrial hygiene, equipment safety, emergency response, ethics, integration, continuous experimentation, complex problem solving, abstraction ability, critical as well as collaborative and linked thinking are not included in the data.

## **6. Recommendations for Skills Panorama Database**

The Skills Panorama Platform encourages users to participate and add information, materials, tools and resources so the platform can provide and maintain up to date data and information for users such as policy makers, experts, researchers or guidance practitioners. The European research project EXAM4.0 pursues the objective to identify and define skill requirements of the advanced manufacturing sector and to turn the achievements and results of the project into impactful initiatives that will bring together VET/HVET centres, companies, policy makers and individuals of lifelong learning. Employees working in the advanced manufacturing refer to different sectors, occupational groups and present several qualification levels. The results already found in the research project of EXAM4.0 can contribute and complement the data presented on the Skills Panorama Database. Therefore, the EXAM4.0 project group inform and contact Cedefop and aims to present results of the experts interviews, focus groups carried out in the project partners countries, developments and resulting frameworks and models in a virtual meeting due to the current pandemic situation. As a connecting factor regarding the Cedefop expert department of skills forecast and European skills index, the results of the expert interviews and focus groups provide insights about future trends in Spanish, Swedish, Dutch and German companies. In the interviews, company representatives were asked about the current status and situation of companies concerning technological developments, qualifications, and current demands of employees. Furthermore, the focus groups explored future technological trends, changed demands due to Industry 4.0, and how to prepare and reskill employees for the AM. The information and responses of this survey as well as the resulting EXAM4.0 Competence Model implies complementary data.

The Skills Panorama platform provides a lot of data and information about different occupational groups. Readers can find facts and figures of the respective occupational groups, drivers of change and future trends regarding specific European countries. Information about current and future skills does not display all skills required in an I4.0 environment for employees of the respective occupational group (CEDEFOP, 2015). Especially soft skills and non-technical skills are not presented in the respective tables. For example, regarding occupational groups of medium level qualifications, skills concerning the competence category of emotional intelligence are missing. For example, skills such as decision making, stress tolerance, cooperation, collaboration, intercultural skills, mindset towards lifelong learning or a structured and systematic working approach are not listed in the description and information of the science & engineering technicians or ICT technicians. In the future, communication skills will become more





important, both virtual as well as conventional exchange of information. Innovation will also be increasingly important for future employees. This competence implying skills like integration, complex problem solving, experimentation, abstraction, critical thinking and transfer skills will be crucial in order to be optimally equipped for the increasingly complex work environment. The developments of I4.0 and the progressing implementation of linked and interconnected technologies and machines evoke a great risk regarding data security and safety. Therefore, skills referring to the competence category of quality, risk & safety will be required of future employees to prevent new forms of crime and threat.

In order to contribute to the goals of the Skills Panorama Database and participate of the platform, the EXAM4.0 project group will provide access to research results and offer to jointly elaborate opportunities to integrate missing data or add information for users. This could be done within articles issuing country-specific findings and impacts concerning Spanish, Dutch, Swedish and German labour market. Moreover, the results could contribute to the department of skills forecast concerning sectors and occupational groups referring to the advanced manufacturing.

## 7. Annex

### 7.1 Executive Summary

This document lists the main activities performed in WP02 during the first 12 months reporting period of the project (November 1st, 2019 – October 31st, 2020).

The majority of the first reporting period was dedicated to:

- **WP02: Learning Dialogues**

By the end of the reporting period, the EXAM 4.0 consortium completed its goals within the WP02. The following milestones were completed during this period:

- D.2.1. Report on the State of the art of AM and HVET/VET in Europe
- D.2.2. Report on Most Relevant Trends for AM.
- D.2.3. Methodologies for analysing and anticipating skills need in the AM sector.
- D.2.4. List of Promising Practices templates (description, roles, timing, funding, results, etc.).
- D.2.5. Declaration of the Platform on views and perspectives regarding the AM and the VET Sector.
- **D.2.6. Record of the updates done in the EU Skills Panorama database**





Different project monthly meetings were organized by TKNIKA where the results of the previous weeks in D2.6 were discussed, quality criteria and risks clarified, and technical issues to proceed solved and decisions taken for the next steps:

- Project Kick-off meeting. November 20-21 2019.
- Project meeting. December 18 2019.
- Project meeting. January 15 2020.
- Project meeting. February 3 2020.
- Project meeting. March 17 2020.
- Project meeting. April 21 2020.
- Project meeting. May 22 2020.
- Project meeting. June 23 2020.
- Project meeting. July 7 2020.
- Project meeting. (WP2) September 3 2020.
- Project meeting. October 16 2020.
- Project meeting. November 17 2020.

During every meeting WP02 topics have been discussed in an atmosphere of collaboration and professionalism where the entire partnership contributed actively with presentations and open discussions. The WP02 tasks development and research concepts continued to evolve into a unique structured and shared view.

Conference calls have been set up to track the WP2 progress and evolution of key findings. Key quality criteria and risk were addressed, existing problems discussed and solutions decided. The future actions (for the upcoming 4 weeks) were presented and WP2 deliverables and goals concluded. The major results of the WP2A6 activities have been reported in the project deliverables planned for the period. (see chapter 3 of this report)

This document is structured as follows:

- WP02 Task template: Description of the WP02 tasks, participating organisations, overview of the short and long-term results and qualitative indicators,
- Detailed description of the project objectives and achievements organized by WPs.
- Project management, including deliverables, milestones, project meetings
- Detailed reporting of the use of resources.





## 7.2 Table of Contents

- WP task template
- WP2A6 Summary report of the results

### WP2A6 Work Package Task Template

<b>Work package &amp; Task</b>	<b>WP2A6 Record of the updates done in the EU Skills Panorama database</b>
<b>Planned Delivery Date</b>	<b>31.10.2020</b>
<b>Finalization at TPM/Webinar</b>	<b>In Feb 2021</b>
<b>Result Summary on Project by Website by</b>	<b>Oct 2020 Feb 2020</b>
<b>Lead</b>	<b>DHBW</b>
<b>Participation</b>	<b>Tknika, Miguel Altuna, Da Vinci College, Curt Nicolin High School,</b>
<b>Expected Results/Outputs</b>	x <b>External report</b> x <b>Internal report</b> x <b>Other, please specify: <u>Upload - Platform EXAM4.0</u></b>
<b>Task/Description of Work</b>	<p><b>Overall aim and link to ESCO</b> ESCO needs to be continuously improved to remain an added value for the labour market and the education and training systems, as new emerging occupations and skills are regularly requested by employers and changes in curricula and in terminology are also regularly introduced in education and training programmes.</p> <p><i>To address these changes it is important to share frequently feedback, suggestions and proposals on how to improve the content and management of the classification with organisations using ESCO and other ESCO stakeholders.</i></p> <p><b>Project aim WP2:</b> Fulfill ECSO concepts for I4.0 technology applications:</p> <ul style="list-style-type: none"> <li>• what knowledge and skills are usually required when working in a specific occupation;</li> <li>• what knowledge, skills and competences are obtained as a result of a specific qualification;</li> </ul>



	<ul style="list-style-type: none"> <li>• what qualifications are demanded or often requested by employers from those searching for work in a specific occupation</li> </ul> <p>Document with the updates of skills, competences and occupations of the EU Skills Panorama Database in order to maintain the data updated.</p> <p><b>Approach:</b></p> <ul style="list-style-type: none"> <li>• Identify and categorise I4.0 specific skills, competences, qualifications and occupations relevant for the EU labour market and education</li> <li>• Focus on learning outcomes of qualifications</li> <li>• Use standard ESCO format to describe I4.0 qualifications</li> <li>• Inform ESCO database about changes according to the identified procedures of updating</li> </ul>
<p><b>Methodology</b></p>	<p><b>Desk Research - DHBW</b></p> <p>In phase 1 (WP2_A6) DHBW will compile research and provide a concise introduction to the ESCO concepts and standards.</p> <p>Based on the <b>template describing good practices and their main features</b> and the work done in WP2_A4, DHBW will add to the list of competencies the learning outcomes for two qualifications.</p> <p>The same typology as in the ESCO database will be used.</p> <p><b>Peer Review – Partners</b></p> <p>In phase 2 the consortium will inform the ESCO database about the changes of two I4.0 qualification programmes and corresponding learning outcomes as shown in WP2-A4.</p>
<p><b>Template written by</b></p> <p><b>Last modified by</b></p>	<p>Raimund Hudak 13.12.2019</p> <p>Raimund Hudak 1.10.2020</p>

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